PART I

DESIGN STANDARDS AND PROCEDURES

FOR

WATER DISTRIBUTION AND SANITARY SEWER SYSTEMS

PRINCE GEORGE COUNTY, VIRGINIA

May 2008
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GENERAL

These design guidelines have been prepared to assist engineers preparing plans for water and sanitary sewer projects in Prince George County, Virginia. These guidelines are for use by experienced design professionals. Variations will be permitted based solely on sound engineering practice and will be reviewed and approved by the County Utility Department on an individual basis. Such variations must be requested in writing along with sufficient documentation supporting the request.

Public sanitary sewers, private sewer 8" and larger (with manholes and service laterals), and public water mains shall be designed by a Professional Engineer licensed in accordance with the requirements of the Code of Virginia or a Professional Surveyor with a Class B license issued by the State of Virginia. Designs shall be in accordance with the Latest Edition of Waterworks Regulations and Sewerage Regulations, Virginia Department of Health, Commonwealth of Virginia and any other local, State or Federal agencies having jurisdiction. The engineer shall also comply with the requirements of the County's subdivision and utilities ordinances as they pertain to water and sewer systems. It is the responsibility of the Engineer to inform developers of the contents as set forth in the applicable local ordinances as it relates to the project under review and consideration by the County Engineer.

Prior to construction of public water and/or sanitary sewer facilities, construction drawings for the proposed facilities must be submitted for review to the County Engineer, Prince George County. The construction drawings must be in a form acceptable to the County Engineer and be submitted in three copies. If deemed necessary by the County Engineer, the developer or his agent shall submit an overall plan for the water and/or sanitary sewer systems for the proposed development. The plan must be submitted to the County Engineer for review and approval at least thirty (30) days prior to submission of any schematic, tentative subdivision, construction or site plan for the property. A detailed checklist of plan requirements can be found in Appendix 11 of this document.

It is suggested that, for complex projects and projects which may require special considerations, the engineer arrange a meeting with the County Engineer to discuss the approach to be taken to supply water and sanitary sewer service. All water and sanitary sewer systems must be located and sized properly to serve the entire service area in conformance with the County's approved Water and Wastewater Facilities Plan.
It should be noted that where it is determined that water or sanitary sewer lines are necessary to serve property beyond the subdivision or development in question, the developer will be required to design and construct his system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question. The system must terminate, at all points in new development, to the adjacent and/or upstream properties to be served by the system in the future. Elevation of the sewer system must be designed such that future extensions are taken into consideration to allow service to all the area which naturally drains towards the system. Public water systems must be designed and constructed along major roads and/or through the development to facilitate for future extensions. In selecting routes for water and sanitary sewer extensions, the Department requires that the location must be such that it maximizes the potential for serving areas of existing and/or future developments.

The developer must enter into a contract with the Board of Supervisors before any work begins. A copy of the Utility Contractor's bid proposal as accepted by the developer is required to prepare the contract. The Unit Price Bid Proposals shall be based on the approved water and/or sanitary sewer plans. All work must be performed by a Class A licensed contractor and/or as deemed acceptable to the County Engineer. Refunds shall be considered for all extensions of the public water and sewer systems where:

1. The County Engineer has required that additional water or wastewater lines be installed to serve property beyond the furthest property line of the developer's property; or

2. The developer is required to oversize the water or wastewater line being constructed to serve his development.

Attached to these guidelines are the following appendices:

1. Developer's Checklist for Utilities Projects
2. Contacting Property Owners (Sample Letter)
3. Engineer's Checklist for Water and Sewer Plans
4. Review Procedures for Water and/or Sewer Plans
5. Review Process for Water and Sewer Lines in Virginia Department of Transportation's Right-of-Way
6. Site Plan Requirements
7. Fire Sprinkler Systems Requirements
8. Standard Procedures for the County's Acceptance of Newly Constructed Pump Stations

9. Procedure for Installing Water Meters in Commercial and
Industrial Developments

10. Procedures for Coordinating Proposed Water Line Designs with Existing Septic Tank and Drainfield Systems

11. Overall water/wastewater system plan.

12. Drawing Quality Control Specifications

The engineer should carefully review each of the appendices and follow the instructions and requirements stated therein.

CONTACTING PROPERTY OWNERS

Prior to performing any survey and design work on private property, the engineer/ surveyor shall notify all landowners that may be affected by the design or installation of the proposed utility line. Notification shall be made in the form of a letter to be sent to the property owner a minimum of ten (10) days before commencing work. Copies of such letters shall be provided to the County Engineer along with the initial plan submittal. (See sample letter - APP 3-1)

CONSTRUCTION DRAWINGS

Construction drawings shall contain the information necessary, presented in a clear and legible manner, to construct the utility. Drawing quality shall conform to the specifications as reflected in Appendix 12. The engineer shall coordinate the location of all proposed water and/or sanitary sewer lines within all existing and proposed road rights-of-way with regard to existing and proposed roads and drainage structures. In addition, coordination shall be made with other appropriate utility companies and agencies with regard to their existing easements, rights-of-way and facilities. Where the possibility of conflicts with existing utilities exist, it shall be the Engineer's responsibility to secure accurate information on the horizontal and vertical location of such utilities through subsurface exploration.

Construction drawing requirements are summarized in Appendix 3, Engineer's Checklist for Water and Sewer Plans. The engineer must submit a copy of the checklist with a certification that the plans reflect all applicable items on the checklist. The plans will be reviewed and a review letter will be sent to the engineer with a copy to the developer. When the revisions are made, the engineer must resubmit the plans for final review. A letter of approval will be sent when all the County criteria are met. Vertical datum for surveys shall be Mean Sea Level (USC & GS Datum). Horizontal control shall be based on Virginia State Plane Coordinate Grid, South Zone, North
American Datum of 1983 (NAD 83) by a minimum of two coordinate points. Traverse closure shall be at least 1:5000.

SANITARY SEWER LOCATION

All sanitary sewers located as described in the General Section and in existing or proposed streets shall be constructed along the center of the street or center of the travel lane except when this space has been previously used by another utility or when the width of the street justifies two lines. Exceptions to this specified location will be allowed only when it has been definitely shown that it is not practicable to adhere to the standard location. All sanitary sewers shall be laid on a straight line between manholes. Sewer lines will not be allowed to be located in rear or side yards of lots in a subdivision.

In a parallel installation sanitary sewer lines or manholes shall be at least 10 feet horizontally from any water main whenever possible. The distance shall be measured edge to edge between the affective structures.

When local conditions prevent a horizontal separation of 10 feet, a sanitary sewer may be closer to a water line provided that:

1. The bottom of the water main is at least 18 inches above the top of the sewer.

2. Where the vertical separation cannot be obtained, the sewer shall be constructed of ductile iron, (Class 52) and shall be pressure tested to assure watertightness prior to backfilling.

3. The sanitary sewer manhole shall be of watertight construction and be tested in place by vacuum testing.

In a crossing installation, sanitary sewers crossing water mains shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer. When conditions prevent a vertical separation of 18 inches, the following shall be used:

1. Sewers passing over or under water mains shall be in accordance with Item 2 above.

2. Water mains passing under sanitary sewers shall, in addition, be protected by providing:

   A. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main.
B. Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking of the water mains.

C. A section of water pipe centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer. Where the sanitary sewer is installed parallel to a storm drainage structure, there shall be at least 10 feet horizontally, measured center to center, between them.

Design of sanitary sewer lines and laterals as it relates to sidewalks must be designed to accommodate at least a 10 foot horizontal separation between the County’s public sewer mains. If sidewalks are designed within the public road right-of-way, the end of the sewer lateral must be designed 3 feet behind the house side of the sidewalk or to the right-of-way line, whichever is greater. If sidewalks are designed outside of the public right-of-way and are less than 5 feet from the right-of-way line, the end of the sewer lateral must be designed 3 feet behind the house side of the sidewalk. If the sidewalks are designed outside of the public right-of-way and are more than 5 feet from the right-of-way line, the sewer services must be designed within 1 foot outside of the right-of-way line.

Carrier pipe within bores for sanitary sewer installation shall be Ductile Iron (Class 52) and is to be used from manhole to manhole. C-900 PVC DR-18 pipe (Class 150) may be used as an option, provided there are no proposed or future house laterals connected directly into this pipe.

All sanitary sewer line crossings of railroads and, where required, roadways, and other major structures shall be encased in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 - Pipelines (latest revisions). The engineer shall be responsible for the preparation of the necessary application, at least 180 days in advance of construction or advertisement for bid, for submission by the County to the railroad or in a timely fashion as determined by the Department and/or the Engineer. All applicable railroad fees will be paid by the developer.

Ductile iron pipe (Class 52) shall be used when crossing storm sewer and other rigid underground conduits when the vertical separation is 18" or less.
The tops of all sewers entering or crossing streams shall be a sufficient depth below the natural bottom of the streambed to protect the sewer line. In general, one foot of suitable cover shall be provided where the stream is located in rock and three feet of suitable cover in other material. Less cover will be considered if the proposed sewer crossing is encased in concrete and/or ductile iron pipe is used and will not interfere with future improvements to the stream channel.

All sewer pipe within a 100 year backwater where cover is less than 3.0 feet shall be of non-float pipe. Other anti-flotation methods or devices will be considered on an individual basis.

Clay dams shall be utilized where the possibility exists that ground or surface water will follow the sewer trench, causing damage or undermining of pipe bedding.

In paved channels, the top of the sewer lines shall be placed at least 18" below the bottom of the channel pavement.

Sanitary sewers constructed in fill shall be of ductile iron pipe (Class 52) with manholes founded on original ground unless a licensed geotechnical engineer can furnish a certification that the fill has been sufficiently compacted so that settlement of the sewer or manhole will not occur. Such certification shall apply to that area directly above as well as below the pipe. Sanitary sewers shall remain fully operational during the 100 year flood. Sewers and their appurtenances located along streams shall be protected against the normal range of high and low water conditions, including the 100 year flood. Sewers located along streams shall be located outside of the streambed and sufficiently removed there from to provide for future possible channel widening.

Sewers entering or crossing streams, estuaries, lakes, or reservoirs shall be constructed of watertight pipe. The pipe and joints shall be tested in place and shall exhibit zero infiltration. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that not other practical alternative exists. Such sewers on piers shall be constructed in accordance with the requirements for sewers entering or crossing under streams. Construction methods and materials of construction shall be such that sewers will remain watertight and free from change in alignment or grade due to anticipated hydraulic and physical loads, erosion, and impact. In cases where sanitary sewers are to be constructed on steep grades and velocities greater than 15 feet per second are indicated, solid wall PVC pipe or other abrasion resistant material shall be used.
In addition, sewers laid on a slope of 15 percent or greater shall be anchored securely with concrete anchors or other approved means. Suggested minimum anchorage is as follows but should be determined by the engineer:

1. Not over 36 feet center to center on grades 15 percent to 20 percent.

2. Not allowed on grades above 20 percent.

**DEPTH OF SANITARY SEWER LINES**

All sewer lines within existing or proposed streets or areas subject to traffic shall be so constructed as to provide a minimum cover of 6' over the pipe. Greater depths shall be required to serve low properties, where street grades may be lowered in the future, where there is a possibility of further extension of the sewer line, or where clearance must be provided for other utilities. Clearance shall be provided for enlargement of undersized drainage structures. Maximum cover for sewer lines will be 12 feet. Minimum cover for sewer lines in easements shall be 3.5 feet.

**SANITARY SEWER MANHOLES:**

Manholes shall be constructed in accordance with Prince George County standards and details. Manholes shall be located at the end of each line, at all changes in pipe size, alignment, grade and at sewer junctions. Maximum spacing between manholes on straight runs shall be 400 feet for sewers 15 inches or less and 500 feet for sewers 18 inches and larger. Manholes subject to flooding shall be easily accessible and have watertight manhole covers. All manhole rims shall be 6 inches above the 100 year flood elevation.

Drop manholes shall be used when the spring line elevation of the incoming sewer line exceeds the spring line elevation of the outgoing sewer line by 2' or more. When the spring line elevation of the incoming sewer line is less than 2 feet above the spring line elevation of the outgoing sewer line a smooth transition between inlet and outlet must be provided. Unvented sections of sewer shall not exceed 1,000 feet in length.

Sampling manholes shall be provided for all Significant Industrial Users (SIU) and any facilities discharging over 25,000 gal/day of non domestic wastewater, which includes industrial facilities, food processing, metal processing, hospitals, animal hospitals, photographic finishers, printing shops, etc. Physical design of the
sampling point must be appropriate for the type of wastewater to be sampled. For further information, contact the Industrial Waste Pretreatment Section.

**SERVICE CONNECTIONS**

Service connections shall be provided in accordance with existing County ordinances, specifications and details. Plugged service connections are to be provided when required by the County Engineer for all lots and parcels within the new development. A minimum size of 6" diameter pipe is required for sewer lateral connections.

Service connections are to be marked with an “S” stamped in the wet concrete of the curb.

**STRUCTURAL DESIGN**

Structural requirements must be considered in the design of all sanitary sewers and appurtenances. This is a matter of detail design and is not subject to simple generalization. The following criteria should be considered by the design engineer:

1. **Special Structures** - Whenever possible sanitary sewer structures shall be built as shown in the standard details. Structures other than those shown in the standard details shall be considered special structures and shall be designed and detailed by the design engineer.

2. **Pipe Foundation** - In all cases the proper strength sewer pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.
HYDRAULIC DESIGN FOR SANITARY SEWERS

The quantity of sewage for design purpose shall be determined by the future requirements of the total drainage area tributary to the section of sewer under consideration. Average quantities of sewage, including allowable infiltration, shall be computed as follows:

<table>
<thead>
<tr>
<th>Gallons per day per acre</th>
<th>Equivalent Persons/Acre</th>
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<tbody>
<tr>
<td><strong>Residential</strong></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Agricultural/Undeveloped</td>
<td>1,000</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Residential Agricultural</td>
<td>1,000</td>
</tr>
<tr>
<td>High</td>
<td></td>
</tr>
<tr>
<td>R-1, R-2, R-3</td>
<td>2,500</td>
</tr>
<tr>
<td><strong>Commercial</strong></td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>2,000</td>
</tr>
<tr>
<td>Office</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Industrial</strong></td>
<td></td>
</tr>
<tr>
<td>M-1 Light</td>
<td>2,000</td>
</tr>
<tr>
<td>M-2, M-3 Medium, Heavy</td>
<td>3,500</td>
</tr>
</tbody>
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Where site specific determinations can be made, sewage flows may be determined by using the design information in the Commonwealth of Virginia Sewerage Regulations. The engineer shall insure that the following design criteria are adhered to:

1. Sewers shall have a continuous slope, straight alignment and uniform pipe material between manholes.

2. At all junctions where a smaller diameter sewer discharges into a larger one, and at all locations where the line increases in size, the invert of the larger sewer shall be set so that the energy gradients of the sewers at the junction are at the same level. Generally, this condition will be met by placing the pipes at crown's level where possible, however, as a minimum, placing the 0.8 depth of flow in each sewer at the same elevation.
3. 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, when flowing full, of not less than 2.25 feet per second. Computations of velocity of flow shall be based on a value of "n" = 0.013 as used in the Kutter or Manning formula for velocity of flow.

4. In cases where the calculated depth of flow is less than pipe flowing full the velocity at actual depth of flow should be computed. For sewage flow depth less than 1/4 full, allowance should be made for increased value of "n". In no case should velocities of less than 1.3 feet per second be permitted. Increased velocities shall be accomplished by steeper grades.

5. The following are minimum slopes in feet per hundred feet to be provided for pipes flowing 1/4 of full depth to full depth:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>15&quot;</th>
<th>18&quot;</th>
<th>21&quot;</th>
<th>24&quot;</th>
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<tr>
<td>Slope %</td>
<td>.40</td>
<td>.32</td>
<td>.24</td>
<td>.20</td>
<td>.16</td>
<td>.12</td>
<td>.10</td>
</tr>
</tbody>
</table>

A minimum slope of 0.520 shall be maintained for terminal 8" lines not likely to be extended. Minimum pipe size between manholes shall be 8".

6. In general, the pipe diameter should be continually increasing with increase in tributary flow. Where steep ground slopes make possible the use of a reduced pipe size and substantial economy of construction costs is thereby indicated, the pipe size may be reduced but due hydraulic allowances shall be made to provide for head loss at entry, increased velocity and effect of velocity retardation at the lower end where the flow will be on flatter slopes. In no case, should pipe sizes be thus reduced more than one nominal size in diameter.

Hydraulic computations shall be submitted to the County Engineer for approval. Engineer shall submit with all sewer plans the information and calculations on sewer flow demands for the project. Upon receiving a written request from the developer and/or his agent and the information furnished by the developer's engineer, the Department will then provide the available sewer capacity. After evaluating this information on available capacities, the engineer shall then furnish his calculations supporting that these demands can be met and that the sizing of the proposed sewer mains are adequate.
SEWAGE PUMP STATIONS AND FORCE MAINS

Sewage pump stations will be used when it has been determined to be the only practical way to provide sanitary service based upon a finding that:

1. It is economically impractical to extend the gravity sewer; and

2. The gravity sewer would be in a location that would be difficult to maintain and would be susceptible to damage and future inflow and infiltration problems; and

3. Individual grinder pumping stations shall be owned and maintained by the business or residential dwelling that is served by the grinder pumping station.

The design of the sewage pumping facility shall be discussed with staff and the required design criteria determined. At a minimum the following data shall be provided:

1. Structural design and calculations, including reinforcing drawings where applicable, of the facility.

2. Hydraulic design for the equipment selected, including scaled drawings.

3. Electrical and mechanical drawings and specifications for the equipment selected.

4. Job Specifications to include but not limited to Appendix 8, "Standard Procedures for the County's Acceptance of Newly Constructed Pumping Stations".

Sanitary sewage force mains shall be ductile iron (Class 52) or approved equal. A higher class if the design parameters require a thicker pipe. For 6" and smaller, PVC C-900 or other approved water type pipe may be used, unless they are located outside of the street in a subdivision. Force mains to be designed with a minimum flow velocity of 2.0 feet per second, a maximum flow velocity of 8.0 feet per second; and a Hazen-Williams "C" value of 120. Minimum size shall be 2 inches in diameter. A constant grade shall be used where feasible. Minimum ground cover shall be same as required for water lines or deeper where necessary to accommodate water services and/or future water lines, etc. Valves and air releases will be provided at appropriate locations. Manholes receiving the discharge from force mains shall be designed in accordance with the County's standard details. In addition, special acid resistant manholes and sewer pipe
shall be provided downstream of the discharge point as determined by
the engineer (hydrogen sulfide calculations are required). On
existing systems, manholes shall receive an application of a
corrosion resistant product meeting the following specifications:
amine cured epoxy, VOC Content 0%, Compressive Strength 18,000 psi
minimum, Tensile Strength 7,500 psi minimum, Flexural Modulus 600,000
psi minimum, Adhesion to Concrete, mode of failure (ASTM D4541):
Substrate (concrete) failure, chemical resistance for all types of
service for: municipal sanitary sewer environment, sulfuric acid,
30%, Sodium hydroxide, 5%, minimum wet film thickness of 125 mils.
As an alternative manholes may be lined with fiberglass as a
corrosion resistant liner. Liner shall be as shown in the standard
details.

WATER PUMP STATIONS

Water pump stations shall be considered a special project and
specific project standards and plans will be prepared by the Engineer
and submitted to the County for review and approval. The project
standards shall include but not limited to contents as set forth in
Appendix 8.

WATER LINE LOCATION

Generally, water lines to be installed in proposed subdivision and
local streets shall be located 3 feet behind the ditch line where
there is no curb and gutter and in a 10 foot easement beginning at
the edge of right of way where there is curb and gutter. However,
within proposed curb and gutter streets, an alternate design should
be considered if right-of-way is available and a design acceptable to
Virginia Department of Transportation is feasible. Water lines to be
installed along existing roads will generally be installed in
easements where the road is likely to be widened in the future and in
the right of way where the road will not be widened in the future.

The soil in the general area in which the water line is to be located
must be sampled to the satisfaction of the County Engineer to show
that the existing soil will not be corrosive to the pipe
appurtenances proposed by the development. Where excessively low pH
soil is present it will be replaced with select backfill around all
appurtenances which will be subject to corrosion. This will include
water lines, meter yokes, and tapping saddles.

Design of water mains and water meter boxes as it relates to
sidewalks must be designed to accommodate at least a 4 foot
horizontal separation between the County’s public water mains. If
sidewalks are designed within the public road right-of-way, the
street side of all water meter boxes must be designed 3 feet behind the house side of the sidewalk or to the right-of-way line, whichever is greater. If sidewalks are designed outside of the public right-of-way and are less than 5 feet from the right-of-way line, the street side of all water meter boxes must be designed 3 feet behind the house side of the sidewalk. If the sidewalks are designed outside of the public right-of-way and are more than 5 feet from the right-of-way line, the water services must be designed within 1 foot outside of the right-of-way line. Where water lines are to be installed in roads expected to be widened in the future, they shall be located in easements unless the future road cross section is known and location of water line is designed to avoid future relocation.

Water lines shall be designed so that changes in alignment are made with bends using both approved thrust blocks and approved mechanical joint restraint systems applicable. See Part V for additional specifications and requirements. Where it is necessary to change alignment by deflecting successive lengths of pipe, the joint deflection shall be limited to the allowable deflection according to standard details) in Part II of this manual, which represents one-half the maximum allowable by most manufacturers. For PVC pipe, the deflection is made by curving the pipe, since there is no deflection capability in the joints. The bending radius shall be limited as per standard detail(s) in Part II of this manual. Bending and joint deflection limits apply to vertical as well as horizontal curves.

Engineer is to verify existing field conditions to develop soil classifications for calculated bearing pressures. The engineer must design the system to ensure that the maximum deflection can be accomplished, however, fittings may be necessary and the engineer shall make this determination during design.

In subdivisions, water mains will be permitted in easements only when there is no other feasible alternative and prior approval is obtained from the County Engineer. Easements shall be wide enough to provide sufficient space for both installation and maintenance. The engineer shall consider the location of existing and proposed sanitary sewer and storm drainage systems and all other underground structures and utilities that could affect the location and type of materials for the pipeline. The selected location should avoid conflicts and facilitate future maintenance. Where the possibility of conflicts with existing utilities and/or other structures exist, it shall be the Engineer's responsibility to secure accurate information on the exact horizontal and vertical location of such utilities through subsurface exploration and reflect this exact information on the plans.
The engineer shall consider the requirement for separation of water and sanitary sewer facilities and shall use the same requirements stated in the SANITARY SEWER LOCATION section of these standards.

Water main crossings of railroads and roadways when required, shall be encased in a casing pipe. Design of railroad crossings shall comply with the requirements of American Railway Engineering Association Specifications, Part 5 - Pipelines (latest revisions). The engineer shall be responsible for the preparation of the necessary application, at least 180 days in advance of construction or advertisement for bid, for submission by the County to the railroad or in a timely fashion as determined by the Department and/or Engineer. All applicable railroad fees will be paid for by the Developer.

Water mains entering or crossing streams, shall be Ductile Iron Pipe (minimum Class 52). The tops of these mains shall be a sufficient depth below the natural bottom of the streambed to protect the pipe. In general, 3.5 feet of suitable cover is required. The pipe and joints shall be designed, constructed, and protected against anticipated hydraulic and physical, longitudinal, vertical, horizontal loads, erosion and impact. Reasons for requesting less cover shall be given in writing to the County prior to plan submittal. Water mains constructed in fill shall be Ductile Iron Pipe (Class 52) with restrained joints unless a licensed geotechnical engineer can furnish a certification that the fill has been compacted so that settlement of the main will not occur. Such certification shall apply to the area directly above as well as below the pipe.

Water mains constructed on piers will be permitted only when it can be demonstrated that no other practical alternative exists. The engineer shall submit a design for the piers, pier foundation and pipe that will demonstrate the structural integrity of the proposed system. Above ground pipe shall be adequately supported, protected from damage from freezing, accessible for repair or replacement and above the 100 year flood elevation.

Subaqueous water main installations will be permitted only when it can be demonstrated that no other practical alternative exists. The pipe shall be of special construction having flexible watertight joints. Special attention shall be directed to foundation conditions for the pipe and to thrust resistance. For both the above ground and subaqueous crossings the design shall provide:

Valves at both ends of the crossing so that the section can be isolated for tests and repairs. The valves shall be easily
accessible and not subject to flooding. There will also be located a flushing connection on each side of the crossing.

**DEPTH OF WATER LINES**

Standard Minimum cover will be 42 inches. All water lines shall be constructed to a depth that will provide protection against freezing and thawing, insure adequate cover over valves and other appurtenances and provide service. New installation of water lines adjacent to road ways shall have a minimum of 42 inches of cover from existing/proposed edge of pavement. Greater depths shall be required where street grades will possibly be lowered in the future. Clearance shall be provided for enlargement of undersized drainage structures. Any development which takes place over an existing water main shall be required to maintain the water main at a maximum depth of 42” below finished grade. Where the depth exceeds 42” the water main shall be raised to the standard minimum depth of 42”.

**WATER LINE APPURTENANCES**

Valve manholes, air relief valves, fire hydrants, service lines and other appurtenances shall be constructed in accordance with Prince George County standards and details.

Hydrants in residential areas should be located at corners or in mid-block, or low points and high points as approved by the County Engineer. Maximum hydrant spacing shall be 750 feet and no more than 350 feet to any house. When cul-de-sacs are longer than 400', the last fire hydrant shall be designed at the end of the cul-de-sac, where practical. The developer is to make the necessary improvements to satisfy fire flow demands of 500 gallons per minute as a minimum or as required by the fire marshall. Valves shall be located at not over 2,000 foot intervals and at all changes in pipe diameter. Valves shall also be provided at all pipe line intersections so as to provide shut off for repairs of limited sections without interruption of service to large areas and to facilitate testing and flushing.

A minimum of two valves shall be provided at tees, three valves at crosses and shall-be located on the tee or cross. All Valves are to be restrained to fittings by approved method. When connecting to an existing water main, installing a tee as opposed to a tapping sleeve and valve is especially desirable when there are long distances between main line valves (greater than 1,000 feet) or even if the distance is less than 1,000 feet where it would be an advantage to add a main line valve for better system control. Therefore, it is important that each project be carefully evaluated by the developer's engineer with the County Engineer’s assistance to
determine if a main line valve is needed and/or cutting in a tee is practical, taking into consideration how many residences, businesses, etc. may be without water.

Water mains shall be provided with air release valves and blowoffs at suitable locations to allow testing, chlorination and draining of the line. Fire hydrants, blowoffs or flushing hydrants shall be installed at dead-end mains.

STRUCTURAL DESIGN

Structural requirements must be considered in the design of all water mains and appurtenances. This is a matter of detail design and is not subject to simple generalization. The following criteria should be considered by the design engineer:

1. Special Structures - Structures shall be built as shown in the standard details, however, structures other than those shown in the standard details shall be considered special structures and shall be designed and detailed by the design engineer and submitted for review and approval to the County Engineer prior to plan submittal or brought to the County Engineer’s attention at the time of plan submittal.

2. Pipe Foundation - In all cases the proper strength water pipe shall be specified for the proposed depth, width of trench and bedding condition. Soil condition should be considered with samples being obtained where necessary to verify pipe selection and foundation design.

3. Thrust protection as shown on plans in the standard details shall consist of concrete thrust blocks against undisturbed earth. Approved mechanical joint restraint systems is also required for ductile iron and PVC C-900 pipe. Hydrant valves shall be installed with hydrant tees and hydrant protected from thrust by, approved mechanical joint restraints, and concrete thrust blocks.

4. Where valves are placed for future water line extensions, valves are to be restrained to the fitting and a minimum 20' length of pipe shall be installed past the valve except where calculations or local conditions indicate more pipe is required to provide adequate restraint. Dead-end lines shall be provided with a flushing hydrant or fire hydrant whichever is practical. Approved mechanical joint restraint systems are to be used as required to provide adequate retention of the pipe and valve when thrust blocks cannot be used.
HYDRAULIC DESIGN FOR WATER LINES

Water distribution systems shall be designed to provide adequate flow and pressure for both domestic supply and fire flow based on sound hydraulic analysis. Design shall be based on a maximum flow velocity at peak flows (excluding fire flow) of 5 feet per second and a Hazen-Williams "C" Value of 120. The water distribution system and any extensions thereto shall be designed to supply the demands of all customers while maintaining 20 psi at maximum day plus fire flow or peak hour domestic, whichever is greater.

Design of the water system shall generally be such as to maintain 45 psi at maximum day demand. When 45 psi cannot be maintained, the engineer shall be responsible for coordinating with the County Engineer to investigate alternatives in order to provide 45 psi. Designs providing less than 45 psi will be evaluated on an individual basis.

Also, the design of the water line should be such that a velocity of 2.5 f.p.s. can be maintained at blowoff devices (flushing hydrants) and at hydrants for proper flushing.

The following criteria shall be used in estimating average daily demands:

<table>
<thead>
<tr>
<th>Gallons per day per acre</th>
<th>Equivalent Persons/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Agricultural/Undeveloped</td>
<td>500</td>
</tr>
<tr>
<td>Medium</td>
<td>1,000</td>
</tr>
<tr>
<td>High</td>
<td>2,500</td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>2,000</td>
</tr>
<tr>
<td>Office</td>
<td>1,500</td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>M-1 Light</td>
<td>2,000</td>
</tr>
<tr>
<td>M-2, M-3 Medium, Heavy</td>
<td>3,500</td>
</tr>
</tbody>
</table>
Where site specific determinations can be made, sewage flows may be determined by using the design information in the Commonwealth of Virginia Department of Health Waterworks Regulations. The engineer shall insure that the following design criteria are adhered to:

To determine maximum daily demands and peak hourly demands the following multipliers shall be used:

- **Maximum Daily Demand** = 1.8 times Average Daily Demand
- **Peak Hourly Demand** = 2.36 times Average Daily Demand

Fire flow requirements for non-residential areas shall be in accordance with the National Fire Protection Association Handbook (latest revisions) and the applicable sections of BOCA, and shall be coordinated with the Fire Marshall. That portion of the Fire Sprinkler Systems to be maintained by the Utilities Department shall be designed in accordance with the requirements as set forth in Appendix 7.

Minimum pipe size shall be 8", except that terminal water lines will be six (6) inches in diameter unless a larger diameter line is needed to meet the peak domestic demand and/or fire flow requirements. Dead-ends shall be eliminated by looping when feasible.

Services and meters shall be sized and locations designed in accordance with the Standard Details. Minimum service size shall be 3/4" pipe with 5/8" meter. Services shall be designed and reflected on the plans for both residential and commercial developments. A 1" County service line will be installed when the residential water service from the main to the meter is 60’ or greater; or the peak hour pressure at the main is 45 psi or less.

When the peak hour pressure at the probable house site is less than 45 psi and depending on such variables as: house location, number of fixtures, number of finished floors, etc., a note must be added to the plans: “The builder may consider installing a larger plumbing line from the meter to the house and/or installing a booster pump to obtain a desired pressure”.

Pressure reducing valves shall be installed on the customer side of the meter by builder or property owner, to be operated and maintained by the customer, when the service connection system pressure will be greater than 80 psi.

Blowoffs shall be provided at low points on mains 16-inches and larger. For 12-inch mains, blowoffs shall be provided at creek crossings. Engineer should use the following guidelines, in regard to
location of flush points, air release valves, blowoffs, etc. during
the design of public water systems:

1. Access to flush points by contractors and especially to the
Utilities Department is very important. Flush points serve no
purpose if access to the flush points can not be obtained.

2. Engineer needs to make sure that appropriate notes i.e., flow
(gpm) expected to be dispersed at points of flushing; etc. are
put on the plans.

3. Emphasize (through appropriate notes) to contractor to maintain
good erosion control and flushing procedures. Erosion control
and environmental impact consideration must be taken into
account whenever a flush point is chosen, therefore, certain
controls may be needed at the time water line is installed.

4. Engineer needs to advise contractor to coordinate his work
through the inspectors and the inspector coordinate with the
County Engineer regarding when to flush (time of day and season,
etc.).

5. On most 16" or larger water lines, attempt to locate the flush
points as near to the roadways or at a stream (keeping in mind
adverse effects to downstream ponds, etc.).

6. Contractor is to perform flushing prior to acceptance of the new
water line.

7. Minimize the number of blowoffs, and strategically place them so
that proper flushing can be performed.

8. Minimizing number of air release valves, taking into
consideration the depth that the water line is to be placed.

9. Standardize the design of a blowoff needed taking into account
the size of blowoff, height of blowoff, positioning of blowoff,
etc.

10. Look at easement considerations that would be needed during
flushing process. Property owners and the County Engineer shall be
solicited for advice during easement acquisition. Two supply points
shall be provided for subdivisions containing more than 49 lots.
All exposed water mains shall be adequately insulated as determined
by the engineer.
APPENDIX 1

DEVELOPERS CHECKLIST FOR UTILITY PROJECTS

The following steps must be completed before the County will permit the Utilities Contractor to start construction:

_____ 1 - The County Engineer has reviewed the utilities plan. (Initial review of the plan will normally be completed within 3 weeks of receipt provided the engineer has submitted all required information needed to perform a proper review.

_____ 2 - The project plan has been approved by the appropriate agencies (i.e., County - erosion control, sewer, water, roads and drainage; Virginia Department of Transportation - roads and drainage; Virginia Department of Health and Department of Environmental Quality) and written verification has been furnished to the County Engineer, where applicable.

_____ 3 - The developer has submitted a water agreement and wastewater agreement for the extension of each utility. The Board of Supervisors must approve all contracts for extensions of utilities.

_____ 4 - All off-site and on-site easements, not included in a subdivision plat for the project, have been dedicated to the County. The Developer is to provide a check payable to the Clerk of the Circuit Court in the amount of the recordation costs when the executed easements are returned to the County Engineer.

_____ 5 - The Utilities Contractor has obtained the highway permit, if required, and sent a copy of the permit to the County Engineer.

_____ 6 - For the onsite subdivision work, the erosion control measures have been installed and approved by the County Erosion Control Specialist. However, for the offsite utility work in conjunction with a subdivision, the field installation has been inspected by the Utility Inspector as approved by the County Erosion control Specialist. Confirmation of approval should be obtained by the developer as early in the process to avoid any unnecessary delays in starting construction of the utilities.
7 - Prior to the installation of water mains, the Developer's engineer has submitted his certification that:

a. All pavement and shoulder areas within the right-of-way and/or traveled areas of the development are graded to within 6" of subgrade.

b. All ditches and slopes have been graded to final grade to a point 1 foot outside the right-of-way area.

c. Markers for the sewer laterals are visible.
APPENDIX 2

(SAMPLE LETTER)

(ENGINEER'S/SURVEYOR'S LETTERHEAD)

(Date)
(Property Owner's Name)
(Address) Re: County Project # ______________

Dear _____________________,

Our firm has been retained to design a water/sewer line to become a part of Prince George County's overall utility system. In conjunction with this, surveying is the first phase of work that must be completed.

Information obtained by this survey will allow our firm to recommend a location taking into consideration existing trees, shrubs, creeks, etc. Should you have any trees or topographic features you wish preserved, we would appreciate being advised so that we may consider these in our design.

After surveys and design are complete, you will be contacted should it become necessary to obtain easements for construction.

We propose to start survey work on or near your property within ten days to two weeks. Should you have any questions concerning either the survey or utility line, please contact this office at _________ to discuss this matter.

Your cooperation in this matter is greatly appreciated.

Sincerely,

______________________

cc: Prince George County Engineer
APPENDIX 3
UTILITIES DEPARTMENT
ENGINEERS CHECKLIST FOR WATER AND SEWER PLANS

I. Title Page

A. ____ Project Name
B. ____ Engineer's or Class B Surveyor's Seal and Signature
C. ____ Vicinity Sketch (complete in detail)
D. ____ Table of Estimated Quantities (including breakdown of type of pipe).
E. ____ Title Block and revision block
F. ____ Tax Identification Numbers (formerly known as the Tax Map And Parcel Numbers)
G. ____ Magisterial District
H. ____ Name, Address, and Phone Number of Developer/Owner
I. ____ Legend of sanitary sewer and water lines, other utilities And structures existing and proposed ground and pavement profile. Profile information must be shown on profile sheet.
J. ____ Certification statement of the lot numbers, block letters/numbers and road names, etc.

II. General

A. ____ The utility plan includes an overall plan of the water and Sewer layout, including any phasing of the development.
B. ____ A subdivision plat indexed to sheet numbers.
C. ____ Engineer and/or Surveyor has notified all property owners Prior to performing any design and/or surveying work (copy of such notification is attached).

III. Standards

A. ____ Water and Sewer Notes (as a minimum, reference has been made To County Standard specifications and details).
B. ____ Vertical scale is 1" = 5' or 1" = 10'; and horizontal scale is 1" = 50' or as approved by the County. A "bar" scale is shown on each sheet.
C. ____ All water and sewer designs conform to the latest County, State and Federal regulations or standards.
D. ____ Plan and Profile sheets are on 24" x 36" paper.
E. ____ Scale drawings are accurate to within +/- 2% for vertical and horizontal scales.
IV. Plans

A. Utility Plans

1. _____ All water, sewer, road, and drainage structures are shown on one plan sheet, where applicable. May require larger scale to adequately obtain horizontal integrity.

2. All plans include:
   a) _____ Existing water and/or sewer lines are properly labeled with size and with horizontal and vertical distances referenced on the plan.
   b) _____ A bench mark is required on the site plan.
   c) _____ Horizontal and vertical scale shown on each sheet (scale should be same on plan and profile).
   d) _____ All existing easements are shown accurately and proposed utility easements are shown on plans. The existing easements reflect accurate recordation information.
   e) _____ All existing and proposed storm sewer lines, gas, telephone, power, and other utility lines, which cross or run parallel to the sewer or water lines, are shown with exact horizontal and vertical separations given, where applicable. Subsurface exploration has been performed where potential conflicts exist, where applicable.
   f) _____ Adjacent road and drainage projects are shown as required.
   g) _____ Consideration has been given to areas where roads and drainage structures may be lowered in the future.
   h) _____ Road names, state route numbers, and right-of-way widths are shown.
   i) _____ Plan and profile are drawn in the same direction. Stations shall ascend from left to right.
   j) _____ Proposed water and/or sewer lines are shown with reference distances from right of way, boundary, buildings, other utility lines, etc.
   k) _____ All property lines and property markers (stones, rods, pins, pipes, monuments, etc.) are shown.
   l) _____ Location of existing houses, buildings, fences, wells and other structures are shown on plans. In lawn or kept areas, trees and shrubs in the easements are shown (size and type).
   m) _____ All designs conform to the latest County and State erosion control and sedimentation rules, regulations, and ordinances. An erosion control and sedimentation plan must be approved by the County Erosion and Sediment Control Specialist, and included in the final approved set of utility plans.
n) _____ The engineer understands that he/she is responsible for coordinating the utility design and construction work with other engineers where their projects connect or are affected by other projects.

o) _____ Locations of special features (conc. encasement, rip-rap stabilization at creek crossings, clay dams, etc.).

p) _____ Detail drawings of all stream crossings and storm sewer outlets, with elevations of the stream bed and high (100 year flood elevation) and normal water elevations.

q) _____ Proper labeling of subdivision (lot, block, street names, subdivision boundaries, etc.).

r) _____ Locations of special features (conc. encasement, rip-rap stabilization at creek crossings, clay dams, etc.).

s) _____ All fill and cut areas are shown within the area of the existing and proposed sewer and/or water lines.

t) _____ Necessary easement plats onsite and/or offsite have been submitted for processing by the County Engineer.

u) _____ Pavement replacement detail, boring detail, etc. are shown on all plans.

v) _____ Location and dimensions of all water and sewer service connections are shown.

x) _____ Proposed, existing, and original ground elevations are shown.

y) _____ Municipal, subdivision and/or drainage area boundaries are shown.

z) _____ North Arrow is reflected on all plan sheets.

aa) _____ Miss Utility notation is shown.

bb) _____ Engineer understands that any changes made to the road, drainage, water and/or sewer design will require a submittal to the County Engineer for review and approval of the revised water and sewer plans reflecting those changes.

c) _____ All revisions include an explanation either on the plans or by separate transmittal. Such transmittal to include the original comment and the revision or response.

d) _____ Plans have been submitted to State Health Department for review and approval where applicable. A copy of transmittal letter is attached to checklist.

e) _____ If horizontal bore is required, bore location, length of bore, pit location (average 8' x 35') are shown and shown in relation to all existing and/or proposed utilities on plan and profile.

f) _____ Alignment of utility in existing VDOT right of ways is consistent with County guidelines. A copy of a transmittal letter to Virginia Department of Transportation for their review is attached. Engineer Understands that a letter of approval from Virginia Department of Transportation is required prior to final utility plan approval.
gg) ______ Clay dams or other acceptable designs are shown at the appropriate locations to avoid water from creek and/or lake being diverted along pipe bedding.

hh) ______ Utility plans reflect those conditions as approved by the Planning Commission/Board of Supervisors.

ii) ______ Engineer has contacted Virginia Power to obtain exact location of power lines and received as-built information. Utility plans reflect this information accurately and is in accordance with the "Overhead High Voltage Line Safety Act".

3. Sanitary Sewer Plans

a) _____ All sanitary sewer plans are labeled with size, grade, length, direction of flow, and type & class of pipes (with backup calculations on the type & class pipe needed, where applicable).

b) _____ Manholes are labeled with top and invert elevations; coordinates; and locations, size and inverts of drop stacks when a vertical drop exceeds 2 feet.

c) _____ Deflection angles at all manholes or bearings of all lines are shown on the plans.

d) _____ All minimum finished floor elevations and basement elevations are to be shown on plans, where applicable.

e) _____ A sewerage drainage area map with hydraulic analysis is included in plans.

f) _____ The engineer has field verified the inverts of the existing manhole(s). Where invert elevations are different from the as-built plan, the engineer has verified his survey work and notified the Utilities Department of the discrepancy.

g) _____ All manholes are designed to an elevation above the 100 year flood plain elevation as set forth in the design standards, unless otherwise approved by the Utilities Department.

h) _____ Reference all manholes in easements.

i) _____ Ground coverage over sewer pipe meets minimum criteria.

j) _____ Engineer has put a notation that a backwater valve is to be used where the building with a finished floor elevation of the building is below the top elevation of the nearest upgrade manhole from the building connection.

k) _____ The sewer lateral must be identified and a note indicating that they will be installed in accordance with the standard details, including clean out and the appropriate notes are reflected on the plans.

l) _____ A NOTE stating that the contractor must field verify the inverts of all existing manholes, gas lines, other utility lines prior to the start of construction.

m) _____ All "%" slopes are divisible by 4 to the nearest hundredth, where possible.
n) _____ Greater than 0.4% minimum slope has been used whenever possible.
o) _____ Solid lines have been used for proposed sewers, short dashed lines for existing sewer and labeled future sewer or portions covered under other phases of construction.
p) _____ A minimum of ten (10) feet horizontal separation is maintained between sewer lines, sewer laterals and water meters or water blowoff devices (flushing hydrants) and between sewer line and storm drainage structures.
q) _____ All calculations have been checked for accuracy.
r) _____ All pipe between manholes are of like material and class.
s) _____ All temporary and/or permanent silt basins are shown and the sewer lines and manholes have been designed around these structures.
t) _____ All existing sewer laterals are shown on the plans, with station, length and depth, as depicted on the as-built plans.
u) _____ All sewer lines are designed with the entry into the manhole by the proposed sewer lines at an angle of 90° or greater to the downstream line, or if an exception has been granted, the engineer has increased the drop through the manhole to compensate for the reduced angle and has provided a blowup detail for the appropriate invert shaping that achieves the same results as a 90° or greater entry.
v) _____ The crowns of all sewer lines enter the manholes at crown's level or higher as specified in the design standards.
w) _____ Whenever connecting sewer lateral to an existing sewer line, Engineer has put on the plans the proper notation that "the contractor must use a mechanical hole cutter when tapping the existing sewer line and that an approved saddle shall be used" and the appropriate lots affected by this have been identified in the note.
x) _____ Where new manholes are proposed over existing lines, distance from the new manhole to the two existing manholes is shown; inverts of the manhole and each existing manhole are shown; slope of existing line from new manhole to upstream and downstream existing manholes is shown.
y) _____ Where future extensions are necessary, these lines are reflected on the plan.
z) _____ All manholes proposed within areas where vehicles travel are to be located either on center line of road or center of traveling lane.
aa) _____ Sampling manholes are required for new facilities currently regulated by local or federal industrial waste pretreatment laws. Examples of these commercial facilities include restaurants, carwashes, auto repair shops, and Laundromats to name a few. Appropriate measures have been included in
the design to allow for sampling of industrial waste. A sampling manhole shall be provided at the property line to facilitate random 24-hour composite sampling. In those cases where a private manhole on site can be utilized for this function, adequate provisions will be agreed upon to facilitate sampling. Provisions include ingress/egress to the private manhole, ability to sample, and adequate space to set a 24-hour composite sampler. Existing on site manholes, possibly inside buildings, will be approved on a case by case basis.

bb) The following data appears on all lots with minimum finished floor (sewer) designations and for those lots where gravity sanitary sewer service is questionable:

1. The minimum finish floor (sewer) elevation;
2. A note on the plans stating that the 6” sanitary sewer lateral for that lot is to be installed at 1% grade;
3. The invert elevation at the end of the 6” lateral;
4. The “building envelope” (at a minimum) and if possible, the building location (i.e. footprint);
5. A “lot shot” elevation within the “building envelope”/building footprint line; and
6. Contours (labeled with elevations on each) of the lot.

4. Water Plans

a) Plans show all fittings, fire hydrants, and valves including sizes. Each appurtenance is properly labeled.
b) The location of fire hydrants comply with design guidelines.
c) All conflicts with storm sewers and other utility lines are shown with appropriate design changes shown.
d) A minimum of eighteen (18) inches of vertical clearance has been designed and obtained at all crossings of other utilities, or as specified by other utility agencies, or otherwise approved by the Utilities Department.
e) All water lines have a minimum of 3.5' of cover.
f) Fire hydrants and air relief valves are shown on plans and profile.
g) Hydrants or blow-off valves are designed at major low places in the line where possible and air release valves are designed at the high points.
h) Blowoff devices (flushing hydrants) or hydrants are designed at the end of all lines in cul-de-sacs. Location of hydrants comply with guidelines outlined in design standards.
i) All water services are shown in accordance with the design standards.
j) _____ Plans show all connections to the existing subdivision mains, etc.
k) _____ Engineer has designed water system in accordance with available pressures and has provided fire flow and pressure calculations.
l) _____ Line location is shown in a 10' easement when there is curb and gutter or 3' behind the ditch line when there is no curb and gutter.
m) _____ Pipe sizes noted on plans.
n) _____ Ditch lines are shown on the plan and depth of ditch(s) are shown on the profile at the fire hydrant locations and service lines, where necessary.
o) _____ Water line stubs for future extensions are designed to be installed beyond the edge of pavement.
p) _____ Location of water meter boxes are shown outside of non-vehicular traveled areas. Where it is not possible to locate the boxes out of the driveways, and/or vehicular traveled area, a concrete box with traffic worthy lid is required. For all other meter boxes a cast iron box and lid is specified.
q) _____ For water line tie-ins, the engineer has shown the valve to be used for cut off during the tie-in. Where tapping the main line vs. cuttings in a tee is applicable, the engineer has evaluated which method will be used as outlined in the County's Design Standards.
r) _____ Water line profiles are shown.

date: ___________________________________________

Engineering Firm: ___________________________________________

Engineer's Name: ___________________________________________

(Print Name)

___________________________________________

CERTIFICATION
EXHIBIT A

EASEMENT PLAT REQUIREMENTS

1. Current owner(s) names
2. Deed/will book & page numbers
3. Parcel identification number
4. Parcel street address
5. Subdivision name, section, block, lot, and plat book & page numbers
6. Deed/plat book & page numbers on existing easements
7. Adjacent property owners, with subdivision name, section, block, lot and plat book & page numbers (if applicable)
8. Road widths, road names, route numbers
9. Type of easement
10. Metes & bounds of variable width easements and all parcels to be conveyed based on the Virginia State plane coordinate system, south zone nad83 (centerline data is acceptable for standard width easements)
11. Curve data and chord bearing & distance
12. 2 coordinate points on easements or parcels to be conveyed
13. Tie to property corners and an existing physical intersection
14. Project number
15. Site plan/case number
16. North arrow (nad83 noted)
17. Magisterial district, county, state
18. Signed surveyor's/engineer's seal
19. Date/revised dates
20. Standard engineer's scale & bar graph (1" = 10', 20', 30', 40', 50', 60', 100', 200')
21. Size(8 1/2" x 11", 8 1/2" x 14" or 16" x 24")
22. Title
APPENDIX 4

REVIEW PROCEDURE FOR WATER AND/OR SEWER PLANS
(Developer Projects)

Prior to construction of public water and/or sewer facilities and issuance of any building permits, water and/or sewer plans must be submitted to and approved by the County Engineer.

A. It is required for water and sewer projects, that the engineer arrange a meeting with the County Engineer, Prince George Administration Building, Prince George, Virginia 23875, (804) 722-8687, to discuss the approach to be taken to supply water and sewer service. All water and sewer systems must be sized properly and the location designed to provide sewer and water availability to the entire service area. An overall water and sewer plan shall be submitted for development.

B. The water and sewer plans must be designed by a Professional Engineer in Civil Engineering or Professional Surveyor with a Class B license who is registered by the State of Virginia. The plans must conform to the County's latest overall water and sewer master plan and the Engineers Checklist for Water and Sewer Plans (see Appendix 3).

C. Prior to approving the water and/or sewer plans, the Erosion and Sediment Control Specialist must approve the erosion control plan for the water and/or sanitary sewer installations.

D. The engineer shall coordinate the location of all proposed water and/or sewer lines within all existing and proposed road rights-of-way with regard to existing and proposed roads and drainage structures. In addition, coordination shall be made with other appropriate utility companies and agencies, i.e., Virginia Power, C&P, gas companies, railroad rights-of-way, VDOT, State Health Department, etc. with regard to their existing easements, rights-of-way, and facilities.

E. The engineer must submit a copy of the checklist with his/her certification that the plans reflect all applicable items on the checklist. The plans will be reviewed and a review letter will be sent to the engineer with a copy to the developer. When the revisions are made, the engineer must resubmit the plans for final review. A letter of approval will be sent when all the County criteria are met. Six sets of additional plans shall be sent once all the approvals are granted for construction purposes.
F. Prior to the beginning of construction, all water and/or sewer easements outside the boundaries of the new subdivision and/or within a complex not recorded by a subdivision plat, must be dedicated to the County. The developer is to provide a check payable to the Clerk of the Circuit Court in the amount of the recordation costs when the executed easements are returned to the County Engineer. When a VDOT permit is required to install the water and/or sewer line, the engineer needs to follow the "Review Process for Water and Sewer Lines in VDOT's Right-of-Way" (see Appendix 5). A letter from VDOT accepting the location of the water and sewer lines in the right-of-way and design of the pavement replacement is required prior to approval of the water and sewer plans. The developer is responsible to have a copy of the highway permit sent to the County Engineer prior to the start of construction within the VDOT highway.

G. The developer must enter into a Contract with Prince George County. The Board of Supervisors must approve the contracts prior to the contractor beginning construction. The developer needs to allow sufficient time for the contracts to be approved by the Board of Supervisors.

H. Before the utilities contractor can start work, a road grade certification must be furnished by the engineer. It shall include his verification that the entire proposed road rights-of-way where water lines are proposed have been graded as required in Appendix 1. Also, prior to the release of any on-site work, the County Erosion and Sediment Control Specialist must approve the erosion control devices for the subdivision.

I. Upon meeting all the above criteria, plans will be approved. The contractor must give the inspector at least 48 hours notice before construction may begin. At such time, a pre-construction meeting may be required and if so, shall be arranged by the contractor and the County Engineer.
APPENDIX 5

REVIEW PROCESS FOR WATER AND SEWER LINES IN VIRGINIA DEPARTMENT OF TRANSPORTATION'S RIGHT-OF-WAY

1. Horizontal location of proposed water and/or sewer lines within the existing VDOT right-of-way will be reviewed and approved by VDOT. In addition, the pavement replacement detail must be approved by VDOT.

2. The Engineer and/or his agent will be required, with VDOT's assistance, to determine the type of existing pavement. In order to determine the type of existing pavement, VDOT shall require corings to be taken every 1,000 feet +/-.

3. The Engineer will be required to submit to the VDOT the applicable sheets of the proposed water and/or sewer plans which reflect the proposed lines in relation to the existing right-of-way plus show and identify the type of pavement that exists along with any sample pavement corings.

   a. Inspection and testing of all fill embankments, storm sewer and utility trench backfill shall be performed in accordance with all applicable sections of VDOT’s Road and Bridge Specifications (current edition).

   b. A licensed geotechnical engineer (or certified technician under the direction of a licensed geotechnical engineer) shall observe the placement of all fill embankments, and storm sewer and utility trench backfill.

   c. Inspection services shall be provided utilizing one of the following options:

      o The permittee may retain services of licensed geotechnical engineer (or technician under the direction of a geotechnical engineer) to perform required inspection and testing, or,
The permittee may request that VDOT provide inspection services through the establishment of an accounts receivable with the contractor responsible for providing all required material testing.

d. All testing reports and engineer's certification shall be submitted to VDOT for review and approval prior to completion of the VDOT Land Use Permit.

5. Prior to the water and/or sewer plans being approved by the County Engineer, VDOT will send a written response (with a copy being sent to the County Engineer) to the Engineer with their comments and/or approval of the water and/or sewer line(s) location and pavement replacement detail.

6. Prior to the release of water and sewer work, County's Erosion and Sediment Control Specialist shall approve the erosion control measures proposed within State Right of Way.
APPENDIX 6

SITE PLAN REQUIREMENTS
FOR WATER AND/OR SEWER MAIN LINE EXTENSIONS

1. The location of the existing sewer main and water lines must be shown on the site plan.

2. The exact location of the existing sewer (lateral) connection and/or water service and box must be shown, making reference to the length, depth and station location of the sewer lateral and the relationship of the water and sewer services and appurtenances with the existing, proposed and future buildings, etc. Also, show size of existing water meter where applicable.

3. Existing and proposed water and sewer line easements must be shown on the site plan and Engineer needs to make sure there are no buildings or other permanent structures encroaching onto easements. Also, if there are any other type of structures and/or activities proposed i.e., storm sewers, retaining walls, grading, curb and gutter, concrete paving, obstacles (garbage pads, light posts, and other utility lines) etc., the Engineer shall make site design changes and take appropriate measures to protect the existing water and/or sewer line and its' appurtenances.

4. Existing plumbing from building to connection and/or water meter must be shown. Proposed plumbing from building to sewer connection and/or new water meter must also be shown.

5. When the site plan reflects the installation of a new sewer connection, the appropriate notes outlining the Utilities Department's requirements for installing a connection must be shown on the plan. The point where the utilities contractor stops his work and the plumber begins needs to be clearly denoted on the plan.

6. Site plan needs to clearly reflect the proposed "Fill" and "Cut" areas. Engineer is to analyze how it will affect the existing and/or proposed water and/or sewers and submit his evaluation and recommendation with the site plan in writing for review and approval by the County Engineer.

7. Adjustment of water and sewer appurtenances will require notes, i.e., notifying the Inspector to inspect any adjustments, that an acceptable licensed Utilities Contractor perform all utility work, etc.
8. Engineer must be aware of where proposed and future water and/or sewer extensions are needed and show this information on the plans and reflect sufficient (minimum of 16' permanent and 10' construction for water lines and/or 16' permanent and 20' construction for sewer lines) easement width for future water and/or sewer extensions. A separate easement plat needs to be submitted to the County Engineer and an agreement will be prepared by the County Attorney for developer to obtain necessary signatures. All onsite and offsite water and/or sewer easement(s) for future improvements where septic tanks and/or wells are being used, and offsite utility easements where proposed extensions are needed to serve the site must be recorded prior to the release of the building permit. Normally, the site plan will not be approved until the offsite easement is dedicated.

9. Where additional Road R/W and/or widening is proposed, the site plan needs to reflect the extension of the existing sewer (lateral) connection and/or existing water service and meter box just beyond new R/W line.

10. For all new building additions with proposed water and sewer facilities, the engineer needs to submit calculations for additional water usage for the addition as well as the existing building to determine if the existing water meter size is sufficient for new water usage. At that point the Developer should be aware that additional water and sewer connection fees are required.

11. Engineer shall provide all calculations necessary to support the sizing of the proposed water improvements that provide both fire and domestic demands being placed on the site.

12. If an underground fire line is proposed, engineer must show the proposed water line tie-in and the proposed location of the double check assembly.

13. Schematic Plans will be reviewed by the County Engineer’s Office. As a minimum, all plans must reflect the following information:

   1. Vicinity map – scale 1: 2000’;
   2. Tax Identification Number(s) (formerly known as the Tax Map and Parcel Numbers);
   3. Development name
   4. Conceptual layout of water and sewer;
   5. Existing easement, including deed book and page number;
   6. Proposed easements.

14. The check list included under Appendix 3 is included with each site plan submittal.
PROCEDURES FOR INSTALLING 6 INCH LATERALS
TO EXISTING SANITARY SEWER LINES

When it is necessary to tap the main sewer line and install a 6 inch sewer connection, the following guideline shall be adhered to:

1. The work shall be done by an approved utilities contractor specializing in the installation of public water and sewer lines.

2. If a water line is to be crossed, the tap must be made on Monday - Thursday before 1:00 p.m.

3. The contractor shall notify the Utilities Inspector 48 hours prior to beginning construction.

4. When tapping the sewer line, a mechanical hole cutter and an approved saddle must be used. The tap must be made so that the 6 inch connection will enter the main line on a slope no greater than 45 degrees. No connection shall be cut into the top of a sewer line unless approved by the County Engineer. Approved tapping saddles are to be epoxy coated, double banded and stainless steel.

5. When tapping into a manhole, bring the 6 inch connection in above the shelf, but no higher than two feet above the lowest invert. A channel to carry the flow from the connection must be built inside the manhole. Unless approved for an internal drop connection by the County Engineer.

6. The 6 inch connection is to be constructed only to the property line and/or the edge of the easement in which the main sewer line lies, or as directed by the inspector. A cleanout will be installed at this location in accordance with the county specifications.

7. The contractor is responsible for damages to any existing utilities and shall have in his possession and/or furnish evidence upon request of having sufficient insurance to cover any damages that may occur.

8. Work in the State Right of Way:

   a. The VDOT must grant permission to install a sewer lateral within their right of way. The utilities contractor is responsible for making application to Virginia Department of Transportation for permission to install a 6 inch connection within their right of way and for providing the County Engineer a copy of the permit before commencing work.
b. Use the necessary signs and barricades to divert traffic.

c. One-way traffic must be maintained at all times.

d. The trench must be backfilled with 21A stone, and compacted as required.

e. Pavement should be replaced within 24 hours. All paving is to be done in accordance with State Highway Department specifications.

f. On streets subject to school bus traffic, work should be done only between 9:00 A.M. and 3:00 P.M.

9. Prior to connecting sewer lines from a home or business to the 6-inch connection, a sewer availability fee must be paid and all the above requirements must be met. Building inspector's office must be notified for inspection, from the clean out to the building.

Any deviations from these guidelines must be approved by the Prince George County Engineer.
APPENDIX 7

FIRE SPRINKLER SYSTEM REQUIREMENTS

All fire sprinkler system services may be unmetered and will be equipped with an approved double check valve assembly to assure protection of the public water supply from contamination. Double check valve assemblies will be installed in an approved vault as near to the property line as possible. Maintenance responsibility of the Utilities Department will end immediately preceding the inlet gate valve of the assembly.

1. The County Engineer will perform plan review of the proposed water line extension up to the first OS&Y gate valve located on the inlet side of the double check assembly and the plan review of the assembly as it relates to the backflow device, etc. A gate valve shall be installed at the main at the tee for all proposed fire lines. In all cases Engineer shall provide details illustrating what type of anchoring will be used on the inlet side of the assembly, so that the OS&Y valve (inlet side) of the double check assembly will not blow off when the double check is removed.

2. The Fire Marshall will review from the OS&Y gate valve located on the inlet side of the double check assembly to and including the building. The Fire Marshall will also review the vault for compliance. A separate plan submission is required for Fire Marshall approval. In addition, the submittal to the Fire Marshall shall include underground pipe size, length, location, weight, materials, point of connection to County main, vault details, and what type of restraining devices (thrust blocks, retainer glands, etc.) will be installed.

3. An auxiliary mechanical permit issued by the Building Inspector's Office, along with four (4) sets of plans, is required for the work from the vault to the building and shall be applied for by the installing contractor from the Building Inspector's office and plans submitted to and reviewed by the Fire Marshall.

4. The Fire Marshall will review the location of the vault for the double check assembly at the time that the site plan is submitted for review.

5. The valve pit shall be located at or as near to the property line as possible and out of the main flow of traffic.

6. The vault shall be designed and constructed in accordance with
the County's Standard Details.

The location will be reviewed by both the County Engineer and Fire Marshall for optimum placement. The review of the site plan is not a detailed review of the water and sewer design when it involves the relocation and/or extension of the public system. However, the site plan (the applicable sheets of the site plan) must reflect the approved water and sewer design and show the exact location of the existing facilities. Therefore, it is important that the Engineer submit utilities plans directly to the County Engineer at the same time as or near that time to avoid any unnecessary delays in the approval of the site plan and release of the building permit.

Installation of double check valve assemblies other than at the property line must be approved by the Fire Marshall. In these instances a gate valve will be installed at the property line and/or edge of water line easement to designate the point at which Utilities Department responsibility ends.

Under any circumstances where a siamese connection is required, it will be installed on the outlet side of the double check valve assembly.

The fire line service must be separate from the domestic service to the building with both being tapped to the main in the street or easement in front of the property. This must be reflected on the site plan and the Utility plan.
APPENDIX 8

STANDARD PROCEDURES FOR
THE ACCEPTANCE OF NEWLY CONSTRUCTED
PUMPING STATIONS

I. Pre-Construction Phase

A. A pre-construction meeting is set up by Inspection for both County and Developer projects.

1. This meeting will include the Design Engineer, the Inspector, Contractor, County Engineer, and the Utilities Inspector.

2. The Contractor will furnish to all parties a detailed construction schedule.


4. Minutes will be furnished by the Design Engineer.

B. A Notice to Proceed is issued by County Engineer to the Contractor.

II. Construction Phase

A. Daily, thorough inspection of construction carried out by the Inspector.

1. The Inspector will be responsible for daily reports addressing project status and construction problems which may evolve.

2. In the case that the project is not progressing on schedule, the Inspector is to send a written notification to the County Engineer, with a copy to the Contractor, and the Design Engineer addressing this problem.
B. Monthly meetings will be set up by the Inspector which will include the Engineer, the Contractor, Inspector, County Engineer and the Utilities Inspector with the minutes supplied by the Design Engineer.

C. Once the construction is complete, a letter of completion from the Owner/Owner’s Agent insuring that all work has been completed, which will include Virginia Power work, water services, C&P work, telemetering, etc. This letter will include the Building Inspectors Office Approval. This letter will also request a start up inspection ten days in advance. This letter is to be sent to the inspector.

III. Start Up Inspection

A. The inspector sets up a start up inspection by sending a written notification to the Design Engineer, the Contractor, the County Engineer, and the Utilities Inspector.

B. An extensive inspection is carried out by the County Utility Department, Design Engineer, Inspector, Utilities Inspector and the pumping station manufacturer’s representatives.

1. All equipment is to be operated.

2. All other facilities per plans and contract documents are inspected.

3. The Inspector develops the punch list by using the attached checklist.

C. The Design Engineer will write a letter addressing all deficiencies and send it to the County Engineer with a copy to the Contractor, and the Developer. This letter will also request a time frame for repairs.

1. The Contractor shall notify the Utilities Inspector 24 hours prior to making any repairs or additions regarding the punch list.

2. The Design Engineer is required to respond, in writing, to the County Engineer certifying the completion of the punch list with a copy sent to the Contractor.
3. The Design Engineer shall request in writing from the County Engineer and the Utilities Inspector a Pre-Final Inspection within ten days after completion of the punch list.

IV. Interim - Start Up - Pre-Final

A. The Inspector is responsible for keeping lines of communication open between Inspection and all parties. He is to keep the job progressing.

B. Throughout this period no service connections will be allowed. The County will not be held responsible for the cost of the associated utilities, or operation and maintenance of the facility.

V. Pre-Final Inspection

A. The Design Engineer sets up a Pre-Final inspection by sending a written notification to the Contractor, the County Engineer, and the pump manufacturer’s representative.

B. Re-inspecting the Station
   1. All equipment is to be operated.
   2. All punch list items must be complete.

VI. If Station Deficiencies are still noted repeat procedures detailed in Start Up Inspection

VII. If Station Passes Pre-Final Inspection

A. A letter will be required from the Design Engineer indicating that the project has reached a stage of substantial completion. In this letter a statement that all requirements for the facility have been fulfilled will be included.

B. The Engineer must submit six copies of the Operations and Maintenance Manual to the County Engineer, and send a sufficient number of copies to the Department of Environmental Quality.

C. The Design Engineer is responsible to obtain the Certificate for Operation prior to putting the station into operation, with a copy of the Certificate being sent to the County Engineer.
   1. The Design Engineer sends a letter to the Department of
Environmental Quality stating that the Pumping Station has been built in accordance with the approved plans and specifications.

2. The Virginia Department of Health will issue the Certificate for operation for a water pumping station, and the Department of Environmental Quality will issue the Certificate for Operation for a sewage pumping station.

D. The Inspector is required to notify the County Engineer in writing that the Station is acceptable.

E. Upon receipt of the completion statement, the County Engineer will issue a letter to the Owner/Owner's Agent stating the acceptance of the Station.

F. Connections will be allowed to the Station at this point in time.

G. The Operational Costs (power, telephone, etc.) are assumed by the County at this time.

H. Equipment warranties and contractor warranties begin at this time.

I. The contractor is responsible for furnishing evidence of sufficient bonding during the warranty period.

J. Daily Operations and Maintenance begin at this time at the County's cost.

K. Procedure for handling equipment failures that are covered by warranty are carried out if necessary.

1. The County Engineer contacts the Contractor, either in writing, voice transmission, fax or email.

2. The Contractor will respond either in writing, voice transmission, fax or email indicating the degree of the problem and when the repairs will be completed.

3. The Contractor will make the necessary repairs and will send a letter to the County Engineer indicating that the necessary repairs are complete with a copy sent to the Design Engineer, and the Inspector.
VIII. Final Inspection

A. The Inspector sets up a Final Inspection by sending a written notification to the Design Engineer, the Contractor, the County Engineer, and the Utilities Inspector. This inspection will take place during the final month of the warranty period.

B. All remaining equipment problems should be resolved. The punch list created by Operation and Maintenance throughout the year should be used as the checklist.

C. After the Station passes the Final Inspection

1. The County Engineer will send a written statement stating that the County accepts full responsibility of the station to the Developer with a copy to the Design Engineer.

2. The Utilities Department assumes full responsibility for the station.

IX. General

A. Full open communication between Design Engineer, Inspector, Contractor, County Engineer and Utilities Inspector is mandatory.

B. All correspondence, being written, verbal, or by telephone, email, must be appropriately documented by all parties.

C. The County Utilities Inspector is responsible for making sure all inspection duties are carried out properly.
APPENDIX 9

PROCEDURE FOR INSTALLING WATER METERS
IN COMMERCIAL AND INDUSTRIAL DEVELOPMENTS

1. All commercial and industrial developments (Shopping Centers, Sites, etc.) will be treated the same as residential development where New Water Lines are being installed. However, water lines will only be taken over for operation in such facilities as indicated in the Utility Code.

2. Developer or his agent will be required to complete the water and wastewater service applications and submit them to the Utilities Department.

3. A map clearly depicting location of buildings, etc., must be submitted by the Developer or his agent. Same information must be shown on the water plans.

4. Engineer is required to incorporate with his plans a detail of the method of installing meters.

5. All appropriate notes, details, etc. are to be shown on plan.

6. Contract between the developer and contractor shall include the installation of the water meter services and boxes.

7. Developer shall be responsible for informing all builders that the water and sewer connections fees must be paid prior to the Building Permit being issued.

8. Connection fees shall be as stated in ordinance.

9. Engineer and contractor shall refer to the County Standard Detail Drawings and the latest revised "Approved List of Manufacturers, Materials and Specifications" for approved method for designing and constructing the water meter assemblies.
APPENDIX 10

PROCEDURES FOR COORDINATING PROPOSED WATER LINE DESIGNS WITH EXISTING SEPTIC TANK AND DRAINFIELD SYSTEMS

A. Investigation during preliminary design

1. Coordination by the County's and/or Developer's Design Engineer should be initiated through the local Health Department.

2. Design Engineer is to contact the local Health Department and work closely with their staff to determine location of existing septic tank and drainfield lines; condition of septic tank and drainfield systems; etc. If repairs are determined to be needed, the local Health Department needs to issue a repair permit.

3. Design Engineer is to obtain information, advice, etc. from local Health Department regarding the alteration of existing system, i.e., design criteria; and to find out if it is even possible to alter system.

B. Design Engineer shall identify areas where conflicts will occur or may likely occur.

C. Design of the proposed water line must be done to avoid conflicts, or where it is not practical to do so, the septic tank and drainfield system shall be altered or redesigned to avoid proposed water line.

D. In cases where alterations of the drainfield systems are likely to occur, the Design Engineer shall have bid proposal reflect a bid item to include such work.

E. The alteration work must be done prior to start of water line construction in the area of the conflict and this reflected in the bid documents.

F. The Utilities Construction Section's inspector shall work closely with the local Health Department to ensure that the contractor obtains appropriate inspections.
Appendix 11

Overall Water/Wastewater System Plan Requirements

Checklist for overall water/wastewater system plan submission requirements.

I. General plan requirements for both water and wastewater systems:

   A. _____ The location of all existing water and wastewater lines with the size and reference distance identified. Also, the nearest appurtenance such as a manhole or valve are shown.

   B. ____ The accurate locations of all existing utility easements. The easements denote the proper width and permanent/temporary status.

   C. _____ Existing and proposed storm sewer, gas or other lines (which may cause a conflict with proposed water and wastewater lines at the time of installation) are shown.

   D. _____ All existing and proposed roadways with the name, state route number, and right-of-way widths are shown.

   E. _____ Adjacent property owners' names are shown.

   F. _____ Proposed, existing, and original ground elevations are shown at 5 foot vertical contour intervals, and includes permanent or established benchmarks within the area.

   G. _____ All plans have a north directional arrow, oriented towards the top of the sheet.

II. Wastewater System: Plan includes the following design information:

   A. _____ The routing and size of all proposed wastewater lines.

   B. _____ All proposed/future connection points and the associated easements for all adjacent properties.

   C. _____ A detailed hydraulic analysis for the proposed system, including the overall service area for all trunks and/or sub-trunks, are included with the plans. Also, all of the appropriate land use densities for each area are shown. The
analysis covers any upstream/adjacent properties and, as deemed necessary, any portions of the downstream system.

III. Water System: Plan includes the following design information:

A. ____ The proposed size and routing of all water lines.

B. ____ The location of stubs and easements (if necessary) for future service to adjacent properties.

C. ____ The location of the closest existing valve from the proposed tie.

D. ____ Development densities for each area within the proposed development.
APPENDIX 12
DRAWING QUALITY CONTROL SPECIFICATIONS

I. General

1.01 All plans submitted to the County Engineer for review shall conform to the minimum legibility and quality control requirements of this Section. Any drawing submitted for review which substantially does not meet this specification will not be accepted for review.

1.02 All plans shall conform to the requirements of other Sections of the specifications as to size, form and content.

1.03 As Built drawings will be submitted after completion of the utility system in both electronic and paper form.

II. Documents on Paper

2.01 General Description

A. Plans submitted to the Utility Department shall be direct prints by the Diazo or similar process, in blueline or blackline, on paper equal to the products of the Azon Co. Photocopies or telefacsimile reproductions are not acceptable for plan review, but may be submitted for information or preliminary review purposes.

2.02 Legibility

A. The contrast of the printed material shall be high, with blank areas being as white as possible, and all information being as dark as practicable, while remaining clear and distinct.

B. Shading, especially that done by filling in with a pencil or the use of the darker shading film, shall not be used on the drawings where it will occlude any other information, such as on the plan views of paved areas. Areas to be set off may be accomplished by stippling (maximum density 21 dots per linear inch, minimum 10 dots per linear inch); or by hatching or cross-hatching with maximum line width of 0.30 mm (#00 pen) and minimum line spacing of 1/10" where this method does not obscure other information.
C. Line work shall be consistent and sharply defined, with the best results usually obtained from ink on polyester film. The minimum line width shall be 0.30 mm (#00 pen), with the majority of the work in the wider pen sizes.

D. Lettering (text) shall be consistent and clear, with a minimum height of 0.100" (10 pt.) and minimum line width of 0.35 mm (#0 pen). The larger type shall have correspondingly wider line widths. The preferred font shall be sans serif engineering (LEROY) in vertical or 67½° slant, all capitals.

E. All information must be contained within the borders of each sheet, particularly on the plan and profile sheets.

F. No photographs, or prints or reproductions of photographs, shall be a part of any drawing. Specifically, aerial photography may not be used in the plan views or at any other location. Unless approved by the County Engineer.

III. Documents on Electronic Media

3.01 General Description

A. Drawings submitted on electronic media must conform to all the requirements of this Section, and with the following requirements.

3.02 Compatibility

A. Document must be completely compatible with Prince George Utility Department and GIS Department software.

B. Documents created on compatible software should be received in their standard file formats - for example, AutoCAD documents should be received in .DWG format. The Engineer needs to be aware of discrepancies due to different versions of the software; the Utility Department must be able to work with the media received.

C. All correspondence is to be received in Word format.
D. All CAD documents to be received must be in standard AutoDesk - AutoCAD.DWG Release format compatible to the Utilities Department. These documents must be free of any third party software restrictions. Restrictions must be purged off the files before sending to the Utilities Department.