STANDARDS AND SPECIFICATIONS
SANITARY SEWER SYSTEMS
KING GEORGE COUNTY SERVICE AUTHORITY

KING GEORGE COUNTY, VIRGINIA

KGCSA

August 2006

KING GEORGE COUNTY SERVICE AUTHORITY

SANITARY SEWER SYSTEM STANDARDS AND SPECIFICATIONS

INDEX

APPENDIX

SECTION I
DESIGN PARAMETERS AND CRITERIA

A. General Requirements:

The following "Sanitary Sewer Standards and Specifications" shall be followed for the design, construction, inspection, testing and acceptance of all sanitary sewer facilities installed in King George County, Virginia for operation and maintenance by the King George County Service Authority (KGCSA). The requirements specified hereinafter are considered to be minimal requirements. All public sewer extensions shall be in accordance with the King George County Public Service Authority Regulations (Regulations) and all requirements of the Virginia Department of Environmental Quality (DEQ), the Virginia Department of Health (VDH), the Virginia Department of Highways (VDOT), and the Virginia Erosion and Sediment Control Manual.

The KGCSA may permit the extension of the public sewer system by a developer. All such extensions shall be at the request of the developer and shall be made pursuant to a Public Sewer Extension Agreement (PSEA) between the developer and the KGCSA approved by the Board of Directors and executed by the General Manager on behalf of the KGCSA, and approved as to form by the County Attorney. The PSEA shall include terms providing for the amount of all fees to be paid to the KGCSA and providing the time frames for payment of connection fees by the developer. The PSEA shall set forth any cost sharing and provide that, upon completion and approval of the construction of such facilities, including satisfactory completion of all warranty and guarantee periods, they shall become the property of the KGCSA. Such PSEA shall be executed by all parties prior to the issuance of a Certificate to Construct.

The applicant/developer shall accept responsibility for the costs of all KGCSA, VDOT, VDH, DEQ, and King George County Department of Community Development inspections and/or tests.

Design of all sewage facilities that are to be dedicated to the KGCSA shall be performed by a design professional certified by the Commonwealth of Virginia.

Vertical and horizontal survey datum control shall be based upon, and referenced to, the Primary Geodetic Control Network of King George, Virginia. Ground measurements shall be furnished in U.S. Survey Feet and shall reference the **Virginia State Plane Coordinate System (North Zone), NAD 83 (HARN), NAVD 88**. A minimum of one permanent benchmark that meets the requirements of the Subdivision Ordinance of King George County, Virginia shall be established for each development project.

Sanitary sewers are designed for the collection and transmission of wastewater. Downspouts; commercial garbage disposals; car washes without recycled water; foundation drains; yard drains; area drains; basement drains; residential, industrial and commercial cooling water; hazardous waste materials; and sump discharges for other than sanitary wastes shall not be connected to the facilities of the KSCSA nor into any sewer leading into any facilities of the KSCSA.

Provisions shall be made for logical future extensions at proposed or existing street connections, and at other locations as required by the KSCSA. Future extensions shall be provided for by a stubbed section of pipe. This pipe shall be properly plugged, blocked, and pressure tested.

The safety and protection of public and private water supplies is of paramount importance. There shall be no connection between any public or private potable water supply system and any sewer or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable water supply.

B. Definitions:

Unless the context specifically indicates otherwise, the meaning of terms used herein shall be as follows:

Abut: touching, adjoining, or bordering on.
Acceptance: means approval and subsequent ownership including satisfactory completion of all warranty and guarantee periods by the KSCSA.
ANSI: American National Standards Institute
Applicant: the owner or his duly authorized representative who applies to the KGCSA for either water service or wastewater service or both such services.
Approved: approved by the Board of Directors, DEQ, or where applicable the General Manager and County Engineer.
Appurtenance: any accessory object or component connected to a public water main or public sewer.
As-built Drawing: record drawings of the completed facilities showing actual constructed elevations, dimensions and locations.
ASTM: American Society for Testing and Materials.
Average Daily Flow - ADF: the average flow rate during a typical 24 hour period of normal usage measured over a 30 day period.
AWWA: American Water Works Association.
Board of Directors: the Board of Directors of the KGCSA which serves as the governing body for the KGCSA.
Buffer: an area, structure or landscaping used to separate one use from another or to shield or block noise, light, glare, pollutants or other nuisances.
Building: any structure having a roof supported by columns or walls, including modular and pre-fabricated buildings, which is used for the shelter, housing, or enclosure of persons, animals, or tangible property and, unless specifically

exempted, constructed in accordance with all applicable provisions of the Virginia Uniform Statewide Building Code.

Building sewer: the extension from the building sewage drain to the public sewer or other place of disposal.

Certificate of Occupancy: a document issued by the Department of Community Development allowing the occupancy or use of a building and certifying that the structure and/or site has been constructed in accordance with all applicable plans, codes and ordinances.

Cleanout assembly: includes the riser pipe, fittings, cleanout cap and cast iron cover which are located near the property or easement line for access to the lateral line where connection is made to the building sewer.

Code: The Virginia Uniform Statewide Building Code, National Fire Protection Association, Virginia Safety and Health Codes, Commonwealth of Virginia and the County of King George.

Construction: any placement or installation of sewer facilities or equipment including preparation and/or restoration work for such installation.

Contractor: any person performing work (other than the KSCSA) on facilities of the KSCSA or facilities proposed to be dedicated to the KSCSA.

County: King George County, Virginia.

County Administrator: shall mean the County Administrator of King George County, Virginia, as appointed by the King George County Board of Supervisors..

County Engineer: shall mean a professional engineer hired by the County Administrator whose duty is to ensure that work designed and constructed for the KGCSA complies with these Standards. The County Engineer shall review and approve all facilities prior to acceptance by the KGCSA.

County Inspector: shall mean the inspector(s) supervised by the County Engineer to inspect the construction of wastewater conveyance and transporting facilities that are to be dedicated to the KGCSA for future maintenance and operation.

DEQ: the Commonwealth of Virginia, Department of Environmental Quality.

Developer: any person, firm, corporation, society, or association, or authorized agent thereof, having an interest, whether legal or equitable, sole or partial, in any premises which may in the future be served by the facilities of the KGCSA, and which may in the future be responsible for the design and construction of facilities which are to be under the jurisdiction of the KGCSA and are to become a part of the public utility system of the KGCSA.

Development: any building or subdivision activity which is required to have either site plan or subdivision approval of the County before it is commenced, including the construction of any duplex, and requiring either new or expanded water supply or sewage disposal facilities.

Domestic Sewage: means waterborne wastes normally discharging from the sanitary conveniences of dwellings (including apartment houses and hotels), office buildings, factories and institutions, free from storm and surface waters and industrial wastes.

Dwelling unit: one room or rooms connected together, constituting a separate, independent housekeeping establishment physically separated from any other

dwelling units which may be in the same structure, and containing independent cooking, sleeping and bath facilities..

Easement: a grant by a property owner recorded with the Clerk of the Circuit Court of King George County for the use of his or her land by another party for a specific purpose.

Facilities of the KGCSA: any and all component and pertinent parts of the entire systems of the water and wastewater utilities under the jurisdiction of the KGCSA, such as water pipe lines and their appurtenances, water storage tanks, treatment facilities and pumping stations, sewer lines and their appurtenances, sewage pumping stations and treatment plants, including these items and others now constructed, installed, operated or maintained by the KGCSA, or any which may be approved and accepted in the future as additions to or extensions of the systems.

Force main: a sewer line that carries sewage under positive pressure.

Future use capacity: capacity for the future in system facilities; capacity not needed at time of design and construction to accommodate existing needs; capacity which provides for the security and development of property and for community growth.

General Manager: chief administrative officer appointed by the King George County Service Authority Board of Directors.

Gravity sewer: a collection system where gravity is used to transport wastewater from the customer's premises to a centralized collection or pumping facility.

Grease Trap: a structure designed to facilitate the capture of grease from the effluent stream.

Grinder pump: a compact lift or pump station with pump(s), storage capacity and appurtenant piping, valves and other mechanical and electrical equipment which grinds or reduces the particle size of wastewater solids to yield a sewage slurry and which conveys the waste from its source to a gravity sanitary sewage collection system or a sewage force main.

Health Department: the local or regional offices of the Virginia Department of Health.

Industrial wastes: liquid and liquid carried wastes resulting from industrial, manufacturing, trade or business processes, including industrial cooling water and unpolluted trade or process waste, as distinguished from domestic wastes. Industry/Industrial user: any place of business, endeavor, arts, trade, or commerce, whether public, government, private, commercial or charitable, which uses water in a product, process, or in any manner that generates wastewater which is discharged to a publicly operated treatment works (POTW).

Infiltration: water entering a wastewater system from the ground, through such means as defective pipes, pipe joints, connections, or manhole seepage.

Inflow: water discharged into a wastewater system from such sources as roof leaders, cellar drains, yard drains, area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections, storm sewers and combined sewers, catch basins, storm waters, surface runoff, street wash waters, or drainage.

Interceptor Sewer: a sewer main that receives flow from a number of gravity mains, trunk sewer, sewage force mains, etc.

Lateral line: a sewer line that discharges into a main or sub-main sewer line and has no other common sewer line discharging into it.

Lot: any tract of land described in a recorded deed or on a subdivision plat of record, and which possesses or is in the process of being assigned a number for tax assessment identification purposes. For purposes of development a lot may consist of an individual lot of record, or combinations of adjacent recorded lots and/or portions of lots of the same ownership.

Low Pressure Distribution: the conveyance of effluent through pressure percolation lines at full flow conditions into the absorption area with the prime motive force being a pump.

Main line: a sewer pipeline that receives, or will receive, flow from one or more sub mains.

Manual and Manual of Practice: the Virginia Department of Environmental Quality Sewage Treatment and Treatment Regulations.

Meters: an instrument for measuring the amount or rate of flow.

Minimum Daily Flow - MDF: the minimum flow rate determined by use of the appropriate factor times the average daily flow (generally MDF = 0.5ADF), or as measured directly over a 30 day period for existing developed areas.

Off-site extension: an extension of a water or sewer line from existing local or system facilities of the KGCSA to the property boundary of the developer or applicant in a manner and location approved by the KGCSA.

Owner: any person having an interest whether legal or equitable, sole or partial, in real property which is, or which may in the future be, served by the facilities of the KGCSA.

Peak Daily Flow - PDF: the maximum flow rate determined by use of the appropriate peaking factor times the average daily flow or as measured directly over a 30 day period for existing developed areas.

Person: any individual, partnership, firm, association, joint venture, public or private corporation, trust, estate, commission, board, public or private institution, utility, cooperative, county, city, town or any other political subdivision of the state, any interstate body or any other legal entity.

Premises: any building, group of buildings, or land upon which buildings are to be constructed which is or may be served by the facilities of the KGCSA.

Pretreatment: an on-site process to reduce, alter and/or change wastewater characteristics prior to discharging the wastewater into the public sewer system.

Primary service area: consists of areas presently provided with KGCSA owned water and/or sewer systems; and areas identified by the Board of Directors to receive such services.

Private sewer system: a sewer system owned by one or more persons as opposed to a facility of the KGCSA.

Public sewer: a sewer system in which all owners of abutting properties have equal rights and which is controlled by the KGCSA..

Public Sewer Extension Agreement (PSEA): a contract authorized by the Board of Directors between the KGCSA and a developer for the extension of the public sewer system by a developer.
Regulations: the King George County Public Service Authority Regulations.
Reliability: a measure of the ability of a component or system to perform its designed function without failure or interruption of service.
Septic tank: a tank which provides for the settling of heavy solids as well as oil and grease skimming and the conversion of sanitary sewage to an anaerobic state.
Sewage: that water carried waste which derives principally from dwellings, businesses, institutions, industry and the like exclusive of any storm, surface and/or ground water.
Sewer: a pipe or conduit for carrying sewage.
Sewer system: pipelines, pump stations and all other construction, facilities and appurtenances used for the collection and conveyance of sewage to a wastewater treatment plant or point of ultimate disposal.
Site Plan: a required plan submission, prepared and approved in accordance with the provisions of the King George County Zoning Ordinance, which depicts and provides design details on the proposed improvements on a site.
Standards: means the water and sewer standards and specifications of the KGCSA.
Storm drain or storm sewer: a system which carries storm or surface waters or drainage, but excludes sewage.
Subdivision: the division of a lot, tract or parcel of land into two or more lots, tracts or parcels for the purpose, whether immediate or future, of transfer of ownership or development.
Sub-main Sewers: a sewer pipeline that receives, or will receive, flow from one or more lateral sewers.
Subsurface Disposal: a sewage system involving the controlled distribution of treated sewage effluent below the ground surface in a manner that may provide additional treatment and assimilation of the effluent within the soil so as not to create a point source discharge or result in pollution of surface waters.
Trunk Sewers: a sewer pipeline that receives flow from one or more sub-main sewers.
User: any person who contributes, causes, or permits the contribution of wastewater into the public sewer.
Warranty/Guarantee Period: means the period of time stipulated in PSEA wherein the developer of the sewer facilities is responsible for the correction of any deficiencies in materials and/or workmanship discovered during that specified period of time.
Wastewater: sewage.
Wastewater system: sewer system.
Wastewater Treatment Plant: any system used in the storage, treatment, disposal or reclamation of sewage and industrial wastes, including but not limited to pumping, power, and other equipment, and their appurtenances, and any works, including land that will be (i) an integral part of the treatment process, or (ii) used for ultimate disposal of residues or effluent resulting from such treatment.

Virginia Pollution Discharge Elimination (VPDES) Permit: a document issued by DEQ authorizing, under prescribed conditions, the potential or actual discharge of pollutants from a point source to surface waters and the use or disposal of sewage sludge. Under the approved State program, a VPDES Permit is equivalent to a NPDES Permit.

C. Quantity of Sewage Flow:

The volume of sewage shall be determined by considering the future use capacity requirements of the sewer service area as determined by the KGCSA and County Engineer. The following parameters shall be used when determining the average daily flow of sewage:

1. 85% of the Design Basis for New Developments: Table 1.1
2. Industrial and commercial areas: based on known building and staffing data or by the formula in Figure 1.1:

Figure 1.1

A = acres
FD = Flow Duration (hours) See Table 1.1
ADF = Average Daily Flow (gallons) =

$$\frac{0.25 \times A \times (43560\ sf/acre) \times (.85)(250gpd/1000sf)}{FD \times (1day/24hours)}$$

3. Special developments: detailed studies to determine the average daily flow of sewage will be required.

In addition to the above specified average daily sewage flows, consideration shall be given to the peak daily sewage flow. In general, laterals and sub-main sewers shall be designed to carry, when flowing full, a minimum of 400% of the average daily flow. Main and trunk sewers and sewage pumping stations shall be capable of carrying, when flowing full, a minimum of 250% of the average daily flow. The minimum design flow for interceptor sewers shall be 200% of the average design flow. The hydraulic grade line for all conditions of flow shall be below the crown of the sewer.

The design professional shall include a “Sanitary Sewer System Data Sheet” with all plan submissions. An example is provided in the Appendix.

TABLE 1.1
DESIGN BASIS FOR NEW DEVELOPMENTS

TYPE OF DEVELOPMENT	DESIGN UNITS	FLOW (GPD/UNIT)	FLOW DURATION (HR)
Single Family Sub.	# Homes	300	24
Apartment Complex	# Units	250	24
Retirement Apartments	# Units	225	24
Condominium	# Units	250	24
Timeshare	# Units	225	24
Manufactured Homes	# Units	250	24
Office Building	Gross Sq. Ft.	0.10	12
Medical Offices	Gross Sq. Ft.	0.175	12
Clinic	Gross Sq. Ft.	0.40	12
Nursing Home	# Beds	200	24
Hospital	# Beds	300	24
Restaurant	# Seats	35	16
Carry-out (Chain)	# Seats	15	16
Motel	# Units	130	24
Laundromat	# Machines	500	16
Service Station	Gross Sq. Ft.	0.18	16
Convenience Store	Gross Sq. Ft.	0.15	24
Warehouse	Gross Sq. Ft.	0.02	24
Shopping Center	Gross Sq. Ft.	0.20	12
Grocery Store	Gross Sq. Ft.	0.20	12
Beauty Salon	Gross Sq. Ft.	0.35	12
Gift Shop	Gross Sq. Ft.	0.04	12
Hardware Store	Gross Sq. Ft.	0.04	12
Bar/Night Club	# Seats	10	8
Auto Dealership	Gross Sq. Ft.	0.08	12
Vet. Clinic	Gross Sq. Ft.	0.18	12
Bank	Gross Sq. Ft.	0.06	12
Drug Store	Gross Sq. Ft.	0.10	12
Theater	# Seats	1.5	12
Garage (Auto Repair)	Gross Sq. Ft.	0.02	12
Library	Gross Sq. Ft.	0.10	12
Bakery	Gross Sq. Ft.	0.15	12
Exercise Club	Gross Sq. Ft.	0.13	12
Racket/Tennis Club	# Courts	300	12
Pool	# Members	5	12
Elementary School	# Persons	10	8
High School	# Persons	16	8
School-Dormitory	# Persons	75	24
Nursery School	# Persons	4	8
Church	# Seats	4	6

Camping-Primitive	# Sites	30	24
Camping-Trailer	# Sites	75	24
Picnic Area	# Persons	5	24
Factory	Persons/8 hr. Shift	25	Operating Period

D. Design Considerations - Gravity Sewers:

1. Minimum Size: no sewer line shall be less than 8-inches in diameter, except that sewer lines serving six (6) lots or fewer on cul-de-sacs or sidewalk collector lines may be 6-inches in diameter provided that engineering calculations and justifications indicate that such size is adequate. Any 6-inch in diameter sewer that serves more than two (2) lots shall terminate with a clean-out assembly. The minimum size for a sewer lateral that serves only one lot shall be 4-inches in diameter.

2. Minimum Velocity and Slope: all gravity sewers shall be designed to have mean velocities, when flowing full, of at least 2-feet per second. Computations of full-flow velocity shall be based on Manning's formula using an "n" value of 0.010 for PVC pipe and 0.013 for other pipe.

3. Gravity sewers shall be laid with uniform slope between manholes. The minimum slope of gravity main line sewer shall be as listed in Table 1.2 or as otherwise approved by the General Manager. However, in cul-de-sacs, streets, or easements of less than 800-feet in length (provided it has been determined by the General Manager and KGCSA not to be feasible to provide for future extensions in these locations), the 8-inch gravity sewer main shall be laid with a minimum slope of 0.50 feet per 100 feet.

TABLE 1.2

SEWER SIZE (INCHES)	SLOPE (FEET PER 100 FEET)
6	1.00
8	0.40
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

4. Location of Sewers in Relation to Streams, Estuaries, Lakes, and Reservoirs:

   The tops of all sewers entering or crossing streams shall be at 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 will not interfere with future improvements to the stream channel. In paved channels, the top of the sewer lines shall be placed below the bottom of channel pavement. Sewers shall be designed to remain fully operational during the 25-year flood/wave action. 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/wave action. Sewers located along streams shall be located outside of the streambed whenever possible and sufficiently removed from the stream to provide for possible future channel widening.

5. Sewers Crossing Streams, Estuaries, Lakes, and Reservoirs:

   Sewers entering or crossing the above referenced waterways shall be constructed of watertight pipe. The pipe and joints shall be tested in place, shall exhibit "zero" infiltration, and shall be designed, constructed and protected against anticipated hydraulic and physical, longitudinal, vertical and horizontal loads, erosion and impact. Sewers laid on piers across ravines or streams shall be allowed only when it can be demonstrated that no 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. Any trees subject to dying, which will cause damage to the structure or environment should it fall, shall be removed by the contractor or developer.

   Decreased slopes shall only be considered where the design average flow depth will be 0.3 of the diameter or greater for design average daily flow. In no case shall the assumption of flow be more than can be expected from full development of the area based on criteria from Section I.A.

6. Steep Slopes: sewers constructed on 20-percent slopes or greater shall be anchored with concrete anchors or other methods approved by the General Manager. Concrete anchors shall be installed on 36-foot stations on grades of 20-percent up to 35-percent. Sewers shall not be constructed with slopes greater than 35-percent.

7. Maximum Velocity: in general, average flow velocities greater than ten (10) feet per second shall not be permitted. Drop manholes shall be provided where required to eliminate steep slopes and to reduce high velocities to a limit of eight (8) feet per second or less. Where it is impractical to limit velocities below eight (8) feet per second, reasonable effort must be made not exceed ten (10) feet per second. Where velocities are anticipated to exceed eight (8) feet per second, restrained joint pipe and fittings will be required and the pipe shall conform to appropriate ASTM or AWWA specifications.

8. Depth of Sewers:

   a. The minimum cover depth of all sewer lines shall 42-inches. Lines with less than 42-inches of cover shall be ductile iron pipe.
   b. Sewer lines installed at a depth measured 15-feet or greater from invert to finish grade shall be ductile iron or C-900 DR 18 PVC. Sewer lines installed in fill sections shall be ductile iron or PVC-C900 pipe with restrained joints.

9. Alignment: gravity sewers shall be laid with straight alignment between manholes.

10. Increasing Size: whenever a smaller sewer enters a larger one, the same energy gradient must be maintained. An approximate method for securing these results is to match the 0.8 depth point of both sewers.

11. Easements: a minimum 20-foot wide easement, centered over the sewer, shall be conveyed to the KGCSA when facilities of the KGCSA are to be placed on private property (this width may be modified by the General Manager). No building or permanent structure shall be constructed within these easements. No trees, shrubs, structures, fences or obstacles shall be placed within an easement, which would render the easement inaccessible, by equipment. Temporary construction easements, of varying widths, shall be acquired when necessary to facilitate wastewater system construction.

12. Horizontal and Vertical Separation: sewers shall be laid at least 10-feet, horizontally, from existing or proposed water mains. Should local conditions prevent a horizontal separation of 10-feet, a sewer may be laid closer than 10-feet to a water main if it is laid in a separate trench and the elevation of the top (crown) of the sewer is at least 18-inches below the bottom (invert) of the water main.

    Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pressure type pipe having mechanical joints or approved slip type joints and shall be pressure tested

in place to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling.

When sewers must cross under water mains, the sewer shall be laid such that the top of the sewer is at least 18-inches below the bottom of the water main. If local conditions prevent this vertical separation, the sewer line shall be constructed from a full length section of AWWA specified pressure type pipe having mechanical joints or approved slip type joints for a minimum distance of 10-feet on each side of the water main. This section of the sewer line shall be pressure tested to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling. One full length of water main should be centered over the sewer so that the pipe joints of the water main will be as far as possible from the sewer.

When sewer must cross over water mains, the sewer shall be laid such that the bottom of the sewer is a minimum of 18-inches above the top of the water main. The sewer line shall be constructed from a full length section of AWWA specified pressure type pipe for a minimum distance of ten (10) feet on each side of the water main. This section of the sewer line shall be pressure tested to 50-psig in accordance with the most recent edition of the AWWA C600, Section 4 prior to backfilling. The crossing shall have adequate structural support to prevent damage to the water main.

In addition to the requirements specified above, a water main shall not be allowed to pass through or come into contact with a sewer manhole.

13. Polyethylene Encasement: an approved polyethylene encasement material shall be provided on all ductile iron pipes in areas where corrosive soils exist. It shall be the responsibility of the professional design engineer to satisfy the General Manager as to the extent and aggressiveness of corrosive soils.

E. Design Considerations - Manholes:

1. Location: manholes must be installed at the end of each gravity sewer main line; at all changes in line size, slope or alignment; and at all intersections. Manholes on sewers 24-inches in diameter and less shall be placed at intervals not greater than 400-feet. For sewers larger than 24-inches in diameter, the maximum interval shall be 500-feet. Manholes may be standard type, shallow, straddle, deep, or inside drop.

2. Drop Type: drop pipes shall be provided for all main line sewers entering a manhole at an elevation greater than 24-inches above the manhole invert.

Wherever the difference in elevation between the incoming sewer and the manhole invert is 24-inches or less, the manhole invert shall be installed with a fillet to prevent solids deposition. The drop connection shall be the same diameter as the incoming sewer main.. Generally, only one interior drop is permitted per manhole, multiple interior drops must be approved on a case by case basis.

3. Diameter: the minimum interior diameter of gravity sewer manholes shall be 48-inches. In addition, the minimum interior diameter of the manhole shall be no less than the interior diameter of the largest sewer entering the manhole plus 18-inches.

4. Boot Connections: all pipe connections into manholes shall be installed by the core and flexible boot method.

5. Head Loss in Manholes: all changes of direction, size or shape of sewers shall be made by gradual transitions so as to minimize head loss in manholes. The designing engineer shall take into consideration the head losses occurring at all manhole inlets and outlets. Manholes should be designed with a minimum 0.1-foot drop in elevation from the inverts of the inlets to the invert of the outlet. The elevation of the inverts of all inlets and the outlet shall be shown on the plans along with the elevation of the top of the manhole.

6. Frames and Covers: manhole frames and covers shall be set at elevations to exclude surface water and shall be securely bolted to the manhole structure. Concrete adjustment rings may be used to adjust manhole rim elevations up to 12-inches. A one-foot barrel riser section must be used in adjustments greater than 12-inches. In undeveloped areas the rim elevation shall be set 18-inches above the existing ground elevation. In areas subject to flooding, watertight manhole covers are required to be used. Where a series of watertight manhole covers are used on a main line sewer for a distance of 1,000 feet or more, vent pipes are required.

7. Manholes Receiving Force Main Discharge: the interior of manholes receiving a force main discharge (other than from an individual residential grinder pump force main) shall be coated with an approved coating material. The interior of downstream manholes for a distance not less than 1,000 linear feet must also be coated with the acid resistant material.

8. Manhole Coating: the interior of manholes shall be coated with an approved acid resistant material.

9. Service Connections: a maximum of three (3) service connections may be installed into one manhole. When the service connection is to be installed into an existing manhole, a boot connector or a full joint of ductile iron

pipe must be used. When joining ductile iron to other pipe materials, a rigid connection designed specifically for transition of the two types of material is required. Corings for boot connectors shall not be within 6-inches of a manhole barrel section joint.

F. Design Considerations - Force Main:

1. Force mains shall be 4-inches or larger in diameter. However, if the system is served by a grinder pump, an exception may be granted by the KGCSA.

2. At pumping capacity, a minimum scouring velocity of two (2) feet per second is required. The maximum velocity is eight (8) feet per second. Where velocities within a force main will exceed eight (8) feet per second, restrained joints will be required and the pipe shall conform to appropriate ASTM or AWWA specifications which provide protection against internal erosion. All pipe sections to be restrained shall be clearly marked on the plan and profile drawings.

3. Manual air relief valves shall be installed at high points in the force main.

4. When a force main terminates into a gravity sewer system, it must enter the receiving manhole with an invert elevation that will ensure a smooth flow transition to the gravity sewer system. In no case shall the force main enter the gravity sewer system at a point more than one foot above the flow line of the receiving manhole. An inside drop connection shall be used to terminate the discharge flows of a force main within a sewer manhole.

5. Receiving manholes shall be coated with an approved acid resistant coating material (other than individual residential grinder pump force mains). The interior of downstream manholes within 1,000 linear feet must be similarly coated.

6. Force mains must have a minimum depth of cover of 42-inches and should not exceed 60-inches in depth, unless a greater depth is specifically approved by the General Manager.

7. Pressure and leakage tests shall meet or exceed the requirements specified in these Standards and the latest requirements of AWWAC 600, Section 4.

8. Ductile iron (DI) pipe with restrained joints is required for force mains larger than 2-inches in diameter that are to be installed in casing that cross VDOT rights-of-way.

9. Force mains shall be designed and constructed to have a uniform positive or negative grade.

10. Marking posts shall be installed at 500-foot intervals over all force mains that are installed outside of the VDOT right-of-way. The posts shall be Rhino TriView Flex or approved equal. The posts shall be green and have white/green sewer force main pipeline legend.

11. When it is necessary to deflect pipe form a straight line in either the vertical or horizontal plane, the amount of deflection shall not exceed 2/3 of the deflection limits recommended by the manufacturer.

G. Design Considerations - Pump Stations:

All sewage pumping stations constructed for dedication to the KGCSA shall be designed in accordance with the Commonwealth of Virginia "Sewage Collection and Treatment (SCAT)" Regulations as promulgated by DEQ and the following requirements, and shall satisfy the requirements of the King George County Department of Community Development. All pumping stations shall be designed to minimize air entrainment and odor generation.

All mechanical and electrical equipment which could be damaged or inactivated by contact with or submergence in water shall be physically located above the 100-year flood/wave action or otherwise protected against the 100-year flood/wave action. All pumping stations shall be designed to remain fully operational during the 25-year flood/wave action.

1. Class I Reliability: sewage pumping stations shall meet Class I Reliability as defined in the SCAT Regulations. Class I Reliability can be attained by one of the following:

   a. Storage Capacity: the station wet well and collection system must have the required excess storage capacity to prevent sewage overflows; or
   b. Emergency Standby Power Generator: the station will have an emergency power supply in the event of a power failure.

2. Design Flow: consideration shall be given to the amount of present and future development and the impact to downstream receiving facilities. Therefore, the design professional engineer shall prepare flow projections with a tributary map and perform an evaluation of the adequacy of existing downstream systems to receive average and peak flows from the proposed pump station. Peak flow rates are defined as being 2.5 times the average design flow or as further required by the SCAT Regulations. The design flows used for the design of sewage pump stations is provided in Section I.A. of these Standards.

3. Wet Well Requirements:

a. The effective capacity of the wet well should be such that one pump will run continuously at least 5-minutes during a 30-minute period of minimum flow at ultimate design conditions.

b. Ventilation: The wet well must be mechanically ventilated to achieve the following:

1) Continuous ventilation: There must be twelve (12) complete air changes per hour.
2) Intermittent ventilation: There must be thirty (30) complete air changes per hour.

c. The wet well interior must be protected with a HDPE (high density polyethylene) concrete protective liner to protect the concrete surfaces from corrosion. The liner shall be AGRU Sure Grip (or approved equal) HDPE with a minimum thickness of 2-mm. The liner shall have a pull out of 112.5 lbs./anchoring stud. The minimum distance between studs shall be no less than 2.1275-inches. The liner shall be factory cast into the wet well sections. All joints shall be sealed by means of thermal welding performed by AGRU certified welders. For all lined structures, the use of HDPE grade rings shall be used in lieu of brick or precast rings. Grade rings shall meet HS-25 load rating. Butyl sealant shall be used between each ring to make a watertight joint. The first grade ring shall be welded to the liner to provide a gas tight seal.

d. When specified or required by the KGCSA, the influent sewer line shall have an open flange connection within the wet well and have a bar screen with a maximum clear opening of two and one-half inches. Where bar screens are specified or required, design consideration shall be given to the loss of head through the bar screen. The bottom of the screen channel shall be placed at least 12-inches below the invert of the incoming sewers to allow for some accumulation of screenings without affecting the flow in the sewers. The floor of the screen chamber shall be above maximum high water level in the wet well. Adequate clearances for ease of maintenance shall be provided.

e. All interior metal work shall be of aluminum or stainless steel.

f. All electrical fixtures are to be explosion proof and located in serviceable locations. Interior electrical conduit shall be plastic coated rigid metal or approved PVC conduit. All conduits shall be non-corrosive. Seals shall be installed in the conduit to prevent gases from traveling to the panel box.

g. Hatches shall be flush with floor and have a keyed recessed locking mechanism. All hatch hardware shall be of stainless steel material.

h. The wet well bottom fillets are to have a minimum slope ratio of 1:1.

i. The wet well shall have an adequately sized hatch to permit access for washing the wet well walls..

j. Inlet sewer and sump discharges shall enter into a drop pipe that extends below the low pump vent water level to reduce air entrainment in the wet well.

l. Pipe connections to precast concrete structures shall be made utilizing rubber gaskets cast integrally in the structure at the time of manufacturer. Rubber gaskets shall conform to ASTM C443 and shall meet the performance and test requirements of ASTM C425. Flexible connections shall be A-LOK manhole Pipe Seal, manufactured by A-LOK, or equal.

As an alternate, connections may be made utilizing field installed positive seal gasketing systems. Field installed connections shall be PRESS-BOOT, manufactured by Press Seal Gasket Corporation; KOR-N-SEAL, manufactured by National Pollution Control Systems, Inc., or equal.

m. The design professional shall include buoyancy calculations with the pump station design submittal.

4. Pump Room Requirements (if a building structure is required by the KGCSA):

a. The pump room must be sized for ease of maintenance. A minimum of three (3) feet shall be provided from major pieces of equipment to the next piece of equipment or wall.

b. Access and handling facilities shall be designed to facilitate removal and reinstallation of pumps.

c. The pump room below grade shall conform with the following:

1) Sump pump: The pump discharge is to be located above the wet well high water elevation
2) Pumps shall be installed on raised blocks.
3) Electrical outlets are to be installed three (3) feet or higher above the slab elevation. Installation shall include NEMA Type "4 X" enclosures.
4) All lights are to be accessible from both the bottom slab and the stairs.
5) The motor and pump controls are to be on or above existing ground elevation.
6) All interior piping is to be supported by concrete pedestals and approved hangers and shall be blocked or braced.

7) Ventilation: The dry well pump room must be mechanically ventilated.
8) All ventilating equipment shall be corrosion resistant and explosion proof.
9) Switches to de-energize each motor with a lockout button shall be provided in a NEMA Type "4 X" enclosure.
10) A dry pit submersible pump installation is preferred.
11) A low temperature dehumidifier shall be installed in the dry well; the drain shall be piped to the sump with PVC pipe.

5. Motor Control Room Requirements (if a building structure is required by the KGCSA). If a motor control room is not required, an aluminum and/or stainless steel equipment rack shall be provided.

a. The pump station motor control room shall be located at or above ground elevation.
b. Motor control room structure:

1) Shall be constructed of brick or masonry block with brick veneer on concrete slab.
2) Shall not have windows.
3) Access to the control room must be of sufficient size to allow the removal of installed equipment.
4) A finished ceiling with insulation is required.

c. Motors are to be mounted on concrete blocks secured with dowels to the floor slab.
d. Station electrical and control wiring must meet County and NEC codes and contain a main disconnect.
e. Motors shall be three (3) phase sixty (60) cycle (200, 240 or 480 voltage) unless specifically approved otherwise.
f. Municipal water service supplied to the station must utilize an approved backflow preventer (RPZ type). Hose bibs or year hydrants are to be conveniently located for use at the pumping station site.

6. Pump Selection Criteria:

a. Pumps shall be designed and constructed in accordance with Standards of the Hydraulic Institute. The efficiency of the pump when operating under conditions of the specified capacities and heads shall be as near its peak efficiency as practicable. All pump motors and controls shall be suitable for operation at 40-degrees C ambient temperature unless otherwise approved.

The pump design shall allow for removal and reinstallation of the pump without the need for personnel to enter the confined space of the wet well and without the removal of bolts, nuts or other fasteners.

One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

The manufacturer shall furnish the following spare parts for each size pump supplied:

1) 1 - upper bearing.
2) 1 - lower bearing.
3) 1 - set of upper and lower shaft seals.
4) 1 - set of "O-Rings" or gaskets required for replacement of bearings and seals.
5) 1 - set impeller wear rings (replaceable type).
6) 1 - shaft sleeve (if applicable).
7) 1 - cable cap (if applicable).

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long term storage under humid conditions. Spare parts and tools shall be delivered to the KGCSA at or prior to the time of pump station start-up.

b. Each station shall contain a minimum of two (2) pumps, each capable of pumping the design peak flow. Pump stations with a design peak daily flow rate of 70-gpm or less may be submersible grinder stations equipped with mixer assemblies. The mixer assembly shall be of the "Fixiflush" valve type or approved equal. All other pump stations with a design peak daily flow rate up to 1,500-gpm may be either submersible or vacuum prime stations. Pump stations with a peak design flow of greater than 1,500-gpm must provide for three (3) pumps unless otherwise approved by the General Manager. When three (3) or more pumping units are provided, they shall be designed to fit actual flow conditions and must be of such capacity that, with any one unit out of service, the remaining units will have capacity to handle the peak design flow.

c. Pumps must be sized to pass a 3-inch spherical solid. This requirement will be waived for grinder pumps.

d. The following requirements apply to submersible pump stations:

1) Major components shall be of a minimum ASTM A48 Class35 cast iron with smooth services devoid of blow-holes and other irregularities. All exposed fasteners shall

be ASTM A276 Type 316Ti stainless steel. The pump shall be coated with a two-component epoxy costing approved for both wastewater and water applications.

2) Mating surfaces between components where watertight integrity is critical shall be machined and fitted with Nitrile Rubber or Vitron O-rings.

3) The submersible motor shall be squirrel cage, induction type, housed in a completely watertight and air filled chamber. The motor shall have at minimum a 1.10 service factor and be suitable for use in Class I, Division I, Group C and D atmospheres as Explosion Proof. The motor stator shall use at minimum Class F insulation rated for 300 Degrees F. The motors shall be designed, rated, and warranted for continuous operation and capable of at minimum fifteen (15) starts per hour. Temperature monitors shall be embedded in the motor windings for use in conjunction with and supplemental to external motor overload protection.

4) Each pump shall be provided with two (2) totally independent mechanical corrosion resistant shaft seals, installed in tandem. The seals shall require neither routine maintenance nor adjustment, but shall be capable of being easily inspected and replaced.

5) The motor shall be adequately sized and designed so that integrally cast motor cooling fins have sufficient surface area to allow the motor to run continuous in submerged or partially submerged conditions without the need for internal oil circulation systems or cooling jackets.

6) An electronic probe shall be provided in the oil chamber to detect the leakage of water.

7) Stainless steel guide rails shall be provided. A cast iron guide rail base shall be mounted on the wet will floor. The pump base shall be equipped with a straightening vane that properly aligns the pump on the discharge base just prior to final seating. When the pump is in position, the weight of the pump shall compress the gasket and seal the connection.

8) Pumps having shrouded closed type impellers (single or two vane) shall be provided with a hard, metal wear ring system to insure impeller life and continuing high efficiencies.

9) The impeller shall be statically and dynamically balanced having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibers, sludge and other materials as nay normally be found in wastewater.

10) The pump/motor shaft shall be of sufficient size to transmit full driver output with a maximum deflection of 0.002-inches measured at the lower mechanical seal. The shaft shall be completely of at minimum ASTM A276 Type 420 stainless steel.

11) Upper and lower bearings shall provide a B10 bearing life of at minimum 40,000 hours at anticipated axial and radial loadings. The bearings shall be sealed/shielded permanently lubricated for the life of the pump/bearings.

12) The power cable shall be suitable for the submersible application and sized in accordance with NEC requirements. The cable entry shall consist of a grommet compressed by two stainless steel washers with strain relief being supplied as part of the entry design. The entire end of the cable shall be sealed inside the cable entry housing. The cable entry design shall insure that no entry of moisture is possible into the high-voltage motor terminal area even if the cable is damaged or severed below water level to a submerged depth of up to 85-feet.

13) Submersible wet well pump installation shall include a mixer/flush valve attachment.

e. The following requirements apply to vacuum prime pump stations:

1) The station shall be constructed in one factory-build assembly.

2) Pumps shall be 4-inch vertical, non-clog type of heavy cast iron construction, designed for the use of mechanical seals and vacuum priming.

3) In order to minimize seal wear caused by linear movement of the shaft, the shaft bearing nearest the pump impeller shall be locked in place so that end play is limited to the clearance within the bearing.

4) The bearing nearest the impeller shall be designed for the combined thrust and radial load.

5) The shaft shall be solid stainless steel through the mechanical seal.

6) The pump impeller shall be the enclosed type made of close-grained cast iron and shall be balanced. The impeller shall be keyed with a stainless steel key and secured to the motor shaft by a stainless steel cap screw equipped with a Nylock or other suitable self-locking device.

7) The pump shall have an adaptor providing a large water reservoir above the impeller to provide for positive exclusion of air from the impeller. The seal shall be inside this area to assure lubrication.

8) The pump shall be arranged so that the rotating element can easily be removed from the backhead or seal. The pump shaft shall be sealed against leakage by a single mechanical seal installed in a bronze seal holder and constructed so as to be automatically drained and primed each time the pump is drained and primed.

9) The pump motor shall be vertical, solid shaft, NEMA P-base, squirrel – cage induction type suitable for 3-phase, 60 cycle, 240/460-volt electric current. They shall have Class F insulation, suitable for temperatures up to 105-degrees C. The motors shall have a 1.15 service factor. The motor shall be fitted with heavy lifting eyes or lugs, each capable of supporting the entire weight of the motor.

10) The control equipment shall be mounted in a NEMA Type 1 stainless steel enclosure.

11) A separate and independent priming system shall be furnished for each pump. Each pump shall include a separate vacuum pump. The vacuum pump shall have corrosion resistant internal components.

12) Each priming system shall be complete with vacuum pump, vacuum control solenoid valve, prime level sensing probe, and a float operated check valve installed in the system ahead of the vacuum pump to prevent liquid from entering the vacuum pump. The float operated check valve shall have a transparent body for visual inspection of the liquid level and shall be automatically drained when the vacuum pump shuts off.

13) All components of the pump station shall be given an operational test at the pump station manufacturers facility to check for excessive vibration, for leaks in the piping or seals and correct operation of the automatic control and vacuum priming systems and all auxiliary equipment.

f. Flooded suction and grinder pumps must maintain a positive prime.

g. Pumps shall operate efficiently without cavitation, under existing and proposed future head conditions. The installed pumps shall be capable at a minimum of conveying the average daily flow entering the station (at build-out) against future head conditions.

h. An elapsed time meter is required for each pump motor. Meters shall be installed at "eye" height.

i. A four and one-half inch stainless steel cased, liquid filled pressure sewer gauge measuring in increments of two (2) psi with a range of 0 - 60 psi shall be provided for each pump. The gauge location shall be on the pump
side of the discharge gate valve.

j. A Red Valve Series 742 "diaphragm seal" or approved equal, shall be installed in series with the pump bleed-off lines to monitor discharge pressure. A 0-60 psi liquid filled gauge shall be installed with the sensor (with 1/2" NPT connections).

7. Station Piping Requirements:

a. Ductile iron pipe, installed inside buildings or underground vaults shall have flanged joints. Pipe shall be a minimum Class 53 ductile iron in accordance with AWWA C115/ANSI A21.15. Flanges shall conform to Class 125, ANSIB16.1.

b. Buried pump station piping shall be ductile iron with push-on mechanical (stuffing box type) joints at fittings and valves. Pipe shall be a pressure Class 250 for nominal diameters 12-inch and larger and Class 250 for diameters less than 12-inch. Joints shall be rubber gasket joints in accordance with AWWA C111/ANSI A21.11. Outside coating shall be asphaltic coating.

c. Allowable velocities:

1) Suction pipe velocities shall be in the range of two (2.0) to five (5.0) feet per second (Self priming pump suction velocity may exceed five feet per second).

2) The force main discharge rate of flow shall be greater than two (2.0) feet per second but less than eight (8.0) feet per second.

d. An emergency station bypass connection, in accordance with the Standard Details, shall be provided on the discharge line.

e. A gate valve and a check valve shall be placed on the discharge side of each pump; in either the pump station building or in a valve vault. Limit switches or pressure sensors shall be installed on the swing arms of the discharge check valves. These switches and sensors shall serve as “proof of pumping”. They shall be installed so as to open after the pump has started and the check valve has opened. A time delay relay shall be provided in the control panel circuitry to allow the pump to come up to speed before alarming. This time delay must be a social feed through-type time delay module.

f. In addition to e. above, a gate valve shall be placed on the suction line of flooded suction pumps.

8. Control Panel and Motor Controllers:

a. General: provide a complete control panel with a purged air bubbler system or float system for controlling the sequence of

operation of the sewage pumps. The panel shall include a six digit non-resettable elapsed time meter for each pump.

The equipment shall be housed in a Nema 4X stainless steel enclosure arranged for wall or rack mounting. The enclosure shall be tamper proof and weatherproof, and shall have a gasketed, hinged, front weather door and drop shield with locking capability, and an internally mounted hinged dead front panel so that all components normally actuated by operating personnel are accessible without opening the dead front and yet are not exposed to the elements or to unauthorized personnel. All major components and sub-assemblies shall be identified as to function with laminated, engraved nameplates. The operating logic shall be as follows:

1) Start pumps on rising level (by bubbler or float switches).
2) When the lead pump start switch is activated by rising water level, the pump selected by lead shall start and run until the pump stop switch is deactivated at low level
3) Should the level continue to rise, the lag pump start switch shall be activated, starting the lag pump and allowing it to run until the pump stop switch is deactivated at low level.
4) Should the level continue to rise, the high water alarm switch shall be activated, which shall activate the alarm light and horn, and closing a contact to activate the alarm dialer. The light and horn shall be capable of being disabled by an acknowledge button on the panel.
5) After pump shut down, an automatic alternator shall change the positions of the lead and lag pump for the next sequence.
6) A selector marked Manual/Auto shall be provided on the front of the panel
7) All float switches shall be set to the elevations indicated on the approved drawings.
8) In case of normal power failure, the second pump shall be sequenced to start, if required, with a 10-second delay. At no instance during emergency generator operation shall both pumps be called upon to start simultaneously.

A lightning arrestor shall be supplied in the control panel and connected to each line of the incoming side of the power input terminals.

A 3-pole molded case circuit breaker, separate from pump circuit breakers shall be provided as the main disconnecting device. This

breaker shall be properly sized to handle the entire load of the panel, including all pumps simultaneously starting and running.

A heavy duty, three position hand-off-automatic selector switch shall be flush mounted on the door of the control center for the operation of each magnetic motor starter. This selector switch shall operate in either the “hand” position or the “automatic” position.

The control center shall include a digital three-phase monitor/control connected to the incoming side of the power input terminals. This unit shall provide adjustable time delay dropout protection in the event of phase unbalance, phase, loss, phase reversal, incorrect phase sequence or low line voltage. The phase monitor shall include automatic reset circuitry.

A properly sized heater shall be supplied in the panel. The heater shall consist of a thermostat, resistance type heating grid and fan to circulate air through the enclosure.

b. Install the following indicating lights in the Control Panel Door, each wired and piped into the system for proper operation and each provided with an engraved, laminated, black-core white-background nameplate to indicate its function:

1) A green “pump running” light shall be provided for each pump. The light shall operate off of a motor starter auxiliary contact.
2) A yellow moisture detector indicating light shall be furnished for each pump to indicate presence of moisture in the seal chamber.
3) A red over temperature light shall be furnished for each pump to indicate an over temperature condition in the pump motor.
4) A red alarm beacon in a weatherproof enclosure shall be mounted atop the panel. A warning horn shall also be provided and installed.
5) Pushbutton to "Reset Failure-To-Pump System"; one for each pump.
6) Hand-Off-Automatic selector switch; one for each pump motor.
7) Six (6) digit running time meter reading in hours and tenths of an hour; one for each pump motor (to be mounted at eye height).
8) Pump sequencing selector switch; "Pump #1 Lead - Pump #2 Lead - Automatic."

9) Designation plate indicating name and address and phone number of manufacturer of the control panel.

c. Auto-Dialer: an automatic alarm/dialing device shall be installed on the control panel equipment rack (not in the control panel) in a NEMA 4 waterproof enclosure. It shall be RACO VERBATIUM Series VSS with a minimum of eight (8) channels and shall include a back-up power supply. The dialer shall have a build-in power loss alarm and surge protector and shall transmit an alarm to the KGCSA and the King George County Emergency Dispatch for the following alarm conditions:

1) High water alarm
2) Generator failure
3) #1 pump failure (seal failure or over-temperature)
4) #2 pump failure (seal failure or over-temperature)
5) #1 pump fail to start (check valve limit switch)
6) #2 pump fail to start (check valve limit switch)
7) Test function

In addition, an on-site audio-visual alarm system shall be provided such that each announced alarm condition is uniquely identified. Also, a sign indicating notification procedures to be followed incase of alarm actuation shall be displayed conspicuously on the pump station fence.

d. Level Sensing (bubbler systems):

1) Provide a Thomas LGH-310 or 210 duplex air compressor assembly with manual alternator on a 12-gallon receiver tank for supplying air to the bubbler system. The compressors shall be air cooled, single stage reciprocating type and shall be complete with suction muffler-filters, check valves, automatic on-off switches," Low Air Pressure" alarm signal, pressure gauge, safety valve, outlet needle valve and tank drain with valve. Compressors shall be of the oil-less type. Motors shall be 1/3-horsepower, 115 volts, 60-cycle, single phase with integral thermal overload protection. The air receiver shall be ASME stamped for unfired pressure vessels. A separate 120-volt, 60-cycle, circuit shall be provided to the control panel for power to the air compressors and for operation of internal control components.
2) A combination pressure reducing valve and filter shall be furnished. The regulator shall be of the relieving piston type with a snap-type lock on the adjustment knob. A 0-30

psi pressure gauge shall be provided. The filter shall have a five-micron centered bronze element and manual drain.

3) The air purge rotameter shall be provided with a range of 0-5 SCHF. It shall have a corrosion resistant body and inlet needle valve.

4) Solenoid valves shall be provided for high pressure purging of the bubbler line. Valves shall have stainless steel bodies and plungers, and BUNA-N inserts to provide bubble tight sealing. They shall have a minimum operating pressure differential of 150-psi.

5) Pressure switches shall be provided for the control of the start-stop operation of each pump and any other functions required. Each pressure switch shall have two direct acting, single-pole, double throw micro switches operated by a single diaphragm. The diaphragm shall be made of welded beryllium copper and shall fit in a contoured chamber for over-pressure protection. A wrench plate shall be provided to protect the diaphragm from rough handling. Pressure switch adjustment shall be made by easily accessible, front mounted, self-locking adjustment screws. Each adjusting screw shall have a calibrated dial to lock-in the air adjustment. A cover shall be provided over the adjusting screws, which can be closed and sealed to prevent tampering while still allowing full view of the set point of the dial. Repeatability of the pressure setting shall be plus or minus ½ percent.

6) A flush, panel mounted, 4 ½ inch diameter level gauge with a range of 0-160" water shall be furnished. The gauge shall have a brass bellows type pressure element, aluminum case and removable front ring.

7) Small submersible grinders will be reviewed on a case-by-case basis to determine if a float switch system is to be utilized.

e. Level Sensing (float systems):

1) The level sensing devices shall be Avocado-style or Roto-Float signal-duty hermetically chemical resistant float switches.

2) Switches shall be single pole double throw (SPDT) designed for continuous duty with a mechanical design life of 10 million operations.

3) Float switches shall be mounted by a suspension cable system. This shall incorporate a stainless steel cable attached to a 4-float Type 316 stainless steel mounting

bracket with pads and secured with stainless steel non-intrusion clamps.

f. Electrical Equipment. Provide the following electrical system components:

1) Benshaw solid state "pump-type" (which includes a deceleration feature), combination soft-start type motor starters and motor rated circuit breakers rated for the pump horsepower, 240-volt Delta, 3-phase motors. Provide with NEMA type 12 enclosures suitable for the corrosive fumes present in the station.

2.) Provide complete on-site instructions for the operation, adjustment and programming of the starters.

3) Relays and switches as necessary for lead, lag or alternate operation of the two pumps and for hand-off-automatic operation of each pump.

4) Relays and timers as necessary for failure-to-pump sensing; one system for each pump (limit switches for wet well/dry well applications and pressure sensors for submersible stations). Each system shall be designed so that when a pump motor is signaled to start by the level sensing equipment, or by the hand-off-automatic switch, a timer with a 0-30 second adjustable setting shall be actuated and the position of the limit switch on the discharge check valve for that pump shall be monitored. If the check valve does not open, pump motor shall be stopped and an alarm signal shall be sent to the existing alarm transmitter. It shall be necessary to reset a failure-to-pump system manually before normal pump operation can be resumed. If the check valve opens within the preset time, the system shall reset automatically for its next operation and the pump shall continue to run.

5) Power line sensing equipment shall be provided to continuously monitor and to shut down pumps when incoming voltage drops below 75-percent of rated value or if there is a phase reversal on the incoming power system. Systems shall automatically reset after the power system returns to normal.

6) Timers and relays as necessary to provide a time delay, adjustable from 0-30 seconds, for restarting a pump motor after a power interruption (failure of normal utility power supply system and transfer to the engine generator set or restoration of normal power and retransfer of loads from the generator set to it) and to allow only one pump motor to be started and brought up to speed at a time, regardless of

how many pumps may be called for by the level sensing and control equipment.

7) Fully labeled terminal strips for connection of all incoming and outgoing service, load, control and alarm wiring. All internal wiring and conductors shall be labeled (identified) on each end.

8) Provide circuit breakers for lights, vent fans and convenience receptacles as may be required. A step down transformer may be required to control circuits and station auxiliaries.

9. Standby Power System:

a. General: the KGCSA requires that all pump or lift stations be provided with a complete standby electric power system consisting of a Diesel engine driven generator set, an automatic load transfer switch, time switches, contactors, wiring, conduit, piping and accessories. The engine generator set and automatic load transfer switch shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment and who has parts and service facilities locally available so there is one source of supply and responsibility. The performance of the electric plan shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. All equipment shall be guaranteed free from defects in workmanship and material for a period of 5 years or 1,500 running hours from date of acceptance. An Authorized Distributor of the manufacturer shall inspect the equipment installation after it is completed and perform initial start-up and test of the system and shall submit a certificate of this inspection and test. The date of acceptance as referred to hereinbefore is defined as the date on which this certificate of inspection and test is received by the KGCSA. All equipment shall be listed by UL and so labeled. Equipment shall be manufactured by Olympian/Caterpillar. Engine generator set shall be a diesel engine driven machine with a continuous standby rating of _____ KW, _____ KVA, 80% power factor, 208/120 volts, 3-phase, 4-wire, wye connected, 1,800 rpm, 60 Hertz. It shall be complete with welded steel mounting base, vibration isolators, battery, exhaust silencer, flexible exhaust hose and fuel oil piping and pumps from the fuel tank, air cleaners, and lubricating oil pump .

b. Engine: it shall be Diesel fueled, naturally aspirated or turbocharged, four cycle, water cooled with mounted radiator, fan and water pump. It shall have _____ cylinders with a minimum displacement of ____ cubic inches and a minimum rating of ____ bhp at its operating speed of 1,800 rpm. Free turn, overhead valves

shall be hard chrome-cobalt alloy faced. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have replaceable, full-flow, oil filter. Engine speed shall be governed by a pressure lubricated mechanical governor to maintain alternator frequency within 5-percent from no-load to full-load alternator output. Provide complete fuel injection system with electric motor driven fuel transfer pump and air cleaner with replaceable dry element. The engine shall have a battery charging alternator with rectifiers and a transistorized voltage regulator. Starting shall be by a 12 or 24 volt electric starter with electric solenoid shift. Complete engine control shall be 2-wire which operates to start engine on closing contact and to stop engine on opening contact. A cranking limiter shall be provided to open the starting circuit in approximately 45-seconds if the plant is not started within that time. The electric plant controls shall also include a 3 position selector switch with the following positions; RUN-STOP-REMOTE. High engine temperature, low oil pressure, and overspeed shutdown shall be provided. Selector switch shall be mounted on engine instrument panel as shall a common signal light which shall be illuminated when engine is shut down by cranking limiter, high engine temperature, low oil pressure or overspeed. In addition, provide a separate labeled signal lamp for each of the engine shut-down malfunctions. Shut-down for any of these causes shall require manual resetting before engine can be restarted. Provide a set of normally open contacts to which a remote alarm can be connected to warn of any engine malfunction.

c. Engine instrument panel: it shall contain an oil pressure gauge, water temperature gauge and battery charge rate ammeter in addition to selector switch and pilot lights as described above.

d. Alternator (generator): it shall be 4-pole, revolving field design with temperature compensated solid state voltage regulatory and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing and the rotor and shall be driven through a semiflush driving flange to insure permanent alignment. The insulation system shall be Class F as defined by NEMA MG1.1.65. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 13.0 percent of rated voltage when full load at rated power factor is applied to the alternator. Recovery to stable operation shall occur within 2.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1-percent of rated voltage. Rheostat shall provide a minimum of plus or minus 5-percent voltage adjustment from rated value. Temperature ruse shall be within NEMA MG1-22.40 definition.

e. Alternator instrument panel: it shall be provided adjacent to the engine instrument panel. The alternator instrument panel shall be wired, tested and shock mounted on the generating set by the manufacturer of the alternator. It shall contain panel lighting, manual reset main line generator output circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter (dual range, indicates all voltages), AC ammeter (dual range, indicates current each phase), and voltmeter ammeter phase selector switch with OFF position.

f. Mounting: the electric plant shall be rubber cushioned and mounted on a welded steel base, which shall provide suitable mounting on a 4" concrete slab.

g. Accessories: they shall be provided as follows:

1) Critical type exhaust silencer to reduce exhaust noise level to standards for critical areas;
2) One 12-volt, nickel-cadmium battery with hydrometer, battery cables, rack and an automatic float/equalizer charger. This shall be on a dedicated circuit.
3) Engine coolant heater thermostatically controlled to aid in cold weather starting (supply dedicated circuit from circuit breaker in station control panel);
4) Fuel oil filter, solenoid valve and shut-off valve for fuel lines;
5) Three sets of detailed operating, maintenance and service manuals complete with illustrated parts lists;
6) Anti-freeze coolant in radiator and engine.
7) The generator shall be enclosed in a NEMA-3R generator mounted unit interwired with automatic start. The enclosure shall have hinged lockable doors on each side, fixed intake louvers, and protective grill on the radiator end. The enclosure shall be a minimum of 14-gauge sheet metal, treated and painted to resist corrosion. Suitable muffler support brackets shall be bolted to the roof. The enclosure shall be bolted directly to the generator set base, and shall fully enclosure and protect the generator set, control panel, batteries, and battery charger.

h. Fuel piping: it shall be soft copper tubing, Type K. Flexible connections in fuel piping at engine shall be corrugated seamless bronze or stainless steel tubing with single wire braid. Valves shall be suitable for fuel oil service. Provide a shut-off valve in the fuel supply line at the engine. Strainers shall have steel housing with fiber treated cloth cone tube capable of removing particles 10 microns and larger. Provide a strainer in the fuel supply line at the engine.

i. Exhaust piping: it shall be extra strong black steel pipe with screwed or welded fittings. Pipe hangers and supports shall be provided for exhaust piping and shall be adjustable type. Isolation supports shall be provided for all piping connections to the generator set. The finish of pipe hangers and supports shall be zinc or cadmium plated. The interior pipe and silencer shall be covered with six inches of calcium silicate rigid insulation butted firmly together and wired in place using 16-gauge wires on a 9-inch center. Insulating cement and/or glass cloth shall be applied over the insulation to achieve a smooth finish.

j. Automatic load transfer switch: it shall be rated at ____ amperes, ____ volts, three-phase, 4-wire, 60 Hertz. The manufacturer shall furnish schematic and a wiring diagram for the particular automatic transfer switch and a typical interconnection wiring diagram for the entire standby system. The automatic transfer switch shall be rated for continuous operation in ambient temperatures -25 degrees F to + 125 degrees F. The transfer switch shall be rated for all classes of load, both inductive and noninductive, at 600-volts, and shall be designed, built, and tested to close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contracts. The transfer switch shall be capable of enduring 6,000 cycles of operation, at rated current, at a rate of 6 cycles per minute, without failure. One cycle shall consist of complete opening and closing of both sets of contacts on an inrush current 10 times the continuous rating of switch. The automatic transfer switch, with terminal lugs for either copper or aluminum wire, shall have individual, heat resistant chambers enclosing solid silver cadmium oxide, doublebreak contacts. The transfer switch, with mechanical and electrical interlocks to prevent simultaneously energizing both normal and emergency service, shall be mechanically held on both sides, with manual operator and auxiliary contacts rated 6-amp, 120-volt AC; 3-amp, 240-volt AC on both sides. It shall be wall mounted in a NEMA 12 enclosure. Control accessories shall mount on a dead-front, swing-out control accessory panel to avoid shock hazard while adjusting control functions, but will swing out exposing the wiring to facilitate servicing. Indicating lamps and meters shall be set in the front door of cabinet. Transfer switch shall be of the programmed transition type which shall provide dead band time adjustable from 1 to 10 seconds when the load is not connected to the normal power source, nor to the engine generator. Control accessories shall be solid state type and shall provide the following functions:

1) Monitor each ungrounded line with calibrated dial, adjustable voltage, solid state UNDERVOLTAGE

SENSORS to sense a decrease of voltage below a set point, or a loss of voltage on any phase or a reversal of phases on the normal power source. Voltage sensors shall be temperature compensated for 2-percent maximum deviation above the temperature range -25 degrees F to +175 degrees F (not applicable to open delta).

2) Signal the engine-generator set to start in the event of a power disturbance as sensed by the monitoring system. A solid state TIME DELAY START (adjustable from 0 to 60 seconds) shall delay this signal to avoid nuisance startups on momentary voltage dips or power disturbances.

3) Retransfer the load to the line after normal power restoration. A TIME DELAY RETRANSFER (adjustable from 0 to 30-minutes) shall delay this transfer to avoid retransfer in case of short-term normal power restoration.

4) Provide an automatic RETRANSFER TIME DELAY BYPASS to retransfer the load from generating set to normal source if generating set output interrupts after normal sources restore voltage.

5) Signal the engine-generator to stop after load retransfer to normal source. A solid state TIME DELAY STOP (adjustable from 30-seconds to 5-minutes) shall permit engine to run unloaded to cool down before shutdown.

6) Provide a TEST SWITCH to simulate an interruption of power form the normal source.

7) Provide a constant-voltage automatic charging (1.40- 1.24 volts per cell) SCR, current limited, BATTERY FLOAT CHARGER to maintain fully charged cranking batteries.

8) Provide an EXERCISER CLOCK to automatically start the generating set at regular intervals and allow it to run for a preset time period, such as 30 minutes per week.

9) Provide WITH LOAD - WITHOUT LOAD SELECTOR SWITCH to select test or exercise as follows:
"without load", the generating set runs unloaded.
"With load", the automatic transfer switch transfers load to the generating set, after time delay, the same as it would for a normal source interruption.

10) Provide a CONTROL DISCONNECT PLUG to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.

11) Provide two (2) auxiliary relays or auxiliary contacts on the main power contractors (normal and emergency) so that a remote alarm or light can be connected to indicate that normal power has been lost and that power is being supplied from the engine generator set.

12) The automatic load transfer switch and/or the generator control panel shall have relays and wiring which provide contacts for closure in the event of a generator-set failure after transfer to emergency power. The contacts shall be made available for connection to the existing alarm transmitter.

13) Provide two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the normal position and two (2) sets of auxiliary contacts to be actuated when the transfer switch is in the emergency position.

14) Provide a "neutral" position timer (adjustable from 0-10 seconds) to allow loads, such as motors, to come to a complete stop before being transferred to another source.

k. Installation: the engine-generator set and automatic load transfer switch shall be installed in strict accordance with the recommendations of the manufacturer and with all applicable codes and regulations. Engine generator sets shall be mounted on a concrete foundation isolation pad. All connections to it shall be made with flexible pipe, conduit, etc., to minimize transfer of vibration.

l. Quality Assurance: prior to shipment, the following tests shall be conducted at the plant of the manufacturer, and certified results of these tests shall be delivered to the Engineer for transmittal to the Owner: Full load test of the generator set for one hour with fuel consumption, output voltage, engine speed, voltage, and speed-regulation and generator winding temperature measured and recorded at ten-minute intervals.

m. Start-up and Training: the services of a factory trained and factory authorized technician shall be available, and he shall perform complete start-up services on the engine-generator set after it has been set in place and connected. Upon successful start-up, the technician shall conduct one day (eight hours) of training in the operation and maintenance of the standby power system for KGCSA personnel.

n. Field Testing: provide the manufacturer’s standard certified testing at the factory as specified below. If this certified information is not provided, prior to acceptance of the unit, it shall be field tested in the presence of the County Inspector as follows (the contractor shall provide a load bank for the test):

1) Start and operate at 25% rated load for a period not less than 1 hour, after which increase load to 50% of rated load and operate for the second 1 hour.
2) Then increase total to 100% and hold continuously for a period not less than 2-hours.
3) After this 3-hour period of operation, unload and allow to run under no-load conditions for at least 15-minutes. Then suddenly apply and hold a full 100% load for a period of not less than 15-minutes or more than 30-minutes.
4) Load and unload (at 100%) in this manner for a minimum of three (3) operations, during which observe and report the speed load recovery capabilities of the unit.
5) Submit a full written certified test report indication BHP developed, KW output, voltage, current and frequency variations to the professional design engineer for valuation.

12. Pump Station Construction:

a. Pumping station substructures shall be of reinforced or precast concrete construction. All interior wet well structures shall be lined with AGRU liner in accordance with these Standards. In those locations where an above ground building is required, the above ground structures shall be of brick masonry construction and shall have similar architecture and colors as adjacent buildings and surroundings. In those locations where a building is not required, the control panel structure shall be constructed of pressure treated wood or stainless steel and aluminum components. Other building components are:

. Shingles - fiberglass, fungus resistant, minimum 25-year warranty
. Louvers - Anodized finish with bird screen
. Doors - Fiberglass reinforced plastic (or as otherwise approved by the KGCSA)
. Hinges - "Five Knuckle Full Mortise" polished steel with stainless steel pins
. Lockset -Cylindrical with stainless steel chassis; to meet ANSI A156.2 Series 4000, Grade I

b. A paved entrance and a parking area are required and shall have a minimum twenty-five (25) foot turning radius. A six (6) foot or higher chain link fence, with green or black vinyl colored fence fabric, shall enclose the pump station site, unless otherwise approved by the KGCSA. The interior of the fenced in area shall be graded and backfilled with No. 57 stone.

c. Provision shall be made to facilitate the removal of pumps and motors, valves and piping. Adequate floor openings, doorways or

floor hatches shall be provided. Eye-bolts, trolley beams, trolley and chain fall for hoisting equipment shall be installed. Sufficient clearance between equipment and storage walls shall be provided for ease of maintenance and to meet all applicable code requirements.

d Where required, provide OSHA approved switchboard matting in front of electrical panels and transfer equipment are required.

e. Electrical equipment and wiring shall be insulated and properly grounded. Switches and control shall be of the non-sparking type.

f. Adequate lighting shall be provided in all locations including: outside, motor control panel, and wet well or as specified.

g. Electrical equipment in enclosed places where gas may accumulate shall comply with the NEMA Class I, Div. 1, Group D, specifications for hazardous conditions.

h. An adequate supply of potable water shall be provided for use in the pumping station. There shall not be a physical connection between the potable water supply and the sewage pumping station which could cause contamination of the potable water supply.

i. The pump station site shall include a buffer area as required by the King George County Zoning Ordinance and SCAT Regulations. As a minimum, the pump station wet well shall be 100-feet from the nearest proposed structure in new developments.

l. Pump station sites shall be landscaped as required by the King George County Zoning Ordinance.

m. The access frame and cover for wet wells and valve vaults shall have a ¼-inch thick one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor. The door panels shall be ¼-inch aluminum diamond plate, reinforced to withstand a live load of 300 psf. The doors shall open to 90 degrees and automatically lock with stainless steel hold open arms with aluminum release handles. Doors shall close flush with the frame. Lifting handles, hinges, and all fastening hardware shall be stainless steel. The unit shall lock with non-corrosive locking bars. Units for pump stations shall be Haliday Model No. T1R3648 and units for valve vaults shall be Haliday Model No. R1R72.

n. Penetration sleeves shall be Link-Seal as manufactured by Thunderline Corporation, or equal, and shall include the Link-Seal wall sleeve.

I. Design Considerations - Private Wastewater Disposal System:

1. Septic Tanks, Low Pressure Distribution Systems, Elevated Sand Mounds:

a. The use of individual septic tank systems, low pressure distribution systems and elevated sand mounds are permissible when the premises does not have access to the facilities of the KGCSA.

Approval for such a system shall be obtained from the King George Department of Community Development and the Virginia Department of Health (VDH).

b. VDH permits may be issued with any one or more of the following use conditions:

1) Requiring permanently installed water saving plumbing devices to reduce water flow.
2) Restricting the monthly water consumption of potable water to a volume based on a gallon per capita per day rate.
3) Restricting the occupancy of the building to a certain number of individuals.
4) A temporary permit may be issued for a specified time period not to exceed one year. Such permits are renewable when VDH determines there is a good cause for renewal.

c. Before commencement of construction of such systems, the Owner shall obtain approval from the Health Department.

d. The County will not issue a building permit for the property until a copy of the permit from the Health Department is obtained by the Owner and provided to the Department of Community Development.

e. Such systems shall not be utilized until the installation is completed to the satisfaction of the Health Department. The Owner shall operate and maintain the system in a sanitary manner at all times and in accordance with Health Department requirements.

2. Septic Tank Abandonment:

a. Disconnection of a building from a septic tank system requires that the septic tank be removed and the hole filled or that the top be removed and the vault filled with an acceptable fill material. A request to the Department of Community Development to field verify proper septic tank abandonment is required within thirty (30) days of connecting to facilities of the KGCSA.

b. If the abandonment of the septic system is in conjunction with connecting the building to a KGCSA sewer system the lateral being installed shall not pass through or connect to the discharge side of the abandoned septic tank.

J. Design Considerations - Grinder Pumps:

The use of grinder pump/low pressure systems shall be evaluated on a case by case basis and shall be in accordance with the KGCSA Regulations and these Standards. The use of grinder pump/low pressure force main sewer systems may

be authorized by the KGCSA upon a determination that one of the following conditions or circumstances exist:

1. Approved Commercial/ Industrial Uses:

    a. The commercial/ industrial business submits a plan to expand their business and there is insufficient area to expand or relocate the private sewer system in accordance with applicable Health Department regulations.
    b. The property is undeveloped but was intended to be served by a grinder pump/low pressure force main system pursuant to a subdivision development plan, site plan or KGCSA sewer extension plan approved by King George County.
    c. The KGCSA has extended service to the area and as part of the extension project, has determined that the only feasible means of serving a particular property or properties within the project area now and in the future is by use of a grinder pump/low pressure force main system.
    d. A request is made by the property owner to replace a private grinder pump system serving a commercial/ industrial property.

2. Approved Residential Uses:

    a. The private sewer system serving an existing residential property has failed and can not be repaired or relocated in accordance with applicable Health Department regulations.
    b. The property is undeveloped but was intended to be served by a grinder pump/low pressure force main system pursuant to a subdivision development plan, site plan or KGCSA sewer extension plan approved by King George County.
    c. A gravity lateral connection has been installed to serve a lot and the topography of the land or the distance from the dwelling unit to the gravity lateral is such that it is not possible for waste water to flow by gravity from the dwelling unit to the gravity connection.
    d. A request is made by the property owner to replace a private grinder pump system serving a residential property.
    e. The KGCSA has extended service to the area and as part of the extension project, has determined that the only feasible means of serving a particular property or properties within the project area now and in the future is by use of a grinder pump/low pressure force main system.

3. Extensions – Commercial/Industrial and Residential:

    a. All costs shall be borne by the owner(s) of the premises to be served including the procurement of all materials and equipment

and a qualified contractor for the construction and installation of the grinder pump/low pressure system and control system and electrical service.

b. The owner of the premise shall construct the grinder pump/low pressure system in accordance with the DEQ and VDH regulations. The KGCSA's responsibility will begin at the clean-out valve vault assembly located on the property line.

4. Grinder pump systems which must be installed in accordance with the SCAT Regulations require a letter of approval from the DEQ before a certificate to construct can be issued. A grinder pump system needs DEQ approval if the system is served by a common force main, if an individual pump discharges into a pressure sewer line, or if the pump capacity at operating head is equal to or greater than 20-gallons per minute.
5. In such instances that the pump capacity is less than 20-gallons per minute, the KGCSA technical specifications provides the minimum requirements for the grinder pump system.
6. The Department of Community Development must approve all grinder pump installations not requiring DEQ and/or VDH approval. The applicable standards of these sewerage regulations and/or the International Plumbing Code shall apply. .
7. All low pressure lines, cleanouts and valves maintained by KGCSA are to be located within utility easements provided except where connecting to the main sewer. Low pressure lines placed within the VDOT rights-of-way shall be dedicated to the KGCSA.
8. Each residence shall have an alarm installed as part of the system so as to alert the occupants of excessive high liquid levels. This includes a visual alarm installed in a conspicuous location such as a garage or kitchen.
9. Blow off valves will be required at high points in the system.
10. As a minimum, a valve box with cleanout and valve will be located at the property boundary.
11. All force mains shall discharge into a gravity system, lateral, manhole or KGCSA force main.
12. The length of a force main between a cleanout valve box and the connection point shall not exceed 300-feet.
13. All grinder pump units shall bear the National Sanitation Foundation Seal.
14. A profile drawing is required of all force mains that are to be maintained by the KGCSA.
15. As-built drawings of the force main, in accordance with the requirements of Section IV-6, shall be submitted and approved prior to acceptance of the force main by the KGCSA.

SECTION II
SYSTEM COMPONENTS

A. General Requirements: the contractor shall use only new materials, parts, products and equipment in the work which conforms to the specified requirements. Standards and other publications referenced in these Standards shall be of the latest issue or revision in effect at the time of approval of the design documents, unless otherwise specified.

B. Approval of Equipment and Materials: at the request of the County Inspector, the contractor shall supply samples of materials to be used in the work for approval by the KGCSA. Unless waived by the General Manager the contractor shall furnish a Certificate of Compliance from the manufacturer of materials and equipment used in the work stating that the material or equipment meets the requirements of these Standards. Manufacturer catalogs that provide required technical, installation and descriptive data and/or samples of the precise article proposed to be furnished shall be provided to the General Manager for approval of the equipment to be supplied. Test data shall be furnished as requested by the General Manager. Prior to making performance tests, the manufacturer shall notify the County Inspector sufficiently in advance so that the test can be witnessed. Approval of shop drawings does not relieve the contractor from the responsibility of furnishing materials and equipment of proper dimension, size, quality, quantity, and all performance characteristics to efficiently perform the requirements and intent of these Standards.

C. Materials:

1. Suitable Materials:

a. Aggregate granular material shall be washed or crushed material which conforms to VDOT specifications for #57 coarse aggregate and ASTM C 33, or as may be approved by the General Manager.
b. Sand, when specified for backfill, shall be natural sand consisting of grains of hard, sound material free from injurious amounts of clay or other coatings and deleterious material (CBR-20 or greater unless otherwise approved).
c. Select backfill material shall conform to VDOT specifications for #25 or #26. Crusher run aggregate shall conform to VDOT specifications for #21B dense graded aggregate.
d. General fill material shall be deemed as material that classifies in the ASTM D2487 soil classification groups GW, GP, GM, SW and SP, or a combination of these group materials. The maximum particle size shall be two (2) inches in the largest dimension. Maximum sized particles shall not be in excess of 20-percent of

the volume of fill material, and such particles shall be well distributed throughout the mass.

Unsuitable material includes material not meeting the above requirements, and includes clay, frozen materials, saturated materials, cinders, ashes, refuse and vegetable or organic material. Unsatisfactory soils include ASTM D2487 soil classification groups MH, ML, CH, CL, OL, OH, GC, SM, SC, and PT or a combination of these group symbols. Unsatisfactory soils also include satisfactory soils not maintained within 3-percent of optimum moisture content at time of backfill and compaction.

2. Asphalt Concrete Pavement:

   a. The materials, design, mixing, placement, finishing and curing of asphalt and paving materials shall be in accordance with the standards, specifications and requirements of the VDOT.
   b. Tack coat shall be Grade RC-250 or CSS-1h.
   c. Prime coat shall be Grade RC-250 or CSS-1h.
   d. Seal coat shall be Grade CRS-2 or CMS-2 or CMS-2h.
   e. Asphalt concrete base material shall be Type BM-25.
   f. Asphalt concrete surface material shall be Type SM-9.5.
   g. Line markings shall conform to VDOT specifications.

3. Concrete:

   a. The materials, design, mixing, placement, finishing and curing of concrete shall be in accordance with the standards, specifications and requirements of the VDOT and American Concrete Institute (ACI).
   b. Complete certified test reports shall be furnished to the County Inspector in triplicate. The contractor shall furnish the necessary labor, material and facilities for the making, storing, curing and testing of test cylinders. The contractor shall notify the County Inspector 24-hours prior to placing concrete and all samples must be obtained in the presence of the County Inspector. The contractor shall be responsible for all elements of the testing.
   c. Foundations shall at a minimum have a 28-day compressive strength of 3,000 psi or as otherwise approved by the professional design engineer. The requirement for slabs on grade and sidewalks is 4,000 psi and the requirement for precast structures is 5,000 psi. Prior to the start of any concrete work, a statement of the proportions proposed for the concrete mixture shall be submitted to the General Manager. This shall be accompanied by a certified test report from an approved testing laboratory.

d. A minimum of four (4) test cylinders shall be taken for each 50 cubic yards of concrete placed with no less than one set from each pour. The making, curing, storing and testing of the concrete cylinders shall be in accordance with ASTM C 31 and C 39. The testing of the cylinders is to be accomplished by an approved, competent, independent testing laboratory. One cylinder from each pour shall be tested at 7-days and two (2) cylinders from each pour shall be tested at 28-days. If either of the 28-day cylinders in a set falls below the required strength by more than ten (10) percent, or if the average of the two falls below the required strength by more than five (5) percent, then the forth cylinder is to be immediately tested. The strength level of the concrete from any pour will be considered satisfactory if the average of all cylinders tested at 28-days for that pour meet or exceed the required strength, and no single 28-day cylinder is below the required strength by more than 500 psi. Any concrete which does not meet these requirements shall be removed and replaced unless otherwise deemed acceptable by the General Manager.

e. The concrete slump shall be from 2-inches to 4-inches unless approved otherwise by the professional design engineer and will be determined in accordance with ASTM C 143. Samples for slump determination will be taken from the concrete during placement in the forms. Each load of concrete shall be tested for slump.

f. Air content shall be between 5 percent and 8 percent unless approved otherwise by the professional design engineer and will be determined in conformity with the requirements of "Test for Air Content of Freshly Mixed Concrete by the Pressure Method," ASTM C 231. If tests do not show satisfactory results, the mix shall be adjusted as directed.

g. Miscellaneous concrete in sewer construction shall at a minimum have a 28-day compressive strength of 3,000 psi.

h. Steel reinforcement shall be Grade 60 and shall meet ASTM A 615. Steel reinforcement shall be free from excessive rust or mill scale, dirt, paint, oil or other foreign substances. Bends shall be made in accordance with the requirements of the Manual of Standard Practice for Detailing Reinforced Concrete Structures (ACI 315). Bars shall be tied at every intersection where spacing is greater than twelve-inches in each direction. Where the spacing is less than twelve-inches, ties shall be made at alternate intersections. The minimum concrete cover shall be provided in accordance with ACI 318. Reinforcing steel shall be epoxy coated where shown on the plans and/or required in the specifications. Welded wire reinforcement shall meet ASTM A185 requirements.

4. Masonry Work:

a. Concrete masonry units (CMU) shall be manufacturers' standard units with nominal face dimensions of 16-inches length by 8-inches height. The CMU shall be high load bearing that conforms to ASTM C 90, Grade N, Type 1.
b. Brick shall be best quality, machine made of clay or shale, conforming to ASTM C 216, Grade MW, Type FBS. Color and texture is to be approved by the KGCSA.
c. Mortar materials shall be made using potable water and masonry cement conforming to ASTM C 150, Type I. The sand shall conform to ASTM C 144.
d. Hydrated lime shall comply with ASTM C 207, Type S.
e. Reinforcement for composite masonry walls shall be truss design with spacing of side rods two inches less than the nominal thickness of the wall. Side rods shall be 3/16-inch diameter, cross rods shall be #9 wire. The reinforcement shall be galvanized after fabrication in accordance with ASTM A 153. Masonry reinforcement shall be installed in the first course of block and in every second block course thereafter. Reinforcement shall lap at least 6-inches at splices.
f. Vapor barrier shall be 6-mil, clear polyethylene sheeting.
g. Air-entraining agent shall conform to ASTM C260 and be of a type that is compatible with Portland Cement.
h. Water reducing retarder shall be ASTM C494, Type D and shall comply with the water/cement ration standards of ACT 211.1.
i. Expansion joint material shall be pre-molded filler strips and shall conform to ASTM D1752. Material shall be ½-inch thick and shall extend the full depth of the slab.
j. Design and construction of concrete formwork shall be the responsibility of the contractor and shall be governed by the "Recommended Practice for Concrete Formwork", ACI 347.

5. Metals:

a. Structural steel shall comply with the AISC "Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design" and the Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using AASTM A325 or A 490 Bolts".
b. Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel".
c. Structural steel shapes, plates, anchor bolts and bars shall comply with ASTM A36.
d. High strength bolts, nuts and washers shall comply with ASTM A325, Type 1.
f. Gray iron castings shall comply with ASTM A48, Class 30.

g. Miscellaneous aluminum shall comply with ASTM B221, Alloy 6063.

h. Stainless steel shall be Type 316 unless otherwise specified.

6. Gravity Sewer Materials:

a. PVC Solid Wall Pipe and Fittings: pipe and fittings shall be permanently marked with manufacturer's trademark, size, and ASTM conformance designation. Pipe and fitting sizes from four (4) to six (6) inches in diameter shall be SDR 23.5 or SDR 26 and shall conform to ASTM D 3034. Pipe and fitting sizes from eight (8) inch through fifteen (15) inches in diameter shall be SDR 26 and shall conform to ASTM D 3034. Pipe and fittings sizes 18-inch through 27-inches in diameter shall conform to ASTM F 679. Joints shall meet all requirements of the ASTM specification referenced above for the given pipe size. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage.

b. Ductile Iron Pipe: ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and flanged ductile iron pipe shall comply with the requirements of ANSI/AWWA C115/A21.15. The pipe shall be minimum pressure class 350. The pipe and fittings shall have a double thickness cement-mortar lining in accordance with ANSI/AWWA C104/A21.4. Manufacturer's standard asphaltic coating (one-mil thickness) shall be provided on the exterior of all pipe and fittings. If, after installation, the exterior coating has been damaged, the contractor shall provide a two-mil coating of an approved bituminous coating product to those damaged areas. Joints shall be rubber-gasket joints of the mechanical, push-on or flanged type in accordance with ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/21.15. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. The minimum acceptable pressure rating for joints shall be 250-psi.

c. Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53. Fittings shall be compact and have a minimum pressure rating of 350-psi.

d. Polyethylene encasement of the piping shall be provided in accordance with ANSI/AWWA C105/A21.5 were required due to soil corrosivity. Materials and methods of installation shall be in accordance with ANSI/AWWA C105; Method A, B, or C may be used unless otherwise specified. Polyethylene shall be a minimum of eight-mils thick.

e. Other piping systems and/or materials may be approved on a case by case basis by the County Engineer and KGCSA.

7. Manholes:

a. Manholes shall be pre-cast concrete unless otherwise approved by the KGCSA. Pre-cast concrete manholes shall be manufactured in accordance with ASTM C478 and the Standard Details. Base sections shall be the extended base type. Joints shall be sealed with "O"-ring rubber gaskets, "Forsheda" gaskets or butyl resin sealant in accordance with ASTM C 443 or ASTM C 361. Manholes and appurtenances shall conform to the Standard Details.

b. A maximum of two lift holes per manhole section will be permitted. Lift holes shall be filled with a non-shrink grout upon section installation. Grout shall be in accordance with VDOT specifications.

c. Manhole coatings shall be as specified by the professional design engineer and approved by the General Manager and KGCSA.

d. Manhole frames and covers shall conform to ASTM A 48, Class No. 30 and shall be of high quality gray cast iron that is even-grained and free from unsightly defects. Frames and covers shall be designed for AASHTO Highway Loading Class H-20 and shall be finished with one coat (2 mils) of asphaltic coating. Dust covers, locking covers, and watertight frames and covers shall be of approved design. Manhole frames shall be securely bolted to the manhole structure.

e. Manhole steps shall be PVC coated steel encased in a corrosion resistant, nonsparking, non-conductive material. Manhole steps shall conform to the Standard Details.

f. Pipe connections shall be made via a flexible rubber boot type connection. Flexible rubber boot pipe-to-manhole connections shall be of the locked-in factory assembled rubber ring type utilizing a stainless steel band as manufactured by Kor-N-Seal, or Press Seal. Neoprene shall conform to ASTM C443 and ASTM C023 and all stainless steel elements shall be totally non-magnetic Series 304.

g. Manhole Inverts shall be built up of brickwork and cement mortar to match the inside diameters of the connecting sewers (bricks shall be surfaced with cement mortar, ½-inch thick and shall be trowel finished). Invert channels and manhole bottoms shall be shaped and smoothed with sand-cement grout or other appropriate consistency.

h. Cast-in-place base sections are permitted at straddle manholes and at other manhole locations where pre-cast bases are considered impractical upon approval by the General Manager. Cast-in-place bases shall be poured on a properly compacted foundation of a minimum 6-inch thick stone bedding and shall include steel reinforcing bars (one half inch diameter steel reinforcing bars spaced 6-inches on center both ways). The concrete shall be a

minimum of 12-inches thick and shall extend 8-inches outside the manhole. Proper joint construction shall be performed utilizing keyed joints, water stop, or other acceptable measures to insure that joints are leak tight.

8. Force Main Materials:

Force mains four (4) inches or larger may be either PVC, ductile iron or HDPE.

a. PVC pipe, 4-inches or larger, shall be unplasticized poly-vinyl-chloride (PVC) plastic pressure pipe with integral wall bell and spigot joints and shall be in accordance with AWWA C900 Class 150 DR-18. Joints shall be locked-in factory assembled rubber ring type. O-ring gaskets shall conform to ASTM F 477. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. Molecular Oriented PVC may be used if approved by the General Manager. This pipe shall be Class 150 PVCO 1135 pipe conforming to ASTM F1483-03 and AWWA C909.

b. Fittings for PVC pipe shall be ductile iron ANSI/AWWA C153/A21.53, compact fittings with a minimum pressure class of 350-psi. Manufacturer's standard asphaltic coating (one-mil thickness) shall be provided on the exterior of all fittings. Fittings shall have a double thickness cement-mortar lining in accordance with ANSI A21.4 (AWWA C104). Joint restraint shall be used where specified.

c. Joint Restraint: retainer glands for PVC pipe in diameters up to 12-inch shall be EBAA Iron Series 2000PV or approved equal and Megalug Series 2800 for pipe diameters greater that 12-inch. Glands shall be manufactured of ductile iron conforming to ASTM A 536. The restraining glands shall have a pressure rating equal to or greater than the pipe on which it is used. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Ductile iron pipe shall be restrained using Megalug Series 1100. All retainer glands shall conform to ASTM A536 and shall have twist-off nuts.

d. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51 and flanged ductile iron pipe shall comply with the requirements of ANSI/AWWA C115/A21.15. The pipe shall be minimum pressure class 350 for exposed pipe and for pipe diameters less than 12-inch and pressure class 250 for 12-inch diameter and larger. The pipe and fittings shall have a double thickness cement-mortar lining in accordance with ANSI/AWWA C104/A21.4. Joints shall be

rubber-gasket joints of the mechanical, push-on or flanged type in accordance with ANSI/AWWA C111/A21.11 or ANSI/AWWA C115/21.15. Gasket materials shall have been tested and rated as suitable for continuous contact with domestic sewage. The minimum acceptable pressure rating for joints shall be 250-psi. The pipe shall have an asphaltic coating.

e. Ductile iron fittings shall conform to ANSI/AWWA C153/A21.53. Fittings shall be compact and have a minimum pressure class of 350. All fittings shall be cement mortar lined in accordance with AWWA C104/ANSI 21.4.

f. Restrained Ductile Iron Pipe and Fittings: Restrained joint systems for push-on joint type piping and fittings shall be Snap-Loc/Bolt-Loc (Griffin), Super Lock (CLOW), TR Flex (U.S. Pipe) or similar systems as specified by the professional design engineer and approved by the General Manager.

g. Manufacturer's standard asphaltic coating (one-mil thickness) shall be provided on the exterior of all pipe and fittings. If, after installation, the exterior coating has been damaged, Contractor shall provide a two-mil coating of an approved bituminous coating product to those damaged areas.

h. Polyethylene encasement of the piping shall be provided in accordance with ANSI/AWWA C105/A21.5 were required due to soil corrosivity. Materials and methods of installation shall be in accordance with ANSI/AWWA C105; Method A, B, or C may be used unless otherwise specified. Polyethylene shall be a minimum of eight mils thick.

i. Pipe for 3-inch or smaller force mains shall be Schedule 80 PVC meeting ASTM D 1785 standards. Fittings shall be Schedule 80 meeting the requirements of ASTM D 2467. With the approval of the Engineer, SDR 21 PVC pipe meeting the requirements of ASTM D 2241 may be used for low pressure force mains. PVC pipe and fittings shall be manufactured from PVC resin having a minimum cell class of 12454B or 12454C as defined in ASTM D1784. Solvent cements used for joining PVC pipe and fittings must meet the requirements of ASTM D 2564.

j. High Density Polyethylene pressure pipe and fittings (HDPE) shall meet AWWA Standard C600 for force main applications and AWWA Standard C906 for water main applications. The pressure rating shall be DR-9 for 4-inch through 8-inch diameters and DR-11 for 10-inch through 24-inch diameters for water main applications and DR-13.5 for force main applications.

k. Gate valves three (3) inches and larger shall be resilient seat type, shall have a minimum working pressure of 150 psig conforming to AWWA Standard C509 and shall have an interior epoxy coating in accordance with AWWA C550. The valves shall be of the non-rising bronze or stainless steel stem type with an iron body,

mechanical joint or flanged ends, "O" ring stem seals, bronze mountings, and, suitable for buried service. The valves shall open left (counter-clockwise) by a 2-inch square operating nut. Gate valves shall be as manufactured by Darling, A.P. Smith, Mueller, Kennedy, Clow or approved equal. One valve wrench shall be provided for every three (3) valves installed in a project. Gate valves smaller than 3-inches in diameter shall be cast bronze, solid wedge disc, screwed bonnet, inside screw, non-rising stem valves with threaded connections. Valves shall conform to Standard SP80, Type 2, Class 150, Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. and shall open counter-clockwise. Valves in vaults shall have a handwheel of cast iron conforming to ASTM A126, Class B.

l. Tapping valves shall meet the same specifications as gate valves, except they shall have a full, unobstructed opening to receive a full size shell cutter. It shall be a standard mechanical joint type on one end and a flanged joint on the other end. A Mueller H-667 or approved equal shall be used. The valves shall be subjected to a test pressure of 400-psi and be designed for a working pressure of 200-psi. All interior ferrous surfaces of all valves shall be coated in accordance with ANSI/AWWA C550 using a coating approved by the Virginia Department of Health for contact with potable water and shall not contain lead, coal tar resins, lampblack, carbon black, or bituminous materials. The exterior surfaces shall receive a factory applied and KGCSA approved coating.

m. Tapping sleeves shall be mechanical joint, cast iron, or stainless steel furnished complete with plain rubber gaskets, mechanical joint accessories, and duckback gaskets. The connecting flange between the sleeve and valve shall conform to ANSI/AWWA C110/A21.10. The outlet flange for ductile iron and C-900 pipe shall be 125 pound, drilling per ANSI B16.1, with standard tapping flange counterbore per MSS SP-60. Tapping sleeves for other than C-900 PVC shall be furnished with plain rubber gaskets and have a full circumference band made of 18-8 type 304 stainless steel. The flange and all bolts shall conform to AWWA C207 Class D 150 pound drilling, made of 18-8 type 304 stainless steel.

n. Valve boxes shall be approved standard Buffalo-type, cast iron, slip-type adjustable shaft boxes, with a minimum shaft diameter of 5-1/4 inches. Valve box covers for force mains shall have the word “SEWER” cast into them. Valve boxes shall be Tyler Series 6855, or equal, for valves up to 12-inches in diameter and Tyler Series 6865 for valves larger than 12-inches.Valve box tops shall be of cast iron construction in accordance with ASTM A48 Class 30. Valve box frame and cover shall be in accordance with the Standard Details and shall be designed for AASHTO Highway Loading Class H-20.

o. Tie rods shall be in accordance with ASTM A-307.

9. Casing Pipe:

a. The casing pipe shall be either nonspiral welded or seamless steel having a minimum yield strength of 35,000 pounds per square inch (psi) and shall meet the requirements of ASTM A 139, Grade B. All joints shall be butt welded, watertight in accordance with the American Welding Society's recommended procedures.

b. The carrier pipe shall be ductile iron unless otherwise approved by the General Manager.

c. Casing spacers shall be Model No. C8G-2 or C12G-2 as manufactured by PSI, Inc. or approved equal. The spacers shall be sized to fasten securely onto the carrier pipe barrel O.D. and specified with a minimum runner height to keep the pipe from resting or sliding on its joint during installation. Casing spacers shall be bolt on style with a shell made in two sections of 14 gauge 0.074-inch mild steel or 304 stainless steel. Connecting flanges shall be ribbed for extra strength. They shall be lined with a PVC liner 0.090-inch thick with 85-90 Durometer or neoprene rubber. All nuts and bolts shall be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer and shall be supported by risers made of heavy 304 stainless steel.

d. If vent piping is required, it shall be galvanized piping. The threads shall be coated upon installation.

e. The casing pipe shall have the minimum wall thickness and diameters as listed in Table 2.1 (unless otherwise approved by the General Manager):

TABLE 2.1

Carrier Pipe Size (inches)	Casing Sizes (inches)	Wall Thickness (inches)
4	16	.250
6	18	.312
8	20	.312
10	22	.312
12	24	.375
16	28	.375
18	30	.500
20	32	.500
22	34	.500

A pipe that is to be installed under a railroad or public roadway shall meet all requirements of the permitting agent. The contractor

shall arrange for and pay for all flagmen, signs and other measures required by VDOT or the railroad company. Railroad crossings shall conform to Roadway and Ballast Section 5.2 – Specification for Pipelines Conveying Non-Flammable Substances of the American Railway Engineering Association Manual for Railway Engineering.

10. Underground Warning Tape and Tracer Wire:

Underground warning tape shall be printed polyethylene tape, magnetic, 6-inches minimum width, color coded, one-inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types. Color coding shall be green for all sanitary sewers including force mains. Tracer wire shall be plastic coated 10-gauge copper wire. Wire coating shall be suitable for direct burial. Waterproof connectors shall be provided to join tracer wire.

11. Anchor Bolts:

All concrete anchor bolts not cast in place shall be stainless steel. Anchor bolts that are pre-set and cast in place may be either galvanized or stainless steel.

12. Coatings for Manhole Interiors:

Coatings for manhole interiors shall be Sikagard 62, Koppers 300, or an approved equal.

13. Air Release Vents:

Air release vents shall be installed where shown on the drawings and in accordance with the Standard Details.

14. Flowable Fill:

Flowable fill shall have comply with the VDOT requirements for a 50 psi design mix.

15. Lumber, Fasteners and Joint Sealers:

a. Lumber shall dressed, S4S.
b. Dry lumber shall be provided with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less.
c. Plywood shall be DOC PS a in compliance with “Code Plus” provisions of APA Design/Construction Guide : Residential and Commercial”.

d. Treated lumber shall be AWPA C2 and treated plywood shall be AWPA C9.
e. Fasteners shall be hot-dip zinc complying with ASTM A153/A153M.
f. Stainless steel fasteners shall be Type 304.
g. Power driven fasteners shall be CABO NER-272.
h. Bolts shall be steel complying with ASTM A307, Grade A with ASTM A563 hex nuts.
i. Metal framing anchors shall be made from hot dip, zinc coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
j. Joint sealant for exterior work shall be single component polyurethane, ASTM C-920 type W, grade NS, class 25, use NT, M, A.
k. Joint backing shall be closed cell polyethylene rod, circular or rectangular dimension or bond-breaking type coated open cell polyurethane rod similar to "Polytite B" by Sandell Manufacturing.

16. Hinges and Hardware:

a. Door hinges and hardware shall be composed of non-corrosive materials in compliance with ANSI 156.1-1981.
b. Bored locksets shall be heavy duty in accordance with ANSI 156.2-1983.
c. Keying shall be as specified by the KGCSA.

17. Painting shall be in compliance with the most current, applicable regulations of the following agencies and organizations:

a. Steel Structures Painting Council
b. National Fire Protection Association
c. American National Standards Institute
d. Occupational Safety and Health Administration
f. American Water Works Association
g. American Society for Testing and Materials
h. National Association of Corrosion Engineers
i. National Paint and Coatings Association
j. Virginia Department of Health

D. Pumping Stations:

Materials used in the construction of wastewater pumping stations shall meet all applicable requirements specified in Section I of these Standards. Any materials or equipment proposed for pumping stations shall be as specified by the professional design engineer and approved for use by the County Engineer and KGCSA. The professional design engineer shall submit to the County Engineer

and the KGCSA all documentation necessary for the evaluation of the non-specified materials or equipment.

E. Wastewater Treatment Plants:

Wastewater Treatment Plants shall comply with Section 9 VAC 25-790-120 and VAC 25-790-450 of the SCAT Regulations. In addition, Wastewater Treatment Plants shall be in compliance with all requirements of these Standards, the KGCSA Regulations, and the County Department of Community Development.

SECTION III
CONSTRUCTION METHODS AND TESTING

A. General Requirements:

1. Erosion and sediment control/land disturbing activity permit:

   a. No person shall engage in any regulated land disturbing activity until he or she have submitted an erosion and sediment control plan for approval and has received a permit certifying such approval has been issued in accordance with the requirements of the King George County Department of Community Development.

   b. No agency, department or officer authorized under any other ordinance or law to issue grading, building or other required permits for projects involving land disturbing activities shall issue such permits until the following requirements are met:

      1) The Erosion and Sediment Control/Land Disturbing Activity Permit has been issued.
      2) An initial inspection of the erosion and sediment control measures for the project has been conducted.
      3) Notification has been issued that the project is in compliance with the erosion and sediment control plan.

2. Certificate to Construct:

   Before a contractor begins work, an application for a Certificate to Construct shall be submitted to the KGCSA and where applicable, the DEQ. A sample copy of the certificate is located in Appendix. Work shall not commence until the KGCSA or DEQ has issued the Certificate to Construct, and the developer/contractor has acquired a Land Disturbing Permit from the Department of Community Development for the project.

3. Clearing:

   Clearing shall be confined to within the limits identified on the approved erosion and sediment control plan. Any damage outside of these limits that result from the contractor's operations shall be the contractor's responsibility.

4. Grubbing:

   Areas to be grubbed shall have roots or other objectionable materials and debris removed to a minimum depth of 12-inches below ground surface. All stumps shall be removed regardless of their depth from ground

surface. Where grubbing is not required stumps shall be ground up or cut flush with the ground.

5. Disposal:

All unsuitable materials and debris resulting from the contractor's operation shall be disposed of legally by the contractor.

6. Restoration/Replacement:

Trees and shrubs damaged, but remaining, shall be repaired in accordance with the guidelines established by the Virginia Cooperative Extension Agency and the "Virginia Erosion and Sediment Control Manual", latest edition. Trees and shrubs intended to remain but which have been damaged beyond repair, or which have been removed, shall be replaced by the contractor. The contractor shall protect existing trees and shrubs to remain in place against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line.

a. Trees to remain shall be identified by flagging, a 48-inch high snow fence or comparable barrier.
b. Roots of trees to remain shall be protected from damage.
c. Where possible, roots in the trench line over 1-1/2 inch in diameter shall be tunneled by hand with the pipe laid below the roots.
d. Exposed roots are to be temporarily covered with exposed wet burlap to prevent roots from drying out; these roots are to be covered with earth as soon as possible. Roots, which can not be avoided, shall be cleanly cut with a root pruner.
f. The faces of roots over 1-1/2” inches in diameter cut during construction operations shall be coated with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues.
g. Trenches within the root area of trees to remain shall be backfilled to finished grade with one part peat moss and three parts topsoil. The area shall be watered at the time of backfill. The trenches shall be fertilized with 30-10-7 slow-release organic nitrogen fertilizer to stimulate root growth.

7. Topsoil Removal and Restoration:

The following procedure shall be followed for topsoil removal and replacement:

a. Strip topsoil;
b. Stock topsoil in location shown on plans;

c. Perform the work;
d. Scarify subsoil at least four inches in depth;
e. Spread topsoil to preconstruction grades;
f. Remove all objects over two inches in diameter; and
g. Landscape per approved plan.

8. VDOT Tree Trimming Permit:

Before the contractor trims or clears any trees on a VDOT right-of-way, the contractor shall obtain a Tree Trimming Permit from VDOT. One copy shall be provided to the County Inspector.

9. Burning Permits:

Prior to burning construction debris the contractor shall obtain required burning permits from local and state jurisdictions. The contractor shall provide one copy to the County Inspector and post and maintain one copy on-site.

10. Property Corners:

Property corners and survey monuments shall be preserved during construction activities. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be replaced by a land surveyor registered in the State of Virginia. All costs to be paid by the contractor.

11. Stabilization and Maintenance:

Areas utilized by the contractor during the construction activities shall be cleaned to the satisfaction of the County Inspector and KGCSA. All lumber, earth clods and rocks larger than two inches in diameter, or other undesirable materials shall be reduced in size or removed from the site and legally disposed of by the contractor. The contractor shall return all areas disturbed during the course of construction to a condition equal to or better than those existing prior to the commencement of construction.

All disturbed areas not designed for pavement and sidewalk replacement or structural use shall be stabilized. Stabilization shall include topsoil, seed, fertilizer, lime, and mulch applied in accordance with the latest edition of the "Virginia Erosion and Sediment Control Manual."

Disposal of excess materials, cleanup activities, site restoration and stabilization shall be accomplished within seven days of the trench excavation.

Trees, shrubs and ground cover shall be maintained by the contractor until final acceptance but in no case less than 60-days after planting. All plantings shall be guaranteed for a period of one year pending final acceptance. From time to time as work progresses the contractor shall clean up and dispose of off-site, all refuse and unused materials of any kind resulting from the work. Upon failure by the contractor to do so within 24-hours after directed, the work may be done by the KGCSA and the cost of the clean-up charged to the contractor.

B. Excavation, Backfill, Bedding and Compaction:

1. Dewatering:

Excavations shall be kept free from standing water during pipe installation, and to such extent as may be necessary during backfilling. This includes lowering the water table below trench bottom by well points and/or pumping with pumps of sufficient capacity to dewater the excavations. Disposal of excess water shall not affect public health or cause injury or damage to public or private property, the work of other contractors, or to any portion of the work completed, or in progress, or cause impediment to the use of highways or streets by the public. Dewatering flows shall be controlled in accordance with the erosion and sediment control regulations. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device or both and discharged in a manner that does not adversely affect flowing streams or offsite property. Upon completion of dewatering, the removal of sediment from storm sewers and drainage ditches and restoration of the impoundment area is required. Gutters, storm sewers, drains and ditches shall be kept open at all times. No damming or ponding of water in gutters or other waterways will be permitted.

2. Excavation:

All work shall be performed to dimensions and depths shown on the approved plans. Material suitable for backfill shall be stockpiled near the site. Materials undesirable for backfill shall be legally disposed of off-site. Existing utilities, structures and fencing shall be protected during the construction period, and if damaged or removed during operations, shall be repaired or replaced in as good or better condition. Where an excavation is deeper than necessary a layer of consolidated gravel (No. 57 course aggregate or equal) shall be placed in sufficient quantity to allow the pipe to be placed at the proper elevation. Excavated material shall be

stockpiled so as not to interfere with public travel. Bridging shall be provided as necessary to provide access to public or private property.

During the progress of the work, sidewalks, crossings and driveways shall be kept open for the passage of pedestrians and vehicles. Permission and authorization shall be obtained for partial or complete closing of a street, driveway or crossing. The contractor shall perform all work impacting traffic flow or public rights-of-way in accordance with VDOT standards and requirements.

3. Trenching:

Pipe installation operations shall be kept as close to the excavation as possible. As a general rule no more than 200-feet of trench is to be opened at any time. The County Inspector reserves the right to stop the excavation at any time if and when, in his opinion, the trench is opened too far in advance of pipe installation. Trench excavations shall conform with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees. Unless otherwise shown on the plans pipe trenches shall be excavated to a depth that will insure a minimum of 42-inches of cover for gravity sewer lines. Lines with less than 42-inches of cover shall be ductile iron. Pipe for gravity sewer lines shall be laid to the alignment, grades and limits shown on the drawings. The minimum clear width of the trench, sheeting or unsheeted, measured at the springline of the pipe shall be 12-inches greater than the outside diameter of the pipe. The maximum clear width of the trench at the top of the pipe shall not exceed a width equal to the pipe outside diameter plus 24-inches. The excavation shall take into account the pipe bells and shall be of sufficient depth to permit access to the joint for construction and inspection.

4. Bedding:

Type III Bedding, installed to a depth of 1/2 of the outside diameter of the pipe, shall be provided under all flexible piping (i.e. PVC and other forms of non-rigid piping). Aggregate bedding shall not be required when ductile iron pipe is installed unless specified by the design engineer or necessitated by poor bearing conditions of the native soils. Bedding material shall be used for laying ductile iron pipe when needed to provide a suitable foundation. Additional bedding, such as Type II Bedding (installed to a depth of 0.10 of the outside diameter of the pipe, shall be used when local conditions require additional pipe support. Manholes shall be bedded with a minimum of six (6) inches of bedding material in accordance with the Standard Details. Laterals shall be installed with Class III bedding up to and including the cleanout stack. Unstable foundations may be improved with geotextile materials in lieu of extra cut and fill and the use of select material. The use of geotextile materials and

the location of their use shall be shown on a plan and approved by the General Manager on a case by case basis. Installation if approved shall be in accordance with manufacturer's requirements.

5. Backfill and Compaction:

   a. All pipe shall have proper bedding and each joint properly made before backfill is placed. All trenches shall be backfilled with approved material immediately after the pipes are laid, unless other protection of the pipe line is provided and approved by the General Manager. Where trench excavation material is deemed suitable and the use of select material has not been required, the trench excavation material shall be used for backfill. Where trench excavation material is deemed unsuitable for backfilling (unsuitable as described in Section II of these Standards), the contractor shall provide select backfill consisting of clean earth, sand, gravel, or other approved material (as described in Section II of these Standards). The determination of suitability of all backfill shall be made by the professional design engineer or approved soils engineer. The quantity and source documentation shall be provided upon request. Backfill material shall be carefully tamped around and over the pipes in six (6) inch layers up to a level at least one foot above the top of the pipe. The maximum size stone in the first twelve (12) inches of backfill shall not exceed one-inch in diameter. Simultaneous backfilling on both sides of the pipe is required. The remainder of the backfill shall be deposited and compacted by mechanical equipment in thoroughly tamped layers not exceeding one-foot lifts. The maximum size stone permitted in this portion of backfill shall not exceed two (2) inches diameter. In areas where paving is to be placed over the backfilled trench, the entire depth of backfill shall be deposited in six (6) inch layers and compacted by hand or mechanical tampers. Flooding with water to achieve compaction is not permitted.
   b. Backfill compaction requirements shall be in accordance with AASHTO Method T-99, modified. Each layer of material is to be compacted to a minimum of 95 percent of the maximum density at optimum moisture content as described by ASTM D 698, (85 percent is acceptable in yard and non-paved areas).
   c. Compaction Testing:

      1) Conduct compaction testing at locations approved by the professional design engineer during backfilling operations.
      2) Determine compaction by the testing procedure contained in ASTM D 698.

d. It is the intent of these Standards to secure a condition where no further settlement of trenches will occur so that when backfilling is completed the roadway or base or final ground cover may be placed immediately. Additionally, settlement is not to occur around manhole structures. When using mechanical tampers the contractor shall exercise care to insure that pipe joints will not be broken, damaged or disturbed.

e. The trench shall be maintained in a dewatered state during placing of backfill and while compacting. Sufficient water shall be added to fill material, as required, to obtain a moisture content that falls within three-percent of the optimum moisture for the specific backfill material. All saturated backfill material is unacceptable.

6. Testing:

Compaction tests of in-place trench material shall be performed to assure attainment of required density. These tests shall be made at the contractor's expense and shall be performed by a Soils Laboratory approved by the County Engineer and KGCSA. Generally, one test is to be performed per 1,000 linear feet of pipeline for every 24-inches of lift required starting from one-foot above the pipe. The contractor shall give copies of all test results in a report form to the County Inspector to demonstrate compliance with compaction requirements. The number of required tests shall not be construed as to be limited to one test per 1,000 linear feet. If additional testing or alternative test methods are required by other agencies involved in the project, such as VDOT, it shall be the contractor’s responsibility to satisfy all additional requirements. The contractor shall repair any settlement within the one-year guarantee period. The contractor shall make all necessary repairs and replacements within 30-days after notice from the KGCSA.

7. Sheeting, Shoring and Trench Boxes:

All excavations and other work requiring sheeting, shoring or trench boxes shall be performed in accordance with all Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees. The contractor is solely responsible for the safety and condition of all work. The contractor shall not proceed until the necessary trench boxes, sheeting, shoring and bracing have been properly installed. Shoring shall not be removed before a minimum of two-feet of backfill has been placed over the crown of the pipe and compacted to the required density. The contractor shall, at his own expense, protect from direct or indirect injury all personnel, pipes, tracks, walls, buildings, and other structures of property in the vicinity of his work, whether above or below the ground. All sheeting, shoring and bracing shall be removed by the contractor

during backfilling operations unless otherwise approved by the design professional.

8. Unstable Subgrade:

In the event that unsuitable material is encountered at or below the level of the pipe bed, such material shall be removed and replaced, or removed, stabilized and replaced. Material used for replacement must be No. 57 course aggregate or other material specifically designated in writing by the design professional and approved by the General Manager.

9. Overhead High Voltage Lines Safety Act:

The contractor shall comply with the provisions and requirements of the Overhead High Voltage Lines Safety Act (Title 59.1, Chapter 30 of the Code of Virginia) in performing work.

C. Pipe Installation - Gravity Lines:

1. Each joint of pipe shall be inspected for defects prior to being lowered into the trench. The pipe shall be swabbed or brushed out to insure that dirt or foreign materials do not get into the finished line. Trench water , earth and other substances shall be kept out of the pipe and the pipe kept closed by means of a plug whenever work is not in progress. Bell and spigot pipe laying shall proceed upgrade with spigot ends pointing in direction of flow.

2. Pipe installation shall commence immediately after the excavation is started, and every means must be used to keep pipe laying close behind trenching. Holes shall be scooped out for the bells and the entire barrel of the pipe shall bear on the pipe bed.

3. An engineering grade level shall be maintained on site to check pipe grade with project benchmarks. This is required for each run of pipe. Care shall be taken that the pipe is laid accurately to line and grade. The pipe shall lie on a straight sight line between manholes without dips or bends. Any section of pipe found to be laid at the wrong grade, or to have settled shall be dug up and re-laid at the contractor's expense.

4. A laser shall be used to maintain line and grade. A ventilating fan shall be used in conjunction with the laser beam to preclude fumes or air conditions which may cause refraction. A copy of the certification of the laser calibration shall be provided to the County Inspector for each separate job prior to the beginning of pipe installation.

5. Pipes shall be handled carefully as they are lowered into the trench. Proper and suitable equipment and tools shall be used for the safe and convenient handling of pipe during installation. Special care shall be taken to insure that each length abuts against the next in a manner which precludes shoulder unevenness of any kind. A pipe joint shall not be brought into position until the preceding length has been secured in place with sufficient backfill material to prevent movement of the pipeline.

6. Whenever a pipe requires cutting to fit into the line or to bring it to the required location, the work shall be done so as to leave a beveled end in accordance with the manufacturer's requirements. Cuts shall be made 90 degrees with the centerline of the pipe.

7. Ductile iron pipe shall be required for installation of pipe with less than 42-inches of cover or at a depth exceeding 15-feet (PVC C-900 DR18 is also allowed for sewers deeper than 15-feet).

8. A minimum 10-foot section of pipe shall be used to tie into an existing manhole.

9. Clean out assemblies shall be constructed as follows unless otherwise approved by the General Manager. All joints from the first 45-degree elbow (where the lateral begins to turn to the vertical) to the termination of the vertical section shall be solvent weld glue joints or same type of joint as the lateral material. The vertical riser shall be terminated with a glue cap. For existing homes, the pipe cap shall be within four inches of the top of the cleanout casting and the casting shall be set to finished grade. In areas under development or other situations where the cleanout assembly is subject to being damaged by continuing construction activities the clean-out assembly shall be set as follows. The vertical section shall be terminated three (3) feet below grade with the a secure watertight cap. The cleanout casting shall be placed a few inches above the cap and the entire assembly buried to protect it from further construction. A marker post (metal fence post or treated four-by-four post) shall be set to identify the cleanout. It is the contractor's responsibility to insure that the County Inspector has obtained adequate as-built documentation of the location of the cleanout prior to backfilling over the assembly.

D. Pipe Testing - Gravity Lines:

1. Infiltration/inflow shall not exceed 100 gallons per day per mile of sewer per inch of nominal pipe diameter, not including an allowance for manholes (This equates to 1.89 gallons per day per 100 feet of sewer per inch of pipe diameter) and there shall be no visible leaks in the lines or manholes. Low pressure air testing of all gravity lines shall be performed

in accordance with ASTM F 1417. Prior to scheduling tests for the new sanitary sewer, the following must be addressed:

a. A minimum of 30-days must have elapsed since installation of the sanitary sewer lines.
b. Preliminary certified "as-builts" must be submitted to and approved by the County Inspector.
c. All essential underground utilities (water, electric, telephone, gas and cable) must be installed or a plan shall be submitted mitigating conflicts from future utility installations.

2. New gravity sanitary sewer systems will be tested as follows (unless waived by the County Inspector): (1) Visual Test; (2) Deflection Test; (3) Low Pressure Air Test and (4) Closed Circuit Television Camera (TV) inspection. Testing and inspection shall be conducted in the order given and the gravity section must pass each test before moving to the next test.

3. The County Inspector shall be notified 48-hours prior to all tests. Representatives of the developer or developer's design professional may be present. All testing activities require compliance with the Occupational Safety and Health Agency (OSHA) in regard to confined space entry.

4. Responsibilities - The contractor shall furnish all the necessary tools, equipment, and labor and be responsible for conducting all low-pressure air tests. The KGCSA will supply the mandrels for the deflection testing for 8”, 10” and 12” diameter pipes; the contractor shall provide the mandral for other pipe diameters. The County Inspector shall witness all low-pressure air tests and verify the accuracy and acceptability of the test and the equipment utilized. The contractor is responsible for any repair work on sections that do not meet testing.

5. Visual Test:

All manhole lids shall be removed by the contractor as a prerequisite to conducting the visual test. The contractor shall certify that all manhole entries are in compliance with confined space entry procedures and mechanical ventilation shall be provided. A visual inspection shall consist of the following:

a. Inspection for visible leaks in lines or manholes.
b. Inspection for condition of the grout in the interior joints or manholes.
c. Inspection of manhole frames and covers for proper type and installation.
d. Inspection to see if lines are free of debris.
e. Spot check of pipe grades compared to "as-builts."

f. Check of alignment and grade by flushing with water and observing with reflected sunlight or a high intensity lamp.

g. Check that manholes have been completely and properly coated on all surfaces.

6. Deflection Test: the entire length of all flexible gravity sanitary sewer lines shall be tested by means of a rigid mandrel to assure that deformation or deflection does not exceed five percent of the base inside diameter (per ASTM D 3034 and ASTM F 679) of the pipe. The contractor shall pull a mandrel through the line in the presence of the County Inspector. The mandrel, one for each size of pipe, shall be a nine arm mandrel, with a proving ring sized at 95-percent of the base inside diameter of the pipe. Lines must be free of debris for this test and the contractor shall be responsible for installing a stringline in the pipe for the test. The deflection test shall not be performed until a minimum of 30-days after installation of the line to be tested. Any sections that do not pass shall be corrected or replaced by the contractor. Ductile iron pipe and C-900 PVC will not be required to have a deflection test performed. Refer to Table 3.1 for the mandrel sizes used for deflection tests.

TABLE 3.1
King George County Service Authority Mandrel Standard
Based upon ASTM D 3034 and ASTM F 679

Pipe Type	Nominal Pipe Size	Average Inside Diameter	Mandral Size (5% Deflection)
PVC ASTM D 3034 SDR 23.5	6”	5.71”	5.33”
PVC ASTM D 3034 SDR 26	8”	7.71”	7.11”
	10”	9.64”	8.87”
	12”	11.48”	10.55”
	15”	14.05”	12.90”

6. Low-Air Pressure Test:

a. An air test conforming to ASTM Specification F 1417 shall be performed on all gravity lines prior to acceptance. The contractor is responsible for supplying an air-testing rig and pressure gauge, calibrated to the tenth of a pound, for this test.

b. Safety - all plugs must be installed and properly inflated to prevent blowout. All pressurizing equipment used for low-pressure air testing shall include a regulator or relief valves set no higher than nine pounds per square inch gauge to avoid over-pressurizing and

displacing temporary or permanent plugs. No person shall enter a manhole while air is being forced into a pipe with plugs in place or when any pressure remains behind plugs.

c. Equipment - all plugs shall be capable of resisting internal testing pressures without the aid of external bracing or blocking. If pneumatic plugs are utilized, a separate hose is required to inflate the pneumatic plugs from the above ground control panel. To facilitate test verification by the Inspector, all air used shall pass through a single above ground control panel. The above ground air control equipment shall include a shut-off valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from zero to at least ten psig. The gauge dial shall be divided in 0.1 psi or smaller increments. The gauge shall have an accuracy of plus or minus 0.04 psi. Two separate hoses shall be used (in addition to hose for pneumatic plugs) to: (1) connect the control panel to the sealed line for introducing low pressure air, and (2) a separate hose connection for constant monitoring of air pressure build up in the line.

d. Line Preparation (Laterals, Stubs and Fittings) - all service laterals, cleanouts, stubs, and fittings within the sewer test section shall be properly capped or plugged during construction to prevent air loss that could cause an erroneous air test result.

e. Air-Test Procedure (Refer to ASTM F 1417 for complete procedure) :

1) Plug Installation: after a manhole-to-manhole reach of pipe has been backfilled to final grade and prepared for testing, the plugs shall be placed in the line at each manhole and secured. Once the plugs are in place and the air hoses connected, the plugs are inflated. After all lines are plugged, the sewer line can be pressurized to the test pressure.

2) Line Pressurization: air shall be supplied slowly to the section of the sewer being tested until the internal pressure reaches 4.0 psig greater than the average back pressure of groundwater above the pipe, but not greater than 9.0 psig. The groundwater adjustment shall be calculated by dividing the average vertical height (in feet) of groundwater above the invert of the sewer pipe to be tested, by 2.31. The result gives the adjustment in pounds per square inch that must be added. If this results in a required test pressure of above 9.0 psig, then the contractor must lower the elevation of the groundwater surrounding the pipe to a point that will result in a required test pressure of 9.0 psig or less.

3) Pressure Stabilization: after an internal pressure of 4.0 psig (plus required groundwater adjustment) is obtained, allow at least two minutes for air temperature to stabilize.

4) Timing Pressure Loss: after two minutes, the air hose from the control panel to the air supply shall be shut off and disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased by no more than 0.5 psig. At a reading of 3.5 psig (plus required groundwater adjustment), timing shall commence. The watch or timing device shall be stopped and read when the pressure drops 1.0 psig and the elapsed time (in minutes and seconds) shall be recorded.

f. Acceptance of Air Testing:

If the time shown in Table 3.2 (or calculated from the formulas contained in ASTM F 1417) for the designated pipe size and length elapses before the air pressure drops 1.0 psig, the section undergoing test shall have passed and shall be presumed to be free of defects. If the section fails to meet these requirements, the contractor shall determine at his own expense the source or sources of leakage, and shall repair or replace all defective materials and/or workmanship to the satisfaction of the County Inspector. The completed pipe installation shall then be retested until the requirements of this test are met.

TABLE 3.2
AIR TEST TABLE (Based on Equations from ASTM F 1417)

SPECIFICATION TIME (min:sec) REQUIRED FOR PRESSURE DROP FROM 3 1/2 TO 2 1/2 PSI WHEN TESTING ONE PIPE DIAMETER ONLY

LINE LENGTH (FEET)	PIPE DIAMETER (INCHES) 4	6	8	10	12	15	18	21	24
25	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
50	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
75	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
100	3:46	5:40	7:34	9:26	11:20	14:10	17:00	19:50	22:40
125	3:46	5:40	7:34	9:26	11:20	14:10	17:00	21:13	26:51
150	3:46	5:40	7:34	9:26	11:20	14:10	18:19	25:27	32:13
175	3:46	5:40	7:34	9:26	11:20	14:34	21:22	29:22	37:35
200	3:46	5:40	7:34	9:26	11:20	16:39	24:25	33:56	42:57
225	3:46	5:40	7:34	9:26	12:31	18:44	27:28	38:11	48:19
250	3:46	5:40	7:34	9:49	13:54	20:49	30:31	42:25	53:41
275	3:46	5:40	7:34	10:47	15:17	22:54	33:34	46:40	59:04
300	3:46	5:40	7:36	11:46	16:41	24:59	36:37	50:54	64:26
350	3:46	5:40	8:47	13:44	17:48	29:08	42:44	59:23	75:10

400	3:46	5:40	10:03	15:42	22:15	33:18	48:50	67:52	85:54

NOTES:

1) The KGCSA requires a minimum test pressure of 4.0 psig with no more than 1.0 psig pressure loss for the above duration of times listed.
2) Test pressures shall increase according to groundwater levels over the sewer line.
3) Maximum pressure shall be no higher than 9.0 psi.

7. Closed Circuit Television (TV) Inspection:

Upon successful completion of the other three test procedures the General Manager may require a closed circuit television inspection. This inspection will only be required if there is a question of proper pipe installation. If a TV inspection is required, the contractor shall pay for and arrange for a TV inspection; the TV inspection shall be performed in the presence of the County Inspector. Lines shall be cleaned prior to the inspection. The inspection shall conform to the National Association of Sewer Service Companies recommended specification for television inspections for sewer mains. A videotape of the inspection shall be provided to the County Inspector for review. If the television inspection of the pipe shows poor alignment, displaced or cracked pipe, improper joints or slipped gaskets, the defect(s) shall be corrected and the pipe line re-videoed.

E. Pipe Installation - Force Mains:

1. Each joint of pipe shall be inspected for defects prior to being lowered into the trench. The pipe shall be swabbed or brushed out to insure that dirt or foreign materials do not get into the finished line. Trench water shall be kept out of the pipe and the pipe kept closed by means of a plug whenever work is not in progress. The pipe shall be handled carefully and in accordance with the manufacturer's instructions and recommendations.

2. Bell and spigot pipe shall be laid with spigot ends pointing in direction of flow.

3. Pipe installation shall commence immediately after the excavation is started, and every means must be used to keep pipe laying closely behind the trenching. Type III bedding, as a minimum, is required for flexible pipe. Additional bedding may be required, such as Type II for ductile iron pipe or Type IV for flexible pipe, depending upon soil conditions. Bedding requirements shall be specified on the drawings by the design professional.

4. Proper and suitable equipment and tools shall be used for the safe and convenient handling of pipe during installation. Special care shall be taken

to insure that each length abuts the next in a manner that precludes shoulder unevenness of any kind.

5. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded the full length of its barrel. A pipe joint shall not be brought into position until the preceding length has been secured in place with sufficient backfill material to prevent movement of the pipeline.

6. Whenever a pipe requires cutting for the insertion of valves, fittings, closure pieces, or to bring it to the required location, the work shall be performed so as to leave the end smooth in accordance with the manufacturer's instructions or recommendations. A pipe damaged by the contractor in cutting shall be replaced at his expense.

7. All pipe laying and joining shall be performed in strict accordance with manufacturer’s installation instructions.

8. Magnetic Detection: all pressurized underground utility lines shall have installed a continuous strip of identification tape within 18-inches of the ground surface; located over the centerline of the pipeline. PVC pipe shall have in addition to the tape a plastic coated ten (10) gauge copper wire attached to the pipe with plastic strapping. The wire shall terminate above ground at every valve box and air release valve. The wire shall be of sufficient length to allow the wire to be uncoiled and extended one (1) foot above the finished grade.

9. Thrust Restraint: all pipe fittings, bends, tees, and valves shall be properly restrained to resist thrust. Thrust restraint shall be designed utilizing standard engineering practice to meet the requirements of each installation considering parameters such as the pipe size, pressure, and soil conditions. The location and design of the pipe restraint shall be included on the plan and profile sheets; restrained sections of pipe shall be clearly identified by shading or other means on the drawings. All exposed piping, flanges, couplings, tie rods, nuts and bolts shall be given two coats of Koppers Bitumastic 50, or approved equal protective coating.

F. Pipe Testing -Force Mains:

1. All completed pressure lines and appurtenances shall be pressure tested by the contractor in the presence of the County Inspector in accordance with the following procedure:

a. The contractor shall provide the water, pressure gauges (measuring in maximum five pound per square inch (psi) increments), pumps and apparatus for testing. Gauges are subject to inspection and verification of accuracy on a dead weight tester. The contractor shall present documentation that the pressure gauges used for the test have been calibrated within six months prior to the test by an authorized testing facility. Prior to pressure testing, all joint restraint shall be installed.

b. The newly laid pipe, or any valved section thereof, shall be slowly filled with water from an approved source and all air expelled from the pipe at air release assemblies before applying the specified test pressure. The pressure test shall be of two-hour minimum duration at a hydrostatic test pressure of 150 psi or 1.5 times the design operating pressure, whichever is greatest, measured at the highest point along the test section. The contractor shall ensure that all intermediate valves remain open during the test.

c. The piping section shall be deemed as passing the test if there is no more than 5-psi change in the test pressure and does not exceed the allowable leakage.

d. A leakage test shall be conducted concurrently with the pressure test. The leakage allowance is the quality of makeup water that must be supplied to maintain the test pressure. The allowable leakage shall be determined using the equation below:

$$\frac{L = SD(P)\ ½}{133{,}200}$$

Where:
L = allowable leakage, in gallons/hr.
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
(P) ½ = square root of average test pressure during leakage test, in psig

d. At the completion of the test, the pressure shall be bled to zero and test gauge verified as registering zero. Any cracked or defective pipe, fitting or valve discovered in consequence of testing shall be removed and replaced by the contractor with sound material in the manner specified. The test shall be repeated until a satisfactory rating is obtained.

e. Water for the pressure test shall be obtained through a fully valved manifold with an approved backflow perventer.

G. Manhole - Installation:

1. Precast Concrete Manholes: the combined height of the manhole including base, barrel, cone, and casting should be constructed to provide

the fewest number of joints. Apply a non-shrink grout inside and outside of all manhole joints. In adjustment of the manhole rim elevations, a maximum of up to 12-inches of adjustment rings may be used. A one-foot barrel riser section must be used in adjustments of 12-inches or greater. The use of brick and mortar for making height adjustments is not permitted. Top sections shall be precast eccentric cones designed to receive the cast iron frame and cover. The frame and cover shall be securely bolted to the cone top or to the adjustment rings.

2. Manhole Frame and Cover: the rim elevations should be a minimum of 18-inches above the ground in unimproved areas and where specified. The frame shall be securely bolted to the cone top and the adjustment rings (adjustment rings shall be bolted to the cone top).

3. Manhole Steps: manhole steps shall be cast integrally with precast concrete manholes and shall be constructed into and securely anchored to the walls of cast-in-place manholes. Steps shall be uniformly spaced at 12-inches to 16-inches on center vertically and shall project evenly unless otherwise approved.

4. Pipe Connections: installation shall be per manufacturer's instructions and recommendations. Corings for boot connectors shall not be within four inches of the manhole barrel section joint. Manholes with multiple lateral boot installations shall be staggered as shown on the Standard Details.

5. Manhole Inverts: the inverts of manhole channels shall be smooth flow transitions using accurately shaped arcs connecting the inlets and outlet pipes in such a manner as to diminish any loss of head due to a change in the direction of flow. Bench slopes shall be a minimum of three (3) inches vertical per foot of horizontal distance. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit.

6. Manhole Types: manholes shall be one of the following types and shall be constructed in accordance with the Standard Details and the following:

    a. A shallow manhole shall only be constructed at locations where the vertical depth between the invert of the midpoint of flow line and the top of the manhole rim does not exceed four-feet. A case-by-case approval by the General Manager is required for shallow manholes.
    b. A standard manhole shall be used for all locations unless the use of a shallow or drop manhole is required.

c. An Inside Drop Manhole shall be used for all new construction when a drop is required. Drop type manholes are required if the vertical difference in depth between the midpoint of flow line and the invert of any inlet pipe is 24-inches or greater.. Only one inside drop may be installed into a manhole unless specifically approved otherwise by the General Manager.

d. A Straddle Manhole shall only be used when approved by the General Manager for tying into an existing line.

H. Testing - Manhole:

All manholes shall be Vacuum tested by the contractor in the presence of the County Inspector in accordance ASTM C1244. The contractor may elect to make a test for his own purposes prior to backfilling; however, the manhole must be completely backfilled prior to acceptance testing. **The manhole frame shall be installed and the joint between the manhole and the frame shall be included as part of the test.** Prior to testing, the contractor shall thoroughly clean the manhole and seal all openings. The contractor shall (i) inflate the compression band to effect a seal between the vacuum base and the structure; (ii) connect the vacuum pump to the outlet port with the valve open; (iii) draw a vacuum of ten (10) inches of mercury and close the valve. The time measured for the vacuum to drop from 10" to 9" shall be recorded. The required duration of the test is based upon the diameter of the manhole and is found in Table 3.4 below.

TABLE 3.4
VACUUM TEST TABLE

Manhole Diameter (Inches)	Test Period (Seconds)
48	60
60	75
72	90

If the vacuum drop is greater than one inch of mercury during the test period, the manhole shall be repaired and retested.

I. Pipe Installation - Casing Pipe:

1. The minimum cover for a bore and jack casing shall be 42-inches. The depth of cover must conform to that stated in Highway or Railway permits.

2. The casing excavation should not be more than one-inch greater than the casing's outside diameter. Should the casing excavation be more than one-inch larger than the outside diameter of the casing pipe, the void area shall be pressure grouted at the contractor's expense.

3. The contractor shall maintain the boring auger just far enough ahead of the casing being jacked to provide clearance for proper installation. The contractor shall provide a continuous operation until the casing is installed. The bore equipment shall be of adequate size and capacity to perform the work.

4. The elevation of the finished casing shall conform to the approved plans.

5. Welding shall be a full penetration circumferential weld performed by a qualified welder.

6. The jack pit and receiving pit shall be excavated in the location shown on the approved plans and be performed with a minimum of interference with or damage to the adjacent areas.

7. The jack pit shall be kept in a dewatered state throughout the duration of construction. When the work is completed the pits shall be closed by proper backfilling and compaction, and the disturbed areas shall be restored to original or better condition.

8. The contractor shall install sheeting, shoring and bracing as required to insure work area safety at all times.

9. Casing pipe size shall be as specified in Section II and shall be in accordance with the Standard Details.

J. Pump Stations:

1. Detailed plans and specifications of sewage pumping stations shall be reviewed and approved in writing by the County Engineer, KGCSA and DEQ prior to the start of construction. Prior to the contractor commencing construction, the professional design engineer shall provide the KGCSA with a copy of the Certificate to Construct issued by the DEQ. In addition, changes to any previously approved plans and specifications shall be approved in writing by the County Engineer and KGCSA prior to initiating the work.

2. Sewage pumping stations shall be constructed under the supervision of the professional design engineer who prepared the plans and specifications. All structural, electrical, mechanical and other work shall be conducted in strict accordance with all applicable codes, laws and regulations.

3. A minimum of two-weeks prior to final inspection of the pump station, two-copies of the Operation and Maintenance manual shall be submitted

to the KGCSA and two-copies shall be submitted to DEQ. The format and content shall be as required in Section IV of this document.

4. Upon completion of construction, the KGCSA and DEQ will inspect the sewage pumping station. A test run shall demonstrate that the performance requirements of all pump station components have been met by the equipment as installed and shall include, but not be limited to, the following tests:

   a. That all units have been properly installed.
   b. That the units operate without overheating or overloading any parts and without objectionable vibration.
   c. That there are no mechanical defects in any of the parts.
   d. That the pumps can deliver the specified pressure and quantity.
   e. That the pumps are capable of pumping the specified material.
   f. That the pump controls perform satisfactorily.
   g. That the generator and transfer switch operate automatically in a satisfactory manner.
   h. That the alarm system operates satisfactorily.

5. The professional design engineer shall certify to the KGCSA and DEQ that the project has been completed in accordance with approved plans and specifications and in accordance with these Standards and the SCAT Regulations. Prior to the KGCSA accepting the pump station, the professional design engineer shall obtain a Certificate to Operate from the approving agency.

6. As more fully specified in Section IV of these Standards, the professional design engineer shall develop and certify a set of as-built drawings for the station and the associated piping. These drawings shall be submitted to and approved by the KGCSA as part of the acceptance process for the station. The KGCSA reserves the right to reject any station in the event that construction was not in accordance with the approved plans and specifications.

7. As more fully specified in Section IV of these Standards, a guarantee of materials, equipment and workmanship for a period of one-year from the date of acceptance by the General Manager will be required from the contractor and/or developer for stations to be owned by, or dedicated to, the KGCSA.

K. Private Sewerage Disposal and Grinder Pump Systems:

1. Low pressure sewer lines, as part of a private sewerage or grinder pump system, and which is being accepted by the KGCSA for maintenance shall be tested by the contractor between the point of connection and the

cleanout valve box. This test shall be witnessed by County Inspector. Pressure and leakage tests for force mains that are to be dedicated to KGCSA shall be performed in accordance with Section III of this specification.

2. Low pressure sewer lines shall be installed with a minimum depth of 42-inches. All materials and work shall be in accordance with manufacturer's instructions and recommendations.

3. A continuous plastic warning identification tape shall be installed within 18-inches of the ground surface. In addition, all non-metallic pressurized underground sewer lines shall have a plastic coated ten gauge copper clad wire running the entire length of the pipe. The wire shall be attached with plastic strapping or duct tape to the line at a maximum of ten (ten) foot intervals. The wire shall terminate inside the cleanout valve box or valve boxes used to house the wire ends at intervals that do not exceed 500-feet.

4. Proper thrust restraint shall be used. At a minimum thrust blocks shall be required at all vertical and horizontal bends greater than 11-degrees. The thrust blocks shall be placed against undisturbed earth and shall have a minimum bearing area of one square foot.

5. When mechanical joints, fittings, valves, etc. are installed, plastic sheeting material shall be placed around the pipe and fitting joints before the concrete is poured to prevent bonding between the pipe and the concrete.

SECTION IV
SUBMITTALS

A. General Requirements:

1. Detailed utility design calculations, flow projections, impact analysis, and plans and specifications are to be submitted to County Engineer and the KGCSA through the Department of Community Development. The costs for review of designs, calculations, plans and specifications shall be as stipulated in the King George County Code and/or the KGCSA Regulations. All drawings, specifications, engineer's reports and other documents shall be prepared by or under the supervision of appropriately licensed professionals, legally qualified to practice in Virginia. The design professional shall also submit documents to the DEQ when required in accordance with the SCAT Regulations.

2. Changes to any previously approved plan or specification shall require prior approval by the County Engineer, KGCSA and state agencies affected by those changes. Adequate copies of the plans showing proposed changes shall be submitted.

3. Utility plans shall contain a title sheet showing a vicinity map and an index of the construction sheets. An overview map (scale 1 inch = 200 feet) shall be provided that includes the system being constructed, street layout and names, pipe size, manhole numbers, flow direction, drainage facilities, water lines and fire hydrants. Plan sheets shall be twenty-four inches high by thirty-six inches long. Margins shall be one-half (1/2) inch top and bottom, three-quarter (3/4) inch on the right side and one and three-quarter (1-3/4) inch on the left side. A standard title block shall be located in the lower right hand corner of each sheet and shall bear the same general title identifying the overall project, and shall be numbered. All other requirements of the DEQ and the King George County Zoning Ordinance for preparation and submission of development plans shall be satisfied.

4. The General Manager will authorize formal acceptance of the sewer system for operation and maintenance after all requirements of these Standards and the Regulations have been met and a Certificate to Operate has been issued by the KGCSA and/or DEQ.

B. Sewer Systems:

1. The minimum horizontal scale for sewer line plans shall be no less than one inch equals fifty feet (1 inch = 50 feet). Scale factors less than the minimum may be approved by the County Engineer and KGCSA for projects that require greater detail. The vertical scale shall be proportional

to the horizontal scale. Single or double cycle plan profile sheets may be used. The location of the sewer shall be shown on the upper half of the drawing with the sewer profile and ground elevation shown on the lower half of the plan.

2. For gravity sanitary sewer systems, types of material, slope, rim and invert elevations, and centerline station shall be shown in plan and profile views. All manholes shall be numbered and located by station with manhole inverts and rim elevations on both plan and profile. Laterals shall be provided to all lots. Where there is any question of the sewer being sufficiently deep to serve any residence, the elevation and location of the basement floor shall be specified and plotted on the profile. The design professional shall verify that all sewers are sufficiently deep to serve all lots.

3. For water systems and sanitary force mains, all horizontal bends, vertical offsets, valve, hydrants, ends of all lines, sections of pipe to be restrained, and other fittings shall be accurately indicated in the plan and profile view.

4. The plans shall show the location of all road rights-of-way, KGCSA easements (existing and proposed), property boundaries, houses or other structures. New developments shall show all proposed utility placement so as to show the effect, if any, upon utilities and easements that are to be dedicated to the KGCSA. Designs shall endeavor to keep other public utilities out of KGCSA easements.

C. Pump Stations:

1. Sewage pump stations that are constructed within King George County for dedication to the KGCSA shall be reviewed and approved prior to construction. Two (2) complete sets of plans and specifications shall be submitted to the KGCSA for review. These documents shall also be submitted to the DEQ by the design professional engineer for compliance with State regulations and shall be approved by DEQ prior to commencement of construction and prior to formal acceptance by the KGCSA. The design professional engineer's submittal shall include an evaluation of the adequacy of existing downstream sewer systems and shall also include a map showing the extent of the proposed tributary area.

2. Plans: Pump station plan sets shall contain the following:

   a. Title sheet: All pump station plan sets shall contain a title sheet with the following:

      ( ) Project name or designation
      ( ) Sheet index

( ) Project vicinity map
( ) Project service area
( ) Project owner
( ) Professional engineer seal

b. Site plan: All pump station plan sets shall contain a site plan with the following:

( ) North arrow
( ) Bench mark
( ) Locations of existing utilities
( ) Locations of all easements
( ) Scale identified
( ) Erosion control measures
( ) Existing and final topography
( ) Pump station landscaping
( ) Pump station fence location
( ) Site drainage
( ) 100-year flood elevation, if applicable
( ) Other requirements of the County Zoning Ordinance

c. Construction plans and details shall be clearly and neatly drawn with proper identification, dimensions, material and other information necessary to insure the desired construction, to include:

( ) Proposed equipment layout
( ) Elevation of operating levels and alarms
( ) soil boring information
( )plan and elevation views of the station and piping showing all valves and appurtenances.

2. Specifications shall typically be of the Construction Specification Institute (CSI) format and contain technical data on the following:

a. Projected flow rate/existing and future head conditions.
b. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on eight and one-half (8½) inch by eleven (11) inch sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves will not be acceptable.
c. Other pertinent engineering data.

d. All construction information not shown on the drawings which is necessary to inform the contractor in detail of the requirements as to quality of materials and workmanship and fabrication of the project; the type, size, strength, operating characteristics and rating of equipment including machinery, pumps, valves, piping and joining of pipe; electrical apparatus, wiring, operating tools, construction materials, miscellaneous appurtenances, and operating, testing and maintenance instructions.

3. Operation and Maintenance Manuals for Pumping Stations:

a. The contractor shall furnish four (4) copies of a loose-leaf type manual that contains complete operation and maintenance instructions for the following equipment (2 copies to DEQ and 2 copies to the KGCSA):

1) Control System
2) Air Compressor
3) Sewage Pumps, Including Pump Curves
4) Electric Motors
5). Generator Set, Including Transfer Switch Wiring Diagrams
6) Alarm Systems
7). Check Valves
8) Gate Valves
9) Unit Heaters
10) Lights
11) Odor Control Facilities

b. The manual shall include model numbers, a complete parts list and the names and addresses of applicable subcontractors, suppliers, and manufacturers.

c. A Schedule of Values of major pump station items shall be included in the submittal.

d. The manual shall be in conformance with Section 9 VAC 25-790-290 and VAC 25-790-300 of the SCAT Regulations.

D. Wastewater Treatment Plants:

Construction drawings for wastewater treatment plants shall be in compliance with Section 9 VAC 25-790-120 of the SCAT Regulations and shall be designed in accordance with Section 9 VAC 25-790-450 of the SCAT Regulations.

E. As-Built Drawings:

1. **PRIOR TO THE INSPECTION** of sewer, water, or drainage improvements by the County Inspector, the professional design engineer

or surveyor shall submit two (2) preliminary paper copies of as-builts for the project to the County Inspector. The County Inspector will distribute the as-builts to the KGCSA and coordinate the review and approval of the as-builts. Copies should be submitted as soon as possible to facilitate a prompt acceptance process. The developer will be allowed no more than five (5) connections to the newly installed utility prior to the submittal of final as-built drawings and acceptance by the KGCSA. The remaining connections will be allowed only after the developer has completed item E.2 below. If there are ten (10) or less connections resulting from the new development, the developer shall complete item E.2 below before any connection will be permitted.

2. Upon approval of the preliminary as-builts, the developer shall:

    a. Submit a letter requesting the General Manager to accept the project. The letter shall include the costs associated with installing the sanitary sewer, both on-site and off-site if necessary. A one (1) year letter of warranty shall accompany the letter.
    b. Through the design professional, submit one (1) reproducible mylar drawing and two (2) complete sets of prints for the entire project.

3. The following are minimum requirements for sewer as-builts:

    a. The name of the development.
    b. The size of the as-built sheet shall be 24 inch x 36 inch and shall have a thickness of 0.003 mil (final reproducible). The original construction plan drawings may be modified in that design parameters can be erased and "as-built" information incorporated.
    c. A certification statement prepared by the design professional shall be included on the as-built as follows:

        "The sanitary sewer, water, and drainage structure locations and grades shown on these drawings, are accurate and complete to the best of my knowledge and belief and I certify that I, or my agent, have made sufficient inspections to ensure the accuracy of this statement."

    d. The name of the professional engineer or surveyor along with his or her seal (King George County will only accept flow calculations from surveyors with parts A & B licenses).
    e. Show lot numbers and property lines (and addresses if available).
    f. Show drainage and utility easements with the deed book and page of recordation. (on-site and off-site if necessary).
    g. Indicate bench mark(s) used and the description.

4. In addition to the requirements outlined above, the following information shall be included on gravity sewer and force main as-builts:

    a. The rim and invert elevations of manholes.
    b. The length, type, size, and slope (gravity sewer) of sewer lines are required. Note: If the slope is less than the minimum required by these Standards or DEQ, then a flow certification by the professional engineer or surveyor will be required and drafted on the as-builts.
    c. Manholes shall be numbered and measurements given between manholes using continuous stationing running from downstream to upstream. All measurements shall be taken from the center of the manhole cover.
    d. Except in a cul-de-sac, lateral clean-outs/water meter locations shall be measured using continuous stations and off-set from the center line of the main line sewer or water main. Sewer lateral clean-outs located out of end manholes or water meters in cul-de-sacs shall use continuous stationing along the end main line alignment providing an offset distance from this stationing and the actual lateral length. The following information shall be provided for each sanitary sewer or water service line:

        1) Run Up (RU) = The horizontal measurement of the actual lateral pipe (right or left).
        2) Height (Ht) = The distance measurement at 90 degrees offset from the main line to the end of the actual lateral pipe.
        3) Depth (D) = The depth of the lateral at the property line (minimum shall be 42-inches).
        4) Wye = The station location of the wye (actual location using continuous stationing).
        5) Corp. = The station location of the corporation stop (for water mains).
        6) All horizontal bends, vertical offsets, valves, hydrants, ends of all lines, and other fittings shall be accurately located on the as-built by triangulation from two permanent structures, which will be visible on the ground surface.

    f. Show significant physical conflicts with the mainline, in relation to other utilities.
    g. Identify and label all existing sewers or water mains affecting respective project.

5. In addition to the requirements outlined above, the following information shall be included on Pump/Lift Station as-builts:

a. Number of homes to be served and total number of homes capable of being served.
b. Internal piping and mechanical layout with sizes, material, and measurements from the structure.
c. Architectural drawing of the structure showing sizes and materials.
d. Dimensioned site plan showing easements, deed/plat book and page number of recordation, station external piping, driveway, landscaping and drainage as situated on the plans.
e. All pump criteria as to present an ultimate capacity, head conditions, RPM's, impeller size, pump type and motor size.

6. An "as-built" checklist is provided in Appendix D.
7. Construction record information shall conform to the tolerances listed in the table below:

INFORMATION ACCURACY

	SURVEY	CONSTRUCTION	CONSTRUCTION TOLLERANCE
Manhole Rim & Invert	X		± .05 ft.
Manhole Location	X		± 1.0 ft.
Fire Hydrant Location	X		± 1.0 ft.
Valve Location	X		± 1.0 ft.
Fitting Location		X	± 1.0 ft.
Offset Location		X	± 3.0 ft.
Lateral Location		X	± 1.0 ft.
Corp. Stop Location		X	± 1.0 ft.
Meter Location	X		± 1.0 ft.
Blowoff, Air Vent Location	X		± 1.0 ft.
Pressure Pipe Location		X	± 1.0 ft.
Pressure Pipe Depth		X	± 6.0 in.
Pump Station Elevations	X		± .05 ft.
Pump Station Other		X	± 1.0 in.

E. Guarantee and Warranty:

1. The developer shall submit a letter requesting the General Manager to accept the public facilities for use by the KGCSA. Accompanying this letter shall be a final quantity take-off and a one-year letter of warranty containing the following verbiage:

> "On _____, 20___, we submitted to you the manufacturer's warranties relative to _____ (project). This firm hereby agrees to be responsible for performance in connection with all of the guarantees provided

under these warranties. Additionally, this firm hereby warrants, for the period of one (1) year after acceptance of the project, all materials, equipment, and workmanship associated with the project. Additionally, this firm does hereby agree to conform in all respects to the requirements of KGCSA Regulations."

2. Sewer systems to be owned by, or which will be dedicated to, the KGCSA shall be guaranteed by the developer or contractor for a period of one (1) year after the date of formal acceptance by the General Manager. The guarantee shall cover all materials, equipment and workmanship and shall commence on the date that the facilities are accepted by the General Manager.

3. Should any item of equipment malfunction within the year of guarantee, the developer or contractor shall, at its own expense, renew or replace it, or do whatever is necessary to remedy the fault. The developer or contractor shall, during the same one-year period, repair promptly at its own expense all breaks or failures due to faulty material or workmanship.

4. In addition to the above stated one (1) year guarantee, the developer or contractor shall, for all equipment installed for which the manufacturer thereof has a standard guarantee in excess of one-year, furnish to the KGCSA all the necessary warranties to properly guarantee such equipment by the manufacturer for the standard term of the manufacturer's guarantee. The warranty period will not commence until the facility is formally accepted by the General Manager.

5. The above warranty shall be secured by a Virginia surety bond or letter of credit as specified in the Regulations.

APPENDIX 1

KING GEORGE COUNTY SERVICE AUTHORITY

CERTIFICATE TO CONSTRUCT SEWER FACILITIES

_____is hereby granted a Certificate to Construct Sewer Facilities in accordance with the King George County Service Authority (KGCSA) Regulations, as amended by the KGCSA Board of Directors. Sewer construction is to be in accordance with the provisions of the KGCSA Sanitary Sewer Standards and Specifications, the Commonwealth of Virginia Sewage Regulations, the Occupational Safety and Health Standards, and the KGCSA Regulations.

This certificate is valid from the date of issue for a period not to exceed one (1) year and is subject to revocation for non-compliance with the above requirements. Any changes in these approved plans require notification to, and approval by, the General Manager and the County Engineer.

A pre-construction meeting is required before any sewer work is started. The required pre-construction meeting must be conducted at least two (2) weeks (14 days) lead time prior to the ordering of materials. Additionally, the contractor shall notify the County Inspector a minimum of 48 hours prior to beginning any sewer facilities construction or testing to ensure that an inspector will be available.

LOCATION AND DESCRIPTION

Plan approved on: _____ Name of Project: _____

Plan dated: _____ Location: _____

Design Engineer: _____ Contractor: _____

APPROVED: _____ APPROVED: _____
County Engineer General Manager

Certificate Number: _____

Date: _____

APPENDIX 2

SANITARY SEWER DATA SHEET

Date: _____

1. Project Name: _____
2. Project Location: _____
3. Sewer Service Area: _____
4. Design Engineer: _____
5. Number of Connections: _____
6. Projected Average Daily Flow: _____
7. Projected Peak Daily Flow: _____
8. Sanitary Sewer System Piping:

Diameter (inches)	Pipe System (gravity or force main)	Length (Feet)	Material (PVC,DI, etc)

9. Sanitary Sewer Manholes:

Standard:_____ Total Depth: _____
Watertight: _____ Total Depth: _____
Drop: _____ Total Depth: _____

KING GEORGE COUNTY SERVICE AUTHORITY

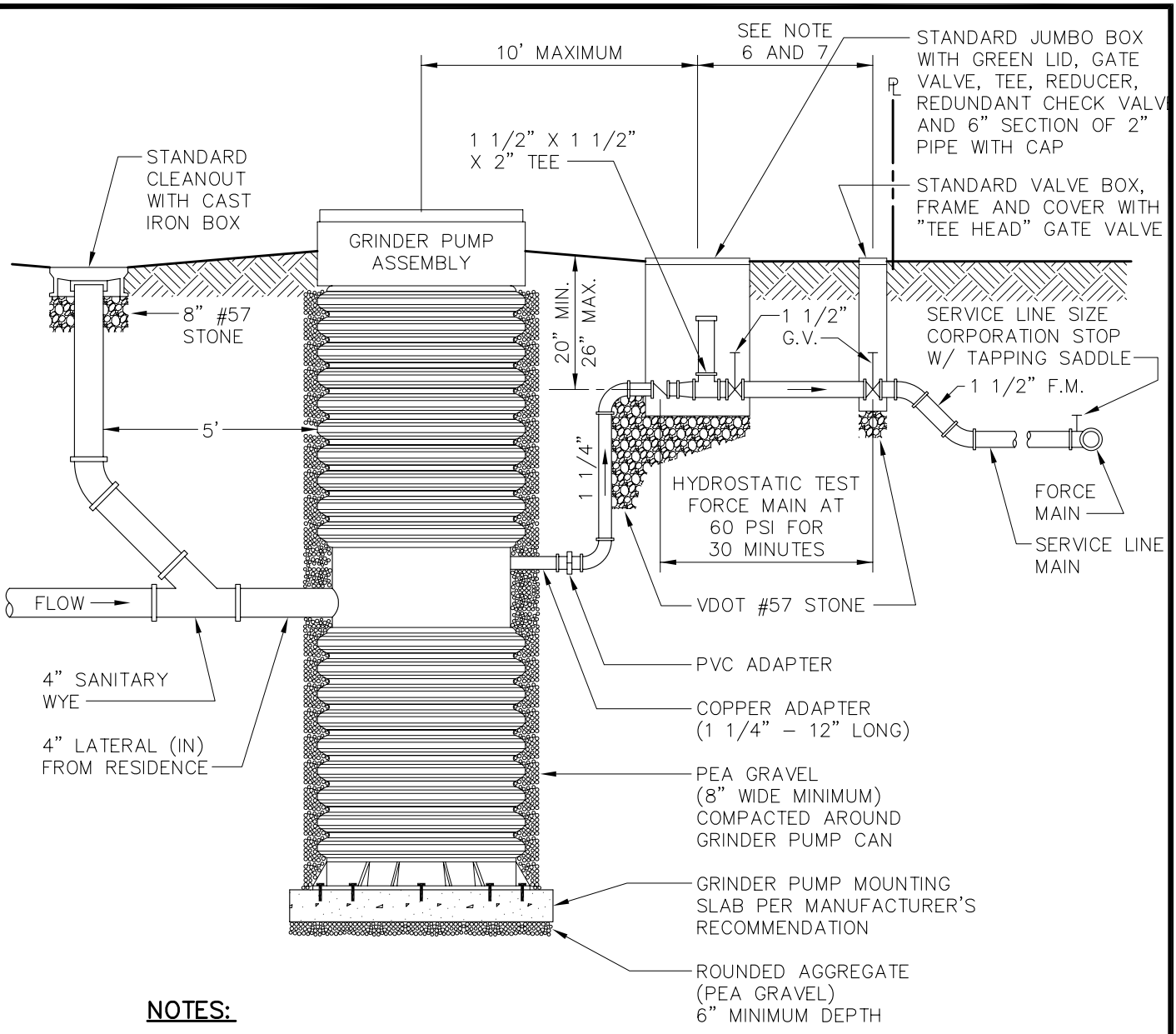
APPENDIX 3

GENERAL NOTES – SANITARY SEWER SYSTEMS
(to be placed on construction drawings)

1. All components of the sanitary sewer system shall be installed and tested in accordance with the latest edition of the King George County Service Authority (KGCSA) Standards and Specifications for Sanitary Sewer Systems, the Department of Environmental Quality SCAT Regulations, the Virginia Erosion and Sediment Control Manual and the VDOT Road and Bridge Specifications. The contractor shall contact all agencies prior to commencement of construction.
2. The contractor shall submit a list of materials for approval to the County Inspector prior to commencement of construction.
3. The contractor shall contact the County Inspector a minimum of 2 days prior to commencement of construction to schedule a pre-construction meeting.
4. The contractor shall notify Miss Utility (800-552-7001) a minimum of 72 hours prior to commencement of construction.
5. The contractor shall obtain all permits required for construction, including a business license to perform work in King George County.
6. All erosion and sediment control requirements shall be installed and maintained during sewer system construction.
7. Prior to the inspection of the sewer improvements, the developer's representative shall submit as-built drawings to the County Inspector. Occupancy Permits will not be issued by the County Department of Community Development until all inspections and tests have been satisfactorily completed, and as-built drawings have been approved by the KGCSA.
8. Routine periodic inspections will be made by the County and KGCSA during construction. These inspections do not relieve the developer from its obligation and responsibility for constructing a sanitary sewer system in strict accordance with the standards and specifications of the KGCSA and DEQ.
9. Any changes to the final plans and specifications shall be approved by the County and KGCSA and shall be accurately indicated on the as-built drawings.
10. All lots shall be provided with sewer service connections. The connections shall be installed in accordance with the KGCSA Standard Details.
11. The developer shall submit sewer data sheets and shall obtain a Certificate to Construct prior to commencement of construction.
12. The contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The contractor shall erect, and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection. The contractor is solely responsible for all job site safety. The contractor is solely responsible for all job site safety.
13. The contractor shall comply with all provisions and requirements of the Overhead High Voltage Line Safety Act of the Code of Virginia.
14. For construction activities in existing developed areas, the contractor shall maintain access for mail and paper delivery vehicles, school buses, emergency vehicles, trash collection, and homeowners through construction. Disturbed mail and paper boxes and driveways shall be repaired and/or restored the same day.

King George County Service Authority
Detail Sheet Index

APPENDIX 4



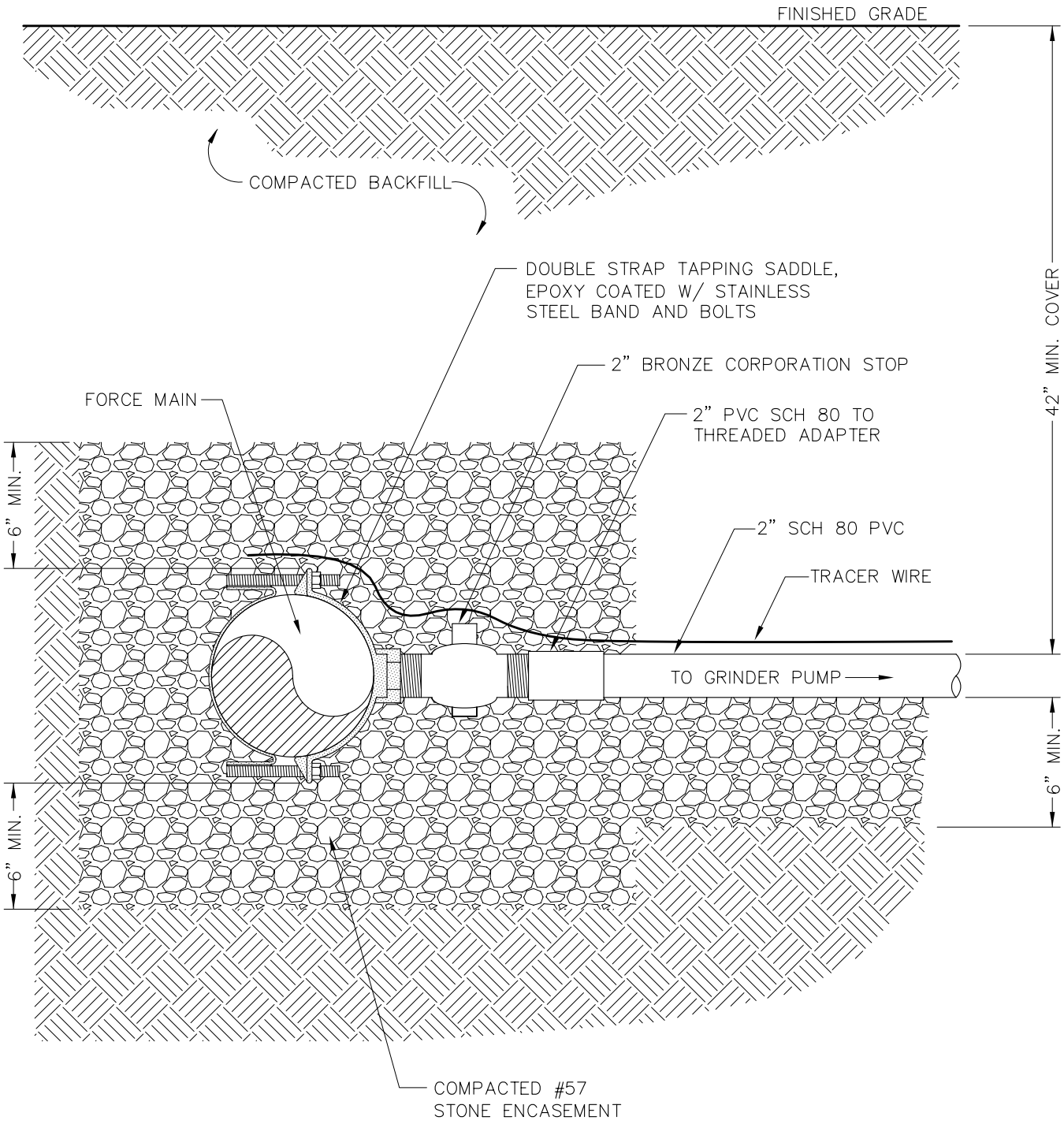
NOTES:

1. GRINDER PUMPS SHALL BE LOCATED ON EACH LOT/PARCEL AS SHOWN ON THE APPROVED DEVELOPMENT PLANS.
2. FORCE MAIN TRAP IS REQUIRED WHEN DISCHARGING INTO A GRAVITY SYSTEM.
3. GRINDER PUMP ASSEMBLIES SHALL BE "ENVIRONMENT–1" MODEL 2010 OR MODEL 210 AS MANUFACTURED BY ENVIRONMENT ONE CORPORATION
4. SADDLES MAY BE USED FOR CONNECTIONS TO GRAVITY SEWERS.
5. ALL MATERIALS AND INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
6. SHUT OFF VALVE SHALL BE LOCATED AT PROPERTY LINE.
7. SHUT OFF VALVE MAY BE DELETED WHEN JUMBO VALVE BOX CONNECTION IS LOCATED ON/AT THE PROPERTY LINE.
8. THE LOCK AND PUMP WRENCH DELIVERED WITH THE GRINDER PUMP ARE TO BE LEFT IN THE CAN UNTIL COUNTY PERSONNEL ARRIVE.

RESIDENTIAL GRINDER PUMP

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–1



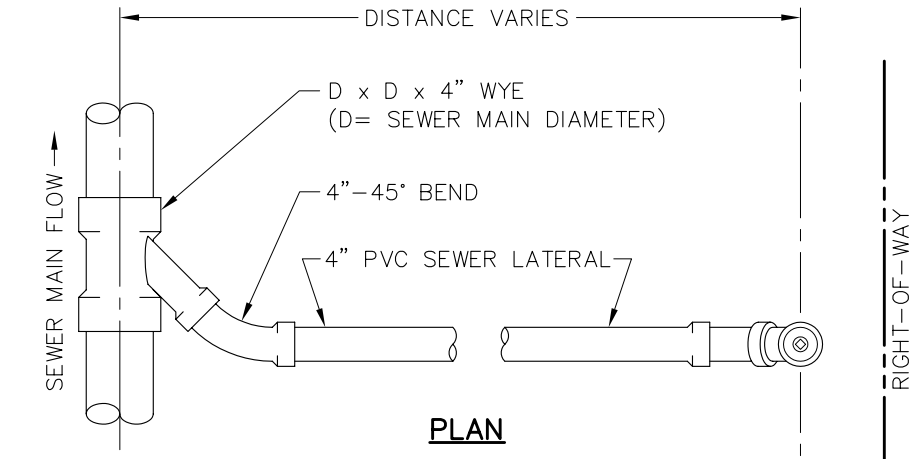
NOTE:

TAPPING SADDLE SHALL BE USED IF MAIN IS PVC PIPE OR 6" OR SMALLER DUCTILE IRON PIPE. DUCTILE IRON MAINS LARGER THAN 6" MAY BE DIRECTLY TAPPED WITHOUT SADDLES.

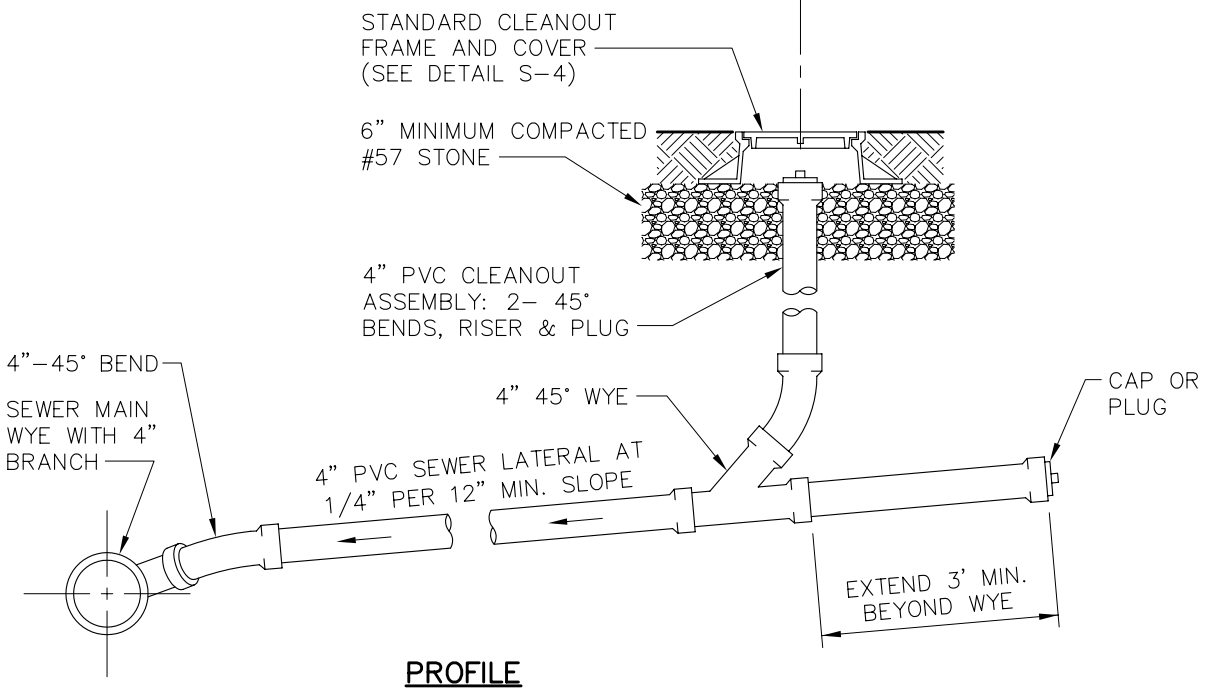
RESIDENTIAL GRINDER PUMP

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: S-1



PLAN



PROFILE

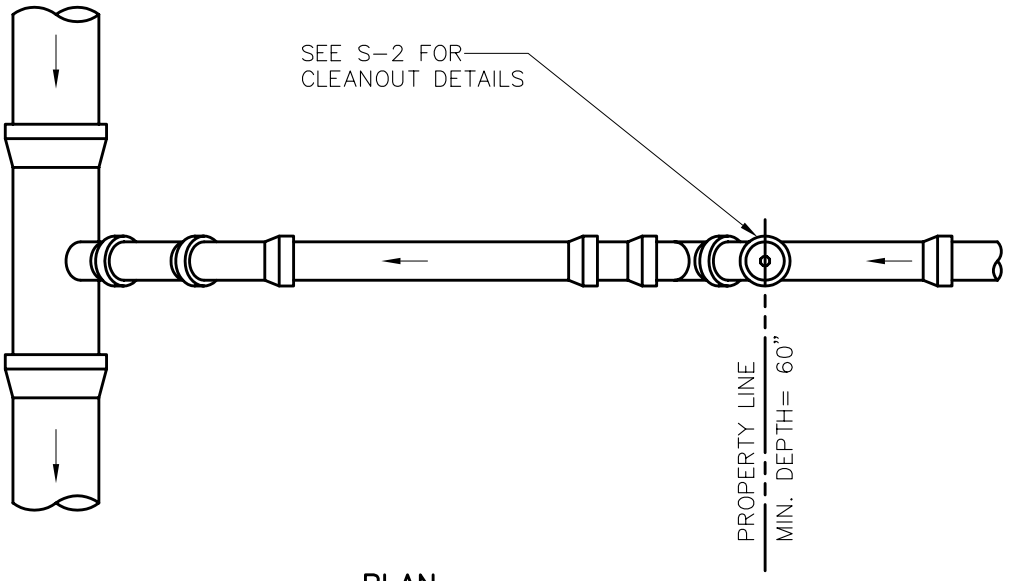
NOTES:

1. SLOPE OF 1/8" PER FOOT MAY BE USED I DUCTILE IRON PIPE IS USED.
2. SEWER SERVICE LATERAL PIPING AND FITTINGS SHALL BE SDR 26 OR 23.5 PVC WHICH CONFORMS TO ASTM D–3034, UNLESS DEPTH DICTATES OTHERWISE.
3. EACH CLEANOUT SHALL BE FITTED WITH STANDARD CLEANOUT FRAME AND COVER.
4. NO BENDS GREATER THAN 45° SHALL BE USED IN SERVICE LATERAL CONSTRUCTION.

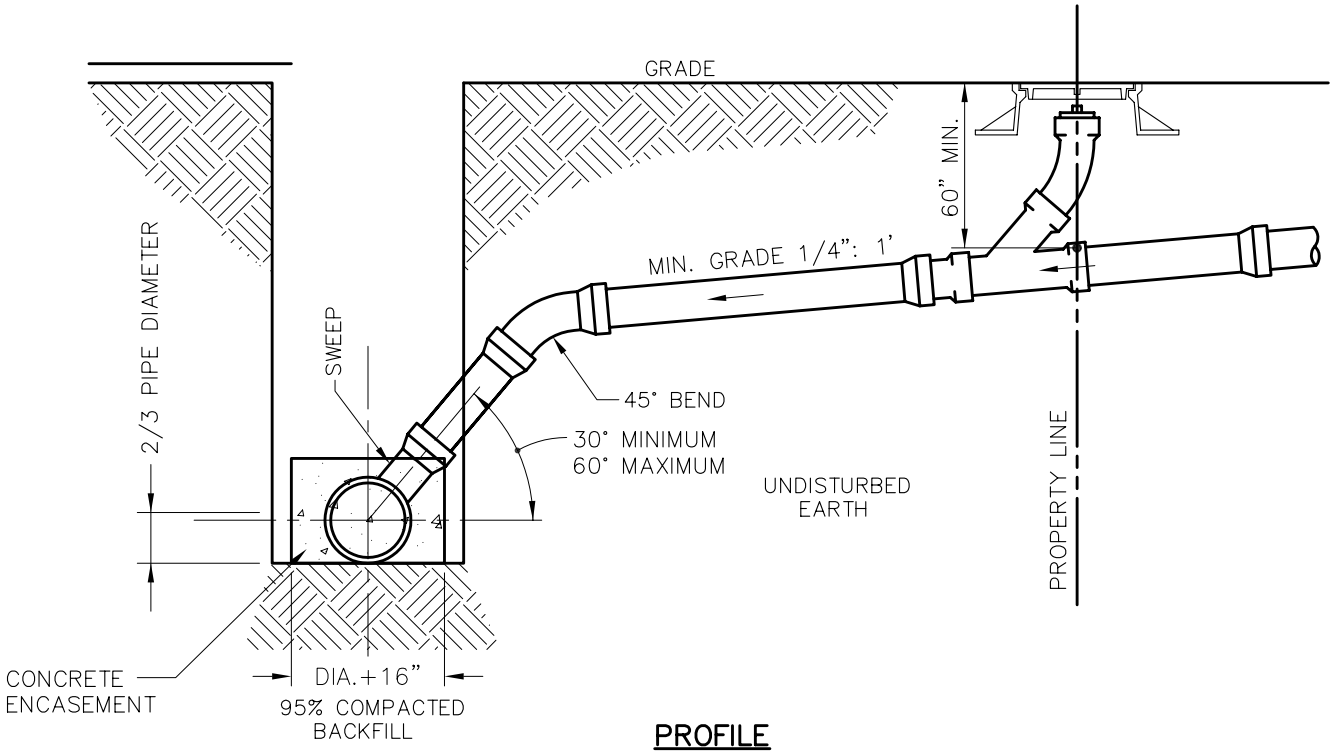
TYPICAL SEWER SERVICE CONNECTION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–2



PLAN



PROFILE

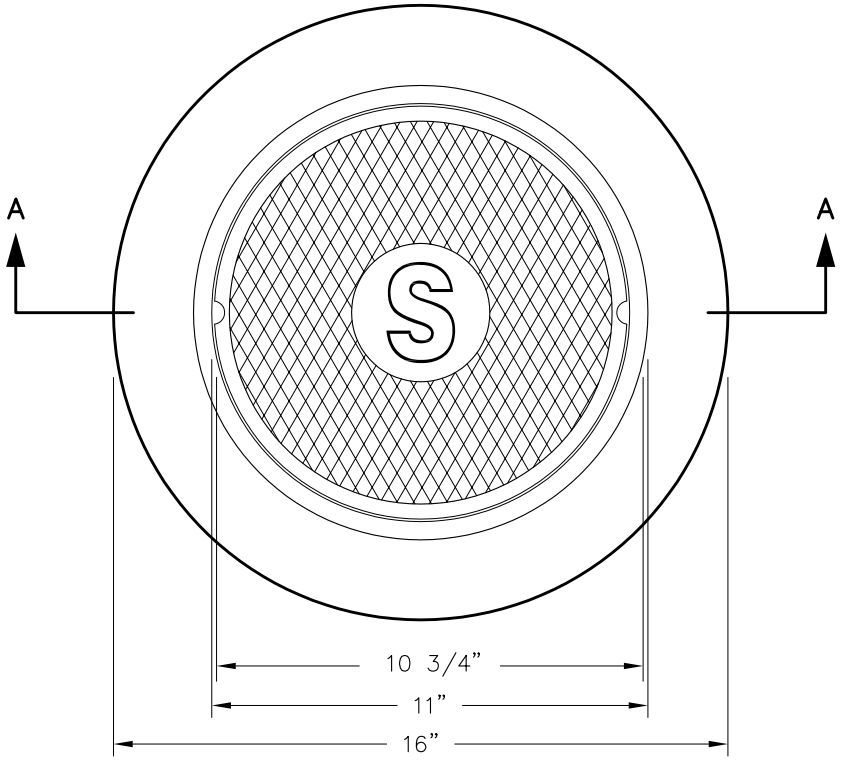
NOTES:

1. SLOPE OF 1/8" PER FOOT MAY BE USED I DUCTILE IRON PIPE IS USED.
2. SEWER SERVICE LATERAL PIPING AND FITTINGS SHALL BE SDR 26 OR 23.5 PVC WHICH CONFORMS TO ASTM D-3034, UNLESS DEPTH DICTATES OTHERWISE.
3. EACH CLEANOUT SHALL BE FITTED WITH STANDARD CLEANOUT FRAME AND COVER.
4. NO BENDS GREATER THAN 45° SHALL BE USED IN SERVICE LATERAL CONSTRUCTION.

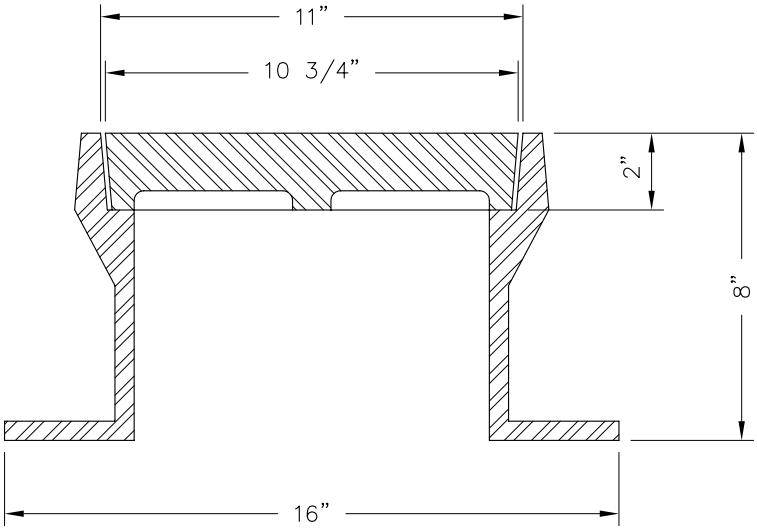
SERVICE CONNECTIONS FOR DEPTHS OVER 8'

KING GEORGE COUNTY SERVICE AUTHORITY

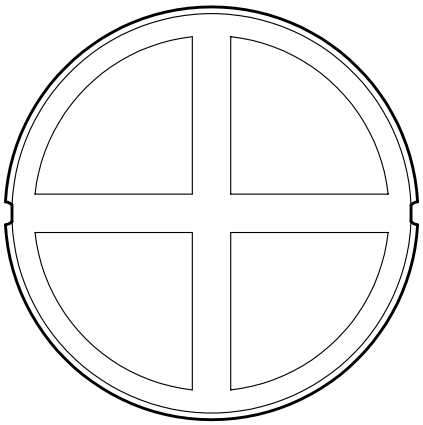
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-3



TOP VIEW



SECTION A – A



BOTTOM VIEW OF COVER

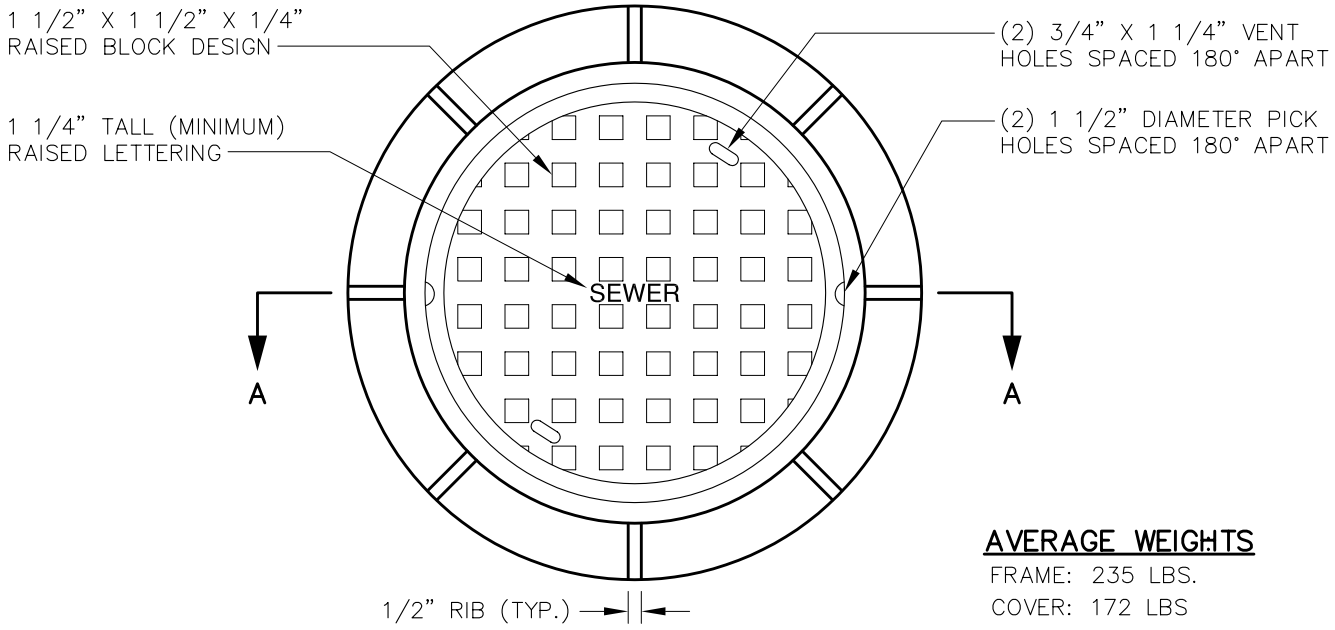
NOTES:

1. ALL GRAY IRON CASTINGS SHALL CONFORM TO ASTM A–48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
2. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8" ±.
3. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING USING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.
4. FRAME AND COVER SHALL BE H–20 HIGHWAY LOAD RATED FOR PARKING LOTS, SHOPPING CENTERS, ECT.

SEWER CLEANOUT FRAME AND COVER

KING GEORGE COUNTY SERVICE AUTHORITY

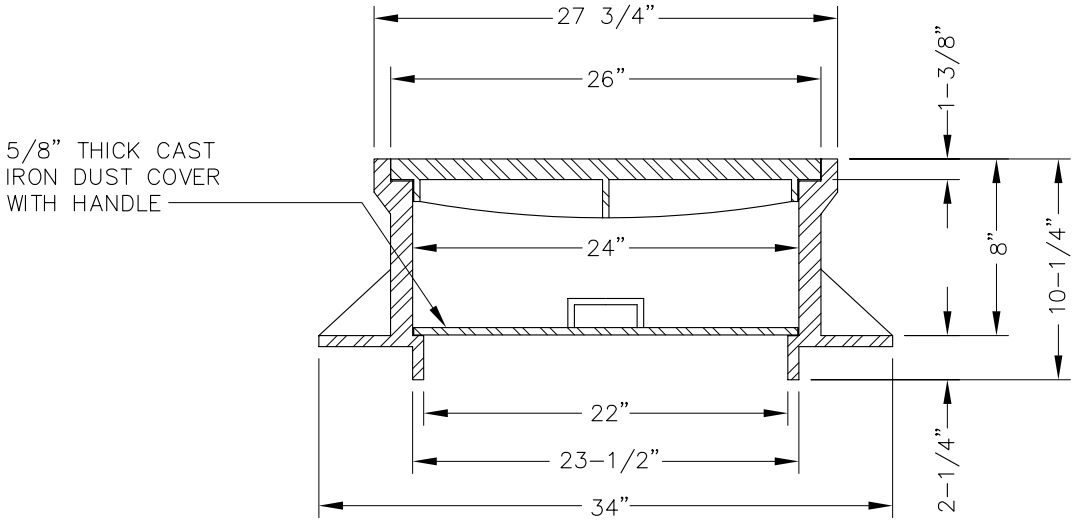
SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–4



PLAN

AVERAGE WEIGHTS

FRAME: 235 LBS.
COVER: 172 LBS
DUST COVER: 43 LBS.
TOTAL: 450 LBS



SECTION A–A

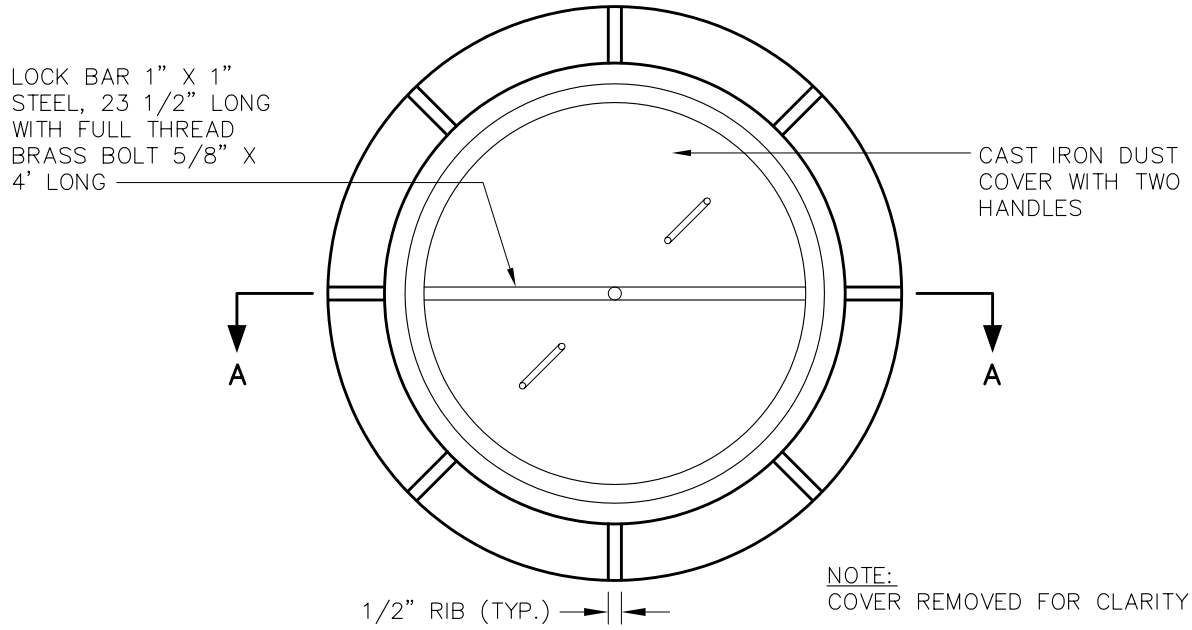
NOTES:

1. ALL GRAY IRON CASTINGS SHALL CONFORM TO ASTM A–48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
2. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8"±.
3. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING USING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.

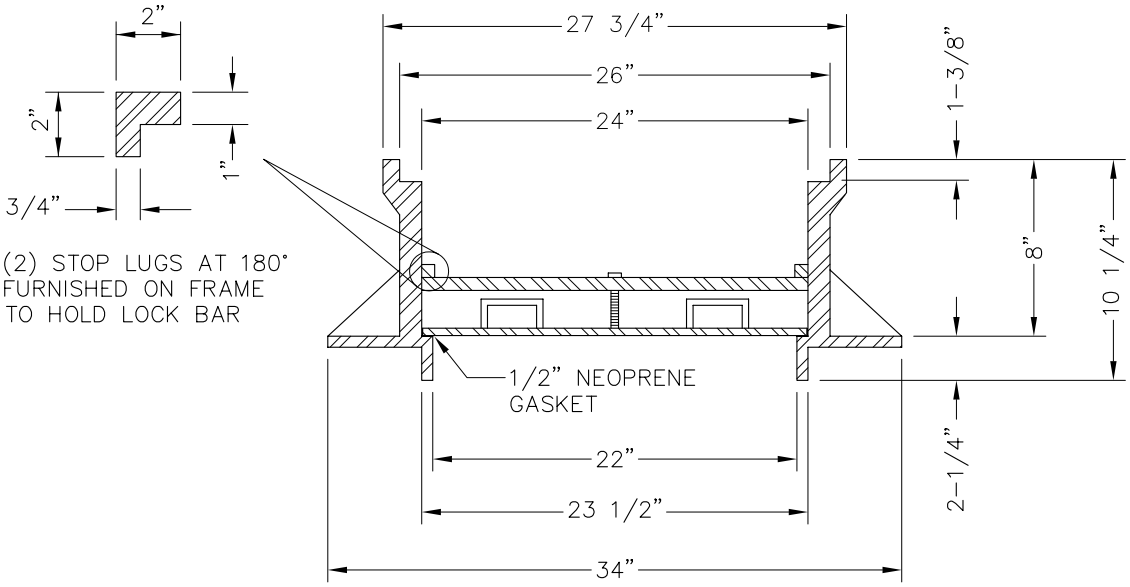
STANDARD MANHOLE FRAME AND COVER

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–5



PLAN: CASTING



SECTION A–A

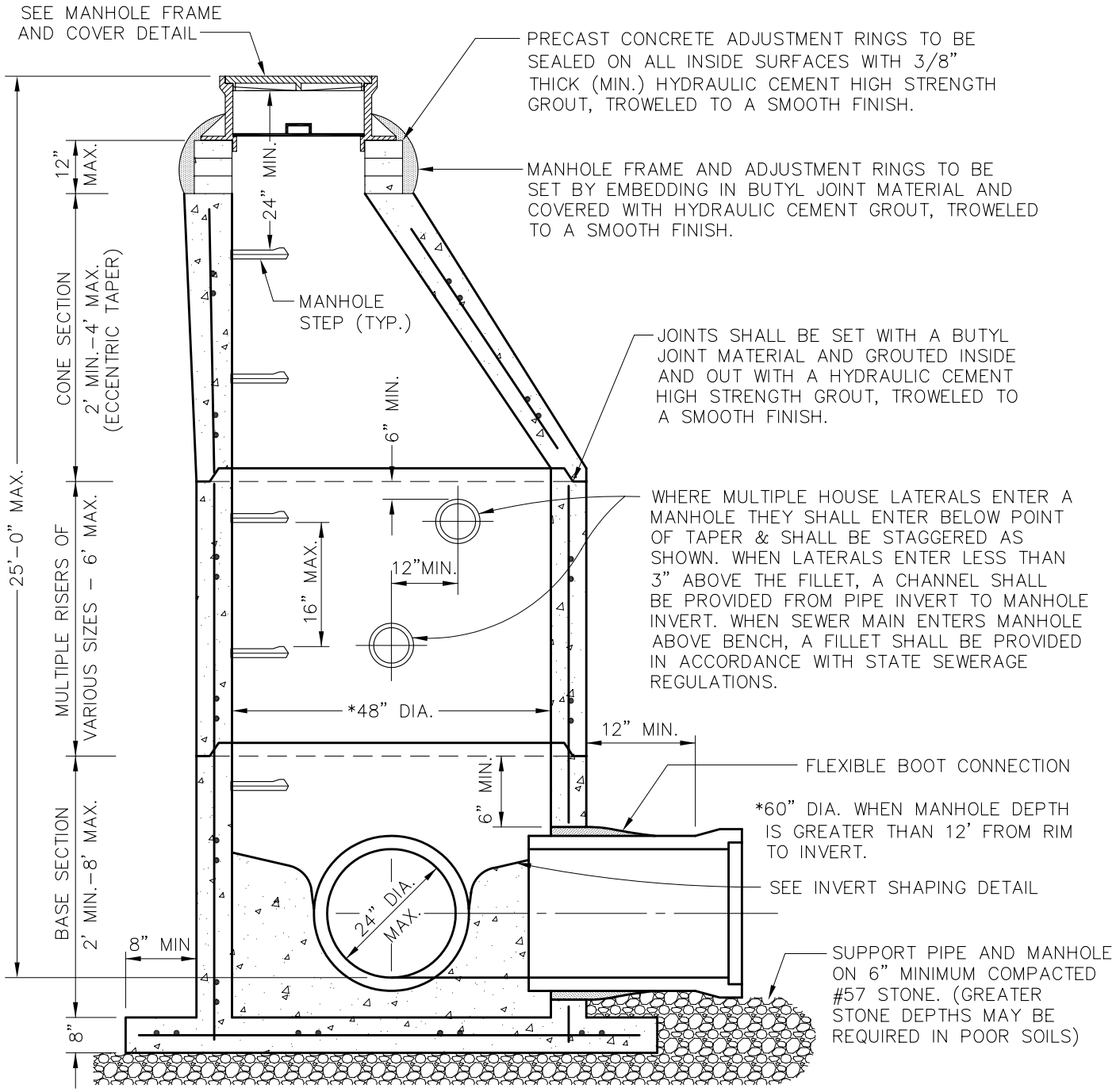
NOTES:

1. ALL GRAY IRON CASTINGS SHALL CONFORM TO ASTM A–48, CLASS 30 AND SHALL BE OF UNIFORM QUALITY.
2. ALL CASTING DIMENSIONS SHALL HAVE A TOLERANCE OF 1/8"±.
3. ALL CASTINGS SHALL BE CLEANED BY SHOT BLASTING AND HAND CHIPPING USING STANDARD INDUSTRY PRACTICES PRIOR TO SHOP APPLICATION OF ASPHALTIC COATING, BY DIPPING.

WATERTIGHT MANHOLE FRAME AND COVER

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–6



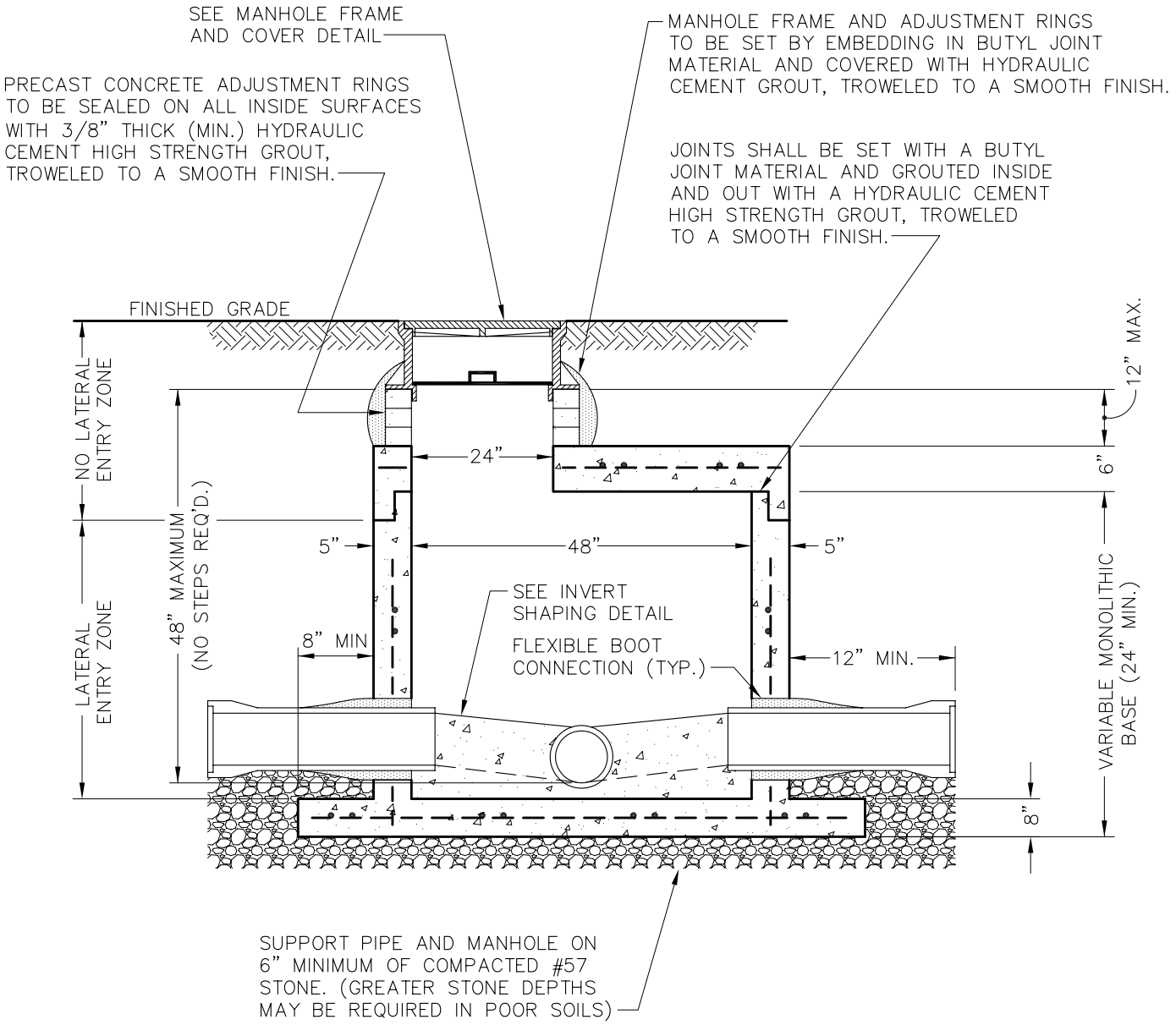
NOTES:

1. PRECAST CONCRETE MANHOLE SHALL BE IN COMPLIANCE WITH ASTM C-478.
2. MANHOLE WALLS SHALL BE 5" THICK MINIMUM FOR 48" INSIDE DIAMETER MANHOLES AND 6" MINIMUM FOR 60" DIAMETER MANHOLES.
3. MANHOLE INTERIOR WALLS SHALL RECEIVE A 10 MIL MINIMUM THICKNESS ACID RESISTANT COATING.
4. PROVIDE A MAXIMUM OF TWO LIFT HOLES PER SECTION. PLUG HOLES WITH RUBBER PLUG AND GROUT FOR A WATERTIGHT SEAL.
5. MAXIMUM OF FOUR LATERALS ALLOWED PER MANHOLE.

STANDARD MANHOLE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-7



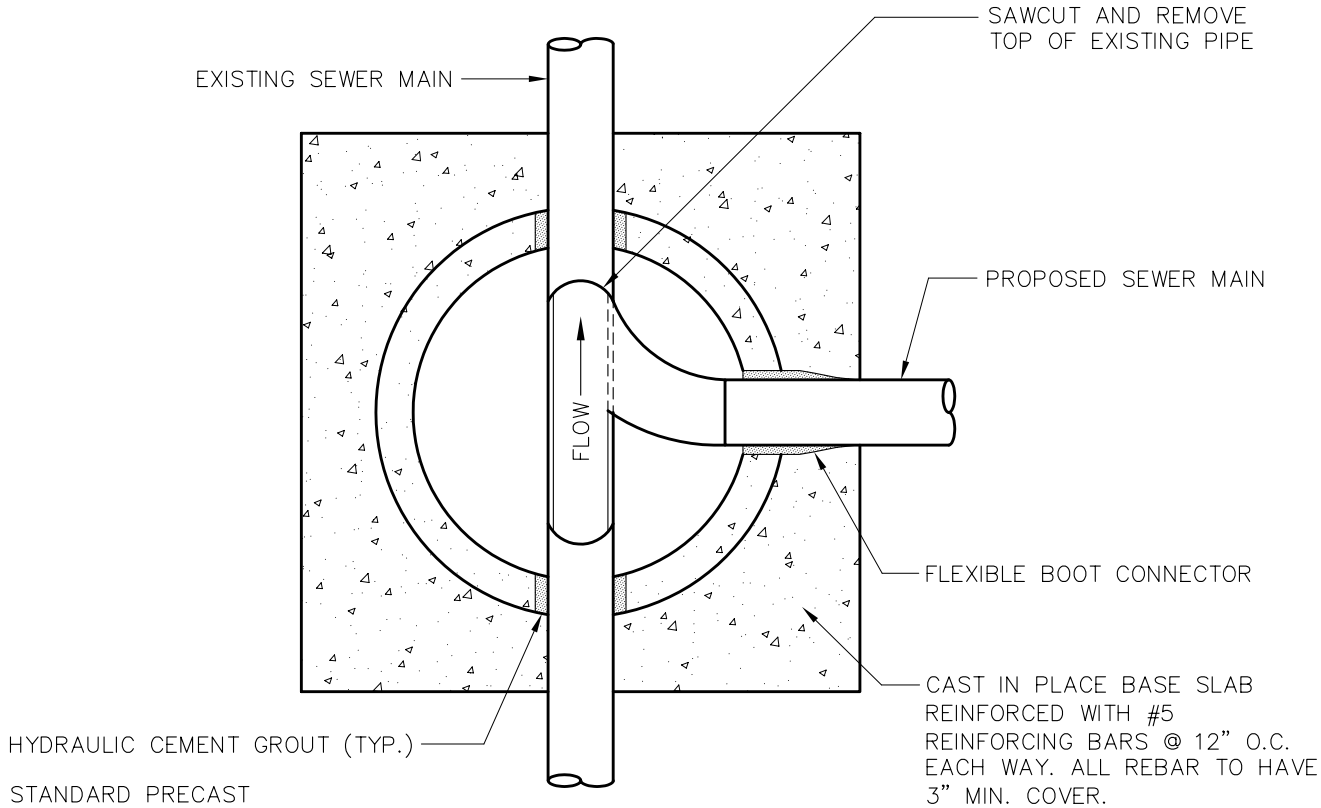
NOTES

1. FLAT TOP MAY BE REPLACED WITH A 1'–4" ECCENTRIC SHALLOW CONE.
2. PRECAST CONCRETE MANHOLE SHALL BE IN COMPLIANCE WITH ASTM C–478.
3. MANHOLE INTERIOR WALLS SHALL RECEIVE A 10 MIL MINIMUM THICKNESS ACID RESISTANT COATING, IF A FORCE MAIN IS PROPOSED TO DISCHARGE INTO IT.
4. PROVIDE A MAXIMUM OF TWO LIFT HOLES PER SECTION. PLUG HOLES WITH RUBBER PLUG AND GROUT FOR A WATERTIGHT SEAL.
5. SEE DETAIL OF STANDARD PRECAST CONCRETE MANHOLE FOR ADDITIONAL DETAIL AND REQUIREMENTS.

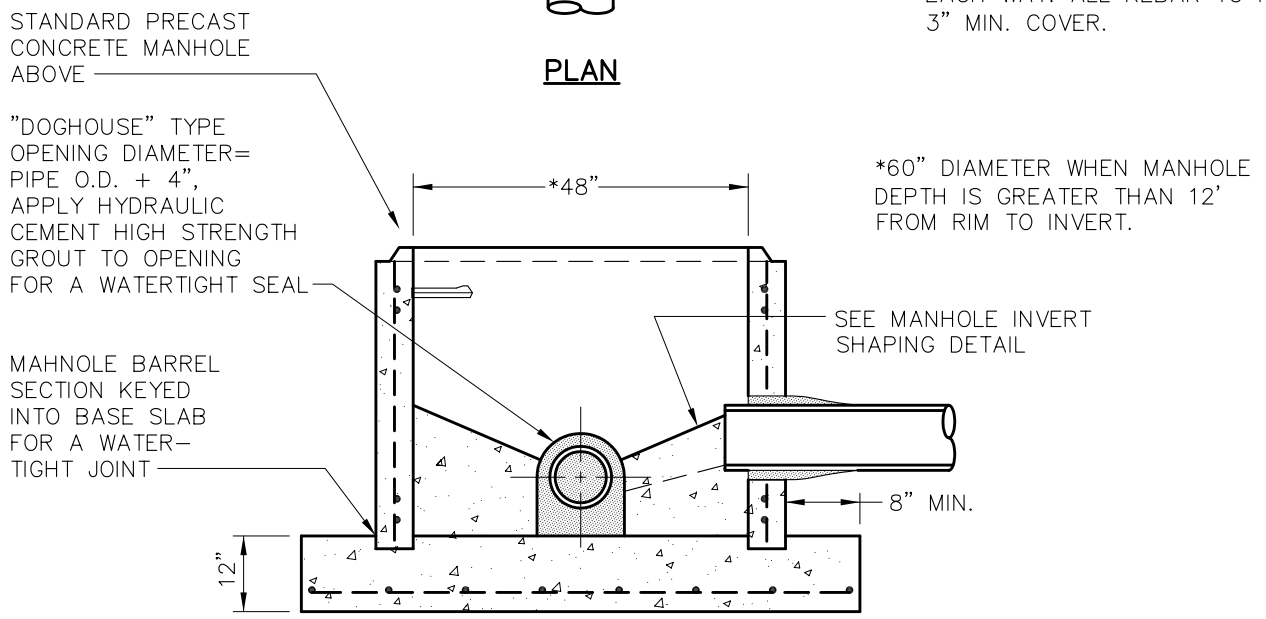
SHALLOW MANHOLE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: S–8



PLAN



SECTION

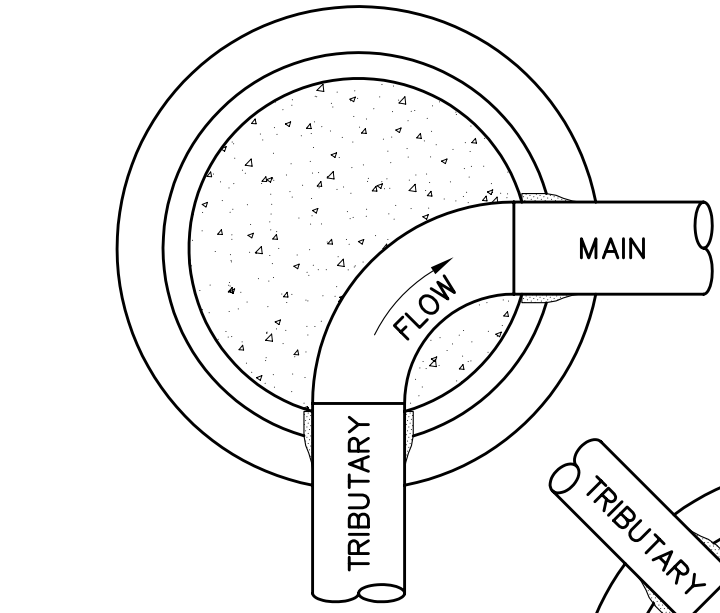
NOTES:

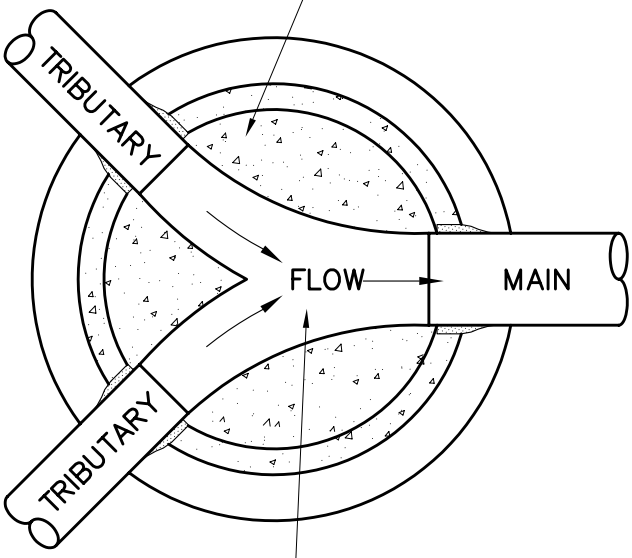
1. SEE DETAIL OF STANDARD PRECAST CONCRETE MANHOLE FOR ADDITIONAL DETAIL AND REQUIREMENTS.

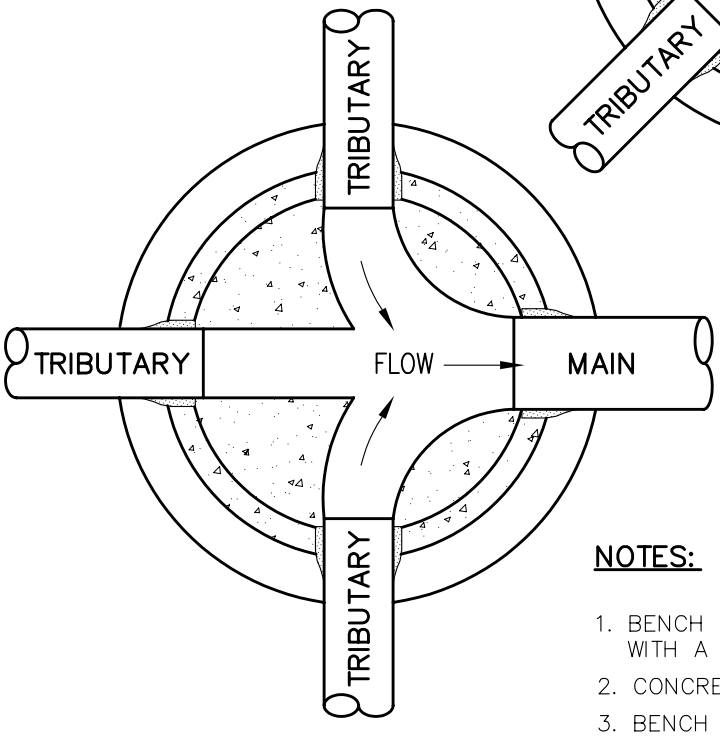
DOGHOUSE MANHOLE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-9







CHANNELS FORMED WITH A SMOOTH CURVE BETWEEN PIPES. CHANNEL DEPTH TO BE 3/4 DIAMETER OF THE CONTRIBUTING SEWER MAIN (TYP.)

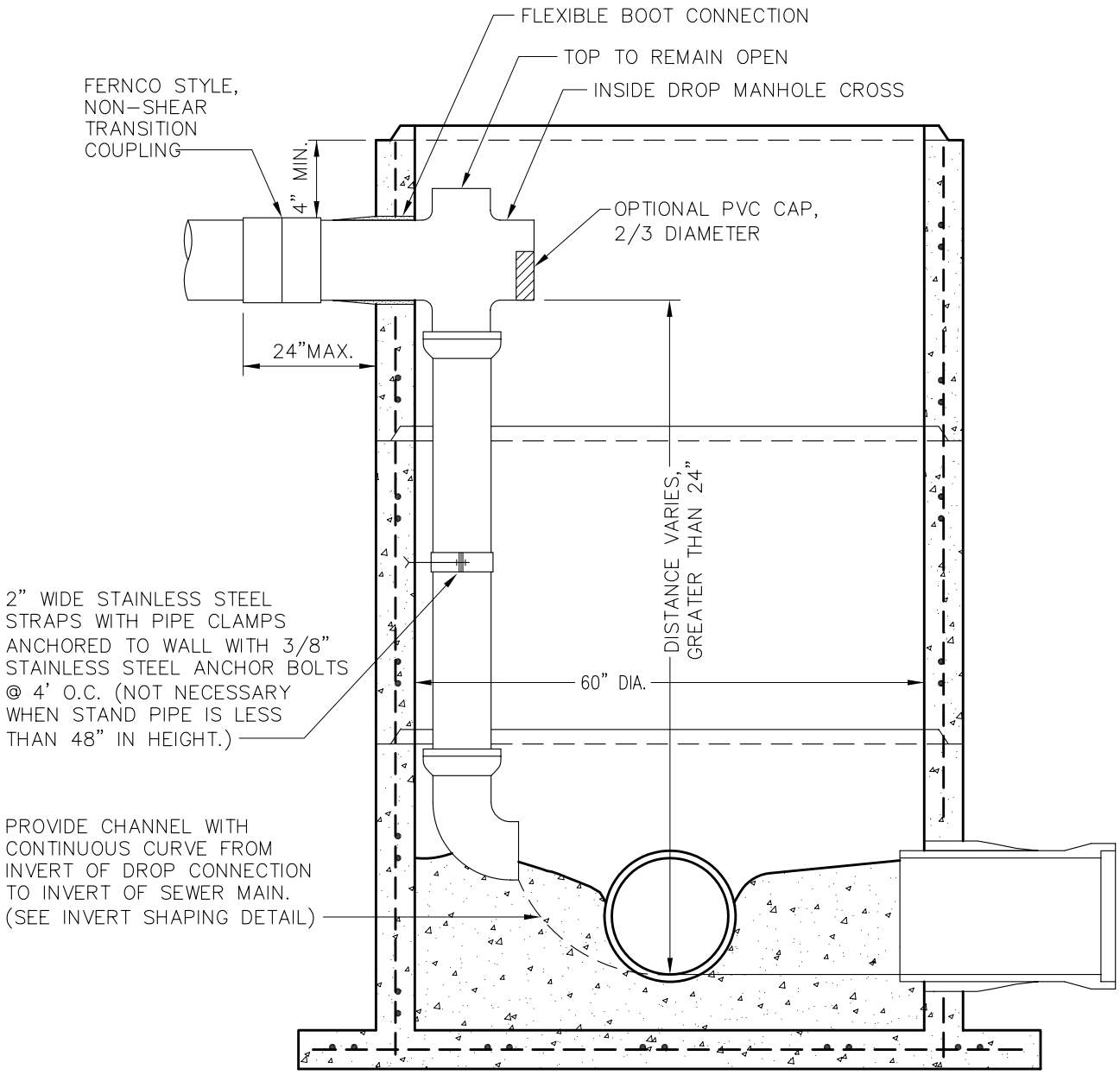
NOTES:

1. BENCH AND CHANNELS TO BE FORMED USING CONCRETE WITH A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI.
2. CONCRETE SHALL BE TROWELED TO A SMOOTH FINISH.
3. BENCH AND INVERTS SHALL BE COATED WITH A 10 MIL THICKNESS OF AN ACID RESISTANT COATING.

SANITARY SEWER MANHOLE ADJUSTMENT

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-10



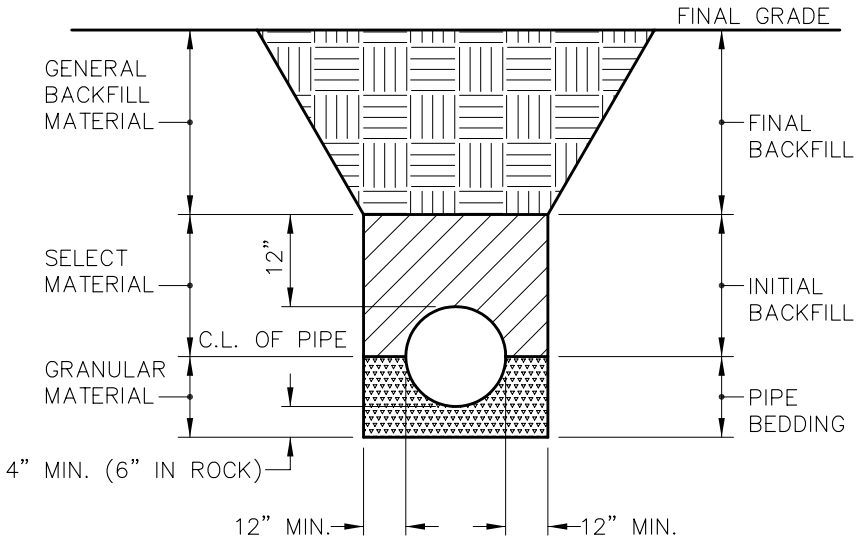
NOTES:

1. LOCATION OF STEPS SHALL NOT CONFLICT WITH DROP CONNECTION.
2. BOTTOM 90° BEND OF DROP CONNECTION SHALL BE ORIENTED AT 45° TO THE FLOWLINE OF THE MAIN CHANNEL.
3. ALL PIPING AND FITTINGS INSIDE MANHOLE SHALL BE PVC SDR 26 OR 23.5 WITH SOLVENT WELD JOINTS.
4. SEE DETAIL OF STANDARD PRECAST CONCRETE MANHOLE FOR ADDITIONAL DETAIL AND REQUIREMENTS.

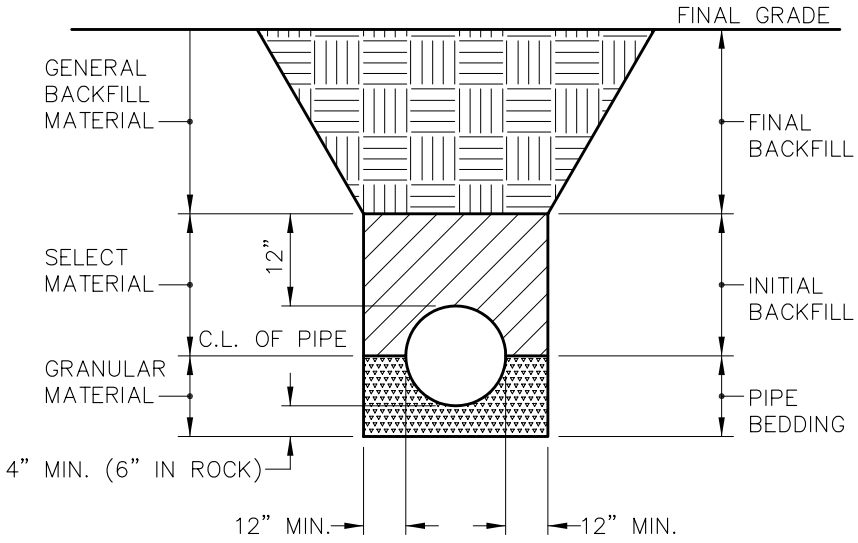
INSIDE DROP CONNECTION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-11



DUCTILE IRON OR PVC GRAVITY SEWER
PIPE BEDDING AND BACKFILL DETAIL

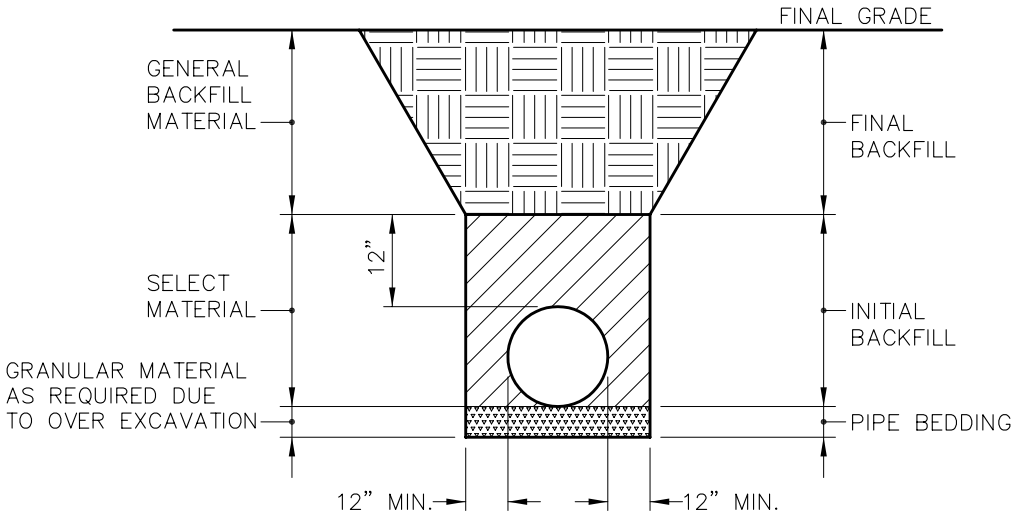


PVC OR HDPE PRESSURE PIPE
BEDDING AND BACKFILL DETAIL

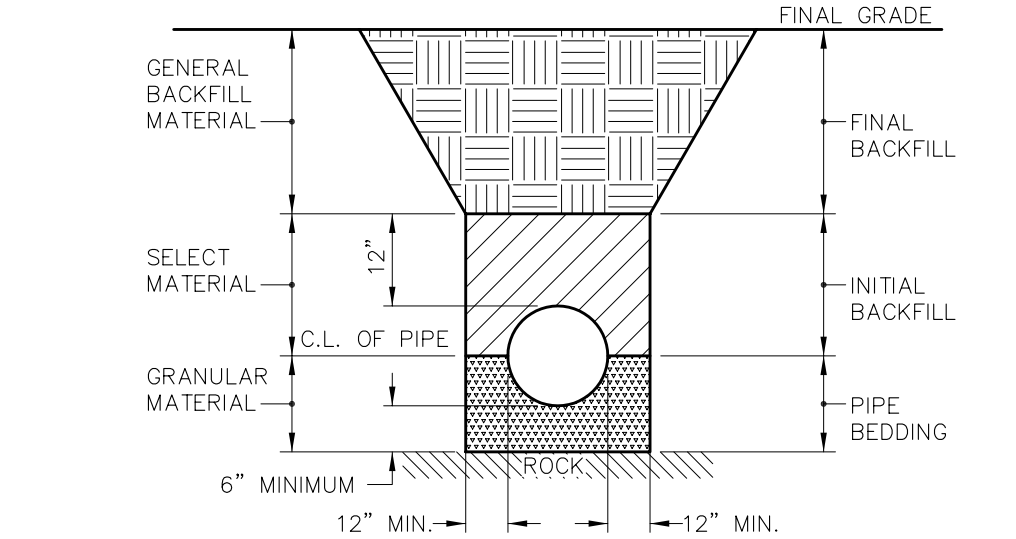
SEWER TRENCH INSTALLATION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: S-12



DUCTILE IRON PRESSURE PIPE
BEDDING AND BACKFILL DETAIL

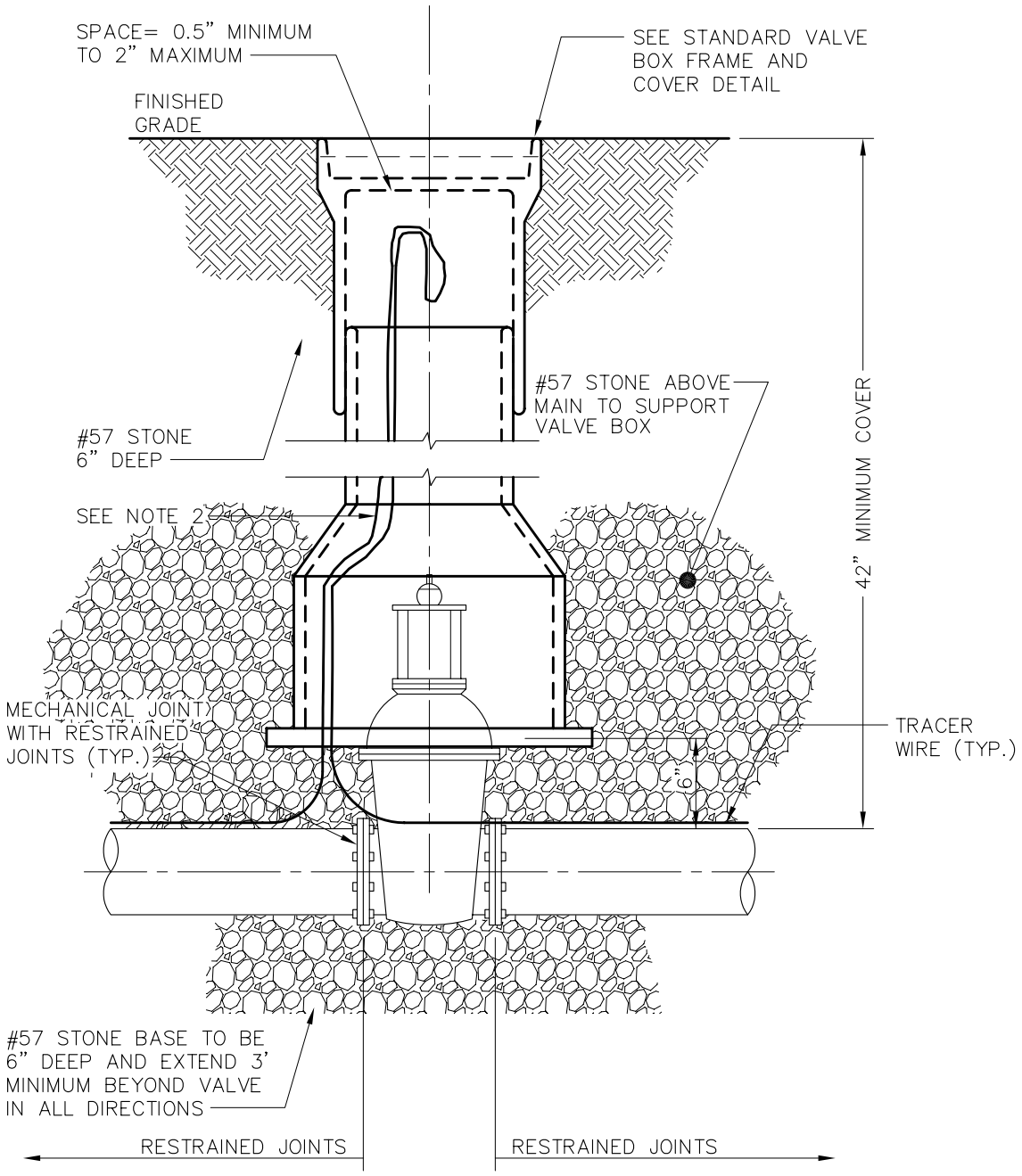


DUCTILE IRON PRESSURE PIPE BEDDING
AND BACKFILL DETAIL (IN ROCK)

SEWER TRENCH INSTALLATION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: S-12



NOTES:

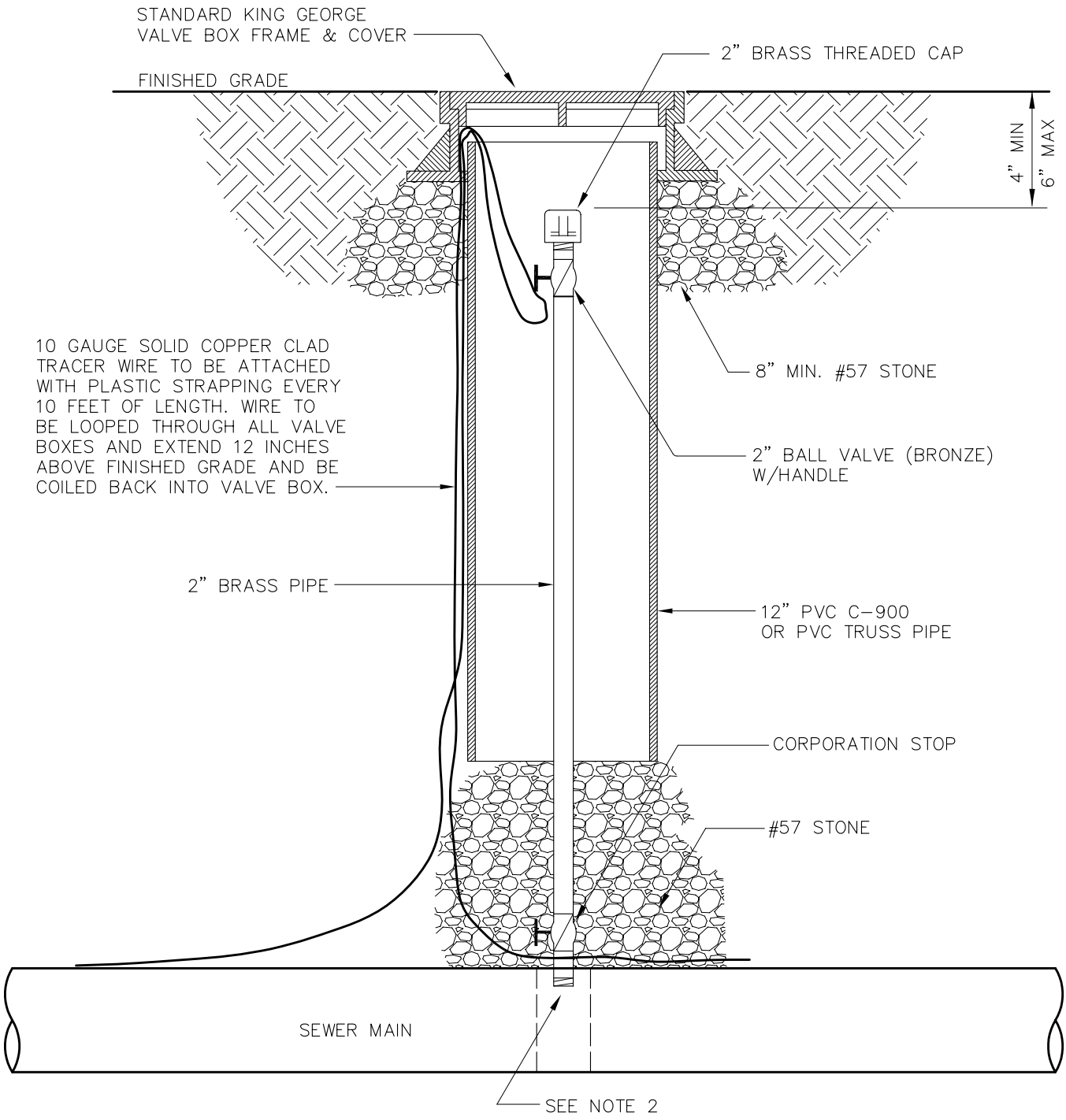
1. IF OPERATING NUT IS GREATER THAN 48" BELOW TOP OF VALVE BOX FRAME, A VALVE STEM EXTENSION MAY BE INSTALLED. THE EXTENSION SHALL REPLACE OR BE SECURELY ATTACHED TO THE NORMAL 2" SQUARE OPERATING NUT, SHALL BE AT LEAST AS STRONG AS THE VALVE STEM, AND SHALL BE COATED IN ACCORDANCE WITH AWWA C550. VALVE STEM EXTENSIONS MUST BE APPROVED BY THE LOCALITY.

2. PLASTIC COATED 10 GAUGE SOLID COPPER TRACER WIRE TO BE ATTACHED WITH PLASTIC STRAPPING EVERY 10 FEET OF LENGTH. WIRE TO BE LOOPED THROUGH VALVE BOX AND EXTEND 12" ABOVE FINISHED GRADE AND COILED BACK INTO THE VALVE BOX.

VALVE SETTING DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-04-05
DETAIL NO: S-13



NOTES:

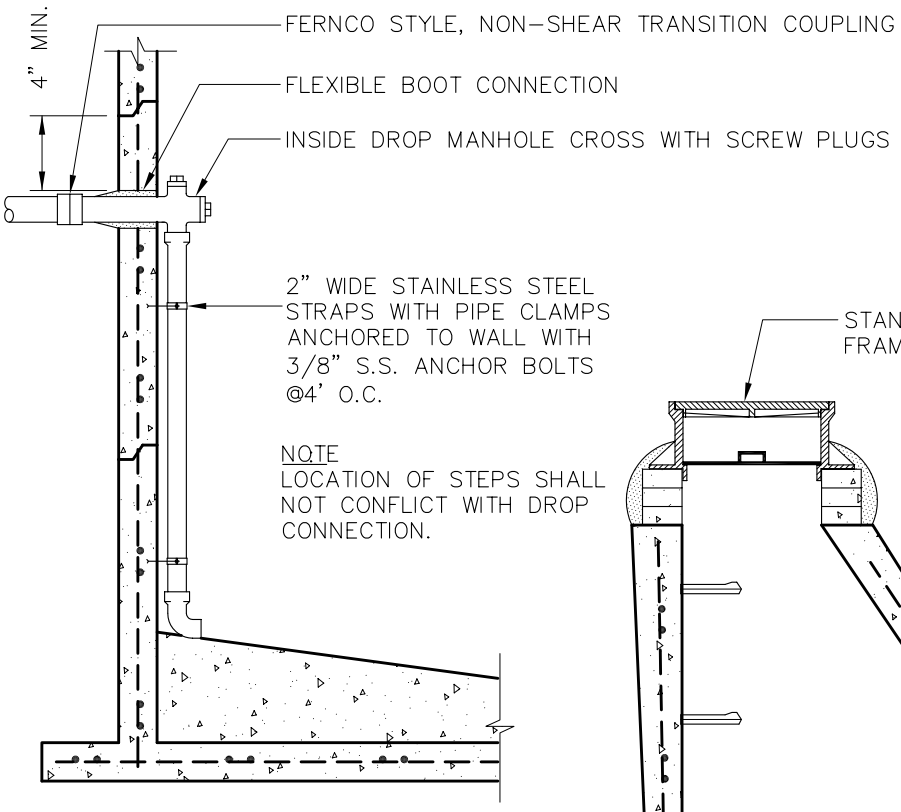
1. 2" BRASS PIPE AND FITTINGS SHALL BE USED FOR AIR RELEASE VALVE.

2. ALL DUCTILE IRON MAINS, SIX INCHES IN DIAMETER AND LARGER, MAY BE TAPPED WITHOUT SADDLES. WHERE PVC MAINS ARE PERMITTED BY LOCALITIES, THE CONNECTION TO A PVC MAIN MUST BE TAPPED. A TAPPING SADDLE IS REQUIRED FOR ALL CONNECTIONS TO PVC PIPE. ALL SADDLES TO BE STAINLESS STEEL OR EPOXY COATED.

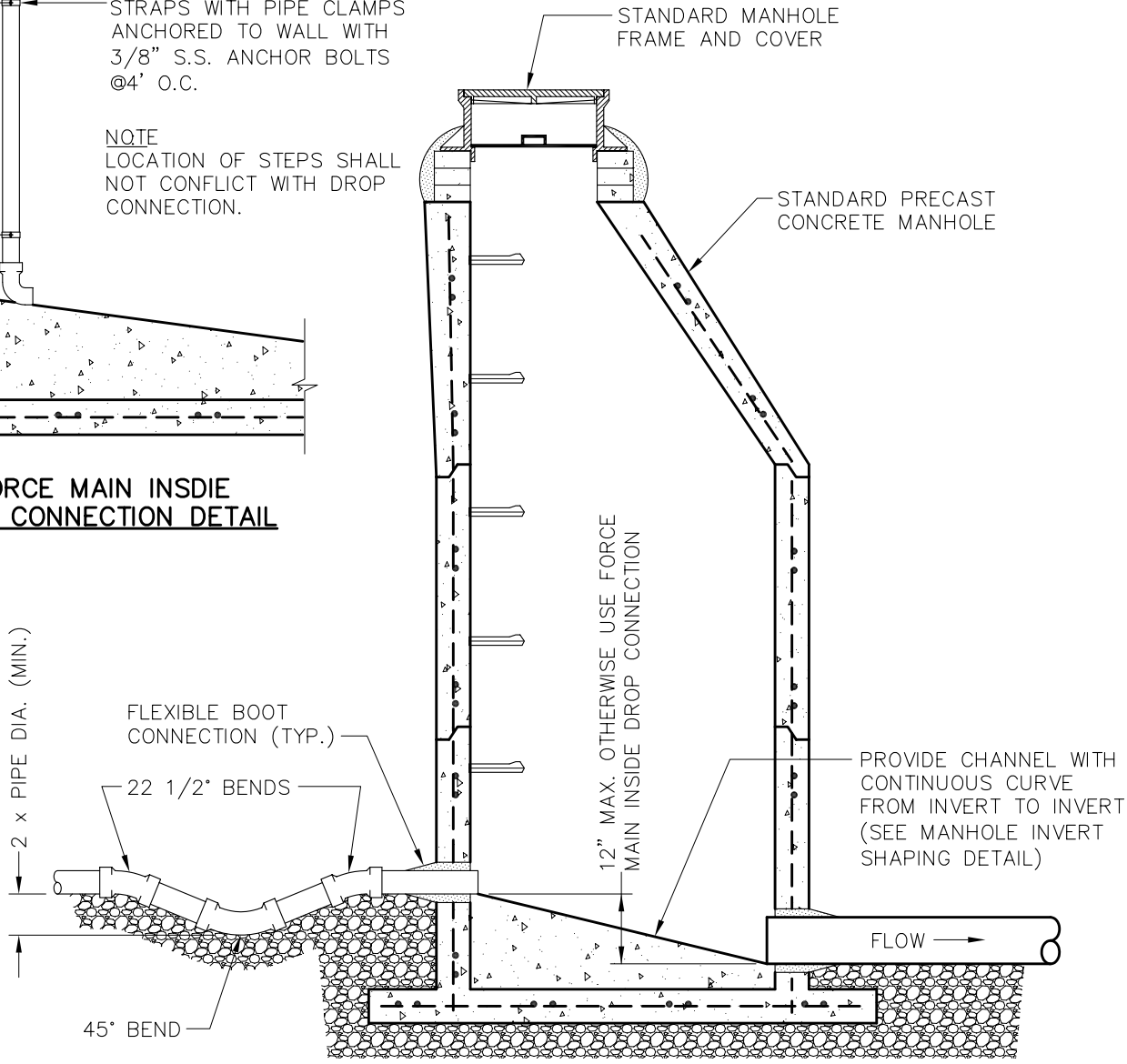
MANUAL AIR RELEASE VALVE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-14



FORCE MAIN INSDIE DROP CONNECTION DETAIL



FORCE MAIN TO MANHOLE CONNECTION

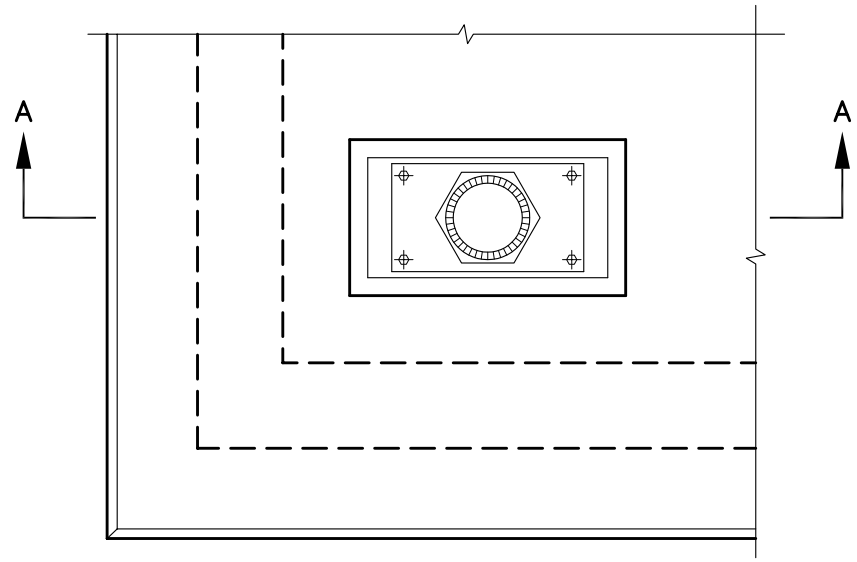
NOTES:

1. THE RECEIVING MANHOLE AND ALL DOWNSTREAM MANHOLES WITHIN 1000 FEET SHALL BE COATED WITH A 10 MIL THICKNESS OF AN ACID RESISTANT COATING.
2. ALL PIPING AND FITTINGS INSIDE THE MANHOLE SHALL BE SCHEDULE 80 PVC WITH SOLVENT WELD JOINTS WHICH CONFORMS TO ASTM D-1784 AND D-1785.

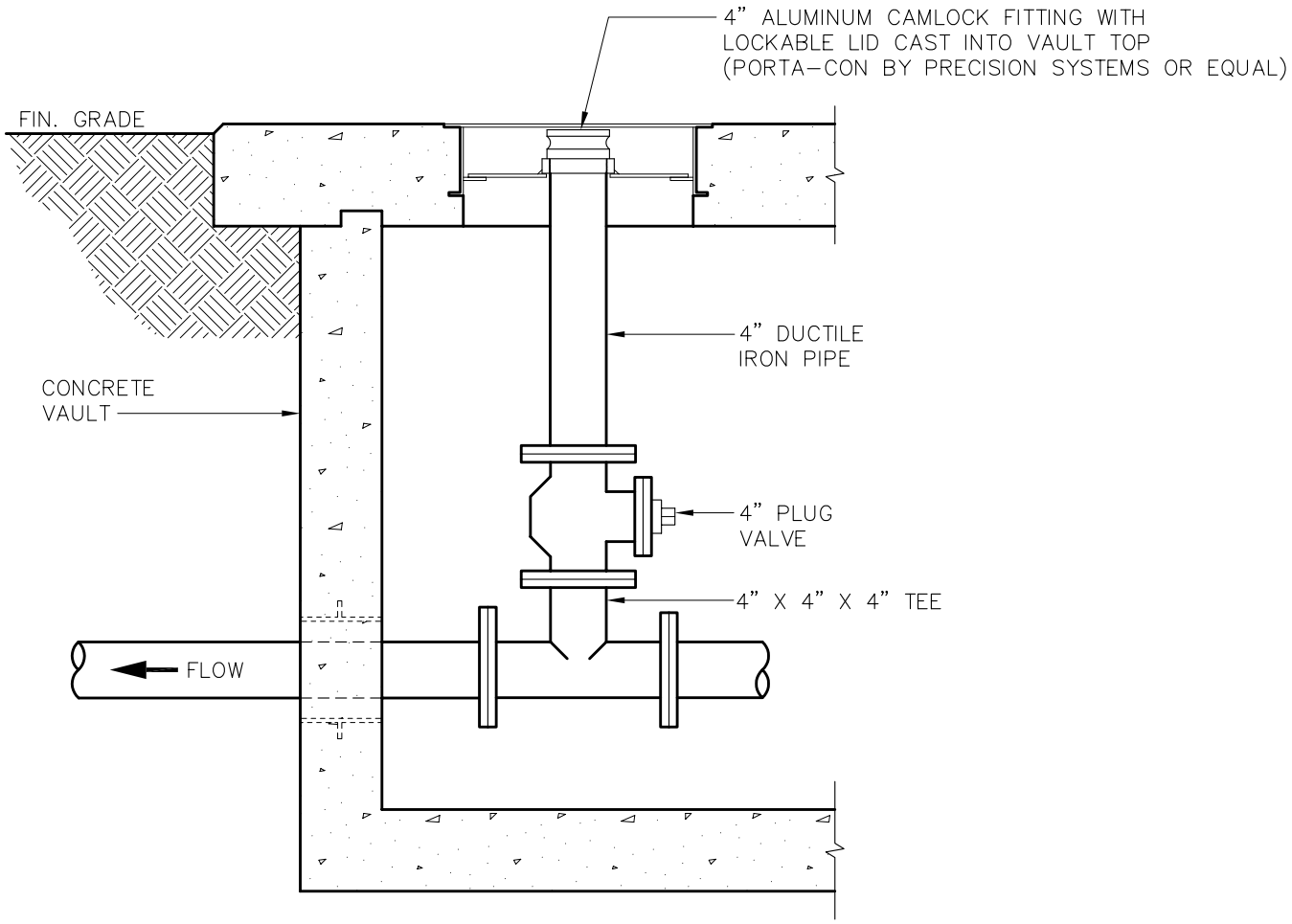
FORCE MAIN TRAP DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-15



TOP VIEW LESS LID

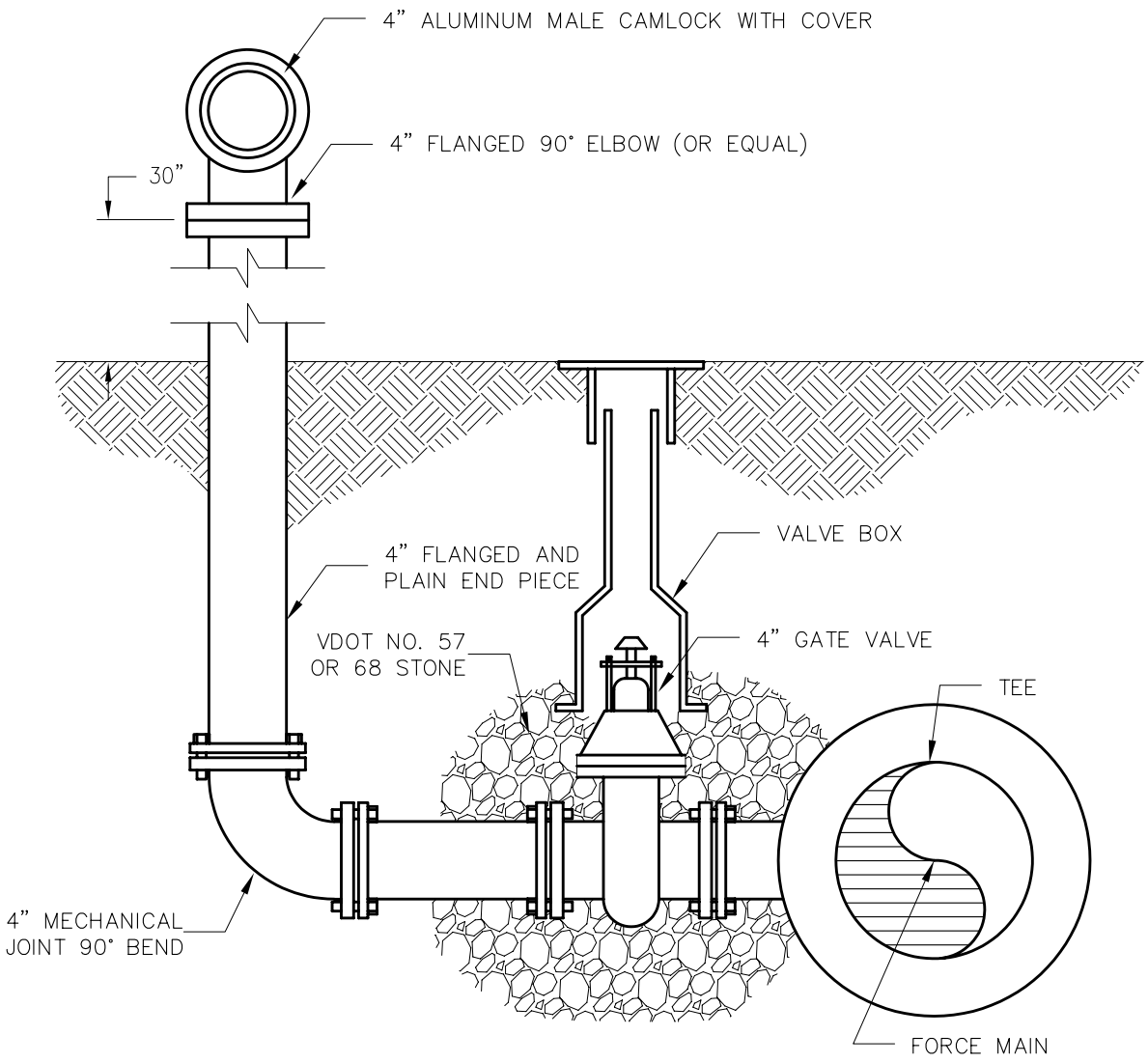


SECTION A-A

EMERGENCY PUMP CONNECTION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-16



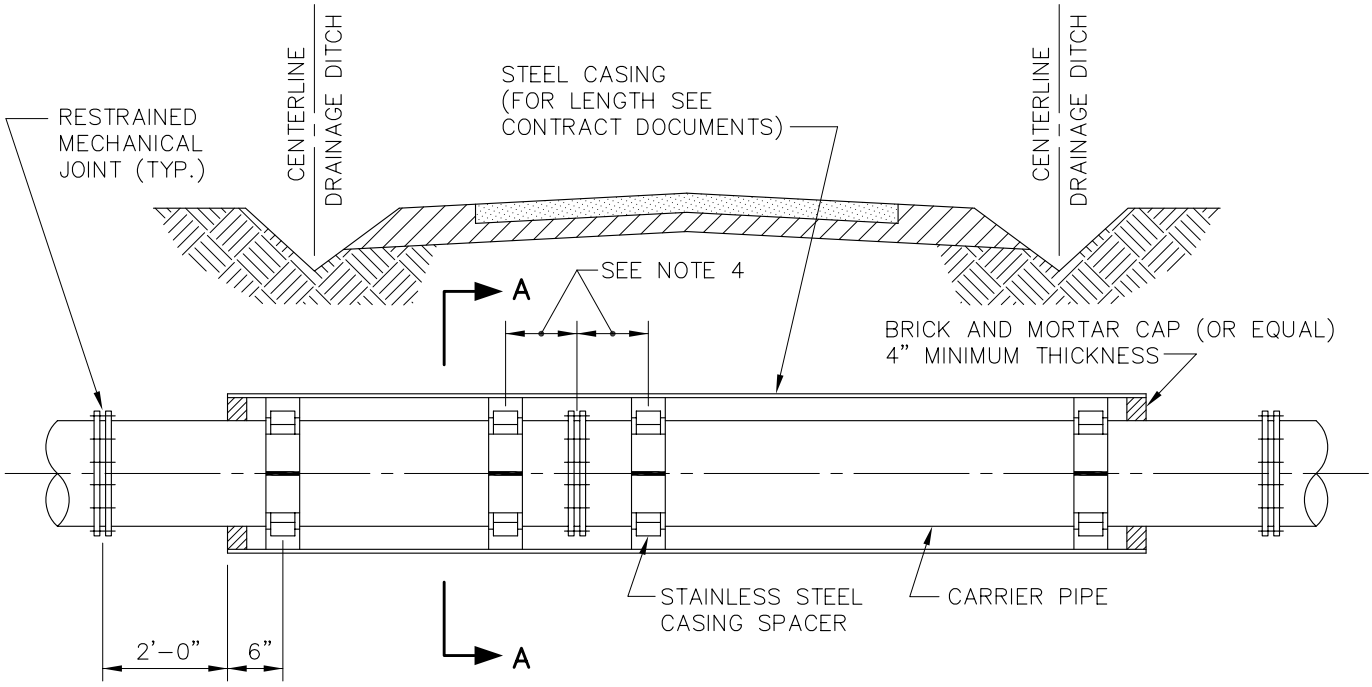
NOTES:

1. ALL NEW PIPE AND FITTINGS SHALL BE DUCTILE IRON (CLASS 52).
2. RESTRAIN ALL FITTINGS WITH MEGALUG (OR EQUAL) RESTRAINER GLANDS.

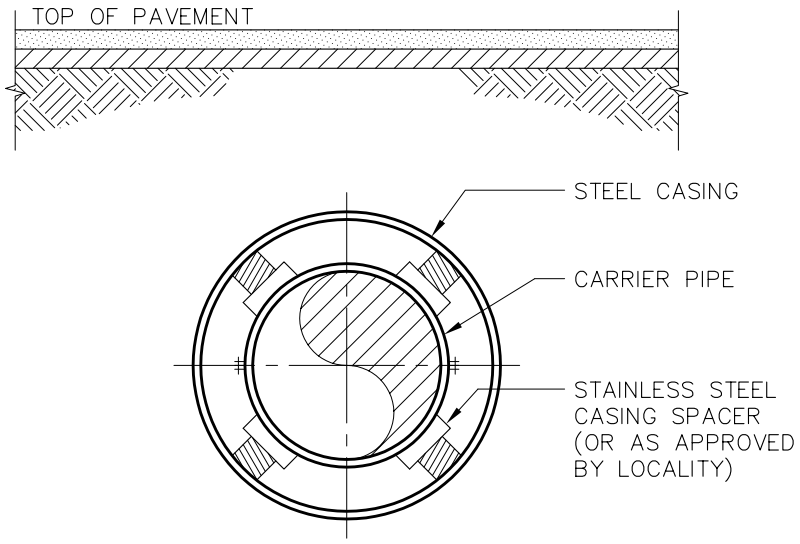
EMERGENCY PUMP CONNECTION

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: S-16



PROFILE



SECTION A–A

HIGHWAY CROSSING

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–1

STEEL CASING PIPE SELECTION CHART					
DUCTILE IRON PIPE SIZE	4"	6"	8"	12"	16"
STEEL CASING PIPE SIZE (O.D.)	12"	16"	20"	24"	30"

NOTES:

1. CARRIER PIPE MAY BE DUCTILE IRON (C1.350), HDPE (DR-17), OR PVC (C-900).

2. ALL JOINTS INSIDE OF CASING PIPE AND ONE JOINT BEYOND SHALL BE RESTRAINED MECHANICAL JOINTS OR AS APPROVED BY LOCALITY.

3. INSTALL CASING PIPE AS SHOWN ON DRAWINGS OR MINIMUM 5 FT. BEYOND EDGE OF PAVEMENT.

4. STAINLESS STEEL SPACERS
SPACERS SHALL BE BOLT-ON STYLE WITH A TWO PIECE SHELL MADE FROM T-304 STAINLESS STEEL OF A MINIMUM 14 GUAGE THICKNESS. THE SHELL SHALL BE LINED WITH A RIBBED PVC SHEET OF A 0.090" THICKNESS THAT OVERLAPS THE EDGES. RUNNERS MADE FROM UHMW POLYMER, SHALL BE ATTACHED TO RISERS AT APPROPRIATE POSITIONS TO PROPERLY LOCATE THE CARRIER WITHIN THE CASING AND TO EASE INSTALLATION. RISERS TO BE MADE FRON T-304 STAINLESS STEEL OF A MINIMUM 14 GUAGE THICKNESS AND SHALL BE ATTACHED TO THE SHELL BY MIG WELDING. ALL WELDS SHALL BE FULLY PASSIVATED. ALL FASTENERS SHALL BE MADE FROM T-304 STAINLESS STEEL. CASING SPACERS SHALL BE MODEL CCS AS MANUFACTURED BY CASCADE WATERWORKS MANUFACTURING COMPANY OF YORKVILLE, IL., MODEL SSI AS MANUFACTURED BY ADVANCE PRODUCTS AND SYSTEMS, INC. OF LAFAYETTE, LA., OR APPROVED EQUAL.

5. SPACER WIDTH AND PLACEMENT INTERVALS
IN ALL INSTANCES SPACER SHOULD BE PLACED TO SUPPORT THE CARRIER WITHIN TWO FEET OF THE END OF EACH PIPE JOINT. CONSULT SPACER MANUFACTURER FOR RECOMMENDATIONS OF SPACER WIDTH AND ADDITIONAL PLACEMENT INTERVALS.

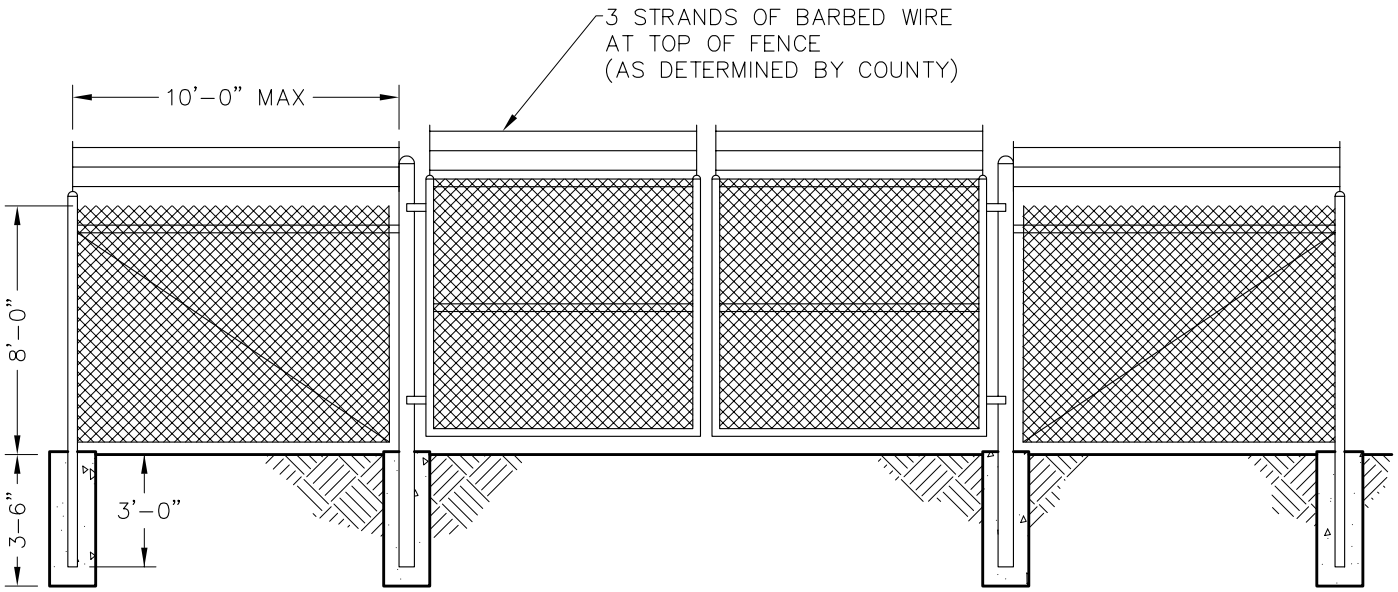
HIGHWAY CROSSING

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE

DATE: 09-01-04

DETAIL NO: G-1



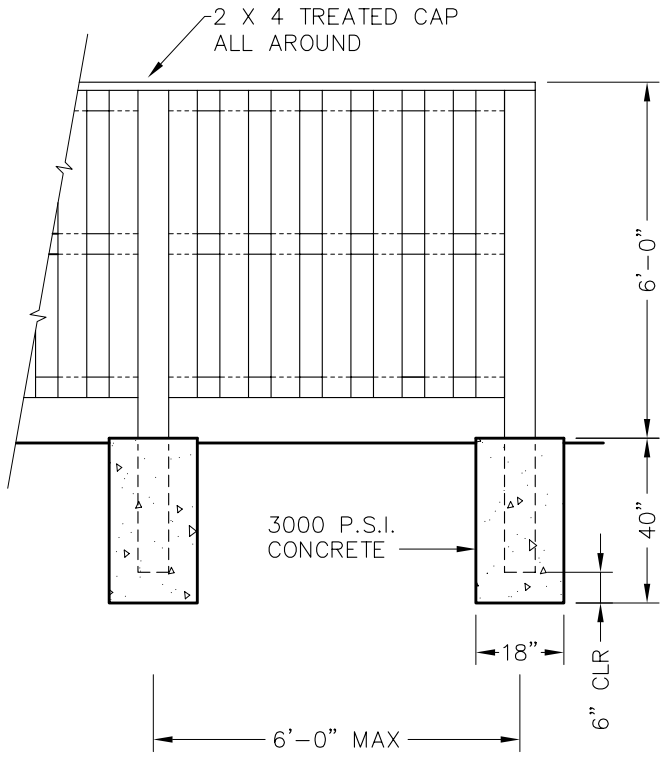
NOTES:

1. SINGLE STRAND, No. 9 GAUGE WIRE TO BE USED TO SUPPORT MESH WHEN NO FRAME IS AVAILABLE.
2. No. 6 GAUGE WIRE CLAMPS TO BE USED TO ATTACH FABRIC TO COLUMNS AND POSTS.
3. CONTRACTOR SHALL PROVIDE ALL NECESSARY HARDWARE, POSTS, TRACKING, AND LOCKS.
4. ALL GATE OR CORNER POSTS SHALL HAVE A CONCRETE FOOTER 14" IN DIAMETER. ALL LINE POSTS SHALL HAVE A FOOTER 10" IN DIAMETER.
5. BOTTOM OF FENCE SHALL BE AT FINISHED GRADE.

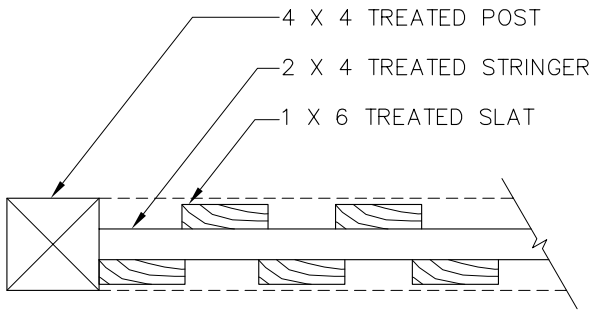
CHAINLINK FENCE AND GATE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

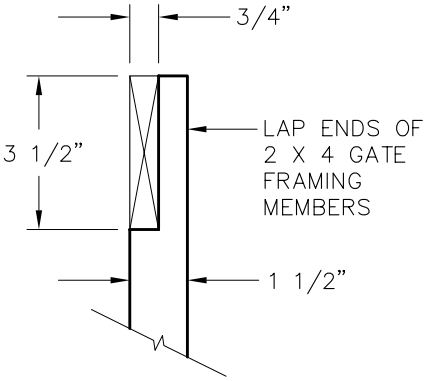
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-2



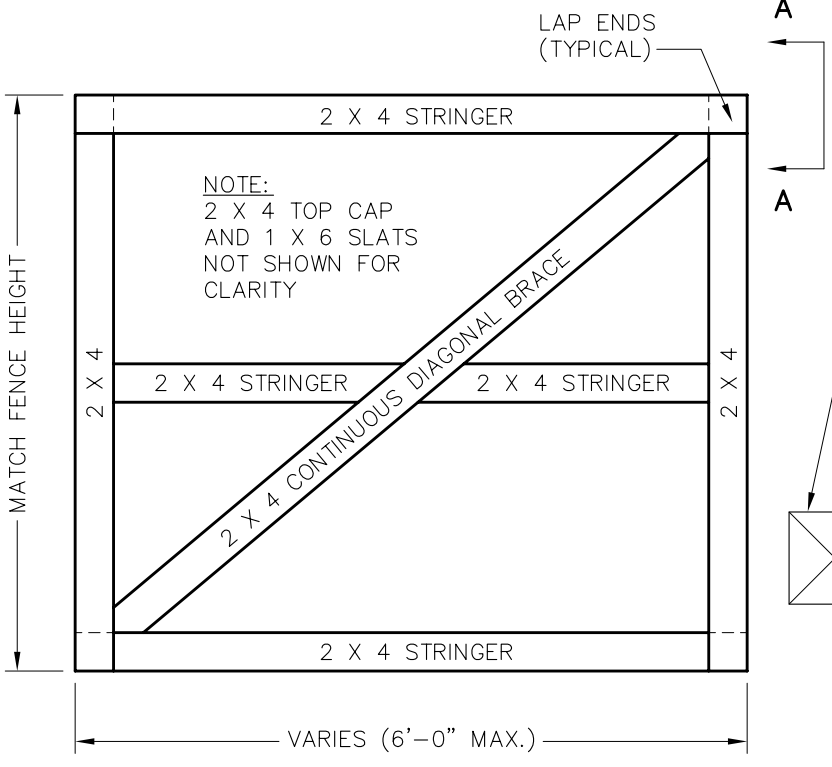
FENCE ELEVATION



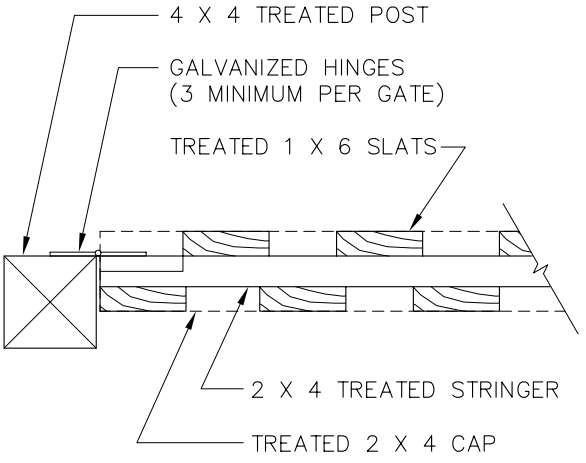
FENCE PLAN



DETAIL A–A



GATE FRAME ELEVATION

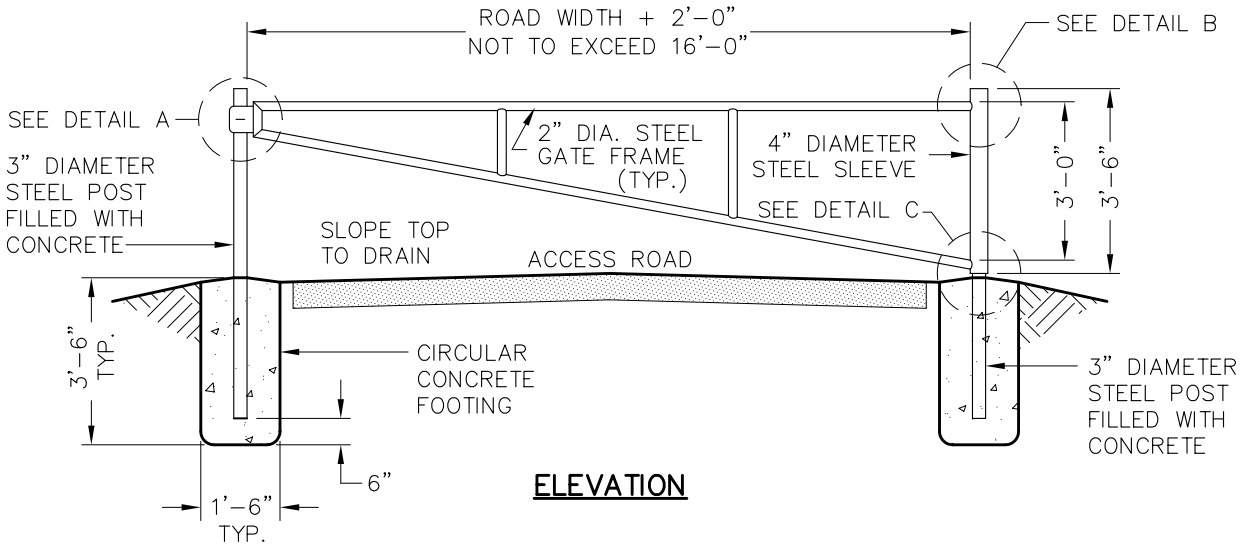


GATE PLAN

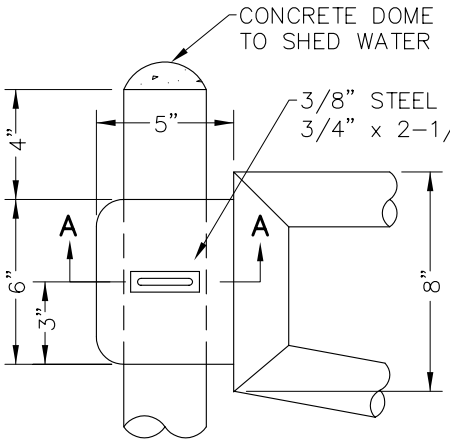
WOOD FENCE AND GATE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

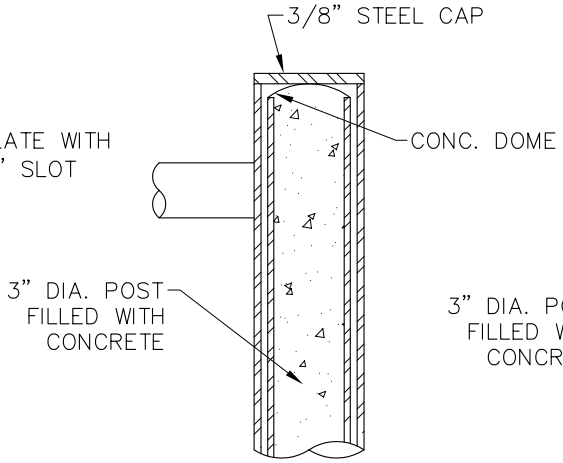
SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–2



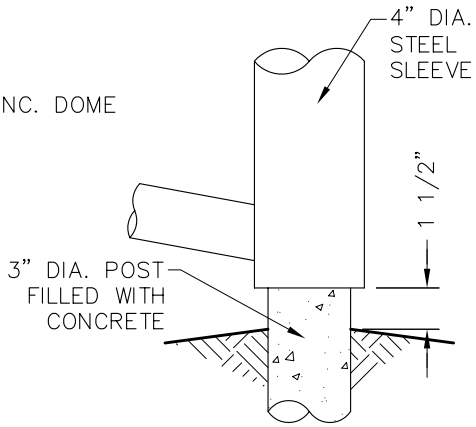
ELEVATION



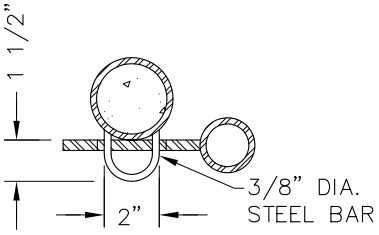
DETAIL A



DETAIL B



DETAIL C



SECTION A-A

NOTES:

1. STEEL USED IN THE MANUFACTURE OF THE GATE SHALL BE HOT DIPPED GALVANIZED.
2. ALL PIPE AND WELDS SHALL BE PAINTED ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
3. ALL WELDS SHALL BE 3/16" FILLETS ALL AROUND.
4. PIPE MATERIAL SHALL BE SCHEDULE 40 STEEL. DIAMETERS ARE NOMINAL PIPE SIZE.
5. CONTRACTOR SHALL INSTALL AN ADDITIONAL 3" DIA. POST WITH 3/8" DIA. STEEL BAR, LOCATED TO SECURE THE GATE IN AN OPEN POSITION 90 DEGREES FROM THAT SHOWN ABOVE. GATE SHALL SWING TOWARDS THE COUNTY'S PROPERTY.

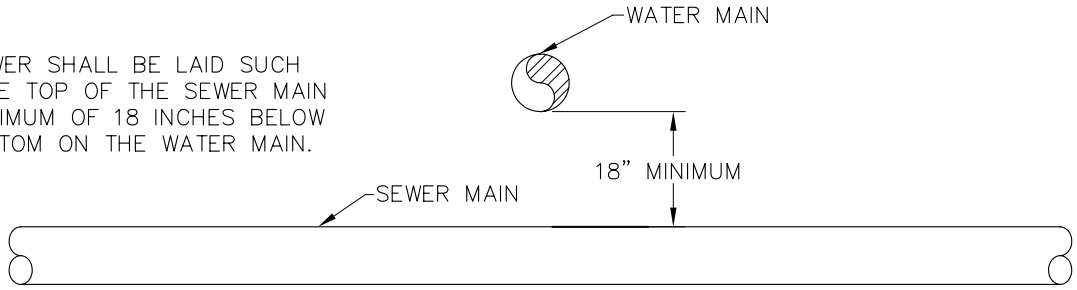
ACCESS ROAD GATE

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-3

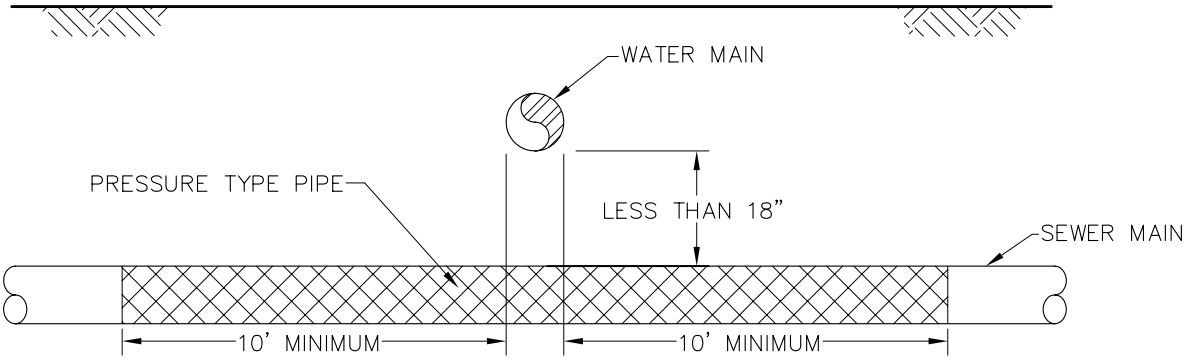
NOTES:

1. THE SEWER SHALL BE LAID SUCH THAT THE TOP OF THE SEWER MAIN IS A MINIMUM OF 18 INCHES BELOW THE BOTTOM ON THE WATER MAIN.



TYPICAL INSTALLATION

(SEWER MAIN CROSSING UNDER WATER MAIN)

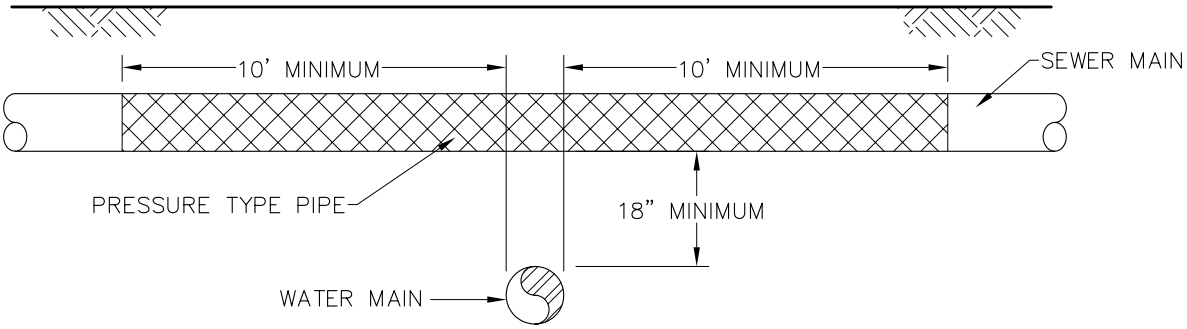


INSTALLATION WHERE VERTICAL SEPARATION IS LESS THAN 18"

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

NOTES:

1. THE SEWER MAIN SHALL BE CONSTRUCTED FROM A FULL LENGTH SECTION OF AWWA SPECIFIED PRESSURE TYPE PIPE HAVING MECHANICAL OR APPROVED SLIP TYPE JOINTS FOR A MINIMUM OF 10 FEET ON EACH SIDE OF THE WATER MAIN.
2. ONE FULL LENGTH OF WATER MAIN SHOULD BE CENTERED AT THE SEWER MAIN SO THAT THE JOINTS IN THE WATER MAIN WILL BE AS FAR AS POSSIBLE FROM THE SEWER MAIN.
3. ZERO LEAKAGE OF SEWER LINES AND MANHOLES IS ALLOWED WHEN THE REQUIRED HORIZONTAL OR VERTICAL SEPARATION FROM WATER LINES IS NOT MET.



SEWER MAIN CROSSING ABOVE WATER MAIN

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

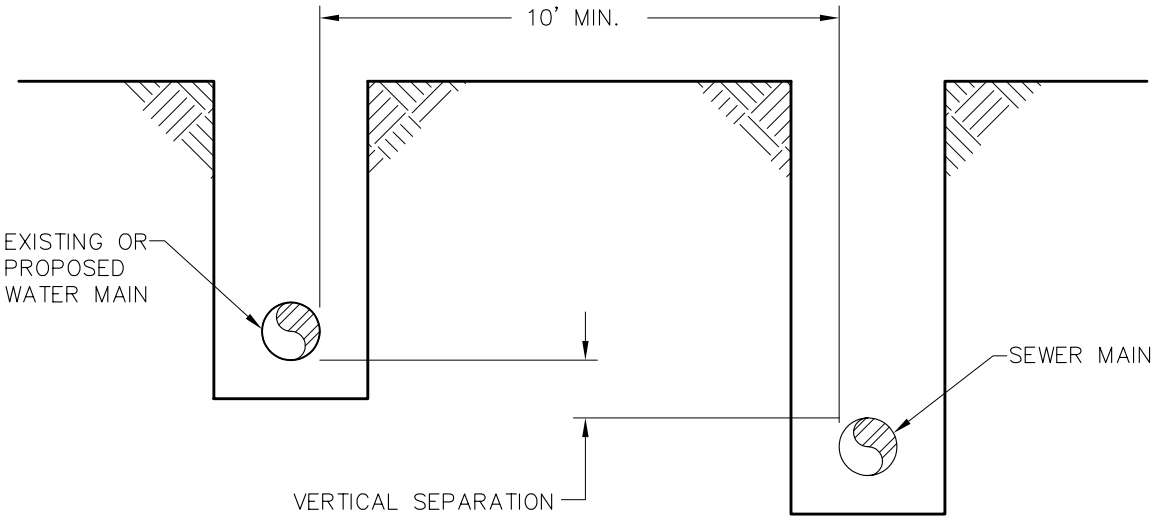
NOTES:

1. & 2. SAME AS ABOVE.
3. THE CROSSING SHALL HAVE ADEQUATE STRUCTURAL SUPPORT TO PREVENT DAMAGE TO WATER MAIN.

SEPARATION OF WATER AND SEWER MAINS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE:	DATE:	DETAIL NO:
NOT TO SCALE	02-27-06	G-4

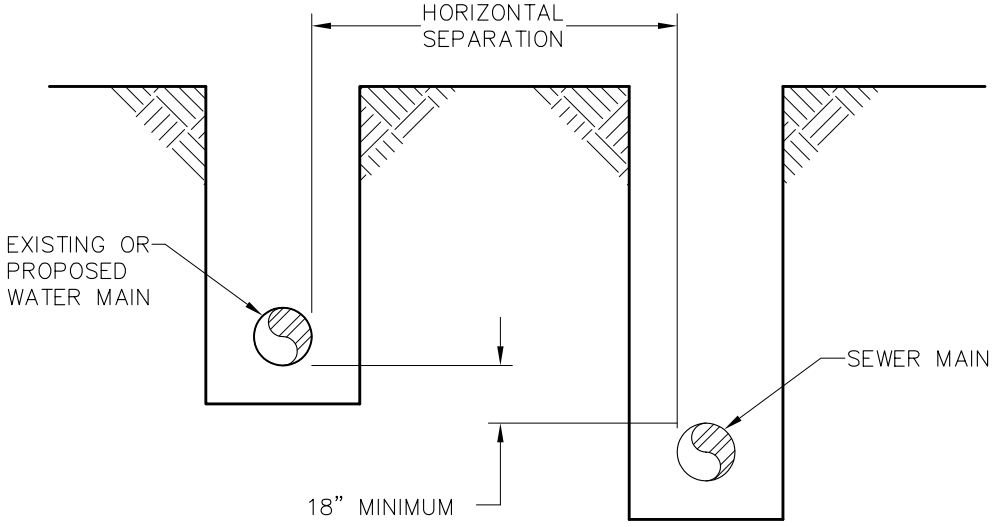


TYPICAL INSTALLATION

(MINIMUM 10' HORIZONTAL SEPARATION)

NOTES:

1. THERE ARE NO VERTICAL SEPARATION REQUIREMENTS WHEN HORIZONTAL SEPARATION IS 10' OR GREATER.



INSTALLATION WHERE HORIZONTAL SEPARATION IS LESS THAN 10'

(USED ONLY WHEN LOCAL CONDITIONS PREVENT TYPICAL INSTALLATION)

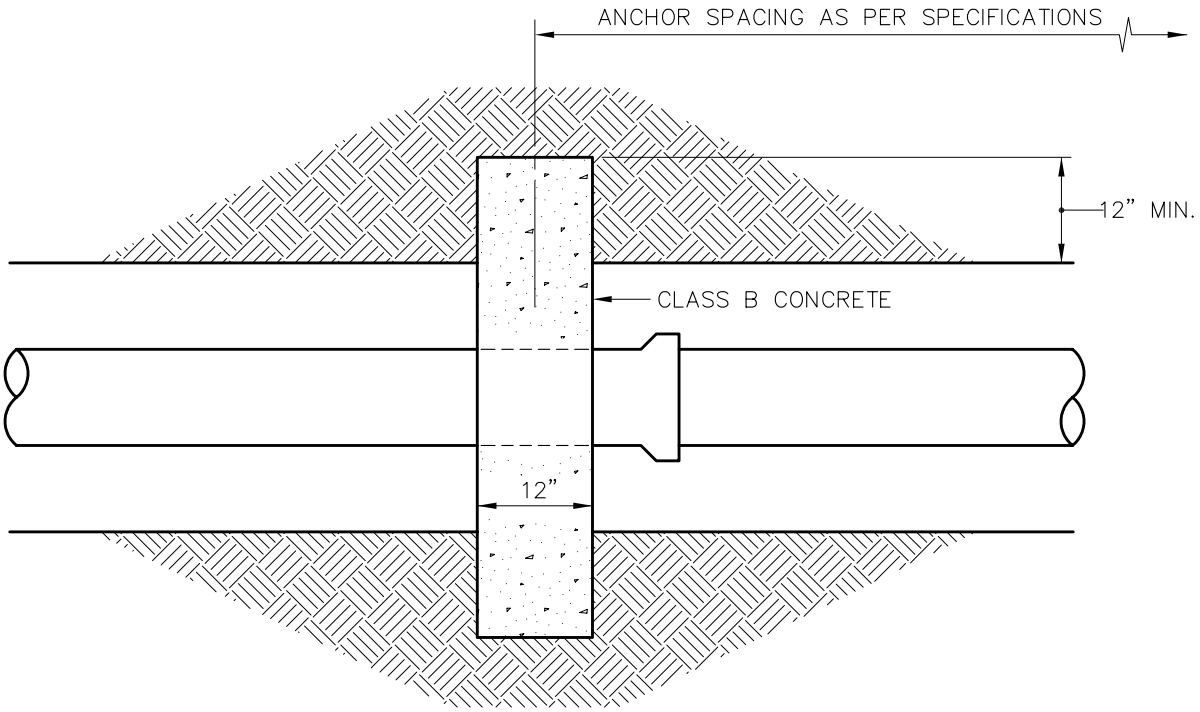
NOTES:

1. THE SEWER MUST BE LAID IN A SEPARATE TRENCH FROM THE WATER.
2. THE TOP OF THE SEWER MAIN MUST BE A MINIMUM OF 18" BELOW THE BOTTOM OF THE WATER MAIN.
3. WHERE THE MINIMUM 18" SEPARATION CANNOT BE OBTAINED. THE SEWER SHALL BE CONSTRUCTED OF PRESSURE TYPE PIPE.
4. ZERO LEAKAGE OF SEWER LINES AND MANHOLES IS ALLOWED WHEN THE REQUIRED HORIZONTAL OR VERTICAL SEPARATION FROM WATER LINES IS NOT MET.

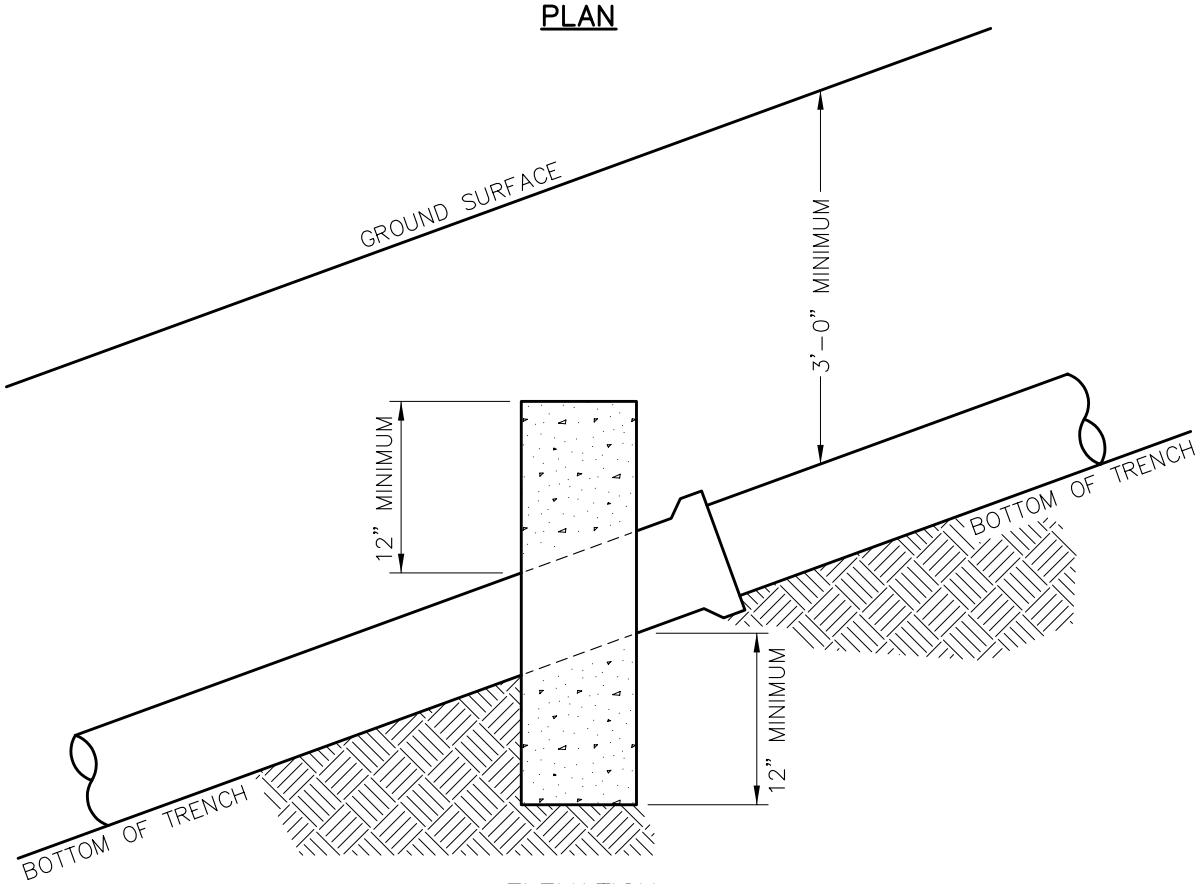
SEPARATION OF WATER AND SEWER MAINS

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 02-27-06
DETAIL NO: G-4



PLAN



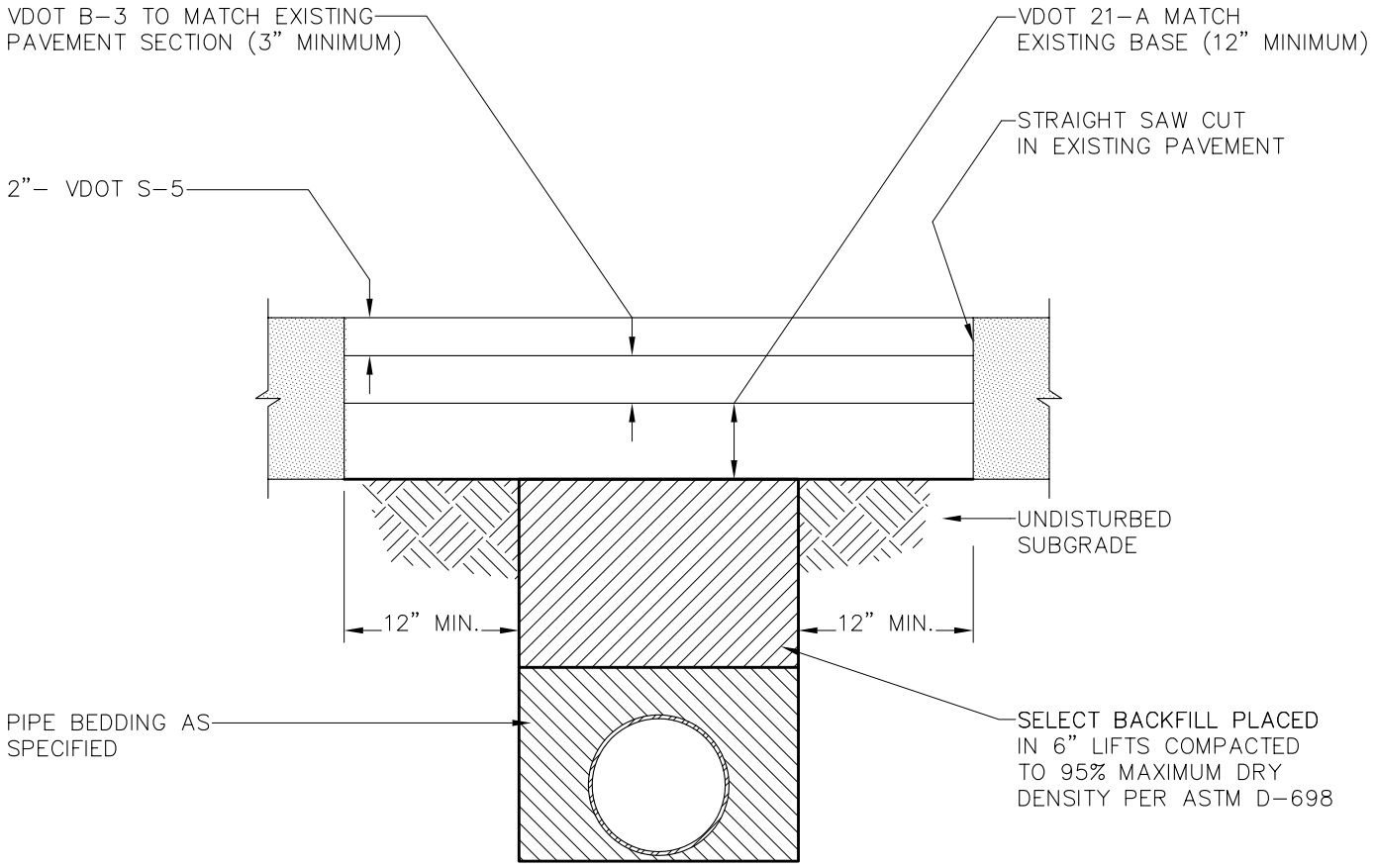
ELEVATION

NOTE: CONCRETE TO BE POURED AGAINST UNDISTURBED EARTH.

CONCRETE ANCHORS

KING GEORGE COUNTY SERVICE AUTHORITY

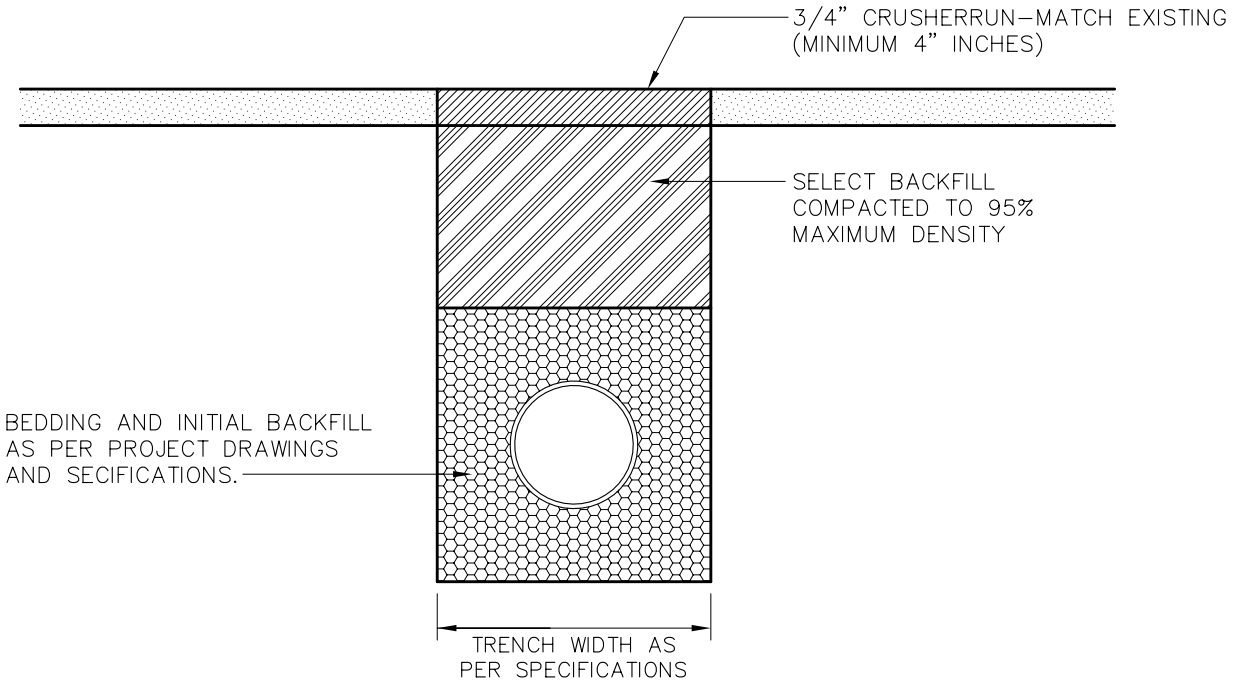
SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-5



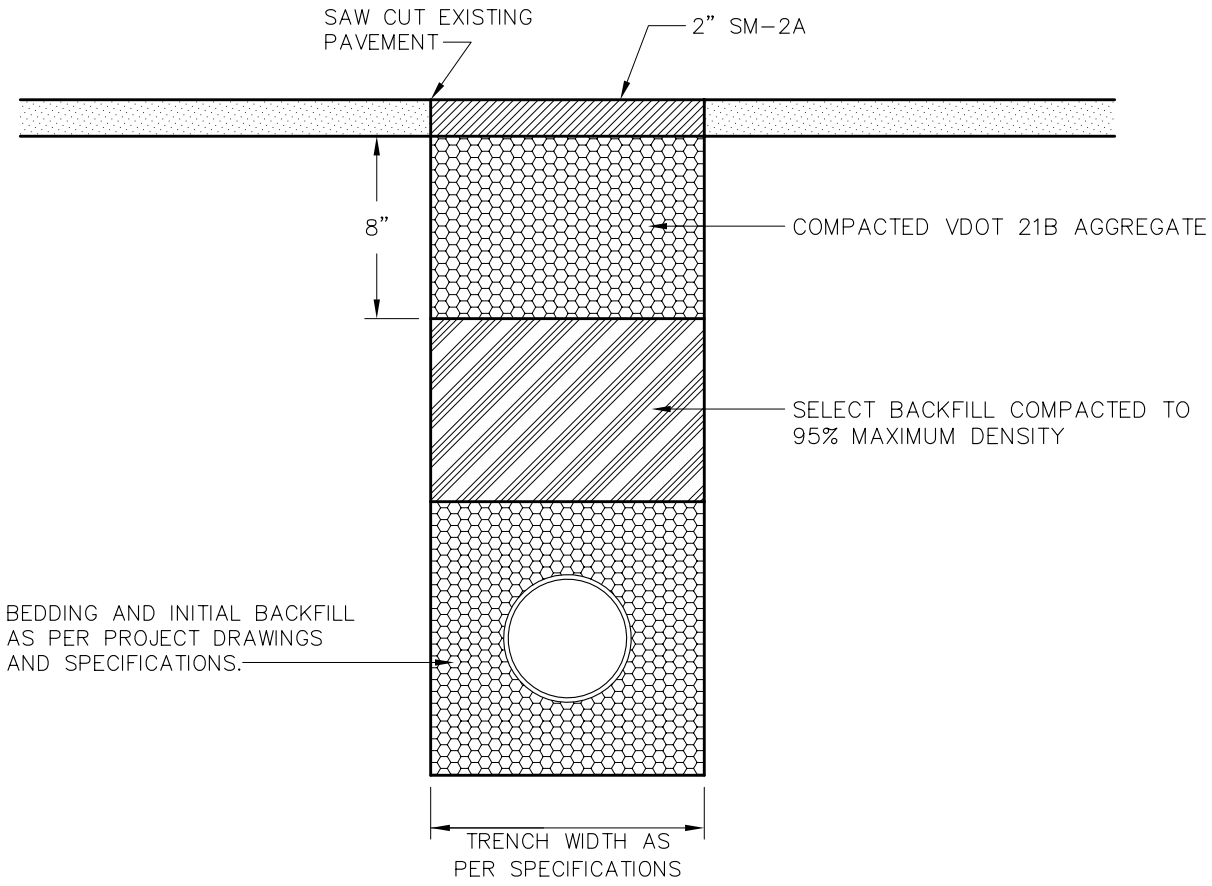
PAVEMENT REPAIR DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE:	NOT TO SCALE
DATE:	09-01-04
DETAIL NO:	G-6



GRAVEL DRIVEWAY/PRIVATE ROAD REPAIR

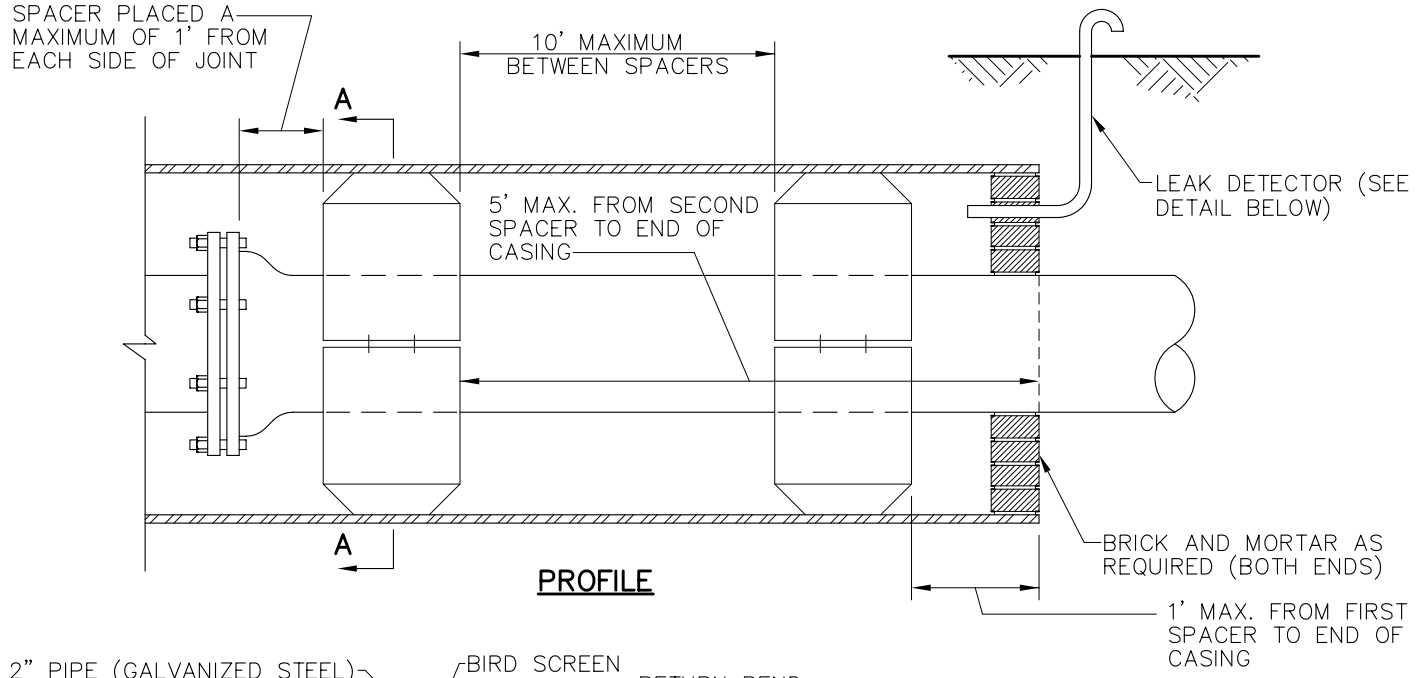


PAVED DRIVEWAY/PRIVATE ROAD REPAIR

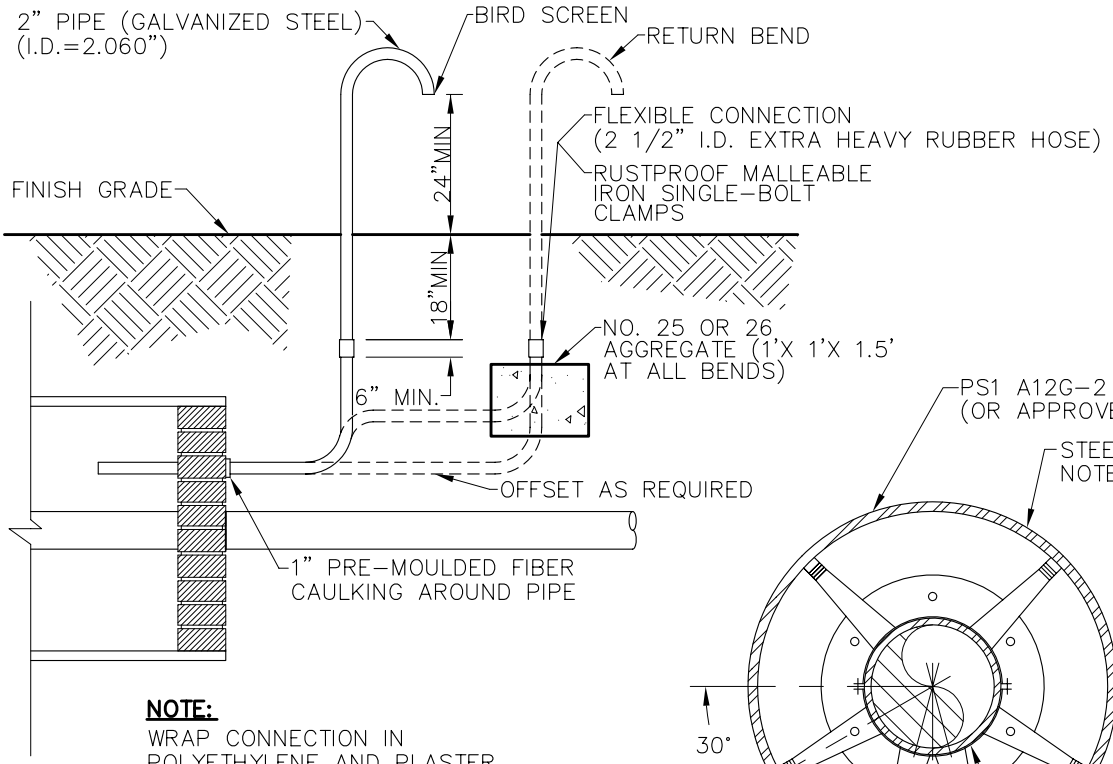
GRAVEL AND PAVED DRIVEWAY REPAIR

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09–01–04
DETAIL NO: G–8

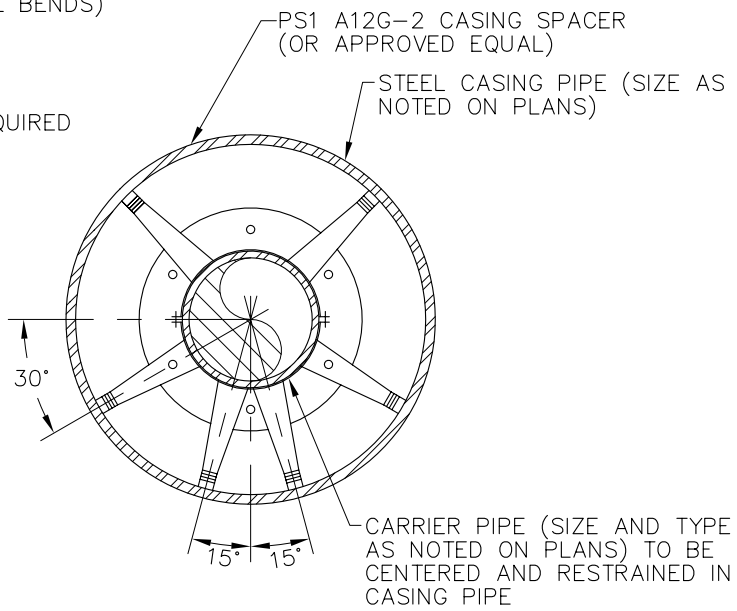


PROFILE



NOTE:
WRAP CONNECTION IN POLYETHYLENE AND PLASTER WITH ROOFING CEMENT OR ASPHALTIC MATERIAL.

STANDARD LEAK DETECTOR

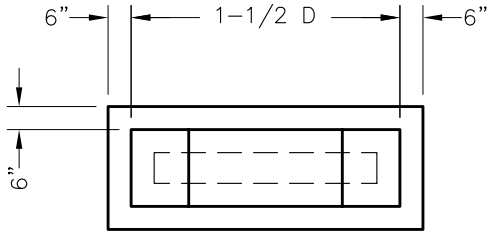


SECTION A-A

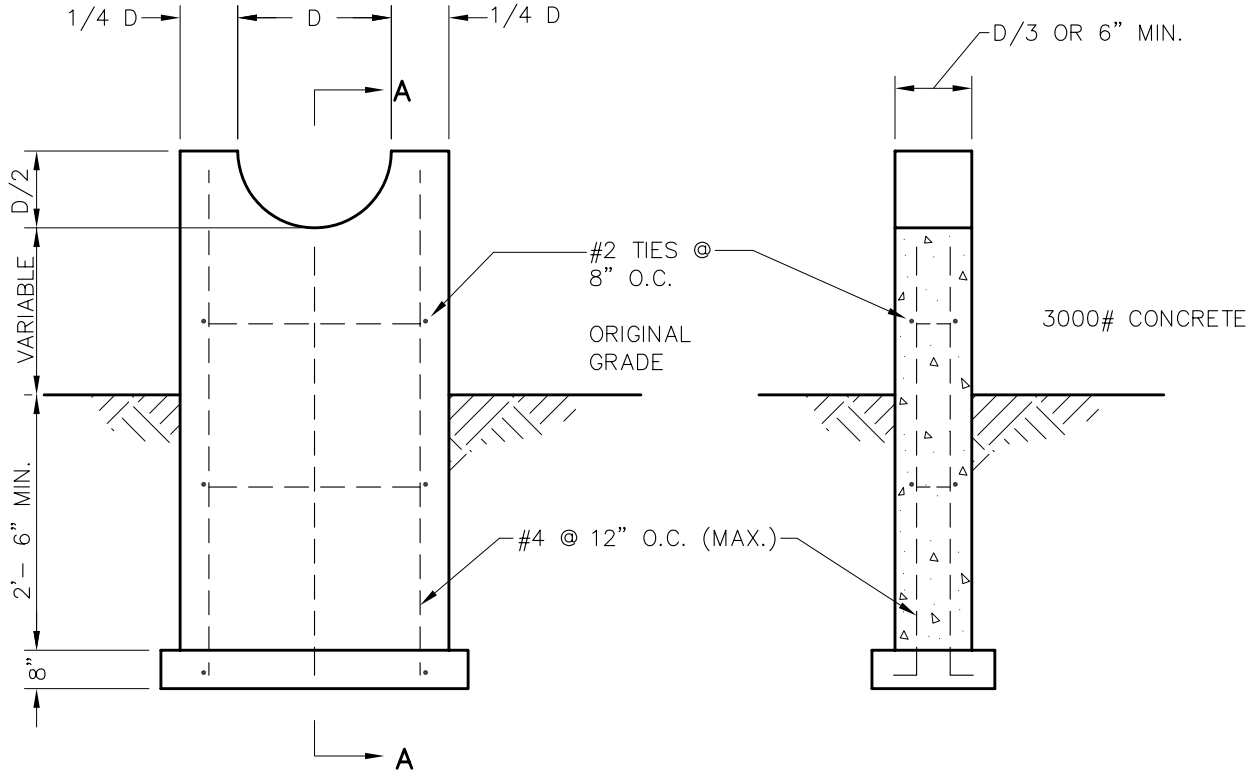
PIPE ENCASEMENT DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-9



PLAN



ELEVATION

SECTION A-A

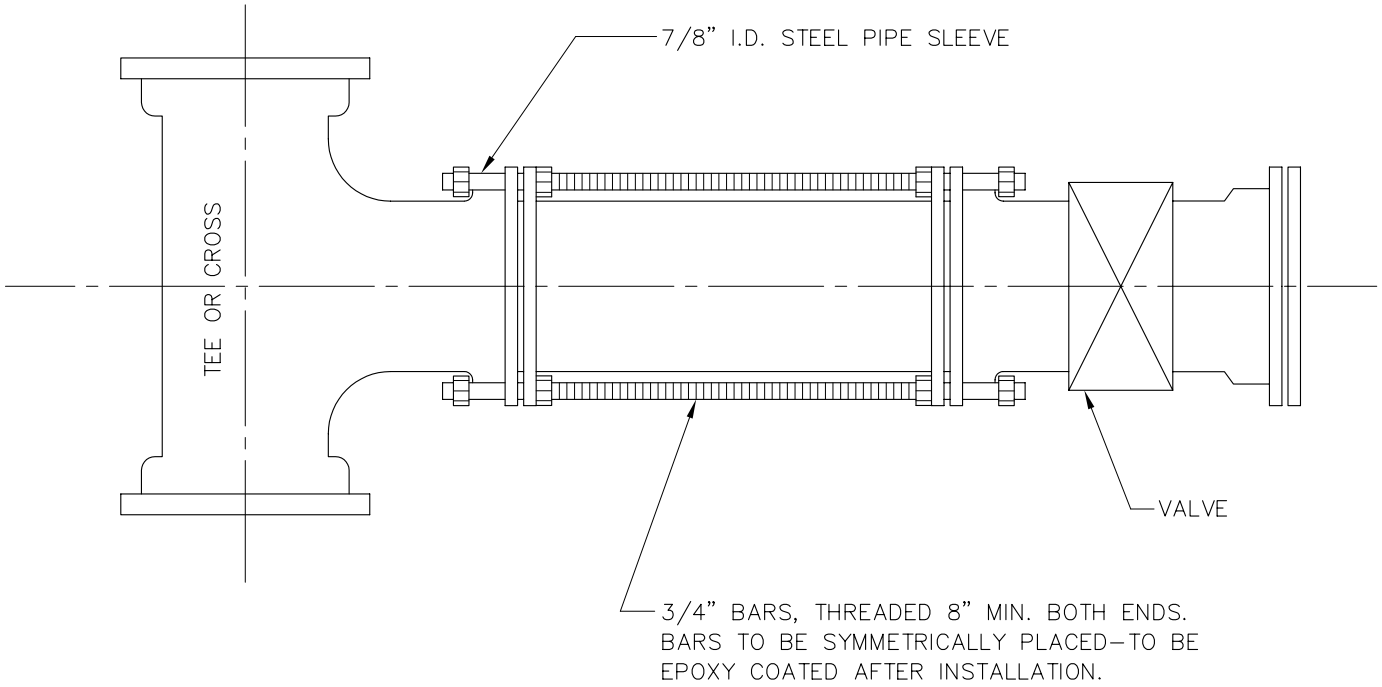
NOTE:

1. STRAP PIPE TO CONCRETE ANCHORS WITH 12 GA. 316 STAINLESS STEEL STRAPS AND BOLTS.

PIPE BRIDGE DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-10



VALVE SIZE	NUMBER OF 3/4" BARS REQUIRED	MAX. LENGTH OF SPIGOT PIPE
3"	2	24"
4"	2	24"
6"	2	27"
8"	2	27"
10"	4	27"
12"	6	27"
16"	8	36"
20"	12	36"
24"	16	36"
30"	20	42"

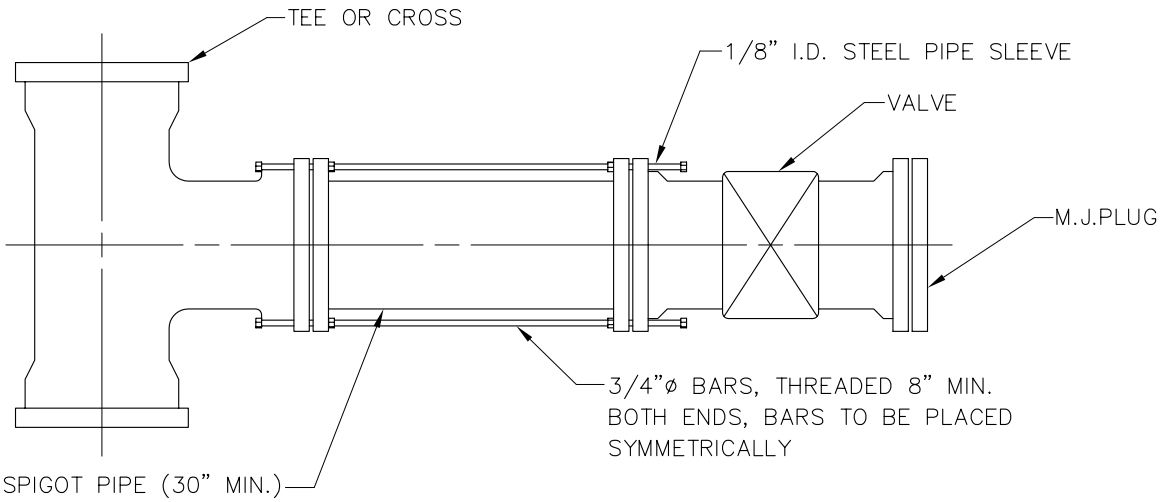
PIPE RESTRAINTS

KING GEORGE COUNTY SERVICE AUTHORITY

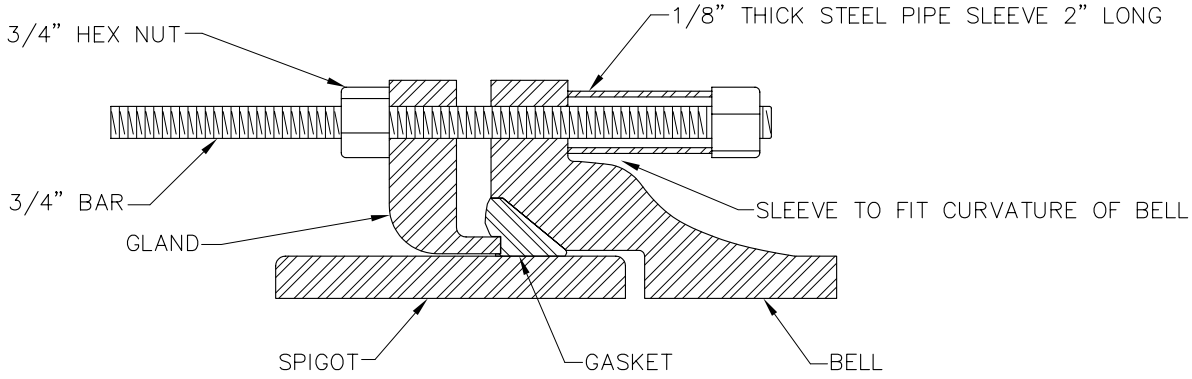
SCALE: NOT TO SCALE

DATE: 09–01–04

DETAIL NO: G–11



PLAN



CROSS SECTION
SLEEVE AND BAR ASSEMBLY

VALVE SIZE	No. OF 3/4"ø BARS REQUIRED	MAXIMUM LENGTH OF SPIGOT PIPE
6"	2	30"
8"	2	30"
10"	2	30"
12"	6	30"
14"	8	36"
16"	8	36"
18"	10	36"
20"	12	36"
24"	16	36"

NOTES:

1. PAINT ALL STEEL W/ TWO COATS OF VALDURO ASPHALT PAINT OR APPROVED EQUAL.
2. EYE BOLTS WILL BE ACCEPTED AS AN ALTERNATE TO THIS DETAIL.

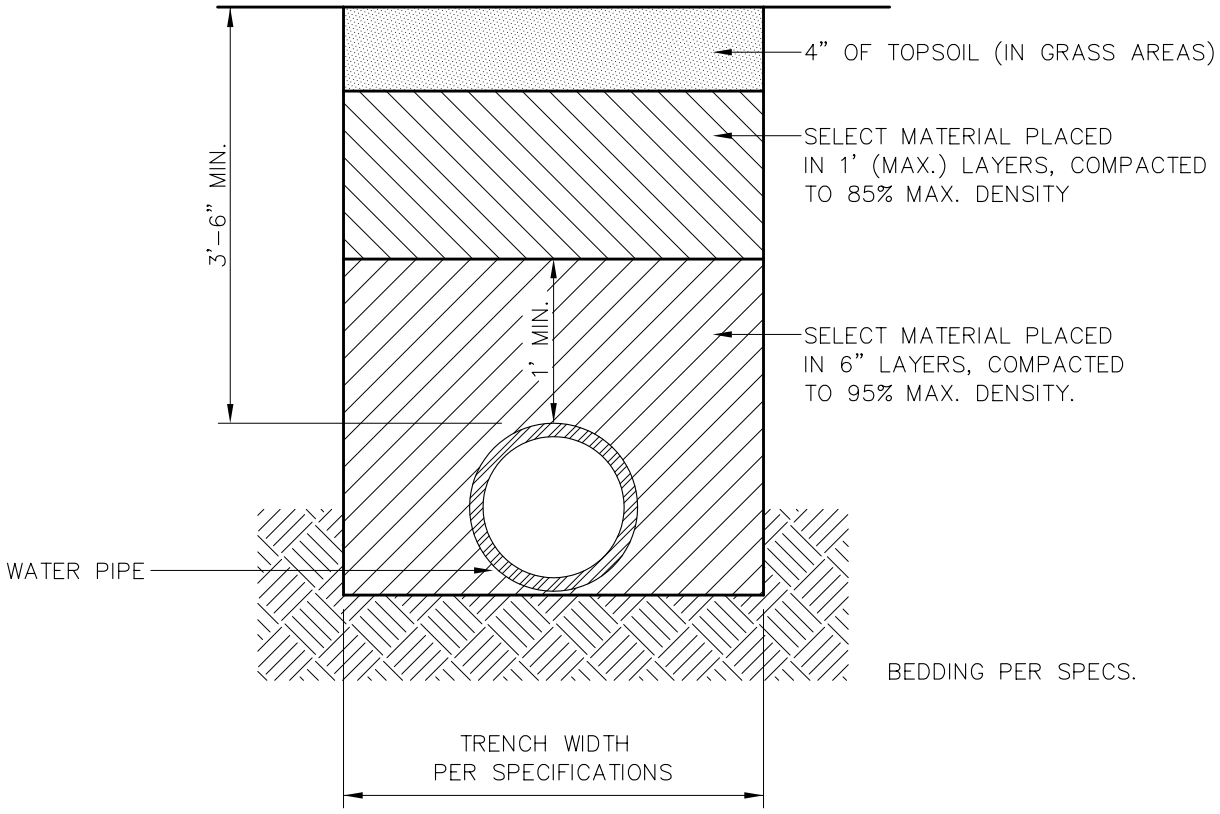
RESTRAINING ROD DETAIL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE

DATE: 09-01-04

DETAIL NO: G-12



PAYMENT LIMITS
TRENCH EXCAVATION & BACKFILL

KING GEORGE COUNTY SERVICE AUTHORITY

SCALE: NOT TO SCALE
DATE: 09-01-04
DETAIL NO: G-13