

STANDARDS AND SPECIFICATIONS
DEPARTMENT OF PUBLIC UTILITIES
COUNTY OF GOOCHLAND, VIRGINIA

JULY 2015

INTRODUCTION

These Standards have been developed for use by consultants working on water and sewer utility projects within Goochland County and for County personnel who review those projects. The standards are not intended as a regulation but should be used as a guide which will establish a degree of uniformity for drawings and specifications for all water and sewer utility projects.

Consultants working on water and sewer utility projects should recognize the fact that State and Federal regulations must be satisfied on all projects. In the event that the County Standards differ from State or Federal Requirements, the more restrictive standard shall be utilized.

It is very difficult to generalize when addressing matters of engineering design without endangering the final product; therefore, consultants should strive for designs which show consideration of details presented herein. However, these details are secondary to good engineering judgment.

The work described herein is under the jurisdiction of the Goochland County Department of Public Utilities hereinafter referred to as the Department.

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Director of Public Utilities

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SECTION 1 - GENERAL DESIGN STANDARDS

1.1 GENERAL REQUIREMENTS

1.1.1 Definitions

A. COMPLETION:

Completion of work indicates that all sewer pipe, water pipe, valves, appurtenances, buildings, equipment and any other required items have been installed and appropriately tested in accordance with the plans, specifications and contract, all submittals including any O&M manuals have been made, all punch list items, right-of-way, easement, property and pavement restoration work has been completed as required. The use of water or wastewater lines by the contractor for the purpose of completing the testing of equipment or piping, the tie-in of water or wastewater lines, or the continued necessary use of equipment or piping because of tie-ins or testing shall in no way be construed as completion of work until the conditions of the first sentence of this definition has been satisfied.

B. CONTRACTOR:

The Developer's Agent, acting directly or through his agents, who has been contracted by the developer to perform the work.

C. COUNTY:

The party of the second part to the County/Developer Agreement, Goochland County, acting through the Director of Public Utilities or his duly authorized agents.

D. DEVELOPER:

The Party who is in contract with the County to install the subdivision development or general utility improvements.

E. ENGINEER:

The Consulting Engineer who has been designated by the Developer as the Engineer of record in relation to the project, whether acting directly or through properly authorized agents, inspectors or representatives.

F. FINAL INSPECTION:

An inspection by the county inspector and contractor of all items covered by the County/Developer contract which results in a punch list of items remaining to be completed or submitted to satisfy the County's specifications.

G. FINAL ACCEPTANCE:

A written statement from the County to the Developer stating that as of a certain specific date all punch list items from the final inspection have been corrected and all necessary submittals have been made and the conditions of the County/Developer contract have been satisfied.

H. INSPECTOR:

The person appointed by the County's Director of Public Utilities to carry out instructions given by the County and to inspect the materials and work performed under this Agreement.

I. SUBCONTRACTOR:

Any individual, firm or corporation having a direct contract with the Contractor for the performance of any part of the work.

J. WARRANTY PERIOD:

A one year guarantee of equipment and labor by the Developer that begins on the date of final acceptance (with a three year warranty on road work or in accordance with VDOT's latest requirements). Warranty periods of more than one year if mentioned in the specifications shall prevail to the specific equipment, service or system.

K. OTHER:

Other definitions applicable may be found in the County's latest Utilities and Subdivision Ordinances and all Parts of the County's Construction Specifications.

1.1.2 General

A. The design of all utility systems and extensions or modifications thereto shall be performed under the direction of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 3 of the Code of Virginia, 1950, as amended. Where applicable, design may be performed under the direction of a certified land surveyor in accordance with Sec. 54.1-408 of the above- cited code.

B. All design shall conform to the latest Virginia Department of Environmental Quality Sewage Regulations (12VAC5-580), the Virginia Department of Health Waterworks Regulations (12VAC5-590) and to the requirements of other State and Federal Agencies having jurisdiction.

- C. Additionally, all designs shall conform to the requirements of the Goochland County Department of Public Utilities (hereinafter referred to as "Department"). Where the requirements of the State and County are in conflict, the more restrictive requirements shall govern.
- D. The engineer shall be responsible for obtaining the review and necessary approvals of all drawings and specifications by applicable County, State, and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the Department at the time of final review by the Department.
- E. Sanitary sewer lines and water lines are to be designed to serve the entire sewer shed or service area of which the subdivision or development is a part. This necessitates consideration of property beyond the development or subdivision in question.
- F. The developer is required to design and construct his system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question. Elevation of the sewer system must be designed such that future extensions can serve the entire area that naturally drains towards the system.
- G. The design shall include documentation of the adequacy of the downstream facilities. This should include all downstream gravity sewers, Pump Stations and the receiving Wastewater Treatment Plant. Drawings shall include the Name and address of any pump stations and the Wastewater Treatment Plant.

1.1.3 Laws and Regulations

- A. The Contractor shall keep fully informed of all State and Federal laws and local ordinances, and regulations in any manner affecting those employed or engaged in the work, or in any way affecting the conduct of the work, and of all such orders or decrees of bodies or tribunals having jurisdiction or authority over same.
- B. The Contractor shall protect and indemnify the County and its officers and agents against any claim or liability arising from or based on the violation of such laws, ordinances, regulations, orders or decrees, whether by himself or his employees.
- C. Attention is called to Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.
- D. The Contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

1.1.4 Permits

- A. The Contractor must obtain all required licenses and permits and pay all charges and expenses connected with the work, and be responsible for all damages to persons or property which may occur in connection with the prosecution of the work.
- B. Misunderstanding or ignorance of these laws on the part of the Contractor will not be considered as a valid excuse for his failure to secure the necessary permits.

1.1.5 Materials and Workmanship

- A. It is the intent of the County's specifications to describe definitely and fully the character of materials and workmanship required with regard to all ordinary features, and to require first-class work and new materials in all aspects of the project.
- B. For any unexpected features arising during the progress of the work and not fully covered in the County's specifications, the County will require first class work to be performed and first class materials to be used by the Contractor. It is understood that the County/Developer contract includes any and all work that may be necessary to connect the work done with the adjoining work in a proper and workmanlike manner.
- C. The County reserves the right to employ an independent testing laboratory to conduct tests of materials, etc. as the County may deem necessary to assure complete compliance with the requirements of the County's specifications. The Contractor shall offer full cooperation with personnel in the employ of the County in making these tests.

1.1.6 Deviation from Plans

- A. The Contractor shall not deviate from the plans, profiles, cross-sections and specifications in any particular except on written consent of the County. If deviation occurs on the part of the Contractor, he shall correct the error at his expense in a manner satisfactory to the County.

1.1.7 Other Plans and Working Drawings (Shop Drawings)

- A. All materials and equipment used in the project or is required for completion of the project shall be submitted for approval in accordance with the shop drawing procedures. No payment will be made for materials purchased or installed that have not been approved.
- B. Such information as is necessary to give a comprehensive idea of the construction contemplated, shall be shown on the plans. Contractor shall submit to the County Inspector and Engineer, for their approval, all equipment and materials

incorporated in the project and such additional detailed shop or working drawings as may be required for the construction of any part of the work. Pending the approval of such drawings, any work done or materials ordered shall be at the risk of the Contractor.

- C. Working drawings shall consist of such detailed drawings as may reasonably be required for successful prosecution of the work, and which are not included in the plans furnished by the Engineer. These may include drawings for anchor bolts, centering and form work, masonry, layout diagrams, flanged pipe spool drawings, etc.
- D. It is expressly understood that the approval of working drawings relates to the general concept and not the detail and such approval will not relieve the Contractor from any responsibility for errors or omissions in dimensions or quantities.
- E. It is understood that Shop Drawings or Working Drawings processed by the Engineer are not Change Orders; that the purpose of Shop or Working Drawing submittals by the Contractor is to demonstrate to the County that the Contractor understands the design concept, to demonstrate his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use.
- F. If deviation, discrepancies, or conflicts between Shop Drawing submittals and the plans and specifications are discovered either prior to or after Shop Drawings submittals are processed, the plans and the County's specifications shall control and shall be followed. All Shop or Working Drawings and blueprints shall be made at the expense of the Contractor.

1.1.8 Discrepancies

- A. Any discrepancies found between the plans and the County's specifications and site conditions or any inconsistencies or ambiguities in the plans or specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

1.1.9 Correction of Work

- A. The Contractor shall promptly remove from the premises all work rejected by the Engineer or County Inspector for failure to comply with the County's specifications, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the work in accordance with the County's specifications and shall bear the expense of making good all work of other Contractors that may potentially be destroyed or damaged by such removal or replacement.

- B. All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected work within ten (10) days after receipt of Written Notice, the County may remove such work and store the materials at the expense of the Contractor.

1.1.10 Character of Workmen and Equipment

- A. The Contractor shall employ such superintendents, foremen and workmen as are careful and competent.

1.1.11 Superintendent

- A. The Contractor shall personally supervise the work and when not personally present shall be represented by a Superintendent who shall have full authority to act as the Contractor's representative and all orders and instructions given to the Superintendent shall have the same force and meaning as if given to the Contractor in person. The Superintendent or Contractor shall be on duty at all times while the construction work is being done. Superintendent shall be on duty at all times that subcontractors are working.

1.1.12 Responsibility of Contractor

- A. The Contractor shall take all responsibility for the work, and take all precautions to prevent injuries to persons and property in or about the work.
- B. Until final acceptance of the work by the County, it shall be under the charge of the Contractor, and he shall take every care and necessary precaution against injury or damage to the work or any part thereof by the action of the elements or any other cause whatsoever, whether arising from the execution or the non-execution of the work.
- C. The Contractor shall rebuild, repair, restore and make good, at his expense, all injuries or damage to work occasioned by any of the above causes before it will be accepted.

1.1.13 Work In Bad Weather

- A. During stormy or inclement weather, no work shall be done except as can be done satisfactorily and in a workmanlike manner to secure first-class construction throughout.

1.1.14 Work Outside Regular Hours

- A. If the Contractor desires to perform work outside the regular hours or on Saturday, he shall request permission to work 48 hours in advance to allow arrangements to be made for proper inspection. The County may refuse the

Contractor permission to work if the 48-hours notice is not given or for other just cause. Reasonable efforts shall be made by the Contractor to avoid undue noise during the night and on Sundays, if it is necessary to work at such times. Under normal circumstances the Contractor will not be permitted to work on Sundays or County holidays.

- B. The County reserves the right to schedule the Contractor to work outside normal working hours in the interest of public safety or convenience. Normal working hours are defined as 8:00 A.M. to 5:00 P.M., Monday through Friday.

1.1.15 Use of Water

- A. No water shall be drawn from the County's facilities for testing or other purposes until suitable arrangements have been made with the County Inspector.

1.1.16 Conflicts

- A. Should any requirements of the County's specifications conflict with the requirements of governmental or private authority having jurisdiction, then and to the extent of such conflict, these specifications shall be superseded.

1.1.17 Job Safety

- A. The County shall not be responsible for the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work; such precautions include but are not limited to shoring, scaffolding, underpinning, temporary retainment of excavation and any erection methods and temporary bracing.

1.1.18 Existing Structures

- A. The location of existing sewers, water and gas pipes, conduits and other structures across or along the line of the proposed work are not necessarily shown on the plans, and if shown, the location, depth and dimensions of such structures may only be approximately correct. The Contractor shall have a working pipe locator on the job at all times.
- B. The Contractor shall dig the necessary test holes for the purpose of locating existing underground structures. Such excavation shall not be undertaken without 48 hours prior notice to the County or owner of the existing facility.

1.1.19 Care of Existing Structures:

- A. The Contractor shall be liable for all damage done to any structure or property arising through his negligence or carelessness. He shall take care of and maintain all underground, overhead or surface utilities encountered in the performance of the work.

- B. Prior to commencing work Contractor shall contact the Utility Information Center ("Miss Utility"), telephone 1-800-552-7001 for assistance in locating existing underground utilities.
- C. The Contractor shall observe all precautions with respect to fire and avoid the indiscriminate mutilation, or cutting down trees, within and outside of project work areas or easements. Any damage to property not in the work area or easements will be the Contractor's responsibility.

1.1.20 Inspectors

- A. The Inspector is authorized to inspect all work done and materials furnished. In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector will have the authority to reject material or suspend work until the question at issue can be referred to and decided.
- B. The Engineer or Inspector shall have access at all times to all parts of the work being done for the purpose of inspection, measurements and establishments of lines and grades.

1.1.21 Responsibility Of Contractor's Employees

- A. Each and every employee of the Contractor, and each and every one of his Subcontractors, engaged in said work shall for all purposes be deemed taken to be exclusive servants of the Contractor. The Contractor shall in no manner be relieved from responsibility or liability on account of any fault or delay in the execution of said work, or any part thereof, by any such employee or any Subcontractor or any material supplier whatsoever.

1.1.22 Final Inspection

- A. Before final inspection of the work, the Contractor shall clean up the site of the work including all rights-of-ways, leaving it in as clean, neat and sanitary condition as originally found, and shall remove all machinery, tools, surplus material, temporary buildings, and other structures from the site of the work.

1.1.23 Standards for Computing Pay Items

- A. Where the Developer is eligible for refunds, all pay items shall be based on the standards as outlined in the County Water and Sewer Construction Specifications.

1.1.24 Notification to Property Owners

- A. Contractor shall properly notify all property owners two (2) weeks prior to the start of any construction (including land clearing). Notification shall be in the form of a letter similar to the "sample letter at the end of this section.

1.1.25 Water Line Tie-Ins

- A. All water line tie-ins to the existing distribution system including vertical and horizontal relocations shall be coordinated by the utility inspector, in conjunction with the Operations and Maintenance Section of the Utilities Department. Normal tie-ins shall be scheduled Tuesday thru Thursday from 9:00 a.m. to 4:00 p.m. Tie-ins may be permitted outside of this normal time and/or during nighttime hours only after a justified request in writing has been submitted and approved by the Goochland Department of Public Utilities.
- B. Tie-ins of water mains and sewer force mains will not be allowed during the entire weeks of Thanksgiving and Christmas. Where Christmas falls on a weekend, there will be no tie-in allowed two(2) calendar days before and two(2) calendar days after the holidays. In some cases, tie-ins may be restricted for certain situations such as graduation week of an affected public or private school, as well as, when county forces are flushing as part of their annual flushing program or other Operational requirements. The utility inspector will determine the available tie-in date, in cooperation with the Utilities Operation and Maintenance section. Scheduling of tie-ins is at the discretion of the utility inspector.
- C. The County reserves the right to require the Contractor to perform tie-ins outside of the normal working hours detailed above in the interest of public safety or customer service. No claim for additional compensation shall be made by the Contractor when such occasions occur.
- D. Proper preparation including field verification of the plans shall be accomplished to minimize shutdown time and prevent the tie-in from exceeding scheduled shutdown time. Sufficient personnel, equipment and materials shall be on site prior to the water being shut off. Where applicable, excavation and preassembling of fittings shall be performed. If, in the opinion of the inspector, sufficient resources are not available, the tie-in will be cancelled and rescheduled.
- E. Tie-ins to asbestos cement pipe shall be made to rough barrel pipe. Tie-ins to the machined section of asbestos pipe will not be permitted. Where asbestos cement pipe couplings have been removed, the machined end of the pipe shall be removed. Abandonment of cement asbestos pipe shall be per state and federal requirements.
- F. Tie-ins involving fittings shall include provisions for temporary blocking until concrete blocking has cured.

- G. All pipe and fittings used for a tie-in to the water system shall be swabbed with a 1% chlorine solution prior to connection.
- H. Before a tie-in will be allowed, all new valves, including fire hydrant valves, shall be accessible and verified fully open by the Contractor, unless there are valves designated as “normally closed”. Prior to tie-in, the Inspector shall verify that all valves, including fire hydrant valves, are fully open and accessible. Immediately after a tie-in has been made, all valves used during the shutdown shall be verified fully open by the Inspector. All fire hydrants shall be checked by the Inspector to ensure water is available and each hydrant is in working order.

1.1.26 Project Meetings

- A. Contractor shall be required to attend Project Progress Meetings. Meetings shall be held at a minimum of once a month. Should the County require additional meetings the Contractor shall be required to attend without additional cost to the County.

1.1.27 Responsible Land Disturber (RLD)

- A. Contractor shall provide a certified RLD for the project. Persons name shall be on the title sheet of the drawings with emergency contact information.

1.1.28 Department Review

A. Plan of Development

1. Water and sewer plans shall be included as part of the Plan of Development (POD) application.
2. The POD application shall include a Design Folder. This Design Folder shall contain any of the following documents not shown on the plans:
 - a) Engineering Report with supporting calculations.
 - b) Information Sheet for Water and Sewer Agreements
 - c) Sewer Design Form
 - d) Plan Review Checklist
 - e) Domestic Meter Sizing Form
 - f) Fire Flow Estimate Form
 - g) Notice of Intent to Discharge Non-domestic Wastewater.
3. Upon receipt of the Information Sheet for Water and Sewer Agreements, the water and sewer agreements will be prepared by the Department for signature by the Owner. Since the agreements must be executed by the Owner and County prior to approval of the utility plans or building permits, it is recommended that the Information Sheet be submitted as

soon as possible to avoid delays in approval of plans or building permits. Conflicts between the completed Information Sheet and the plans may generate additional review comments.

4. For phased development, overall water and sewer plans shall be submitted to the Department and shall be approved prior to approval of any construction plans for the first phase of the development.
5. When all of the technical requirements are satisfied, the Department will proceed with signature of the POD construction plans. This signature DOES NOT include approval for construction of water and sewer.
6. When agreements have been executed, applicable Federal, State and Local approvals received, off-site easements recorded, and Department requirements satisfactorily addressed, the plans shall be marked “Approved” by the Director of Community Development or his representative.
7. Six sets of water and sewer plans will be distributed as follows:

a)	Community Development	2 sets & 1 CD
b)	Construction Division	2 sets
c)	Public Utilities	1 set
d)	Fire	1 set
8. The owner’s contractor will contact Public Utilities to schedule a pre-construction meeting. The approved water and sewer construction plans normally will be delivered to the contractor at this meeting and authorization to proceed with construction of water and sewer facilities will be issued.
9. Proposed revisions to the approved water and sewer construction plans shall be submitted directly to the Department. The Engineer shall:
 - a) provide a transmittal letter which clearly states those changes submitted for approval.
 - b) submit the appropriate number of copies for approval.
 - c) clearly indicate, by highlighting in yellow on each copy of the plans submitted, those changes being made.

B. Subdivision Plan Review

1. The Engineer shall make application to the Department for sanitary sewer and/or water service. The Department will accept for review only those applications that are complete. A complete application includes the Water and Sewer Plans and the Design folder. This Design Folder shall contain any of the following documents not shown on the plans:
 - a) Engineering Report with supporting calculations
 - b) Sewer Design Form
 - c) Plan Review Checklist
2. Upon receipt of the Information Sheet for Water and Sewer Agreements, the water and sewer agreements will be prepared by the Department for signature by the Owner. Since the agreements must be executed by the Owner and County prior to approval of the utility plans or building permits, it is recommended that the Information Sheet be submitted as soon as possible to avoid delays in approval of plans or building permits. Conflicts between the completed Information Sheet and the plans may generate additional review comments.
3. Community Development shall sign the plans to indicate that all environmental and erosion and sediment control requirements have been satisfied.
4. When agreements have been executed, applicable Federal, State and Local approvals received, off-site easements recorded, and Department requirements satisfactorily addressed, the plans shall be marked “Approved” by the County Engineer or his representative.
5. For phased development, overall water and sewer plans shall be approved prior to the first phase of the development.
6. Six sets of water and sewer plans will be distributed as follows:
 - a) Community Development 3 sets & 1 CD
 - b) Construction Division 2 sets
 - c) Public Utilities 1 set
7. The owner’s contractor will contact the County Engineer to schedule a pre-construction meeting. The approved water and sewer construction plans normally will be delivered to the contractor at this meeting and authorization to proceed with construction of water and sewer facilities will be issued.

8. When revisions to the approved water and sewer construction plans are submitted for approval, the Engineer shall:
 - a) provide a transmittal letter which clearly states those changes submitted for approval
 - b) submit the appropriate number of copies for approval
 - c) clearly indicate, by highlighting in yellow on each copy of the plans submitted, those changes being made.
 - d) include the Subdivision Certification to certify that all changes have been coordinated with the Subdivision Construction Plans and that all changes conform to the approved Subdivision Construction Plans.
 - e) without certification of conformance to the Subdivision Construction Plans, approval by the Director of Planning will be required prior to authorization to proceed with the proposed revisions.

C. Off-site Improvements

1. Plans for major off-site improvements shall be submitted to the Department. A complete application includes the Water and Sewer Plans, Engineering Report, the Information Sheet for Water and Sewer Agreements, and any supporting calculations. The Engineer shall schedule a meeting with the Department as needed to define the scope of the project and the extent of the off-site improvements required.
2. The Engineer shall submit six sets of plans for approval. For sewage pumping stations or other major facilities additional copies may be required.
3. Upon receipt of the Information Sheet for Water and Sewer Agreements, the water and sewer agreements will be prepared by the Department for signature by the Owner. Agreements must be executed before plans are approved.
4. Community Development shall sign the plans to indicate that all environmental and erosion and sediment control requirements have been satisfied.
5. When agreements have been executed, applicable Federal, State and Local approvals received, off-site easements recorded, and Department requirements satisfactorily addressed, the plans shall be marked "Approved" by the County Engineer or his representative.

6. For phased development, overall water and sewer plans shall be approved prior to the first phase of the development.
7. Six sets of water and sewer plans will be distributed as follows:

a)	Community Development	3 sets & 1 CD
b)	Construction Division	2 sets
c)	Engineer	1 set
8. The owner's contractor will contact the County Engineer to schedule a pre-construction meeting. The approved water and sewer construction plans normally will be delivered to the contractor at this meeting and authorization to proceed with construction of water and sewer facilities will be issued.
9. When revisions to the approved water and sewer construction plans are submitted for approval, the Engineer shall:
 - a) provide a transmittal letter which clearly states those changes submitted for approval
 - b) submit the appropriate number of copies for approval
 - c) clearly indicate, by highlighting in yellow on each copy of the plans submitted, those changes being made.

D. Engineering Report

1. The engineering report which is included in the Design Folder shall be submitted to and approved by the Department before preparing drawings and specifications except for minor sewer extensions. A sewer extension shall be considered minor where less than 15 lots are served, no off-site area is served, and the line diameter does not exceed 8 inches. A water extension is considered minor where less than 15 lots are served and the line diameter is 8 inches or less. The Engineering Report shall include water requirements for and sewer flow generated by the project. The report shall contain a System Layout Map which shall incorporate all of the proposed construction together with a sufficient amount of the surrounding area in order to clearly outline the interrelationship of the two. The Report shall demonstrate that the sewer lines and water lines are designed to serve the entire sewer shed or service area. Existing and proposed development shall be shown as well as existing and proposed utilities. Where phase development is contemplated, the extent of each phase shall be clearly delineated. Additional requirements shall be imposed as detailed in other divisions of these standards and as required by the County.

E. System Layout Map

1. The System Layout Map shall delineate sewer shed area boundaries for sewer projects and pressure zone boundaries for water projects. The map shall clearly define the areas pertinent to interim and ultimate development of the area proposed to be served. The System Layout Map shall show present and future development, proposed interim and future utilities as well as those existing utilities that will be affected by or have an effect on the proposed utilities. Existing and proposed ground elevations shall be shown at contour intervals not exceeding 5 feet unless otherwise approved. Proposed utilities necessary to serve adjacent properties and associated easements shall be shown.

F. Easements

1. Off-site easements shall be recorded and the Deed Book and Page Numbers of the recordation included on the utilities plans before commencement of construction.
2. Where offsite easements are required Contractor shall video tape the property and adjacent property before starting construction to verify the condition and provide a guide line for restoration of the property after completion. Copies of the video tapes shall be submitted to the county before construction begins.
3. On-site easement plats shall be submitted to the Department with the Engineer's certification that the plats conform to the approved plans and any approved revisions and are as shown on the approved POD construction plans. The on-site easement plats with the Engineer's certification will be forwarded to the County Engineer. Any revisions to the approved plans shall be accompanied by the necessary revisions to the easement plats and the Engineer's certification that the revised plats conform to the plan revisions.
 - a) The Construction Division will notify the Engineer if any proposed field change requires revised plans and easement plats.
 - b) The Engineer shall submit all revised easement plats with his certification that the revised plats conform to the approved plans and revisions prior to Tentative Acceptance.
 - c) The Engineer shall address any comments from the Department's Construction Division prior to Final Acceptance.
4. Where easements are required on property owned by the County of Goochland, plans shall be submitted for preliminary review. After the Department agrees to the proposed alignment, the Engineer shall submit

plans and easement plats to the County Department (Agency) controlling the property. When the Agency recommends approval of the installation, the Engineer shall forward the recommendation and plats to the Real Property Department. The Real Property Department will prepare a license agreement for approval by the County Board of Supervisors. Utility Plans will be approved after the County Board of Supervisors grants permission to install the utility lines.

5. Contractor shall be responsible for obtaining all easements. Contractor is responsible for lawyer's fees, property owner's fees, survey fees and any other fees associated with obtaining easements.
6. Installation of trees, structures, buildings, stormwater BMP's, wetlands, berms or other obstruction which prevents the proper installation, maintenance, rehabilitation, operation, inspection or removal of water or sewer facilities shall not be allowed within any permanent water or sewer easement unless approved by the County.

G. Federal, State and Local Approvals

1. Permit conditions for construction and maintenance shall be shown on the plans where any Nationwide or Individual Permit, Virginia Water Protection Permit, Virginia Department of Health or Virginia Department of Environmental Quality Construction Permit, Plan of Development, Virginia Power Right-of-Way Crossing Permit, Railroad Crossing Permit, etc. is required.
2. The Department shall approve all plans for erosion and sediment control before construction of water and sewer facilities may commence. The Department may require a preconstruction meeting at the project site prior to beginning such construction.
3. To assure compliance with the applicable requirements of the Subdivision Construction Plans:
 - a) The Engineer shall certify that Water and Sewer Plans conform to the Subdivision Construction Plans approved by the County Engineer.
 - b) The Engineer shall include this certification on the title sheet of the Water and Sewer Plans and show on the plans all requirements and conditions of the Subdivision which affect the construction or maintenance of the proposed water and sewer facilities.
 - c) In the event that the required certification is not received or if the Engineer indicates that the Water and Sewer Plans do not conform to the Subdivision Plans, those water and sewer plans shall be

approved by the County Engineer prior to authorization for construction by the Department.

4. Where VDOT Right of Way (ROW) is used, the contractor shall obtain a VDOT permit before construction is started. The contractor shall video tape the ROW and adjacent properties to assess the condition and provide a guide line for restoration of the property after completion. Copies of the video tapes shall be submitted to the county before construction begins.
5. All wetlands shall be indicated on the plans. The contractor shall obtain permits, prior to going through, under or in any way impacting the wetlands, from all authorities having jurisdiction.

1.1.29 System Design

- A. An analysis shall be prepared that will tabulate the numbers of people served or proposed to be served as determined from the County Land Use Map or existing Zoning. The tabulation shall be by incremental areas for evaluation purposes.
- B. Average and maximum flows shall be developed for areas and sub-areas and tabulated in the report as deemed necessary or appropriate.
 1. Where development is existing or proposed, average sewer flows within the sewer shed shall be calculated using actual (existing) or proposed population densities in accordance with flow rates cited in the Virginia Department of Environmental Quality Sewerage Regulations or other published data as appropriate.
 2. For undeveloped acreage where no specific development has been proposed, the following average flow rates may be used:

a)	Single Family Residential	800 gpd/ac
b)	Multi-Family Residential	3000 gpd/ac
c)	Commercial	1400 gpd/ac
d)	Industrial	2300 gpd/ac
e)	Public/Government	600 gpd/ac
- C. The design shall address overall present and future flows and system capacities of existing and proposed utilities as they may be affected by or may affect the facilities involved and shall develop proposed water main and sewer line sizes.
- D. The design shall be based on ultimate development and shall present such factors as deemed necessary for a sound evaluation of the several factors used in development of the report.

- E. Where an alternate design is proposed that would in-compass interim or staged construction, the report shall develop the alternate design and shall present a thorough investigation and justification for consideration of the alternate.
- F. Water and Sewer lines shall be located in the roadways. No sewer or water lines shall be in easements between houses of a subdivision. Should this not be possible due to extenuating circumstances, permission shall be obtained from the County for a deviation from this requirement.

1.1.30 System Design – Miscellaneous

- A. For detailed requirements of procedures addressed below, contact the County Engineer.
 - 1. A commercial or industrial establishment that utilizes an individual private well and requests connection to the County’s sanitary sewer system is required to have a water meter installed, at its expense, on the well for the purpose of billing sewer charges. The water meter itself must be approved by the County Engineer, must be installed on the well, and the sewer connection fees paid before a plan for construction of the sewer connection is approved. Water meter shall be located at the property line and be accessible by the county to read the meter. If this is not possible, contact County Engineer for an alternate location.
 - 2. Requests for temporary water and/or sewer service for construction trailers shall be directed to the County Engineer.
 - 3. All existing water and sewer services to the property shall be shown on the utility plan. If the services will not be utilized after construction is completed, they shall be abandoned as follows:
 - a) Water services shall be abandoned at the corporation stop or tee (i.e. at the main line).
 - b) Sewer laterals shall be properly plugged at the main unless approved otherwise.
 - 4. A limited number of hydrant meters are available for construction purposes and wash downs only.

1.1.31 Separation of Water Lines and Sanitary and/or Combined Sewers.

- A. Follow State Health Department Standards for separation of water mains and sewer lines.

B. Parallel Installation

1. Normal Conditions - Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.
2. Unusual Conditions - When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:
 - a) The bottom of the water line is at least 18 inches above the top of the sewer.
 - b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place without leakage prior to backfilling.
 - c) The sewer manhole shall be of watertight construction and tested in place.

C. Crossing

1. Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation as described above.
2. Unusual Conditions - When local conditions prevent a vertical separation described in "Crossing, Normal Conditions" paragraph above, the following construction shall be used.
 - a) Sewer passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions above.
 - b) Water lines passing under sewers shall, in addition, be protected by providing:
 - (1) A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.
 - (2) Adequate structural support for the sewers to prevent excessive deflection of the joints and the settling on and breaking of the water line.
 - (3) A full length of pipe shall be used at the crossings with the center of the water line pipe be centered at the point of the crossings so that joints shall be equidistant and as far as possible from the sewer.

- D. Sanitary sewers or sewer manholes - no water pipes shall pass through or come in contact with any part of a sewer or sewer manhole. A minimum of 10 feet of horizontal separation shall be maintained. If this separation cannot be maintained, the sewer manhole shall be of watertight construction and tested in place.

1.1.32 Sewer in Relation to Streams, Estuaries, Lakes, or Reservoirs

A. Location of Sewer in Relation to Streams, Estuaries, Lakes, or Reservoirs

1. The tops of all sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed 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 shall be provided 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 stream channel. Reasons for requesting less cover shall be given in the application. In paved channels, the top of the sewer lines should be placed below the bottom of channel pavement. Sewers shall remain fully operational during 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 the stream bed wherever possible and sufficiently removed therefrom to provide for future possible channel widening. Reasons for requesting sewer lines to be located within stream beds shall be given in the application.
2. All sewer lines in the vicinity of the Waters of the United States shall be approved by Federal authorities having jurisdiction and all required permits shall be obtained before construction.

B. Sewer Crossing Streams, Estuaries, Lakes, or Reservoirs

1. Sewers entering or crossing the streams 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 and 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 sewer 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.

1.1.33 Protection of Water Supplies

A. Water Supply Interconnections

1. There shall be no cross connection between a drinking water supply and a sewer, sewage pumping station, or appurtenances thereto.

B. Relation to Water Works Structures

1. No general statement can be made to cover all conditions; however, for public wells or other public water supply sources and structures, sewers shall meet the requirements of the Virginia Department of Health Waterworks Regulations with respect to minimum distances from water supply wells or other water supply sources and structures. For all other potable water supply wells or potable water supply sources and structures, sewers should meet the requirements of the Virginia Department of Health Waterworks Regulations with respect to minimum distances from water supply sources and structures. No sewer line shall pass within 50 feet of a potable water supply well or other potable water supply source or structure unless special construction and/or pipe materials are used to obtain adequate protection. The designer is referred to current editions of the Virginia Department of Health Waterworks Regulations, Sewerage Regulations, and Sewage Handling and Disposal Regulations (Waterworks Regulations) and the requirements contained in “Rules and Regulations of the Board of Health, Commonwealth of Virginia, Governing the Disposal of Sewage”) as basic design references. The proposed sewer design shall identify and adequately address the protection of all potable water supply structures within 100 feet of the proposed project.

1.1.34 Backfill and Compaction

- A. Fill: Place and compact fill material in layers to required elevations. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within plus or minus 2 percent of optimum moisture content.
- B. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 3 percent and is too wet to compact to specified dry unit weight.
- C. All subgrades shall be proof rolled prior to installation of structures, slabs, or pavements. Proof rolling shall be performed by the contractor and observed by the geotechnical engineer of record, or his representative, using a loaded tandem-axle dump truck or approved construction equipment.

- D. Compaction: Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers. Only light hand-operated equipment should be used to compact backfill against walls.
- E. Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698:
1. Under structures, building slabs, steps, and pavements, compact all lifts of fill soils to 95 percent of maximum dry density. The top 12 inches of fill shall be compacted to 98 percent of maximum dry density. For existing subgrades, scarify and re-compact top 12 inches (150 mm) below subgrade to 98 percent of maximum dry density.
 2. Under walkways, compact all lifts of fill materials to 95 percent of maximum dry density. For existing subgrades, scarify and re-compact top 6 inches (150 mm) below subgrade to 95 percent of maximum dry density.
 3. In lawn, landscaped or unpaved areas, compact all lifts of fill materials to 85 percent of maximum dry density.
- F. Grading: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 1 inch (25 mm) and pavements and areas within building lines to plus or minus 1/2 inch (13 mm).
- G. Sub base and Base Courses: Under pavements and walks, place sub-base course on prepared subgrade. Place base course material over sub-base. Compact to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- H. Under slabs-on-grade, place drainage course on prepared subgrade. Compact to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
- I. The Engineer shall include compaction requirements on the plans:
1. Minimum compaction requirements will be specified.
 2. Compaction requirements for roads and pavement areas will be specified.
 3. Compaction requirements adjacent to structures will be specified.
 4. Compaction requirements in non-structural areas will be specified.
- J. The Engineer shall indicate on the plans those areas where greater than minimum compaction requirements are specified.

- K. Where compaction greater than 85% is required, test reports must be submitted to the County Engineer before Tentative Acceptance will be made.
 - 1. Where stone backfill is used, test reports are not required.

1.2 DRAWING ORGANIZATION AND FORMAT

1.2.1 Drawing Organization

- A. Drawings shall consist of the following types of sheets arranged in the order listed:
 - 1. Cover Sheet
 - 2. Index Sheet (if necessary)
 - 3. Notes and Legends
 - 4. Erosion and Sediment Control Details/Environmental Site Assessment
 - 5. Index Sheet or Sheets
 - 6. Plan and Profile Sheets
 - 7. Standard Sheets and Special Details
- B. Projects consisting of only structures may not require plan and profile sheets.
- C. Projects for construction of gravity sewers, force mains or water lines require plan and profile sheets except for special details.
- D. All projects impacting public utility infrastructure will require plans submitted and approved by the Department of Public Utilities.

1.2.2 Sheet Format

- A. All construction drawings shall be on sheets 24 inch x 36 inch.
- B. The cover sheet shall contain the Owner's name and project description in large, distinctive letters, a vicinity map on a scale of 1 inch equals 2000 feet to indicate the general vicinity of the contemplated construction, an index to the plan sheets and the signed stamp of the design engineer or principal of the engineering firm. The vicinity map shall include the north arrow and scale. The cover sheet shall also include the Owner/Developer's address, contact, and phone number and the Responsible Land Disturber.
- C. An Index Map (Key Map) shall be prepared for sewer line, sewage force main and water line projects. The Index Map shall be to a scale of not less than 1 inch equals 600 feet and shall show all proposed utility construction with ties to existing utilities. The lines of proposed construction together with proposed utility structures shall be indexed to the drawings to indicate the extent of coverage on each drawing, or, in the case of structures, to the group of drawings involved.

- D. Plan Sheets as well as Plan and Profile Sheets shall show horizontal, vertical and topographic data as outlined in Section 1.2 of these Standards. Plan and profile shall be shown on the same drawing with the plan view on the top half and the profile on the bottom half of the sheet. Plan and profile sheets shall have a horizontal scale of 1 inch equals 50 feet (1"= 50') and a vertical scale of 1 inch equals 50 feet (1"= 50'). For short runs of pipe profile can be shown on a separate sheet but must be clearly labeled and referenced to a plan sheet. Plan and profile sheets shall be stationed to correspond with each other.
- E. All plans shall bear a suitable title showing the name of the municipality, and institution or other Owner and shall show the scale in feet, a graphical scale, the north arrow, the date, and the name of the appropriate licensed professional. Also, each plan sheet shall bear the same general title identifying the overall project, and each shall be numbered.
- F. Drafting Conventions
1. All drawings shall be prepared using computer aided drafting (CAD).
 2. Standard Symbols to be used for drawings are as shown on Drawing No. D-50. Standard Symbols shall be included on the notes and legend sheets. Any symbols not included in the standard symbols shall be added the symbol list. Notes and Legend sheets shall also include an abbreviation list.
 3. Existing facilities shall be shaded gray. New work shall be dark lines and of sufficient width to easily distinguish new work from existing.
 4. Text, Dimensions and Notes
 - a) The minimum text height shall be 0.10 inches for notes, text and dimensions. Plan, section, profiles and detail labels shall be a minimum of 0.20 test height and of a heavier line weight.
- G. Drawing Standards
1. All plans submitted for review shall comply with the minimum format and quality control requirements of the Goochland Standards. Plans which do not substantially meet these criteria will not be accepted for review.
 2. Plans submitted for review shall be AutoCAD blackline and grayscale format.
 3. Drawings shall be clear and legible. Text shall be open so that it is readable when drawings are reduced to half size. All drawings must be

capable of producing legible second generation prints after being reduced to half size.

4. The contrast of the printed material shall be high, with blank areas being as white as possible, and all information being as dark as practicable, while remaining clear and distinct.
5. Shading, such as on plan views for paving, shall not be used on the drawings where it will hide any information when the drawing is photocopied or scanned.
 - a) Screening and hatching shall be in accordance with conventionally accepted standards. Screening and hatching shall not block pertinent information.
6. It is the intent of these Standards that all submitted plans will be scanned for archiving. If there is any question regarding plan legibility, the plan will be scanned and acceptability determined upon printing of the scanned image at ½ size.

H. Additional Information

1. Drawings shall include estimated materials quantities and current Goochland Standard Water and Sewer notes.
2. Horizontal scale in Plan and Profile Sheets shall be no smaller than 1 inch equals 50 feet.
3. A bar scale shall be included on each sheet.
4. Vertical profile scale shall be no smaller than 1 inch equals 10 feet.
5. All existing and proposed underground utilities, both above ground and below ground, which might interfere with the proposed construction, particularly water mains, sewer mains, gas mains, storm drains, utility service lines, etc. shall be shown in plan and profile.
6. Bench Marks shall be set no more than 500 feet apart along the lines of construction but outside the limits of construction. Datum for elevations shown shall be USGS (Means Sea Level).
7. All drawings shall be in the Virginia State Plane NAD 83 coordinate system.
8. All manholes, wet wells, valve vaults, underground fittings, fire hydrants, fence corners and gate posts, buildings and any and all other structures,

equipment and appurtenances must be located with Northern and Easting coordinates.

1.3 EASEMENT REQUIREMENTS

- 1.3.1 Easement surveys shall be made and easement plats prepared in all cases where proposed construction limits exceed the limits of public rights-of-way or properties under the ownership of the developer. These surveys shall tie the lines of proposed construction to existing property lines and property corners, where the property may be identified by corners. Where readily identifiable corners are not found, fence lines and corners, and other indications of property lines may be used. In the absence of any such identifications, the surveyor shall exert maximum effort to tie the survey to boundaries as set forth on existing plats and in descriptions.
- 1.3.2 Permanent easements shall be a minimum of 20 feet in width with consideration for wider easements where more than one facility may occupy an easement, or where, because of line size or access requirements, wider easements are desirable. Where lines have cover in excess of 10 feet, the minimum easement width may be increased between manholes. Buildings or other structures, and trees shall not be placed in easements.
- 1.3.3 Construction easements shall be acquired for all County contracts. Developers constructing facilities are not required to have construction easements where work is on the developer's property. Construction easements shall provide a minimum working width of 50 feet, including the 20-foot permanent easement, unless otherwise approved. Generally it is desirable to provide more construction easement on one side than the other. This allows room for construction traffic and material storage.
- 1.3.4 The standard size of easement plats shall be on sheets 8-1/2 inch x 13 inch or 8-1/2 inch x 26 inch. Where longer easements are required, multiple sheets may be utilized. A sample plat sheet is shown on Form No. F-3.
- 1.3.5 Easement plats of different sizes may be used if the overall size of the sheet does not exceed 18 inch x 24 inch. The easement centerline shall be shown together with the limits of both the proposed permanent and construction easement widths referenced to the centerline of the easement. Bearings and distances shall be shown on the centerline of the easement and on the right-of-way or property lines where they intersect the centerline. Distances shall be shown from fixed points on both the centerline and the property lines to the intersection of the two. Bearings, distances and closures shall be to the degree of accuracy of 1 in 8000 except that approximations will be permitted where it is considered impractical to delineate existing property lines. The body of the plat shall show the name of the property owner and the deed or will book reference for the source of title. The names of all adjacent property owners and a north arrow shall also be shown. Street names or highway route numbers shall also be shown where applicable.

END OF SECTION 1

SECTION 2 - DESIGN STANDARDS FOR GRAVITY SANITARY
SEWERS

2.1 GENERAL REQUIREMENTS

2.1.1 Sanitary sewers are to be provided solely for the collection and transport of sanitary waste. Under no circumstances shall any roof drains, foundation drains, surface or subsurface drains be either directly or indirectly connected to sanitary sewers. The following design parameters include an adequate allowance for normal infiltration but will not accommodate the above forbidden connections.

2.2 TECHNICAL DESIGN

2.2.1 System Layout

- A. The overall layout and general design shall conform to the parameters set forth in the approved Engineering Report.
- B. Since all sanitary sewers must be accessible for operations and maintenance:
 - 1. Locate all sanitary sewers in legally established road rights-of-way.
 - 2. Where it is impossible to avoid placing public sewers on private property, the sewer shall be installed in legally established permanent easements for such purpose, either existing or proposed in accordance with these Standards subject to the approval of the County Engineer. Detailed reasons why alternate routes cannot be used must be submitted for substantiation. Projected cost alone is not an acceptable reason.
 - 3. Sewers shall be located outside of jurisdictional wetland areas whenever possible.
 - 4. Stormwater BMPs shall not encroach on the sanitary sewer.
- C. Construction shall be along the centerline of rights-of-way or easements except when this location has been previously used by another utility, or when the width of a road right-of-way justified the use of two sewer lines. Exception to this specified location will be allowed only when it can be established that it is not practical to adhere to the standard location.
- D. All sewers shall be on continuous grade between manholes.

- E. Sewers should intersect in manholes at angles not less than 90 degrees. Additional manholes shall be installed as required or an alternate route used.
- F. Where sewer depth is 10 feet or less, sewer mains and manholes shall be located a minimum of 10 feet horizontally from any part of a building, structure, or its foundations. Where the depth of sewer is greater than 10 feet, the sewer mains and manholes shall be located a minimum of 15 feet from any part of a building, structure, or its foundation or a distance equal to the depth of the excavation whichever is greater.

2.2.2 System Design

- A. The overall design shall be in accordance with the provisions of the approved Engineering Report.
 - 1. Design carrying capacities of lateral, trunk and interceptor sewers shall be based upon the total drainage area served by the line or lines in question. The design flow shall be based on acreage density, using the Goochland County Land Use Map or approved zoning whichever allows higher densities.
 - 2. Equivalent flow from motels, schools, hospitals, etc. shall be based upon that of the Virginia Department of Environmental Quality Sewerage Regulations.
 - 3. In the absence of information on densities or equivalent flows, the designer shall supply sufficient information, substantiated by sound engineering judgment to verify the design. This information shall be subject to approval by the Department.

2.2.3 Capacity Design

- A. Laterals shall be designed to carry ultimate tributary population with a 50-year projection as an upper limit. Proper allowances for peak flow, as shown on Peak Flow Chart in Section 5, shall be included. Designer shall consult the County Master Plan for future projections.
- B. Trunks and interceptors shall be designed on the same basis as laterals except in cases where capacities of system or parts thereof can be readily increased by future relief, allowing for shorter capacity design life of initial or subsequent lines.
- C. Computations of all lines shall be shown on form similar to the sewer design form in Section 5, including anticipated future relief lines that may be required. Computations shall be accompanied by a System Layout Map. The Map(s) shall show the entire drainage area involved, location(s)

of line(s) in system and points of entry of flows, including any flows being received from other areas. Drainage area map shall be keyed to sewer design form in Section 5. Computations and maps shall be submitted to the Department for approval.

2.2.4 Hydraulic Design - Sewers

- A. Minimum grades shall not be less than those required to produce a velocity of approximately two and one quarter (2.25) feet per second when the sewer size selected is flowing full or half full. Pipe sizes shall not be arbitrarily increased in order to take advantage of a flatter grade.
- B. The minimum size pipe to be used in systems shall be 8 inches.
- C. Allowable minimum grades shall be as follows:

<u>Sewer Size (Inches)</u>	<u>Minimum Slope in Feet/100 Feet</u>
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	0.07
30	0.06
36	0.05

- D. Computations for velocity of flows shall be based upon the following values of “N” as used in the Manning formula for velocity of flow.
 - 1. Sizes 8 inch through 21 inches: N equals 0.013
 - 2. Sizes 24 inch and above: N equals 0.012
- E. In cases where the calculated depth of flow is less than pipe flowing full, the velocity at actual depth of flow shall be computed.
- F. For sewage flow depth less than 1/4 full, an allowance shall be made for increased value of “N” and in no case shall velocities of less than 1.3 feet per second be permitted. The improved velocities shall be accomplished by steeper grades and not by changing pipe diameter.
- G. Generally the sizes of pipe shall be continually increasing with increase of tributary areas. However, when steep grades are available and length is

such that a significant cost savings will result without jeopardizing the system, the size of pipe may be reduced a maximum of two nominal diameters, but not below 12 inches, with approval of the County Engineer. Proper hydraulic allowances must be made for resulting head losses.

H. Miscellaneous head losses at manholes and curves shall be computed as follows. Junctions of more than 2 pipes will require special consideration.

1. Manholes where radius of turn is less than 2 pipe diameters:

$$H = 0.050 \sqrt{\frac{\Delta}{90^\circ}} \frac{V^2}{2g}$$

2. Manholes where radius of turn is greater than 2 pipe diameters:

$$H = 0.25 \sqrt{\frac{\Delta}{90^\circ}} \frac{V^2}{2g}$$

Where:

Δ is horizontal deflection angle

$\frac{V^2}{2g}$ is velocity head of effluent pipe

3. Loss for straight run manhole shall be 0.01 feet. In no case shall loss less than 0.01 feet be allowed.

I. Where pipe diameters increase at manholes in direction of flow, effluent invert shall be lowered below influent elevation in order to match crowns.

1. This adjustment shall be in addition to computed miscellaneous head loss.

J. Special consideration shall be given to cases where pipe diameters decrease in direction of flow to prevent surcharging of the incoming pipe.

K. Where velocities greater than 15 feet per second are expected, special provisions shall be made to protect against internal erosion by high velocity. The pipe shall conform to appropriate ASTM or AWWA specifications which provide protection against internal erosion.

2.2.5 Structural Design

- A. Structural requirements must be considered in the design of all sewers and appurtenances.
- B. The proper strengths shall be determined and indicated for sewer pipe materials being specified. Strength shall be based upon pipe size, proposed depth, width of trench, bedding conditions, existing ground conditions, etc. This is a matter of detail design not subject to simple generalizations. Minimum bedding shall be Class C.
- C. In deep cuts, it is generally preferable to change pipe strengths to obtain proper design rather than vary bedding conditions. However pipe strength or class shall be shown on plans with stations to indicate the location.
- D. No change in strength or material shall be made between manholes unless it can be substantiated that a considerable cost savings would result and integrity of system would not be jeopardized. Proper precautions shall be taken regarding correct location(s) of varying strength of pipe.
- E. The thickness of precast concrete manhole walls shall be increased when total depth of manhole exceeds 30 feet. The minimum manhole diameter shall be increased to 60 inches when the total depth equals or exceeds 24 feet.
- F. Gravity systems receiving pumped flows shall be protected against sulfide attack for a distance of 1200 feet downstream from point of pumped flow entry. This shall be accomplished by the use of acid-resistant pipe and manholes. The Department shall approve the materials and design for the conditions at each individual location. Existing receiving manhole and manholes within 1200 feet shall be internally coated with an approved sulfide resistant lining or coating.
- G. Where odor may be a problem, chemical addition or other odor control method approved by the County Engineer shall be added at the pump station or to the system.
- H. Ductile iron pipe shall be used where sewers enter or cross streams, estuaries, lakes or reservoirs; cross jurisdictional wetland areas; or as a carrier pipe within any bore or tunnel crossing.
- I. Anchor sewers on slopes of 20% or greater.
- J. Steel casing pipe shall be sized in accordance with the Standard Details.

- K. Ductile iron pipe shall be used in subdivisions for sanitary sewer lines installed in an easement along the property line between buildable areas.
- L. Ductile iron pipe shall be used in easements where, in the opinion of the Department, the sanitary sewer is not accessible from a street, parking lot, or driveway.

2.2.6 Sewer Appurtenances

- A. Standard and drop manholes, service connections and other appurtenances shall be constructed in accordance with Standard Drawings.
- B. Manholes shall be installed at the end of each line, at all grade, size or alignment changes, and at all sewer line intersections.
- C. Sewer connections serving more than one building shall be made by construction of a manhole on the County sewer and an 8 inch sewer line terminating in another manhole at the uppermost building connection. Such construction shall be in accordance with County Standards.
- D. When manholes are located in paved areas accessible to vehicular traffic they shall be spaced at distances no greater than 300 feet for sewer sizes up to 15 inch and 400 feet for sewer sizes 16 inch through 30 inch. When located in inaccessible areas, spacing of manholes on sewer lines 30 inch and less, shall not exceed 300 feet.
- E. Spacing of up to 400 feet may be permitted in sewers larger than 30 inch.
- F. Sewer lines shall be protected from a 100-year flood by either raising manhole tops above flood plain or by the use of watertight frames and covers. Where watertight frames and covers are used, unventilated length of sewer cannot exceed 1000 feet. Manhole covers shall be no more than 30 inches above ground level.
- G. Vandal proof manhole frames and covers shall be used on all manholes not in paved streets unless watertight covers are required.
- H. Restaurants, bakeries and other facilities involved in preparation of food that have the potential to discharge oil and grease to the sanitary sewer system shall have grease traps. It is the discharger's responsibility to install and properly maintain grease traps and other such pretreatment systems necessary to ensure that concentrations of oil and grease discharged to the sanitary sewer system do not exceed 300 parts per million (ppm) as required by Section 14-125 of the County Code. Grease traps shall be inspected annually by the County. Grease traps shall comply with the requirements of the County Plumbing Code

- I. Oil/Water separators shall be required on all facilities where oil can infiltrate the sewer system. Oil/water separators shall be shown on the plans. Separators shall comply with requirements of the County Plumbing Code. A schematic of the oil/water separator shall be shown on the plans.
- J. A monitoring manhole shall be required on all new construction or renovations or modifications to existing facilities, where the discharge originating in the new, renovated, or modified facility is, or will have the potential to be, non-domestic in nature. All waste from the facility shall flow through the monitoring manhole.
 - 1. For multi-use buildings such as shopping centers, the sewer should be an adequate distance from the building to allow installation of a monitoring manhole, oil/water separators and grease traps on each sewer lateral when the tenant spaces are changed.
 - 2. For individually metered facilities, a sewer lateral is required for each meter. Enough space to accommodate installation of the monitoring manhole should be provided.
 - 3. If the facility is master metered, a monitoring plan is required for the entire facility. A monitoring manhole shall be provided.
- K. Where possible in unpaved areas, manhole covers shall be approximately 12 inches above final grade.
- L. Sewer laterals for non-residential connections shall be a minimum of 6 inch. Connections shall be made at an angle of 90-degrees to the main. Connections shall be installed at a minimum grade of 1/8 inch per 1 foot. Connections shall be installed a horizontal distance of at least 10 feet past the side property line.
- M. At the upstream manhole in a cul-de-sac, the maximum number of sewer connections allowed into the manhole is 3.
- N. Manholes shall not have bricked-up or partially scored openings for future sewers. Manhole connections shall be in accordance with Section 12 and the Standard Drawings at the time the sewer is to be extended.

2.2.7 Depth of Sewers

- A. Generally, all sewers shall be of sufficient depth to provide service to lowest sewer elevation of structure in question, allowing proper service connection upgrade. Minimum depth of cover over sewers shall be in accordance with Section 12; however, a greater depth may be required due to future extension or possible future lowering of existing road grade or utilities.
- B. The Engineer shall certify that all proposed sites will be served by gravity with 4" sewer lateral connections installed at a slope of ¼ inch per 1 foot. The depth of service connections shall be in accordance with Section 12 and the Standard Details.
- C. Exceptions to the above requirements will be considered only if impractical to provide depths, in which case, special approval must be secured in writing, from the Department. In the special case of less than minimal cover, ductile iron pipe of adequate thickness shall be provided.
- D. Sewers over 18 feet deep shall be of ductile iron. The depth shall be determined by measuring from the ground surface to the pipe invert. Class of pipe shall be as recommended by the pipe manufacturer.
- E. Sewers over 24 feet deep shall have a polyethylene or epoxy lining specifically designed to resist hydrogen sulfide corrosion. Manufacturer's data shall be submitted prior to plan approval.
- F. Sanitary sewers crossing under storm sewers shall maintain a minimum separation of 18 inches. Where this separation is not possible, Ductile Iron pipe shall be used. Concrete supports may be required for the storm sewer. A full length of pipe shall be installed with its center at the crossing.
- G. All sewer pipes entering or crossing streams shall be ductile iron and at a sufficient depth below the bottom of the streambed to protect the sewer line. All joints shall be restrained. 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. Reasons for requesting less cover shall be given in the application.

2.3 DRAWINGS

- 2.3.1 In addition to requirements in Section 1.2 "Drawings Organization and Format" of these Standards, drawing shall also have:

- A. Stationing, pipe size, material, bearings, direction of flow, deflection angles, slope, grade and distance between centerlines of manholes.
- B. All manholes shall be numbered, with drop manholes identified and top, influent invert and effluent invert elevations clearly shown.
- C. The plans shall indicate the following information to provide for service to the elevation of the connection as follows:
 - 1. Lowest sewer existing structure elevation.
 - 2. Lowest ground corner of structure with first floor service and elevation of lowest floor with service.
 - 3. Ground level at building line on unoccupied parcel.
 - 4. The elevation and location of any existing structure to be sewer shall be clearly shown. The street address of existing house(s) shall be shown.
 - 5. All existing utilities with elevations.
- D. Water mains shall be shown and profiles shall indicate points where crossings occur, clearly indicating vertical clearance between utilities.
- E. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia Erosion and Sediment Control Handbook.
- F. Consultants designing facilities for developers shall show the appropriate water or sewer notes on the drawings (see Section 5).
- G. A drop manhole shall be provided when the elevation difference between the invert of the upstream sewer line and the invert of the downstream sewer line in a gravity sewer manhole is greater than or equal to 2.00 feet.
- H. Straight alignments for all sewers of all diameters, unless otherwise approved in writing by the Virginia Department of Health.
- I. A fifty-foot minimum separation distance between sewer lines and wells or other drinking water sources.
- J. The requirement of watertight (AWWA) pipe and “0” infiltration where sewer lines cross under streams or other bodies of water (and a joint will be located underneath that body of water).

- K. Sewer or water lines not to be owned by the County shall be identified as “Private.”
- L. Drawings shall show off-site easements required and identify Deed Book and Page Number.
- M. Northing and Easting coordinates for all manholes and cleanouts. Grease traps and oil/water separators shall be located by dimensioning from buildings and other landmarks.

END OF SECTION 2

SECTION 3 - DESIGN STANDARDS FOR SEWAGE PUMPING STATIONS
AND FORCE MAINS

3.1 GENERAL REQUIREMENTS

- 3.1.1 The design of sewage pumping stations and force mains is an engineering matter and is not subject to detailed recommendations or requirements.
- 3.1.2 Sewage pumping stations and force mains are to be provided solely for the conveyance of sanitary wastes. Under no circumstances shall any roof, foundation, surface or subsurface or any other form of storm drainage be allowed to pass through the proposed facilities.
- 3.1.3 A detailed engineering report shall be submitted to and approved by the County prior to design. The report shall fully comply with all requirements of Paragraph 1.1.2.A; shall evaluate the proposed sanitary sewer service area; shall evaluate overall effect downstream County facilities and shall justify the proposed station peaking factor.
- 3.1.4 The design must conform to the minimum standards set forth in the Virginia Department of Environmental Quality Sewage Collection and Treatment (SCAT) Regulations. County requirements for specific equipment and submittals will be detailed during engineering review.
- 3.1.5 An Operations and Maintenance (O&M) Manual shall be prepared in accordance with the Virginia Department of Environmental Quality SCAT Regulations and approved by the State and County before the County will accept the station for operation and maintenance. The manual shall contain complete operating information for all equipment, a complete set of approved shop drawings and a copy of the record plans for the station. The record plans shall be updated to include all plan revisions and field changes made during bidding and construction. One complete hard (paper) copy of the O&M Manual with a reproducible set of drawings and one complete electronic copy on CD ROM of the O&M Manual and record plans shall be submitted to the County prior to Final Acceptance.
- 3.1.6 Plats for the property occupied by the pump station and force main shall be prepared and submitted to the Department. The pump station property shall be transferred to the County and force main easements recorded prior to Final Acceptance by the County.
- 3.1.7 All federal, state and local permits and approvals must be obtained prior to plan approval.

3.2 TECHNICAL DESIGN

3.2.1 System Layout

- A. The sizing and configuration of the pumping station and the sizing of the attendant force main shall be within the parameters set forth in the engineering report. The facilities to be provided shall be based on ultimate flows unless an

interim flow design shall have been incorporated in the approved engineering report.

- B. The type of equipment to be installed in the pumping station will be influenced by the interim and ultimate capacity of the station and an evaluation of the period of time that the service of the station will be required.
- C. For sewage pumping stations with an ultimate firm rated capacity of 1 mgd or less, the Department will consider design and construction of permanent pumping stations using submersible pumps in accordance with Standard Detail PS-1. For stations with a capacity greater than 1 mgd, only a wet well/dry well configuration will be accepted.
- D. A magnetic-type flow meter shall be installed in the discharge piping and analog wet well level indication instrumentation shall be installed to record wet well level and control pump operation.
- E. An ample, all-weather road, including surface treatment, storm drainage and parking, shall be provided for easy access to the pumping station.
- F. The architecture of the pumping station shall be consistent with the zoning and general appearance of the surrounding area.
- G. Buildings shall be of masonry construction, or as approved by the County Engineer.
- H. Site grading, seeding or sod, and trees or shrubs shall be provided to present a finished appearance, as approved by the County department having jurisdiction.
- I. Approved fencing with gates shall be provided as deemed necessary to properly protect the facility. Unless otherwise approved, an eight-foot chain link fence with three (3) rows of barbed wire shall be installed around the operational area with at least one 12 foot double gate.
- J. The Design Engineer shall determine the availability of electric service and coordinate the available electrical service with that required for the facility. The engineer shall also determine the need for primary service extension and advise the Department if an extension is necessary. Minimum service shall be 240 volts single phase for up to 7.5 horse power motors. Motors larger than 7.5 horsepower shall be 3-phase with VFD's to convert single phase to three phase or the pumping station supplied with 3 phase power. Control cabinets shall have HVAC as required for temperature and humidity control.
- K. "Reliability Class" shall be class 1 for all pump stations in accordance with the Virginia Department of Environmental Quality SCAT Regulations and shall comply with the requirements thereof. Each pumping station shall have a permanently installed emergency generator and automatic transfer switch. The

transfer switch shall be installed inside a building. The fuel storage tank shall be sized to operate all pumps for 48 hours continuous operation.

Generator enclosures with belly tanks shall have a deck around the generator to access all components of the generator. Deck height shall be at the height of the top of the belly tank. Deck shall not interfere with panel removal or maintenance of the diesel engine or generator. Deck shall be built of pressure treated wood with stairs up to the deck and shall be designed by a structural engineer.

- L. The Design Engineer shall consider the need for protection of the pumping station, force main, and receiving manholes against hydrogen sulfide attack and odor, and shall provide the proper equipment if such protection is found necessary.
- M. All motors, motor control and other electrical equipment shall be housed in a building. Adequate provisions shall be incorporated for the proper ventilation, drainage and flood protection in order to ensure maximum reliability, electrical and personnel safety.
- N. Pump Control and SCADA Telemetry shall be through a Programmable Logic Controller as specified by the Department. Telemetry shall be to the SCADA Control Center with equipment provided by HSQ or High Tide for compatibility with existing hardware and software.
- O. All pumping station wet wells shall be considered explosion hazardous. All electrical equipment installed therein shall be explosion proof approved for NEMA 7, Class I, Group D, in accordance with Article 500 of the National Electrical Code (NFPA NO. 70). The use of intrinsically safe controls in accordance with NFPA NO. 493 is satisfactory, and its use is encouraged. No junction boxes shall be installed inside the wet well.
- P. Where structurally separate wet well and dry wells are provided, adequate provision for differential settlement shall be incorporated by means of flexible pipe joints consisting of a minimum of at least two standardized mechanical joint bell connections or the approved equivalent.
- Q. In all permanent sewage pumping stations over 1.0 MGD an adequate headwork structure and wet well shall be provided. The following items shall be provided: employee access via stairs; channel grinders for solids, bar rack for large solids and a davit hoist for removing screenings from headwork. A maintenance platform shall be provided in each wet well.
- R. All handrails, ladders and grating shall be aluminum.

- S. All pumping stations shall be of sufficient size and contain adequate clearances to provide ample room for maintenance and equipment replacement. In wet well/dry well stations a bridge crane shall be provided for removing pumps.
- T. The facility shall be connected to a public water supply. An RPZ type backflow preventer shall be installed on the water service. Where a public water supply is not available, a water supply well shall be installed.
- U. Force main locations shall generally conform to Section 2.2.1 - "System Layout" of these Standards. Force mains shall have a positive slope from the pumping station to the point of discharge unless unusual conditions make it impractical. Extra depth of bury shall be provided in lieu of air or air/vacuum relief valves wherever feasible. Every effort shall be expended to maintain the force main below the hydraulic gradient. Where a relief valve is required, an automatic valve shall be provided and installed inside a standard manhole with adequate means of drainage. When this is not possible, all high points shall have a combination air/vacuum valve installed
- V. Every effort shall be made to maintain a full force main under operating conditions.
- W. Sizing of main shall be such that velocity shall be a minimum of 2.5 feet per second for self-scouring velocity. A velocity of 6 feet per second should not be exceeded.
- X. All force mains shall be cement-lined ductile iron pipe, C900 PVC pipe or HDPE pipe. Where Hydrogen sulfide could be present the ductile iron pipe shall be epoxy lined.
- Y. The Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable cathodic protection and polyethylene bagging where necessary.
- Z. Steel casing pipe shall be in accordance with the Standard Drawings for casing pipe. There shall be a minimum of 4" clear space around the pipe and all appurtenances.
- AA. The potential for sulfide and odor generation must be fully evaluated based on the characteristics and properties of odor causing compounds and the principals of control. The appropriate odor and/or sulfide control system shall be provided.

3.2.2 Capacity Design

- A. Capacity design for the pumping station and force main shall be based on Section 2.2.2 - "System Design" of these Standards, and shall take into consideration such parameters as minimum, average and peak station inflows as well as minimum, average and maximum pumping rates.

- B. Pump selection and force main sizing shall be based on a hydraulic analysis of the required flows, pipeline velocities and receiving gravity sewer capacities.
- C. Pumping into a common force main shall be avoided if possible. When it is necessary the other pumps on the system must be investigated for upgrading. This may require an upgrade in electric service, pump size, controls and the installation of VFD's when force main pressure fluctuations may cause pumps to cavitate.
- D. Calculations shall be prepared and a system friction chart prepared that will show static head and total dynamic head for both single and multiple pump operation. The chart shall also show the pump performance curve for both single and multiple pump operation. Where variable speed pumping is contemplated, pump performance curves shall show performance at maximum speed, minimum speed just above static head and several intermediate speeds that will clearly indicate pump operation. The system friction curves shall illustrate the effect of wet well level on system friction. Particular attention shall be given to the available versus required net positive suction head (NPSH).
- E. Consideration must be given to a design that produces minimum power requirements to accomplish the functions required. If requested supporting data shall be furnished to the County.

3.2.3 Structural Design

- A. In addition to conventional design procedures there are several specific areas that must be considered.
 - 1. The effect of hydraulic thrust must be countered by the use of thrust blocking, pipe anchorage or other suitable means to prevent movement of pumping equipment and pipelines.
 - 2. Structural requirements for force mains include the proper selection of materials and strengths of pipe and pipe accessories. This will involve a study of anticipated trench conditions and bedding methods. The minimum depth of cover shall be governed by depths of other utilities and hydraulic gradient; however, not less than 3.5 feet of cover shall be provided.
 - 3. Surge analysis may be required at the discretion of the County Engineer and surge relief valves installed at the pump station.
 - 4. All pipe joints at the pump station within the fenced in area, and at the discretion of the County Engineer, shall be restrained.

3.3 DRAWINGS

- A. Drawings for pumping stations and plan and profiles for force mains shall be prepared in accordance with Section 1.2. - “Drawing Organization and Format.”
- B. Drawings shall include:
 - 1. Pump information with manufacture’s name, model numbers, serial numbers, horse power, voltage, phase, calculation summary sheet, pump curve and all other pertinent pump information.
 - 2. Buoyancy calculations for wet well, valve vault and manholes.
- C. Drawings and specifications shall be of such quality and contain sufficient details so that no misunderstanding may reasonably arise as to the extent of the work to be performed, the materials to be used, the equipment to be installed or the quality of the workmanship. Manufacturers of major items or equipment shall be specifically approved. No deviation from the approved manufacturers will be permitted.
- D. Drawings shall include mechanical details, structural details, electrical one line diagrams, instrumentation and controls plans (P&ID drawings, panel board schedules and points list), flow diagrams and all other pertinent information.
- E. Drawings for pumping stations shall include a site plan drawn to a scale of not less than 1 inch equals 20 feet and shall contain existing and proposed contours on a 1 foot contour interval. The boundaries of the site shall be clearly shown on the site plan and shall have permanent monuments installed in the field prior to completion of construction.
- F. Drawings for pumping stations shall be drawn on a scale of not less than 1/4” equals to 1’-0”. Drawings required to clarify construction details shall be drawn on an appropriately larger scale.
- G. Drawings for force mains shall show stationing, pipe size, bearings, direction of flow, deflection angles and curve data.
- H. Profiles for force mains shall show the ground line, force main profile, underground utility lines and structures that might affect force main depth. It shall also show area where additional depth will be required, any required vertical curve data and locations of all valves, combination air/vacuum valves, fittings, utility crossings and all other appurtenances. All crossings of existing and proposed water mains shall be shown to clearly indicate vertical clearance between utilities.

- I. Details shall be shown for all blocking, pipe restraints, buried valves and combination air/vacuum valves.
- J. Consultants shall show the location of erosion control devices on the plans. These devices shall be in conformance with the Virginia Erosion and Sedimentation Control Handbook.

3.4 MISCELLANEOUS COMPONENTS

- A. All junction boxes shall have finger proof terminal strips equal to Allen Bradley 1492-J series.
- B. Pump control and level indication shall be by an ultrasonic level sensor with a narrow transmitting cone or an approved pressure transducer. The sensor shall be located in the wet well as indicated on the Standard Details. The transmitter shall be located in the pump control panel with a readout on the cabinet front. Set points shall be field adjustable.
- C. In addition to the ultrasonic level control the pumps control shall have a high level alarm float and a low level alarm float. The low level alarm float shall be wired directly through the pump starter holding coils to stop the pumps and provide an alarm indication. The high level alarm float shall be wired directly through the pump starter holding coils to start the pumps and provide an alarm indication.
- D. Tracer wire and test stations shall be provided as indicated in Section 12.

END OF SECTION 3

SECTION 4 - DESIGN STANDARDS FOR WATER DISTRIBUTION
FACILITIES

4.1 GENERAL REQUIREMENTS

4.1.1 Water and fire protection distribution facilities are to be provided solely for the purpose of supplying potable water and fire protection. Under no circumstances shall cross-connections be allowed to unapproved water facilities. The following design parameters should be used in the design of water distribution facilities. Water transmission facility design parameters are not included herein and such criteria will be established on a case-by-case basis.

4.2 TECHNICAL DESIGN

4.2.1 System Layout

- A. The overall layout and general design shall conform to the parameters set forth in the approved Engineering Report. In general, main line valves are required at intervals of 1000 feet and at each branch of tees and crosses to allow adequate control of the system without major system shutdowns.
- B. Sufficient gate valves are required for all water main extensions to allow adequate isolation of the system for testing and flushing.
- C. All water mains shall be located, where practical, in:
 - 1. Legally established road rights-of-way.
 - 2. Legally established permanent easements for such purpose which are immediately adjacent to legally established road rights-of-way or paved areas either existing or as proposed by the designer in accordance with the "Easement Requirements" of these Standards.
 - 3. Paved Areas
- D. Water lines going across country where normal vehicle access for inspection, testing, and maintenance is not practical are not acceptable.
- E. Construction shall generally be parallel to the centerline of roads or easements. The same offset shall be used throughout except when existing utilities dictate a change in offset along the proposed line.
- F. Water mains shall be installed a minimum of 10 feet from any part of any structure, building, or its foundation.

4.2.2 System Design

- A. The proposed facilities together with the pertinent existing facilities shall be evaluated based on the hydraulic design, demand design and fire protection design requirements contained herein.
- B. The Design Engineer shall submit to the Department a neat and orderly set of design calculations to illustrate normal and fire flows, pipe size selection and fire protection requirements. Where system flow information is needed, the Engineer shall submit a “Water System Flow Request.”
- C. Non-ferrous mains shall have tracer wire attached to the pipe and a detectable tracer tape buried in the trench 18 inches above the main but no less than 24 inches below grade.
- D. The Engineer shall refer to the Virginia Department of Health (VDH) Waterworks Regulations and the EPA Cross Connection Control Manual for backflow requirements. Standard installation schematics are included in the Cross Connection Control Manual.
- E. Domestic meter calculations shall be shown on the plans.
- F. Fire protection flow requirements shall be shown on the plans.
- G. The system shall be designed to maintain a minimum pressure of 20 psi in the distribution system at all service connections at the design flow. Design flow shall be defined as the greater of maximum hour or maximum day plus applicable fire flows. Where the pressure at the service tap exceeds 80 psi a reducing valve shall be required in accordance with the provisions of the Uniform Statewide Building Code. Reducing valves shall be installed on the downstream side of the water meter and shall be the responsibility of the property owner. Provisions shall be made on the downstream side of the pressure reducing valve for pressure build up due to water expansion and contain a pressure relief valve to atmosphere.
- H. Water system design shall incorporate a loop system providing a supply from two different points.

4.2.3 Hydraulic Design

- A. Hydraulic design (Modeling) shall be accomplished by the use of the Hardy-Cross Network Analysis Method or similar method acceptable to the County. A Hazen-Williams coefficient of friction equal to 120 shall be used for purposes of design unless the Department has data to indicate a lesser coefficient should be used for existing lines.
- B. Hydraulic design shall show system pressure during peak flows and system water age including residual chlorine values during normal domestic use flows.

4.2.4 Demand Design

- A. Maximum rates of water consumption shall be calculated and used as a basis of hydraulic design. Average daily water consumption rate values for the number and type of consumers anticipated to be served shall be based on those contained in the Virginia Department of Health (VDH) Waterworks Regulations. Any such rates not given or any deviations from tabulated rates shall be estimated and justified by the Design Engineer and approved by the Department. The average annual daily water consumption rates shall be adjusted by a multiplier to arrive at the maximum daily water consumption rate by the application of a multiplier, expressed as follows:

$$Q_M = Q_A \times C, \text{ where:}$$

Q_M is the maximum daily water consumption rate.

Q_A is the average annual daily water consumption rate.

C is a constant varying from 1.5 to 6.

Q_M shall be used as the basis for hydraulic design.

Furthermore, demand design shall follow the *General Design Considerations* listed in 12VAC5-590-640 of the VDH Waterworks Regulations including:

- 1.) Water consumption shall be based on the estimated water demand 10 to 30 years in the future.
- 2.) Historical data or typical usage figures of service areas with similar characteristics, and appropriate peaking factors, shall be used to support the design.

- 3.) The design shall account for diurnal demand patterns.
- 4.) The Uniform Statewide Building Code (USBC) may be referenced to support the design water usage of non-residential buildings, as appropriate.

4.2.5 Fire Protection

- A. Rates of flow for fire protection shall be estimated based on the latest revision of the Virginia Statewide Fire Prevention Code.
- B. The minimum fire flow from any individual fire hydrant shall be 500 gpm. The minimum flowing pressure at maximum flow shall be 20 psi.
- C. During maximum rated fire flow conditions, the pressure drop in any fire protection system shall not exceed 15 psi from the point of connection at the existing County system to any fire hydrant or any combination of required hydrants.
- D. The minimum size water line used for fire protection to properties zoned agricultural or single family residential shall be 8 inch in size. The minimum size water line used for fire protection to properties zoned multi-family residential, commercial or industrial shall be 8 inch in size.
- E. The minimum sized fire service lines above shall be looped to provide feed from at least two directions. The sizing of minimum-sized fire services lines and larger than minimum fire service lines shall be determined by Sections 4.2.3 and 4.2.5 “Hydraulic Design” and “Fire Protection”. Not more than one fire hydrant shall be installed on an 8 inch dead end line.
- F. Dead end lines shall not contain more than 600 feet of the minimum sized line. Additional lengths required shall be provided by increasing the line size.
- G. Fire hydrants shall be located no further from edge of roadway shoulder than 10 feet.
- H. Fire hydrants shall be placed on legal rights-of-way and shall generally be placed in line with street intersections. This shall be deemed to be the P.T. of the returns on the rights-of-way. Where long block lengths require the use of intermediate fire hydrants, they shall be placed in line with the property boundary between adjacent lots or parcels of land. Where fire hydrants cannot be placed in a legal right-of-way, an easement shall be provided.

- I. Fire hydrants spacing for properties zoned agricultural or single family residential shall not exceed 1000 feet or require a hose lay of over 500 feet from the hydrant to any part of any structure to be protected.
- J. Fire hydrant spacing for properties zoned multi-family, residential, commercial, or industrial shall not exceed 500 feet or require a hose lay of over 350 feet from the hydrant to any part of any structure to be protected. Where multiple fire hydrants are needed to supply the required fire flow, all necessary hydrants must be located within the specified hose lay.
- K. No fire hydrant shall be placed closer than 50 feet from the face or overhang of any building to be protected. For commercial, industrial, and multi-family construction, fire hydrants not more than 300 feet from the protected building may be rated for not more than 1000 gpm. Fire hydrants further than 300 feet from the building to be protected shall be rated in accordance with the ISO standards and the Virginia State Wide Fire Prevention Code.
- L. The above criteria for spacing fire hydrants may be modified by the Department to improve fire hydrant accessibility for firefighting purposes.
- M. Structures fully protected by an automatic sprinkler system and directly connected to the County's water system require installation of a detector check. Structures protected by automatic sprinkler systems and with a fire department connection (Siamese connection) require installation of a detector check, dedicated fire hydrant, and the appropriate backflow device. The dedicated hydrant is not credited towards external protection requirements. Siamese connections must be located within 50 feet of a dedicated hydrant.

4.2.6 Structural Design

- A. Structural requirements must be considered in the design of all water mains and appurtenances.
- B. The proper strengths shall be specified for the pipe material being specified. Strength shall be based on operating pressures, surge analysis pressures, depth of bury, trench width and foundation conditions. This is an engineering matter and not subject to generalization.
- C. Proper blocking and/or restraints must be provided and shown on the drawings. Where blocking is not detailed on the drawings, restrained joints shall be used.
- D. Proper support shall be provided for aerial or suspended lines.

- E. Any potable water line crossing above surface water must be:
 - 1. Adequately supported.
 - 2. Protected from freeze damage.
 - 3. Accessible for repair or replacement.
 - 4. Above the 100-year flood plain elevation.
 - 5. Designed for expansion and contraction, where applicable.

- F. Any potable water line crossing under surface water must meet the following requirements:
 - 1. The pipe shall be of special construction having flexible watertight restrained joints.
 - 2. Valves shall be provided at both ends of the water crossing so that the section can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding.
 - 3. For the purpose of testing the section of line crossing the surface water and for locating leaks in that section, permanent sample taps shall be available at each end of the crossing and at a reasonable distance from each side of the crossing and not subject to flooding.
 - 4. Adequate cover shall be provided over the waterline.
 - 5. For stream crossings, rip rap shall be placed in the stream bed to prevent erosion above the water line.

- G. Steel casing pipe shall be sized in accordance with the Standard Drawings.

4.2.7 Miscellaneous Considerations

- A. The minimum size water line pipe to be used for normal domestic water service shall be 4 inch. Consideration should be given to the use of 4 inch diameter mains in cul-de-sacs.

- B. Air, air/vacuum or pressure reducing valves, blow off tees and related fittings shall be provided. The type, size, etc., shall be specified by the Design Engineer, subject to approval by the Department.

- C. The minimum depth of cover for water mains shall be 3-1/2 feet. Additional depth shall be provided where required for thrust restraint or to clear underground obstructions.

- D. The profile of water services at ditch lines shall be shown on plans and have a minimum of 36 inches of cover at the ditch invert.
- E. Service lines larger than 1-inch, with meters larger than 5/8-inch shall be sized in accordance with AWWA Manual M-22, "Sizing Water Service Lines and Meters" except as follows:

- 1. Use constant pressure factor of 1.
- 2. Include all outside hose bibs in combined fixture value total.
- 3. For non-residential facilities or facilities with flush-valve fixtures, the meter size is recommended as follows:

<u>METER SIZE</u> <u>INCHES</u>	<u>COMBINED FIXTURE</u> <u>VALUE TOTAL</u>
1"	41 - 100
1 1/2"	101 - 400
2"	401 - 1200

- 4. For residential facilities and office buildings with tank type water closets, the meter size is recommended as follows:

<u>METER SIZE</u> <u>INCHES</u>	<u>COMBINED FIXTURE</u> <u>VALUE TOTAL</u>
5/8"	1 - 40
1"	41 - 400
1 1/2"	401 - 5500

- 5. Plumbing Fixtures Values shall be as shown in AWWA No. M-22 for 35 psi.
- 6. Meter installations requiring a flow of greater than 160 gpm or greater than the combined fixture value totals indicated shall be reviewed and/or approved on a case-by-case basis in accordance with AWWA Manual M-22.
- 7. A 5/8-inch meter may be used for non-residential facilities with tank type water closets and a combined fixture value total of 0-40. A 1-inch meter will be the minimum size used for any facility with flush valve fixtures.

- F. Where water lines are subject to extreme variations in temperature (i.e., attached to bridges or box culverts) consideration shall be given to

expansion and contraction of pipe materials and the freezing of the line contents.

- G. Cathodic Protection - Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable cathodic protection where necessary.
- H. Irrigation systems shall use the appropriate backflow devices as indicated in the Department's Cross Connection Control Manual and shall be approved by the County's Building Inspection Department.
- I. Where exposed to traffic, meter boxes and vaults shall be designed for the appropriate traffic loading.
- J. Meter Boxes for residential units shall be rated for a minimum 15,000-lb load and be installed in accordance with the Standard Drawings.
- K. Meter Boxes for 1-1/2 and 2 inch meters shall be rated for a minimum of Tier 22 load.
- L. Dead end lines shall be minimized by looping mains. Where looping is required, the minimum size pipe shall be 6 inch.
- M. Dead ends of all mains shall be provided with either a fire hydrant or a flushing hydrant, as appropriate, to provide adequate flushing of the main.
- N. No flushing devices shall be connected directly to any sewer.
- O. The minimum size service line from the County main to the meter shall be 1 inch.
- P. Chambers or pits containing valves, blow-offs, meters, or other such appurtenances to the distribution system shall not be connected directly to any storm drains or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer.
- Q. Chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits underground.
- R. The open end of the air relief valve should extend one foot above ground and be provided with a screened downward facing elbow.

4.3 DRAWINGS

- 4.3.1 In addition to the requirements of Section 1.2 - "Drawings Organization and Format" of these Standards, the drawing shall incorporate the following features:

- A. Drawings for water lines shall show stationing, pipe size and material, all fittings and valves, bearings, deflection angles and curve data to adequately define the water line location with Northing and Easting coordinates. Water line dimensions including distances to structures, right-of-way, face of curb, edge of pavement, and property lines shall be shown.
- B. The drawings shall also show all fire hydrant and water service connections. Fire hydrants and water services over 1 inch in size shall be shown in plan and profile views which are labeled by station.
- C. Profiles shall be provided for all water lines. Grades shall be calculated and shown on the profiles. Profiles shall also show all air, air/vacuum relief valves, fire hydrants, and blow-off locations.
- D. Water lines shall be referenced by distance from right-of-way lines, buildings and other utilities. All fittings shall have Northing and Easting coordinates.
- E. Blocking and/or restraint details.
- G. Current Goochland County Water and Sewer Notes, Pipe Materials General Notes, Erosion Control Notes and Estimated Materials Quantities shall be shown on the plans.
- H. All drawings for water mains crossing sewers, force mains, or other utilities, shall show points where crossings occur. Crossings shall be shown in both Plan and Profile. The Profile shall clearly indicate vertical clearance between utilities.
- I. Meter sizing form, backflow prevention details, and ISO calculations shall be shown on the plans.
- J. All fittings, including valves, bends, tees, etc., shall be shown on the plan and profile.

END OF SECTION 4

**STANDARD FORMS AND NOTES
GOOCHLAND COUNTY, VIRGINIA
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COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
ENGINEERING REPORT

PROJECT _____
LOCATION _____ SPS (BASIN) N/A
USE _____ ACREAGE _____
EQUIVALENT POPULATION _____ POPULATION DENSITY _____
IS PROJECT PHASED YES NO (circle one)
IF YES, THEN OVERALL PLAN IS REQUIRED AND SHOULD BE ATTACHED.

SANITARY SEWER DESIGN:

DESIGN BASIS _____ SOURCE _____
NUMBER OF UNITS _____
AVERAGE DESIGN FLOW (ON-SITE) _____
OFF-SITE FLOW CONTRIBUTION (AVERAGE) _____
AVERAGE DESIGN FLOW (TOTAL) _____
PEAK FLOW _____ PEAKING FACTOR _____
DOWNSTREAM MH: SEWER SHEET N/A MANHOLE NUMBER N/A
ATTACH FLOW ANALYSIS CALCULATIONS
ATTACH SEWER DESIGN FORM (FORM F-4)
ATTACH SYSTEM LAYOUT MAP

WATER SYSTEM DESIGN:

DESIGN BASIS _____ SOURCE _____
NUMBER OF UNITS _____
AVERAGE DESIGN FLOW (ON-SITE) _____
ATTACH FLOW DEMAND ANALYSIS CALCULATIONS
ATTACH HYDRAULIC CALCULATIONS
ATTACH SYSTEM LAYOUT MAP

SEWAGE PUMPING STATIONS AND FORCE MAINS:

A MEETING WITH THE DPU DESIGN DIVISION IS REQUIRED TO DETERMINE THE REQUIREMENTS FOR ASSESSMENT OF THE SERVICE AREA AND SCOPE OF THIS ENGINEERING REPORT.

CERTIFICATION:

I HEREBY CERTIFY THAT THIS ENGINEERING REPORT AND ATTACHED CALCULATIONS HAVE BEEN PREPARED BY ME OR UNDER MY DIRECT SUPERVISION.

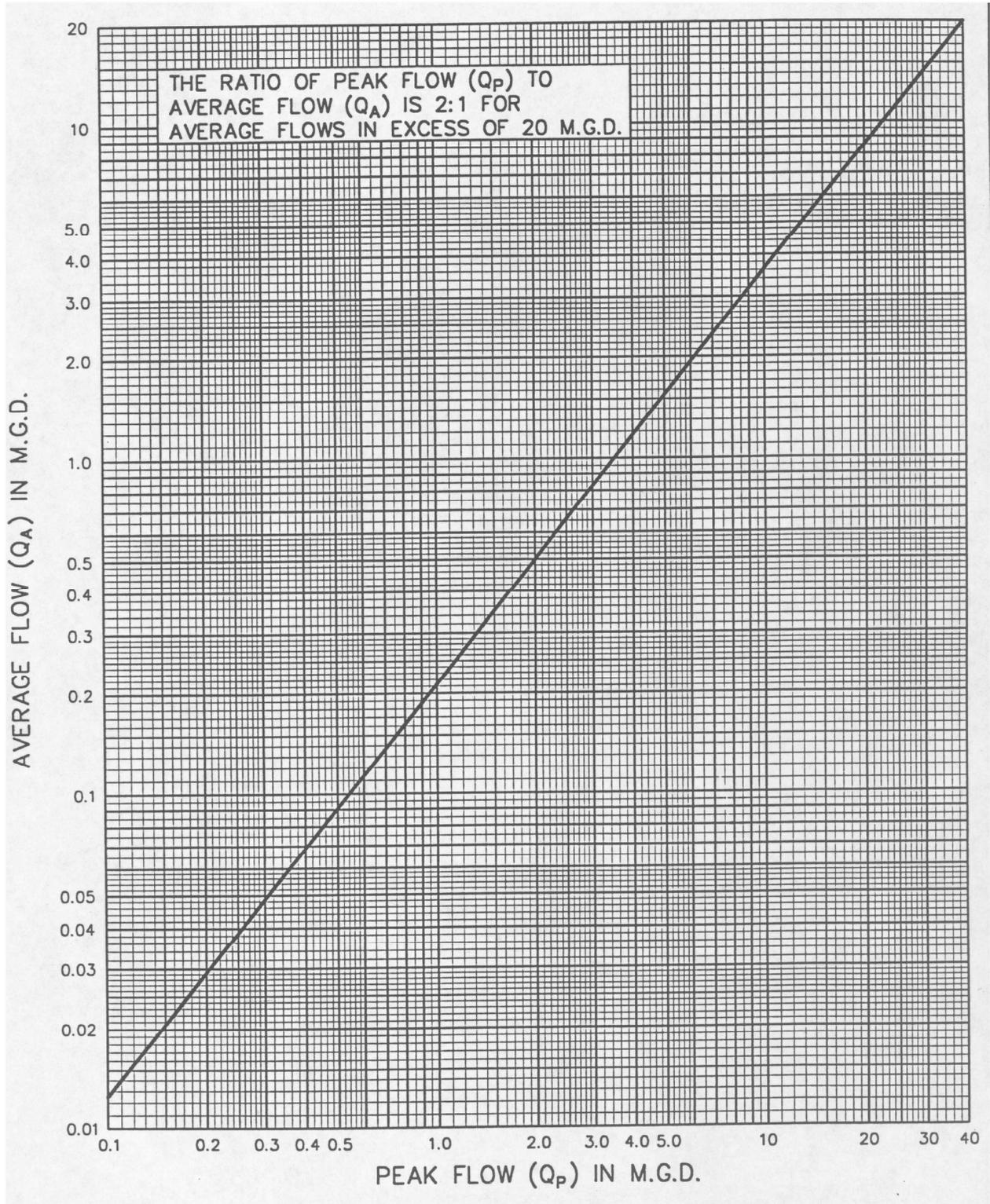
signature

certificate number

name typed or printed

date

COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES



REVISIONS

CHART SHOWING
RELATION OF AVERAGE FLOW TO PEAK FLOW
FOR SANITARY SEWER DESIGN

FORM NO.

F-2

COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES

14" OR 27"
1.4"
12.2" OR 25.2"

OWNER: _____
DEED BOOK: _____ PAGE: _____
PARCEL NO. _____

PERMANENT EASEMENT _____ ACRES
CONSTRUCTION EASEMENT _____ ACRES

PLAT SHOWING THE LOCATION OF EASEMENTS FOR UTILITIES
TO BE ACQUIRED THROUGH THE PROPERTY OF _____

IN THE _____ MAGISTERIAL DISTRICT,
COUNTY OF GOOCHLAND, VIRGINIA.

SCALE: _____ DATE: _____

ENGINEER (FIRM NAME) ENGINEER'S COMMISSION NO. _____	COUNTY PROJECT NO. _____ PLAT NUMBER _____ GPIN _____ SHEET _____ OF _____ RECORDED _____ P.B. _____ PAGE _____
--	---

0.4" 3.85" 3.85" 0.4" 8.5"

REVISIONS

EASEMENT PLAT LAYOUT

FORM NO.

F-3

DEPARTMENT OF PUBLIC UTILITIES
COUNTY OF GOOCHLAND, VIRGINIA

UTILITIES INFORMATION SHEET FOR LEGAL AGREEMENT
FOR COUNTY: _____ WATER _____ SEWER
(Please type or Print)

1. NAME OF PROJECT: _____
2. AGENT'S NAME: _____ Phone () _____
Address: _____ Zip _____
Fax # _____ Email _____
3. PROPERTY OWNER: _____ Phone () _____
Address: _____ Zip _____
4. ATTACH COPY OF DEED (DEED BOOK & PAGE NO. SHALL BE CLEARLY SHOWN)
5. PROPERTY IDENTIFICATION (AS SHOWN ON COUNTY TAX MAPS)

6. ENCLOSE SEVEN (7) COPIES OF THE PROPERTY BOUNDARY DRAWING, NO LARGER THAN 24" BY 16"
7. ACREAGE: _____ acres
8. IF ONLY A PART OF THE ACREAGE IN NO. 7 WILL BE DEVELOPED AT THIS TIME THEN _____ ACRES WILL BE DEVELOPED AS PHASE _____ OR SECTION _____.
9. MAGISTERIAL DISTRICT: _____
10. THE FOLLOWING WILL BE CONSTRUCTED:

RESIDENTIAL:

_____ Single Family: _____ # Subdivision Lots on _____ acres will be developed as follows: Lot No. _____ thru _____ inclusive, Block _____; Lot No. _____ thru _____ inclusive, Block _____; Lot No. _____ thru _____ inclusive, Block _____;	_____ Multi-Family: _____ Townhouse, # lots _____ _____ Condominium _____ # of structure _____ units per structure _____ Apartments _____ total units, _____ clubhouse
--	--

COMMERCIAL:

_____ Office, type _____ _____ Restaurant _____ Motel/Hotel _____ # rooms _____ restaurant _____ manager's apt.	_____ Hospital _____ # beds _____ Nursing homes _____ # beds _____ Dormitories _____ # beds _____ Other _____
--	--

INDUSTRIAL:

Describe the type of industry: _____

Will there be manufacturing? If so specify: _____

11. If this is a nursing home or dormitory include the following:
Is this a facility providing permanent housing for elderly or handicapped persons and operated by charitable, nonstock, nonprofit organizations which are exempted by section 501(c)(3) of the Internal Revenue Code? If so, provide a copy of that documentation and approval by the Internal Revenue Service.

_____ # dwelling units

12. **SIGNATURE PAGE INFORMATION:**

(Submit a copy of your signature page and notary clauses)

A. Specify the business type, (ex. corporation, limited partnership, general partnership, limited liability company) _____

B. State the names and titles of the legally authorized persons to sign the agreements below:

Name

Title

If corporation, state the attesting name and title

Name

Title

C. This business was organized in the State of _____ .

D. Is this business authorized to do business in the State of Virginia? _____ Yes _____ No

13. **PLEASE MAIL THIS AGREEMENT TO THE ADDRESS BELOW:**

14. *I certify that the above information is true and correct.*

Signed: _____ (Owner/Agent) Date: _____

Faxed or emailed information sheets will not be accepted.

For questions please contact the County Engineer.

Submit completed application with the required attachments to:

Goochland County
Department of Public Utilities
P.O. Box 119
Goochland, VA 23063

**DEPARTMENT OF PUBLIC UTILITIES
COUNTY OF GOOCHLAND, VIRGINIA**

**Guidelines for Completing the
Utilities Information Sheet For Legal Agreement**

The County uses this Information Sheet to prepare the Water and Sewer Agreements for execution by the Owner and the County. When the Agreements are executed, the Clerk of the Court records them. The Agreements shall be executed before water and sanitary sewer construction plans will be approved.

Check or Circle County Water and/or Sewer to indicate desired connection to system.

1. The **NAME OF PROJECT** is the title shown on the water and sanitary sewer utility plan.
2. **AGENT'S NAME** is the contact person completing the information sheet and who will be contacted when additional information is needed. The Agent's telephone number, address, zip code, facsimile number and email address shall be included.
3. **PROPERTY OWNER** is (are) the name(s) of the property Owner(s) as shown in the Deed (of Trust). **Enclose copy of Deed (of Trust)**. Include **Phone Number** (Complete Telephone Number of Property Owner); **Address & Zip Code** (Complete mailing address of the Property Owner where County will send the executed agreement).
4. **Attach** a copy of the **DEED (of Trust) with this completed Information Sheet** that clearly shows the Deed Book and Page Number
5. **PROPERTY IDENTIFICATION** shall be the identification number shown on the Goochland County Tax Map for the property included in the Deed of Trust.
6. **ENCLOSE 7 COPIES OF PROPERTY BOUNDARY DRAWING.** This is a map or plat of the property to be included in the Agreement and shall clearly show the acreage, distances, bearings, reference to an intersection, and north arrow. This drawing shall include the required information but does not need to be surveyed or recorded. This drawing will be attached to and recorded with the agreements and shall be no larger than 16 inches by 24 inches.
7. This is the **ACREAGE** to be included in the agreement. If the Owner plans to develop the property in pieces/sections/phases, then the total acreage of the parcel(s) is shown in this item.
8. **IF ONLY A PART OF THE OVERALL ACREAGE SHOWN IN ITEM 7 IS TO BE DEVELOPED AT THIS TIME THEN** (Indicate the actual acreage for which service is to be provided at this time). **ACRES WILL BE DEVELOPED AS PHASE** (Show the phase designation) or **SECTION** (or the section designation).
9. **MAGISTERIAL DISTRICTS** (the district where the property is located.)
10. Provide information on how the site will be developed.
 - a) For residential projects include the required information for either single family or multi-family type construction.
 - b) For commercial projects indicate the type of development proposed. For nursing homes or dormitories, complete item 11 on the Information Sheet.
 - c) For industrial projects describe the type of industry and specify any manufacturing processes to be located at this facility.

11. If a nursing home or dormitory is proposed and if Section 501(c)(3) of the Internal Revenue Code is applicable then provide a copy of the documentation and approval from the Internal Revenue Service.
12. The appropriate signatures and notary clauses are required for execution of the Agreement. Either complete Item 12 or submit a copy of your signature page and notary clauses. Failure to submit complete or correct information will result in delays in completing and executing the required Water and Sewer Agreements. An executed Agreement is required before Water and Sewer Plans can be approved for construction.
13. The County will mail the Water and Sewer Agreements to the address indicated. The individual signing this certification is the person who will be contacted if additional information is needed. Indicate whether it is the "Owner" or "Agent" who is submitting this Information Sheet.

Helpful Hints

1. If there is a need to erase, cross out, or add any information to a preprinted form, the persons who sign the document must also initial each change on all documents.
2. If a church, all trustees for the church must sign and signatures be notarized.
3. If a corporation, two corporate officers of that corporation are required to sign and signatures be notarized.

Submit the completed application with the required attachments to:
Goochland County
Department of Public Utilities
P.O. Box 119
Goochland, VA 23063

Faxed or emailed information sheets and attachments will not be accepted.

For questions about this information sheet please contact the County Engineer.

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
REVIEW CHECKLIST FOR WATER AND SEWER PLANS**

Project Title

- ___ 1. Virginia registered engineer’s stamp, signature, and date. (See Sections 14-37 and 14-127 of Goochland County Code).
- ___ 2. Engineering Report including a System Layout Map has been submitted. (Not required for minor extensions as defined by Paragraph 1.1.2.D).
- ___ 3. Water System is designed to provide adequate domestic service and fire protection to owner’s property. _____” diameter line is required to adequately serve this project in accord with County Standards.
 - a. Average Domestic Design Flow _____
 - b. Peak Hour Domestic Flow _____
 - c. Design Fire Flow _____
 - d. Total Design Peak Flow _____
 - e. Residual Pressure at Total Design Peak Flow (last hydrant) _____
- ___ 4. Sanitary Sewer Service area map is submitted with plans. Sanitary Sewer Analysis is shown on sewer shed map. _____” diameter line is required to adequately serve this project in accordance with County Standards.
 - a. Average Design Flow _____
 - b. Equivalent Residential Units _____
- N/A 5. Information Sheet for Preparation of Water and Sewer Agreements has been submitted.
- ___ 6. Application for Discharge is submitted for non-residential projects. Plan includes location and details for grease trap, monitoring manhole or other devices required by County Standards.
- ___ 7. This is a phased project. Overall water and sewer plans have been submitted for approval with fire hydrants and valve locations shown.
- ___ 8. Plan and profile sheets are on 24”x36” paper. Drawing organization and format comply with Paragraph 1.2.
- ___ 9. A Cover Sheet is provided that includes the Owner/Developer name and address, project vicinity map, and Standard Water and Sewer Notes.
- ___ 10. The sewer plans include stationing, pipe size, material, bearings, direction of flow, deflection angles, grade and distance between centerline of manholes. Benchmarks are shown every 500 feet.
- ___ 11. Domestic water meter calculations are shown on plans where applicable in accord with AWWA Manual M-22.
- ___ 12. ISO Fire Flow computations are shown on plans (where applicable).
- ___ 13. All sanitary sewers are profiled. Crossings with other utilities are shown and conflicts are resolved.
- ___ 14. All water mains 8” and larger are profiled. Where water mains of any size cross other utilities, these crossings are profiled, and the means for crossing and resolving any conflicts are clearly shown.
- ___ 15. Any and all existing sewer and water connections to the property are shown on the plans.
- ___ 16. All proposed water and sewer lines connect to existing water and sewer lines that have been previously accepted by the County for operations and maintenance.
- ___ 17. All off-site easements necessary for the completion of this project have been acquired, recorded and their Deed Book and Page references are shown on the plans.
- ___ 18. A list of approximate Materials Quantities to be used and the latest Material Notes are shown on the plans.
- ___ 19. A Backflow Prevention Device is provided on domestic and fire service connections in accordance with Part II, Article 3 of the Commonwealth of Virginia, State Board of Health Waterworks Regulations and the County Standards.
- ___ 20. Plans comply with all applicable Local, State and Federal regulations including County and State erosion control ordinances and application has been made for all required permits.

I have reviewed this Checklist for accuracy and hereby certify that the water and/or sewer plans as submitted have been designed in accord with the latest County Standards, Waterworks Regulations and Sewerage Regulations (whichever is more restrictive). The plans have been reviewed for completeness and accuracy and are herewith submitted for approval.

P.E.
Signature

Certificate Number

Named Typed or Printed

Date

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
DOMESTIC METER SIZING FORM**

Project Name: _____
 Address: _____
 Parcel No.: _____ or _____
 Subdivision: _____ Lot No. _____ Blk. No. _____
 Type of Occupancy: _____

Fixture	Fixture Value 35 psi		No. of Fixtures	=	Fixture Value
Bathub	8	x	_____	=	_____
Bedpan Washers	10	x	_____	=	_____
Combination Sink and Tray	3	x	_____	=	_____
Dental Unit	1	x	_____	=	_____
Dental Lavatory	2	x	_____	=	_____
Drinking Fountain - Cooler	1	x	_____	=	_____
- Public	2	x	_____	=	_____
Kitchen Sink - 1/2" Connection	3	x	_____	=	_____
- 3/4" Connection	7	x	_____	=	_____
Lavatory - 3/8" Connection	2	x	_____	=	_____
- 1/2" Connection	4	x	_____	=	_____
Laundry Tray - 1/2" Connection	3	x	_____	=	_____
- 3/4" Connection	7	x	_____	=	_____
Shower Head (Shower Only)	4	x	_____	=	_____
Service Sink - 1/2" Connection	3	x	_____	=	_____
- 3/4" Connection	7	x	_____	=	_____
Urinal - Pedestal Flush Valve	35	x	_____	=	_____
- Wall Flush Valve	12	x	_____	=	_____
- Trough (2 Ft. Unit)	2	x	_____	=	_____
Wash Sink (Each Set of Faucets)	4	x	_____	=	_____
Water Closet - Flush Valve	35	x	_____	=	_____
- Tank Type	3	x	_____	=	_____
Dishwasher - 1/2" Connection	4	x	_____	=	_____
- 3/4" Connection	10	x	_____	=	_____
Washing Machine - 1/2" Connection	5	x	_____	=	_____
- 3/4" Connection	12	x	_____	=	_____
- 1" Connection	25	x	_____	=	_____
Hose Connection (Wash Down) - 1/2"	6	x	_____	=	_____
- 3/4"	10	x	_____	=	_____
Combined Fixture Value Total					_____
Maximum Demand					_____ GPM
Meter Size					_____

I certify that the above information is true and correct.

Signature: _____

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
FIRE FLOW ESTIMATE FORM**

ISO (Insurance Service Office) Method of Calculating NFF (Needed Fire Flow)

ENGINEER: _____ DATE: _____

PROJECT NAME: _____ CALC. BY: _____

TYPE OF CONSTRUCTION: _____

GROUND FLOOR AREA = _____ Class of Construction Coef. = F : _____
of Stories _____

Total Floor Area = A_i (effective area): _____

FIRE AREA CONSIDERED

Construction Factor $C_i = 18(F)(A_i)^{0.5}$ $C_i =$ _____
(ROUNDED TO THE NEAREST 250 GPM)

TYPE OF OCCUPANCY: _____

(Worst Case) Occupancy Factor = O_i : _____

EXPOSURE (X) AND COMMUNICATION (P):

$X_1 + P_1 =$ _____ $X_4 + P_4 =$ _____
 $X_2 + P_2 =$ _____ $X_5 + P_5 =$ _____
 $X_3 + P_3 =$ _____ $X_6 + P_6 =$ _____

$$(X+P)_i = 1.0 + \sum_{(i=1)}^n (X_i + P_i) =$$

[Max. $(X + P)_i = 1.75$]
(n = NUMBER OF SIDES OF SUBJECT BUILDING)

NEEDED FIRE FLOW

$NFF = (C_i)(O_i)(X+P)_i$ $NFF =$ _____

Automatic Sprinklers (Yes _____ No _____) Reduction Factor _____% x NFF = _____

TOTAL: _____

Required Fire Flow – Rounded (gpm) _____
(if < 2500, nearest 250)
(if > 2500, nearest 500)

* Fire Hydrants Required: _____

I CERTIFY THAT THE ABOVE INFORMATION IS TRUE AND CORRECT.

SIGNATURE: _____ **P.E.**

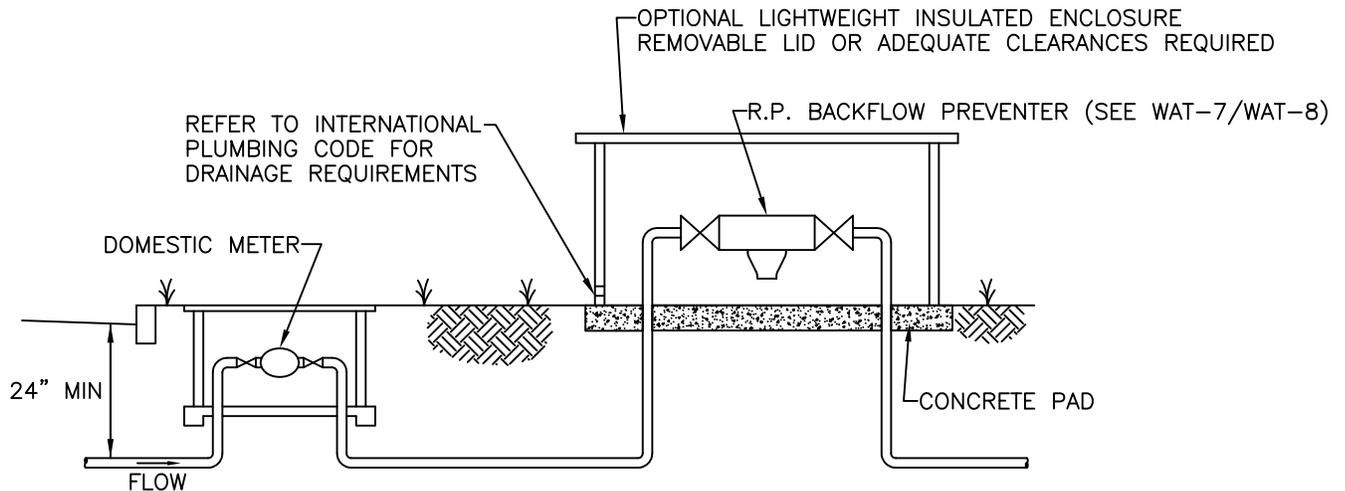
* COMMERCIAL AREA REQUIRES 350 FEET MAXIMUM HOSE LAY.

References: NFF calculation procedure described in AWWA M-31, ISO's 1980 Commercial Fire Rating Schedule and ISO's 1980 Fire Suppression Rating Schedule.

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
WATER AND SEWER NOTES**

1. All construction, materials and installation shall conform to the latest edition of Standards, Department of Public Utilities, Goochland County, Virginia.
2. Contractor shall be responsible for notifying the County Engineer and scheduling a pre-construction meeting at least 48 hours prior to starting any work on this project. All work shall be subject to inspection. The contractor shall obtain all necessary permits.
3. The contractor shall include in applicable bid price, the cost of locating and uncovering all sewer manholes and valve boxes after surface treatment of roads and to adjust them to the final road grades, if necessary. The contractor shall also be responsible for cleaning out sewer mains for final inspection, if necessary.
4. Contractor shall verify location and elevation of all underground utilities. The location of existing utilities across or along the line of the proposed work is not necessarily shown on the plans and where shown is only approximately correct. The contractor shall, on his own initiative and at no extra cost, locate all underground lines and structures as necessary. No claims for damages or extra compensation shall accrue to the contractor from the presence of such pipe obstructions or from any delay due to removal or rearrangement of the same. The contractor shall be responsible for any damage to underground structures.
5. Contractor shall call "Miss Utility" toll free at 1-800-552-7001 prior to construction.
6. Datum for all elevations shown is National Geodetic Survey.
7. Minimum cover over top of water pipe shall be 3.50 feet.
8. Service saddles must be used on all water connections to PVC mains.
9. Fire hydrants shall be installed in accordance with Standard Drawing D-200.
10. Engineer shall certify that unpaved streets are to subgrade prior to Contractor installing water system. Curb and gutter, if required, shall be installed prior to acceptance of water system by County.
11. No structures or planting of trees shall be permitted in utility easements.
12. Vandalproof covers shall be used on all manholes in easements. Watertight covers shall be used in flood plains. The manhole covers shall be in accordance with Standard Drawings D-111 and D-112.
13. Final Acceptance by County shall not be made until all work shown on approved utility plans is completed including paving, grading and all required adjustments.
14. A Wetlands Permit may be required from the U.S. Army Corps of Engineers for this project. For information concerning such requirement, contact the Corps at (804) 462-5382.
15. The Department will inspect all water and sanitary sewer mains, connections and appurtenances thereto, as shown on the approved utility plans, located within dedicated easements and/or Public Rights-of-Way. All other lines to be installed on site to serve roof drainage, water supply and sanitary sewers shall be approved by the Department of Building Inspections prior to installation and shall be inspected by Building Inspections before covering.
16. Concurrent inspections by Building Inspections and County Engineer will be performed for the following: Mainline backflow preventers; monitoring manholes; grease traps; exclusion meters; irrigation meters. County Engineer will inspect to ensure that the proper type facility, as shown on the approved utility plans, has been installed and tested in accordance with DPU Standards.

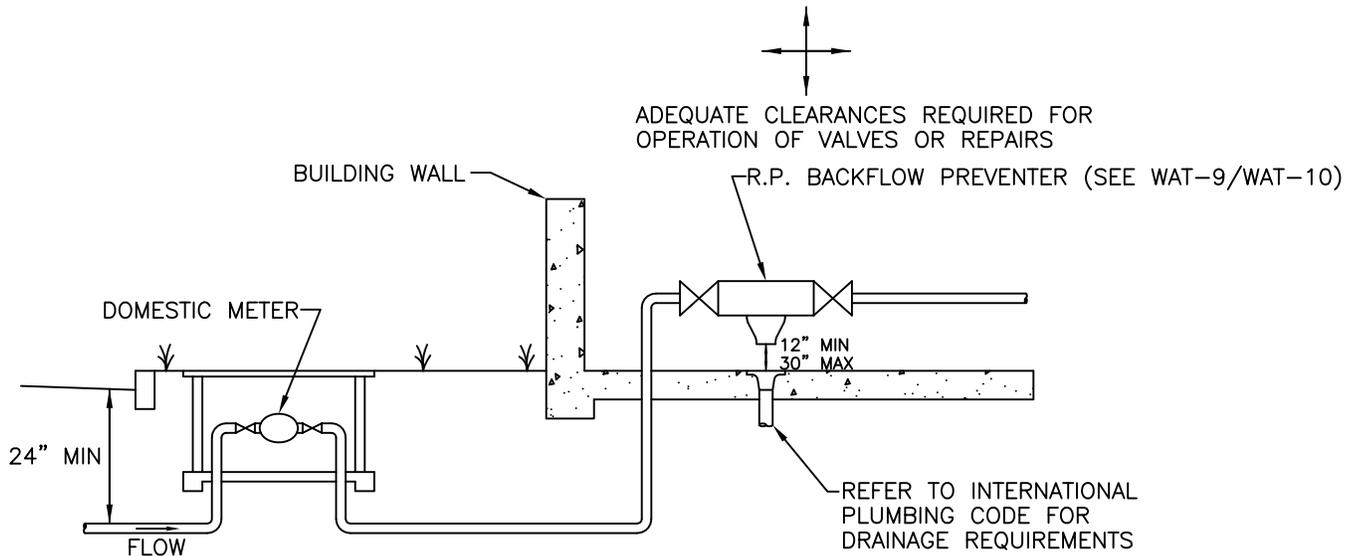
TYPICAL OUTSIDE INSTALLATION
REDUCED PRESSURE BACKFLOW PREVENTER
MAIN LINE DEVICE WITH DOMESTIC METER



PROCEDURE FOR DOMESTIC METERS
WHEN BACKFLOW PREVENTION IS REQUIRED

1. Submit plans to County Engineer sealed and signed by a Professional Engineer for approval.
2. Apply for a plumbing permit from County of Goochland, Department of Building Inspections.
3. Install piping and backflow preventer, including brass male test cock adapters – (4) straight hose adapter fittings, 1/4" SAE 45 flare tube x 1/4" NPT, for connection to test device. Backflow prevention devices will be installed at the water service connection after the domestic meter. Refer to approved DPU plans for typical installation details. No tap-ins will be permitted for any purpose between meter and backflow device.
4. Meter box and yoke in accordance with County of Goochland DPU Standards to be installed by the Contractor. The domestic meter will be installed by the County of Goochland DPU.
5. Call Building Inspections at 556-5815 for inspection of the backflow preventer. Inspection and approval is required before the domestic meter is installed.
6. Call Building Inspections at 556-5815 for inspection of all piping and plumbing work downstream of the domestic meter.
7. Owner to pay basic connection fee at the Department of Public Utilities Office. Fee must be paid for domestic meter before the meter can be installed.
8. Freeze protection is required. Recommended options are: a lightweight, insulated enclosure or installation of heat tape. All methods of freeze protection must allow accessibility to device for testing and repairs.
9. The Backflow Prevention Assembly's shutoff valves shall be the ones approved by the manufacturer for that Backflow Prevention Assembly.

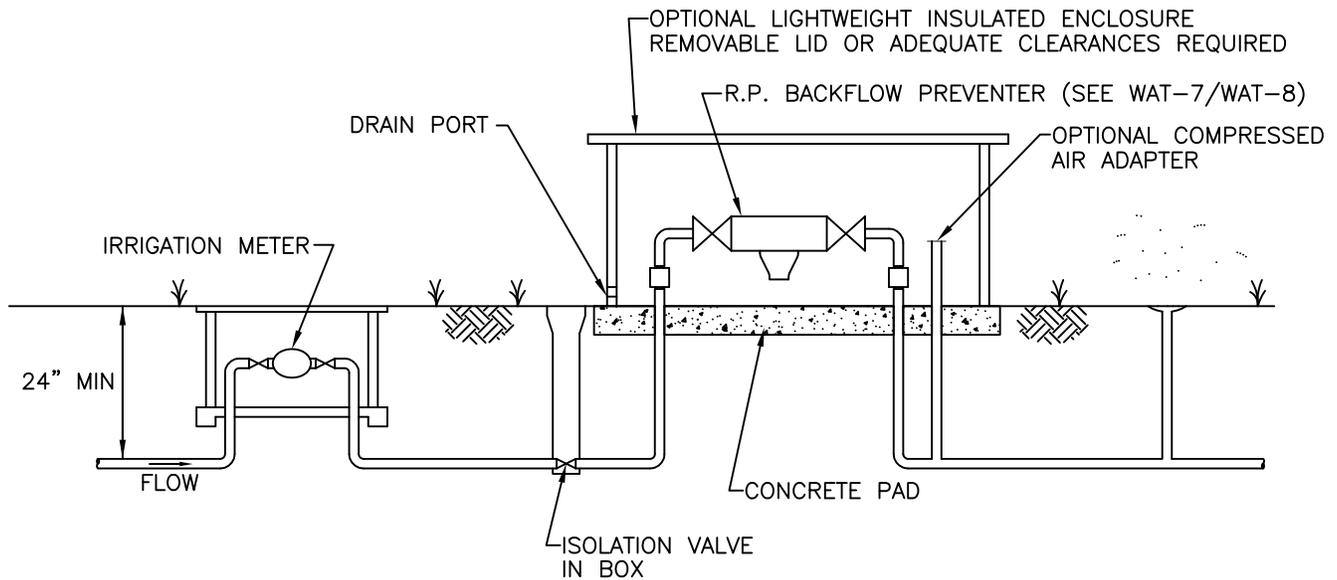
TYPICAL IN-BUILDING INSTALLATION
REDUCED PRESSURE BACKFLOW PREVENTER
MAIN LINE DEVICE WITH DOMESTIC METER



PROCEDURE FOR DOMESTIC METERS
WHEN BACKFLOW PREVENTION IS REQUIRED

1. Submit plans to County Engineer sealed and signed by a Professional Engineer for approval.
2. Apply for a plumbing permit from County of Goochland, Department of Building Inspections.
3. Install piping and backflow preventer, including brass male test cock adapters – (4) straight hose adapter fittings, 1/4" SAE 45 flare tube x 1/4" NPT, for connection to test device. Backflow prevention devices will be installed at the water service connection after the domestic meter. Refer to approved DPU plans for typical installation details. No tap-ins will be permitted for any purpose between meter and backflow device.
4. Meter box and yoke in accordance with County of Goochland DPU Standards to be installed by the Contractor. The domestic meter will be installed by the County of Goochland DPU.
5. Call Building Inspections at 556-5815 for inspection of the backflow preventer. Inspection and approval is required before the domestic meter is installed.
6. Call Building Inspections at 556-5815 for inspection of all piping and plumbing work downstream of the domestic meter.
7. Owner to pay basic connection fee at the Department of Public Utilities Office. Fee must be paid for domestic meter before the meter can be installed.
8. The Backflow Prevention Assembly's shutoff valves shall be the ones approved by the manufacturer for that Backflow Prevention Assembly.
9. Reduced Pressure Zone backflow preventer shall have a minimum clearance of 24" from wall to test cock adapters and all other clearances shall be a minimum of 12".

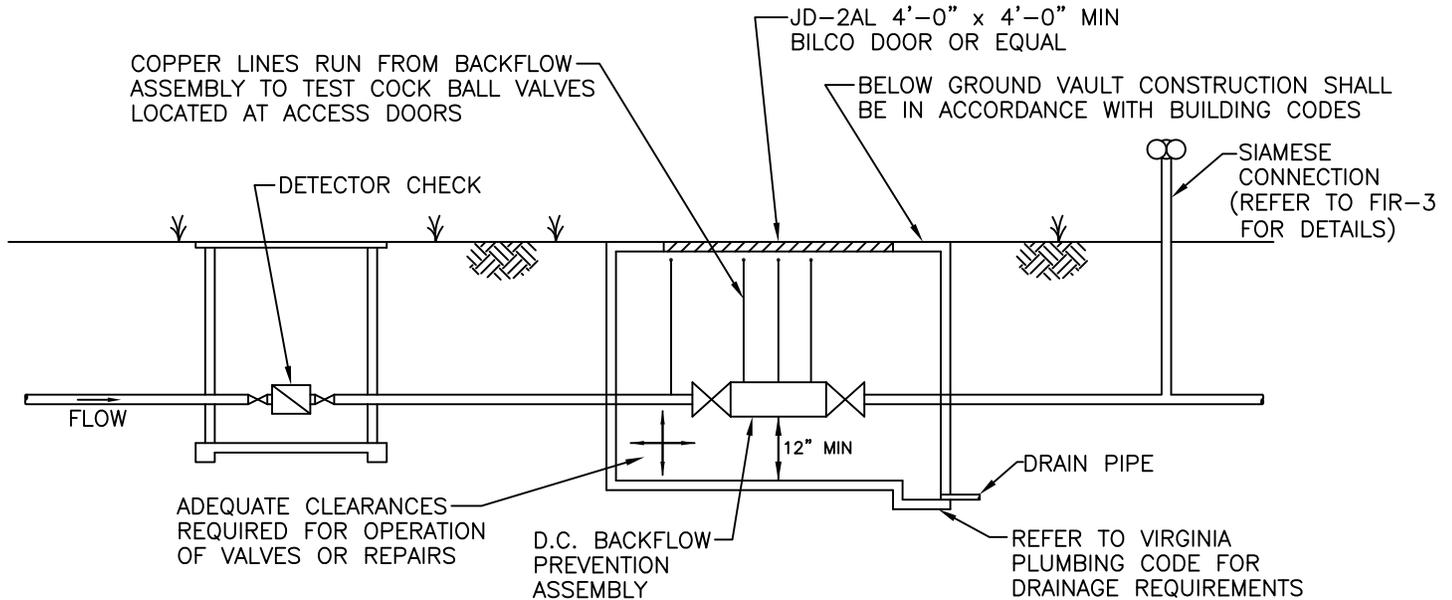
TYPICAL INSTALLATION
REDUCED PRESSURE BACKFLOW PREVENTER
IRRIGATION SYSTEM WITH IRRIGATION METER



PROCEDURE FOR IRRIGATION METERS
WHEN BACKFLOW PREVENTION IS REQUIRED

1. Submit plans to County Engineer sealed and signed by a Professional Engineer for approval.
2. Apply for a plumbing permit from County of Goochland, Department of Building Inspections.
3. Install piping and backflow preventer, including brass male test cock adapters – (4) straight hose adapter fittings, 1/4" SAE 45 flare tube x 1/4" NPT, for connection to test device. Backflow prevention devices will be installed at the water service connection after the domestic meter. Refer to approved DPU plans for typical installation details. No tap-ins will be permitted for any purpose between meter and backflow device.
4. Meter box and yoke in accordance with County of Goochland DPU Standards to be installed by the Contractor. The domestic meter will be installed by the County of Goochland DPU.
5. Call Building Inspections at 556-5815 for inspection of the backflow preventer. Inspection and approval is required before the domestic meter is installed.
6. Call Building Inspections at 556-5815 for inspection of all piping and plumbing work downstream of the domestic meter.
7. Owner to pay basic connection fee at the Department of Public Utilities Office. Fee must be paid for domestic meter before the meter can be installed.
8. Freeze protection is required. Recommended options are: a lightweight, insulated enclosure or installation of heat tape. All methods of freeze protection must allow accessibility to device for testing and repairs.
9. The optional compressed air adapter shall be installed downstream of the Reduced Pressure Zone Backflow Preventer, if provided.
10. The Backflow Prevention Assembly's shutoff valves shall be the ones approved by the manufacturer for that Backflow Prevention Assembly.

TYPICAL INSTALLATION
DOUBLE CHECK BACKFLOW PREVENTION ASSEMBLY
LOW HAZARD FIRE SYSTEM WITH DETECTOR CHECK



PROCEDURE FOR FIRE SYSTEMS
WHEN BACKFLOW PREVENTION IS REQUIRED

1. Submit plans to County Engineer sealed and signed by a Professional Engineer for approval.
2. Apply for a plumbing permit from County of Goochland, Department of Building Inspections.
3. Install piping and backflow preventer, including brass male test cock adapters – (4) straight hose adapter fittings, 1/4" SAE 45 flare tube x 1/4" NPT, for connection to test device. Backflow prevention devices will be installed at the water service connection after the domestic meter. Refer to approved DPU plans for typical installation details. No tap-ins will be permitted for any purpose between meter and backflow device.
4. Call Building Inspections at 556-5815 for inspection of the backflow preventer.
5. All fire system Backflow Prevention requirements shall be met before the domestic meter will be installed.
6. Call Building Inspections at 556-5815 for inspection from the detector check through the internal fire system.
7. Owner to pay basic connection fee at the Department of Public Utilities Office.
8. The Backflow Prevention Assembly's shutoff valves shall be the ones approved by the manufacturer for that Backflow Prevention Assembly. Also, the shutoff valves shall meet fire code standards.
9. As an option, the Contractor may install the siamese connection in the same vault as the Double Check Backflow Prevention Assembly and extend the siamese riser through the top of the vault.

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES
EROSION CONTROL NOTES**

1. It shall be the Developer's responsibility to inspect all erosion control devices periodically and after every erodable rainfall. Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devices shall be made immediately.
2. No disturbed area will be denuded for more than 30 calendar days.
3. All erosion and siltation measures are to be placed prior to or as the first step in clearing and grading.
4. All storm and sanitary sewer lines not in streets are to be mulched and seeded immediately after backfill. No more than five hundred feet are to be open at one time.
5. Electric power, telephone, and gas supply trenches are to be compacted, seeded and mulched immediately after backfill.
6. All temporary earth berms, diversions, and silt dams are to be mulched and seeded for vegetative cover immediately after grading. Straw or hay mulch is required. The same applies to all soil stockpiles on site as well as soil (intentionally) transported from the project site.
7. During construction, all storm sewer inlets will be protected by silt traps, maintained and modified as required by construction progress.
8. Any disturbed area not paved, sodded, or built upon by November 1st, is to be seeded on that date with oats, abruzzi, rye or equivalent and mulched with hay or straw mulch. Modify as applicable depending on proposed time of construction.
9. Temporary seeding will be applied within seven days to denuded areas that may not be at final grade, but will remain dormant (undisturbed) for longer than thirty days. For temporary seeding use fifty percent of all the recommended rates of fertilizer and lime, and full amounts of seed and mulch required for regular seeding.
10. All erosion control devices must be installed and maintained in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook.
11. If during construction, additional erosion control devices are found necessary, they shall be installed as directed by the County Engineer.

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES**

Notification of Intent to Discharge to Sanitary Sewer

The following information is required with the submission of Utility Plans for a Plan of Development and/or Building Permit. It is intended to provide additional information to expedite the review and approval of construction drawings. **Accurate and complete information is required.**

General Information			
Project Name:			
Street Address:			
Mailing Address:			
Contact Person:		Telephone:	
Title:		e-mail:	
Existing Discharge:	(✓One) YES ___ NO ___	Account #	
Discharge to Begin:	(Give Approximate Date)		
SIC CODE(S) or NAICS CODE(S):	Standard Industrial Classification Code, or North American Industry Classification Code, where known: N/A		

Describe the Specific Nature of the Business or Reason for Altering Existing Discharge
Will the Discharge be from Restrooms Only? (✓One) YES ___ NO ___

**IF THE DISCHARGE IS FROM RESTROOMS ONLY, STOP HERE AND SIGN FORM
OTHERWISE CONTINUE WITH PAGE TWO**

I certify that the information provided is true and represents, to the best of my knowledge, the information requested. I also acknowledge that I am qualified to make this certification.

Name	Title	Date
------	-------	------

**COUNTY OF GOOCHLAND
DEPARTMENT OF PUBLIC UTILITIES**

Notification of Intent to Discharge to Sanitary Sewer

Describe the Process(es) that will Result in the Discharge of Non-Domestic Wastewater

List All Chemicals/Pollutants that may be, or have the potential to be, in the proposed Discharge

Describe any Wastewater Pretreatment Methods/Facilities/Devices to be used
Examples: Grease Traps or Interceptors, Oil/Water Separators, Neutralization Tanks, Chemical Precipitation

	Existing Discharge (GPD)	Proposed Discharge (GPD)
Restrooms (Domestic)		
Non-Domestic		
Cooling Tower		

I certify that the information provided is true and represents, to the best of my knowledge, the information requested. I also acknowledge that I am qualified to make this certification.

Name	Title	Date
------	-------	------

Guidance and Instructions for Completing NOI Form

The purpose of the Notice of Intent form is to provide information to the County regarding the nature of wastes that may be discharged into the sanitary sewer. All commercial and industrial customers connected to the sanitary sewer are subject to the local discharge limitations established in Section 14-125 of the County Code. Additionally, a surcharge for strong wastes may be applied to the customer's water/sewer bill. By knowing the nature of the wastes during the design phase, problems with violations of the code and excessive strong waste charges can be reduced.

The following information is provided with the intent of facilitating the completion of the Notice of Intent form. Complete and accurate information will minimize any delays in the plan approval process.

1. Project Name should be consistent with the name shown on the construction drawings or Building Permit application under review.
2. Street Address refers to the actual location of the project in Goochland County.
3. Existing Discharge/Account # refers to an existing water/sewer account used for billing. If the proposed discharge is an addition to a master metered account, please include that account number.
4. SIC codes, or Standard Industrial Classification codes, are 4-digit codes established by the Office of Management and Budget. They have now been replaced by the 6-digit NAICS Codes, or North American Industry Classification System. If you know your SIC code, or your NAICS code, and most industries are aware of them, provide it at the location specified, otherwise, leave it blank.
5. The section asking for the Specific Nature of the Business is very important. Knowing the nature of the business will facilitate the determination of potential impact on the sewer. Single references to "retail," "manufacturing," or "service company" should be avoided. Instead, describe the business as "convenience store and carwash," "Office/warehouse space for future tenants," "fast food restaurant," or "office building with cafeteria."
6. If the project will result in a discharge from restrooms only, such as an office building without a cafeteria or retail sales store, so indicate, sign the form and return it to the County. Otherwise, complete page two. The form will be returned if incomplete, therefore, all spaces that are "not applicable" should be marked "N/A."
7. Page two of the NOI form is to be completed where there will be a discharge of wastewater **other than from restrooms**. Service stations with oil/water separators, car washes, restaurants, water purification companies with resin generation facilities, chemical mixing or printing companies are just a few examples of businesses that generate wastes other than restroom wastes.

If you have any questions pertaining to the completion of this form please contact the County Engineer.

STANDARD DETAILS
GOOCHLAND COUNTY, VIRGINIA
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GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

CARRIER PIPE DIAMETER	CASING PIPE		
	CASING PIPE DIAMETER	MINIMUM WALL THICKNESS	
		CRITERIA WITHIN RAILROAD RIGHT OF WAY	CRITERIA WITHIN VDOT RIGHT OF WAY
		STEEL WITHOUT COATING	STEEL
6"	16"	0.281"	0.313"
8"	20"	0.344"	0.313"
10"	20"	0.344"	0.313"
12"	24"	0.375"	0.313"
15"	24"	0.375"	0.313"
* 16"	30"	0.469"	0.375"
18"	30"	0.469"	0.375"
20"	30"	0.469"	0.375"
21"	30"	0.469"	0.375"
24"	36"	0.532"	0.375"
30"	42"	0.625"	0.500"
33"	42"	0.625"	0.500"
36"	48"	0.688"	0.500"
42"	54"	0.781"	0.500"

STEEL CASING PIPE SHALL BE ASTM 1-139, GRADE B.

NOTES:

1. SLOPES THROUGH BORES SHALL NOT BE BASED ON MINIMUM GRADE UNLESS IT IS THE ONLY SLOPE AVAILABLE.
 2. INCREASING THICKNESS OF CASING MUST BE CONSIDERED WHERE BORE LENGTHS EXCEED 125'.
 3. WHEN USING STEEL CASING, A MINIMUM OF .500" THICKNESS IS REQUIRED WHERE GROUND COVER OVER PIPE EXCEED 15'.
 4. CONTRACTOR SHALL MAKE AN EFFORT TO BORE IN THE APPROPRIATE DIRECTION BASED ON EXISTING SOIL CONDITIONS. ENGINEER MUST SHOW LOCATION AND SIZE OF BORE PIT; AND LOCATION AND SIZE OF PERMANENT AND CONSTRUCTION EASEMENT.
 5. WHERE RESTRAINING DEVICES ARE REQUIRED FOR THE CARRIER PIPE, THE CASING PIPE SHALL BE INCREASED AS NECESSARY.
 6. MINIMUM CASING DIAMETER SHALL PROVIDE A MINIMUM CLEARANCE OF 4" ALL AROUND JOINT RESTRAINTS HARDWARE.
- * WHERE PIPE IS RESTRAINED, APPROVED RESTRAINED JOINT PIPE MAY BE USED IN A 24" CASING PIPE TO AVOID HAVING TO INSTALL A 30" CASING PIPE.

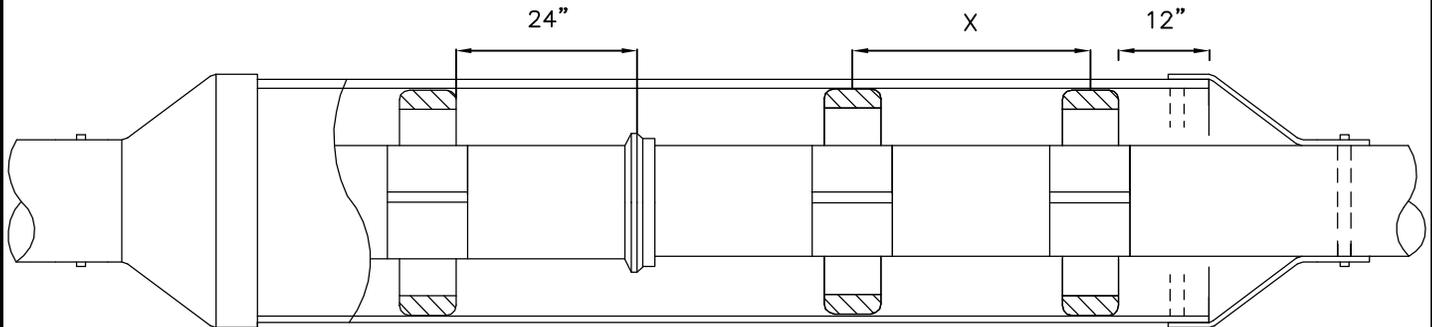
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CASING PIPE REQUIREMENTS

DRWG. NO.
CAS-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

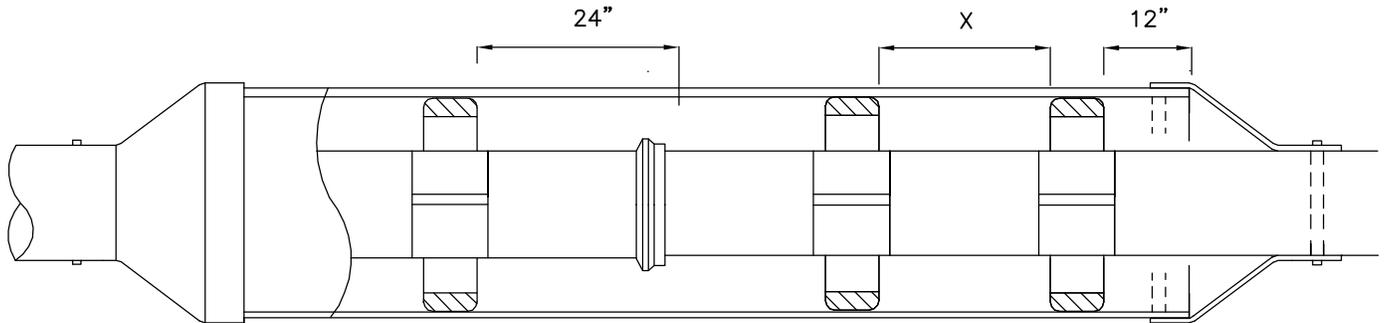
1. CASING SPACERS FOR GRAVITY SEWER LINES SHALL BE OFFSET TO COMPENSATE FOR ANY DIFFERENCE IN THE REQUIRED SLOPE OF THE CARRIER PIPE AND SLOPE OF THE CASING PIPE IF CASING PIPE DOES NOT HAVE THE SAME SLOPE OF THE REQUIRED CARRIER PIPE SLOPE.
2. THREE CASING SPACERS SHALL BE ATTACHED TO EACH JOINT OF CARRIER PIPE WITH ONE AT THE CENTER AND ONE NOT MORE THAN 24" FROM EACH END.
3. ONE CASING SPACER SHALL BE LOCATED NOT MORE THAN 12" FROM EACH END OF THE PIPE CASING.
4. CARRIER PIPE SHALL BE POSITIONED AND RESTRAINED WITHIN CASING TO COMPLY WITH GRADE REQUIREMENTS BY AN APPROVED STAINLESS STEEL CASING SPACER.
5. LINES TO BE ENCASED UNDER STATE ROADS/RAILROADS WILL COMPLY WITH COUNTY AND ANY APPLICABLE VDOT/AMERICAN RAILROAD ENGINEERING SPECIFICATIONS, WHICHEVER IS MORE STRINGENT.
6. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
7. STEEL CASING PIPE SHALL BE ASTM-139, GRADE B. WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI.
8. CARRIER PIPE WITHIN CASING FOR SANITARY SEWER INSTALLATION SHALL BE DUCTILE IRON (CLASS 52) AND IS TO BE USED FROM MANHOLE TO MANHOLE.
9. CASING SHALL BE SEALED BY USE OF WRAPAROUND END SEALS.

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CASING DETAIL FOR GRAVITY SEWER LINES

DRWG. NO. CAS-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. CARRIER PIPE SHALL BE CENTERED WITHIN CASING BY AN APPROVED STAINLESS STEEL CASING SPACER.
2. CASING PIPE SHALL BE SEALED BY USE OF WRAPAROUND END SEALS.
3. THREE CASING SPACERS SHALL BE ATTACHED TO EACH JOINT OF CARRIER PIPE WITH ONE AT THE CENTER AND ONE NOT MORE THAN 24" FROM EACH END.
4. ONE CASING SPACER SHALL BE LOCATED NOT MORE THAN 12" FROM EACH END OF CASING PIPE.
5. VALVES OR OTHER CONTROL/MAINTENANCE EQUIPMENT ATTACHED TO WATERLINE/SEWER FORCE MAINS SHALL BE LOCATED A MINIMUM FOUR PIPE LENGTHS FROM THE END OF THE CASING, OR AS APPROVED BY THE COUNTY.
6. LINES TO BE ENCASED UNDER STATE ROADS/RAILROADS WILL COMPLY WITH COUNTY AND ANY APPLICABLE VDOT/AMERICAN RAILROAD ENGINEERING SPECIFICATIONS WHICHEVER IS MORE STRINGENT.
7. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
8. STEEL CASING PIPE SHALL BE ASTM-139, GRADE B WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI.
9. ALL WATERLINES IN CASING SHALL BE A MINIMUM CLASS 52 DUCTILE IRON WITH M.J. BELLS AND AN APPROVED MECHANICAL JOINT RESTRAINT DEVICE AT EACH M.J. CONNECTION. ALL JOINTS FOR A DISTANCE OF THREE FULL PIPE LENGTHS OUTSIDE EACH END OF CASING SHALL BE M.J. DUCTILE IRON WITH RESTRAINED JOINTS. AS AN ALTERNATIVE, APPROVED RESTRAINED JOINT PIPE MAY BE USED.

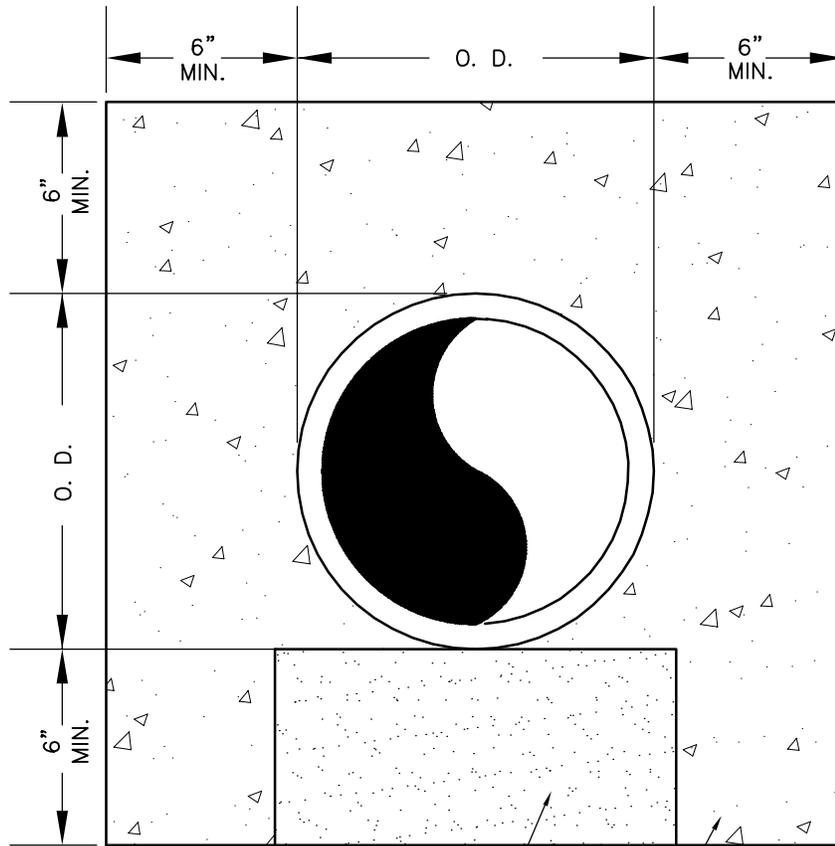
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CASING DETAIL FOR WATER LINES & SEWER FORCE
MAINS

DRWG. NO.
CAS-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



SOLID CONCRETE BLOCK SUPPORT
(MINIMUM OF ONE PER PIPE LENGTH)

3000# CONCRETE

NOTES:

1. ALL CONCRETE ENCASEMENTS MUST BE FORMED AND INSPECTED BY DPU INSPECTOR PRIOR TO PLACING CONCRETE AND BACKFILLING.
2. AT STREAM CROSSINGS, ENCASEMENT SHALL EXTEND A MINIMUM OF TEN FEET (10') ON EITHER SIDE OF THE CROSSING.

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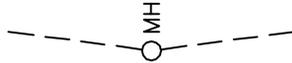
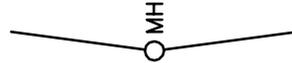
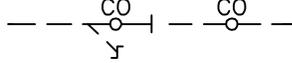
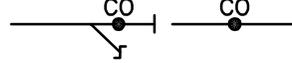
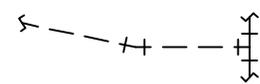
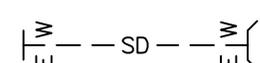
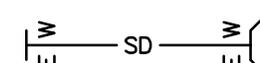
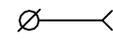
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PIPE ENCASEMENT DETAIL

DRWG. NO.

CAS-4

GOOCHLAND COUNTY
DEPARTMENT OF UTILITIES

DESCRIPTION OF UTILITY	SYMBOL FOR EXISTING	SYMBOL FOR PROPOSED
SANITARY SEWER	- - - - SAN - - - -	———— SAN ————
MANHOLE		
CLEANOUT		
SEWAGE FORCE MAIN	- - - - FM - - - -	———— FM ————
WATER MAIN OR SERVICE LINE	- - - - W - - - -	———— W ————
VALVE	- - - - ⊗ - - - -	———— ⊗ ————
VALVE (ALTERNATIVE TO THE ABOVE)	- - - - ✕ - - - -	———— ✕ ————
METER	- - - - ○ ^M - - - -	———— ○ ^M ————
FIRE HYDRANT	- - - - ⊙ FH	———— ● FH
REDUCER	- - - - ▷ - - - -	———— ▷ ————
PIPE FITTINGS & REACTION BLOCKING		
PIPE END CAP OR PLUG	- - - - ⊔ > - - - -	———— ⊔ > ————
GAS MAIN OR SERVICE LINE	- - - - G - - - -	———— G ————
STORM DRAIN WITH ENDWALLS		
POWER LINE	- - - - P - - - -	———— P ————
TELEPHONE LINE	- - - - T - - - -	———— T ————
CABLE TV LINE	- - - - CTV - - - -	———— CTV ————
UNDERGROUND LINE	- - - - U/G - - - -	———— U/G ————
OVERHEAD LINE	- - - - O/H - - - -	———— O/H ————
UTILITY POLE WITH GUY & ANCHOR		

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STANDARD SYMBOLS FOR UTILITY DRAWINGS

DRWG. NO.
DES-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

		PIPE SIZE (IN.)													
		8	10	12	15	18	21	24	27	30	33	36	42	48	
MANHOLE SIZE (IN.)	48	8	46	48	51	55	60	63	67						
		10		51	53	58	62	65	70						
		12			55	60	65	67	72						
		15				65	69	72	77						
		18					74	77	82						
		21						79	84						
		24							89						
	60	12	40	42	44	48	52	54	58	60	63	65			
		15	44	46		52	56	58	61	63	67	69			
		18	48	50			59	61	65	67	71	73			
		21	50	52				63	67	69	73	75			
		24	54	56					71	73	77	79			
		27	56	58						75	79	81			
		30	60	61							83	84			
	72	33	61	63								86			
		15	37	38	40	43	46	48	51	53	56	58	61		
		18	40	42	43		49	51	54	56	59	61	64		
		21	42	43	45			53	56	58	61	62	66		
		24	45	46	48				59	61	64	66	69		
		27	37	38	40					53	56	58	61		
		30	50	51	53						69	70	74		
	84	33	51	53	54							72	75		
		36	54	56	58								78		
		18	34	36	37	40	42	44	47	48	51	52	55	59	63
21		36	37	38	41		45	48	49	52	53	56	60	64	
24		38	40	41	44			51	52	55	56	59	63	67	
27		40	41	43	45				53	56	58	60	64	68	
30		43	44	45	48					59	60	63	67	71	
33	44	45	47	49						62	64	68	73		
96	36	47	48	49	52							67	71	75	
	42	51	52	53	56								75	79	
	48	55	56	58	60									83	
	54	48	49	50	53	55	56	59	60	62	64	66	69	73	

MINIMUM ANGLE DERIVED BY:

$$\frac{\left(\frac{H_1}{2} + \frac{H_2}{2} + 7\right)}{\pi * MH \text{ DIAM}} * 360$$

Where H = Hole sizes for DIP per hole sizing chart on MAN 1-2

NOTES:

1. MINIMUM ANGLES ARE BASED ON KOR-N-SEAL STAINLESS STEEL WEDGE CONNECTOR HOLE SIZES FOR DUCTILE IRON OUTSIDE DIAMETERS
2. FOR PIPES OTHER THAN DI, THE ANGLE SHALL BE CALCULATED BASED UPON KOR-N-SEAL HOLE SIZING CHART
3. SEE MAN-1 SHEET 2 FOR KOR-N-SEAL HOLE SIZING CHART

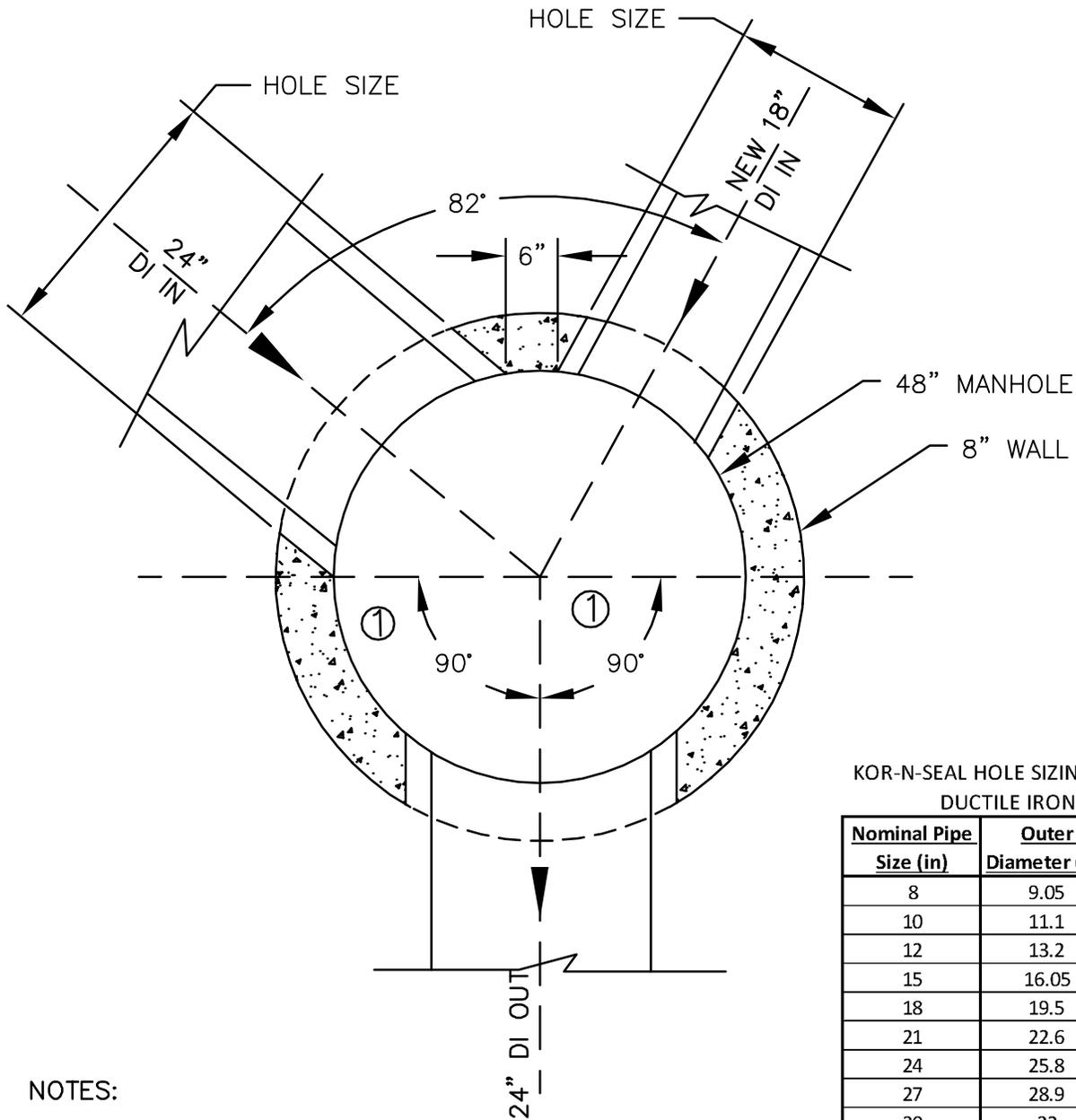
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MANHOLE MINIMUM ANGLE TABLE

DRWG. NO.
MAN-1
SHEET 1 OF 2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



KOR-N-SEAL HOLE SIZING CHART FOR
DUCTILE IRON PIPE

Nominal Pipe Size (in)	Outer Diameter (in)	Hole Size (in)
8	9.05	12.2
10	11.1	14.2
12	13.2	16.15
15	16.05	20.1
18	19.5	24.1
21	22.6	26.2
24	25.8	30.2
27	28.9	32.2
30	32	36.2
33	35.2	38.2
36	38.3	42.2
42	44.45	48.2
48	50.8	54.2

NOTES:

1. MINIMUM ANGLE BETWEEN INFLUENT AND EFFLUENT PIPES IS 90°, EXCEPT BY SPECIAL DESIGN.

EXAMPLE: 48" MANHOLE, EXISTING 24" DI IN, EXISITING 24" DI OUT, NEW 18" DI IN, ALL CONCRETE. MAN-1 TABLE INDICATES A MINIMUM ANGLE OF 82° BETWEEN THE EXISTING 24" (IN)AND THE NEW 18"DI (IN), RESULTING IN APPROXIMATE 6" OF INTERIOR MANHOLE WALL REMAINING BETWEEN THE 2 PIPES.

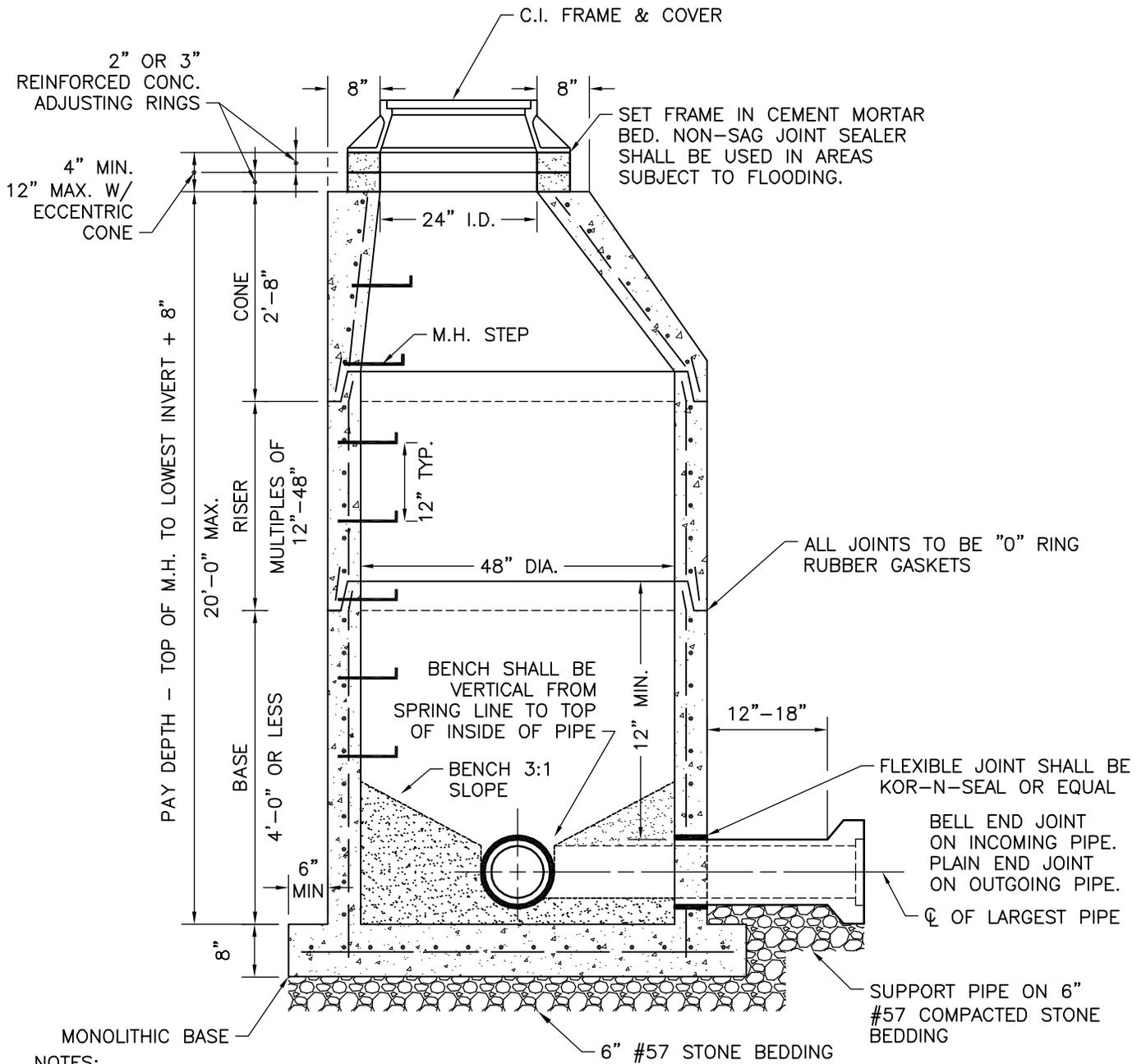
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MANHOLE SIZING

DRWG. NO.
MAN - 1
SHEET 2 OF 2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. BENCH MAY BE CONC. OR BRICK AND MORTAR.
2. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FUTURE CONNECTION BENCH SHALL BE FORMED.
3. DO NOT PLACE STEPS ON DOWNSTREAM SIDE OF MANHOLE.
4. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE.
5. 24" MAXIMUM PIPE SIZE.
6. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
7. INLET PIPE SHALL BE 0.10 MINIMUM ABOVE OUTLET PIPE UNLESS INDICATED GREATER ON DRAWING.

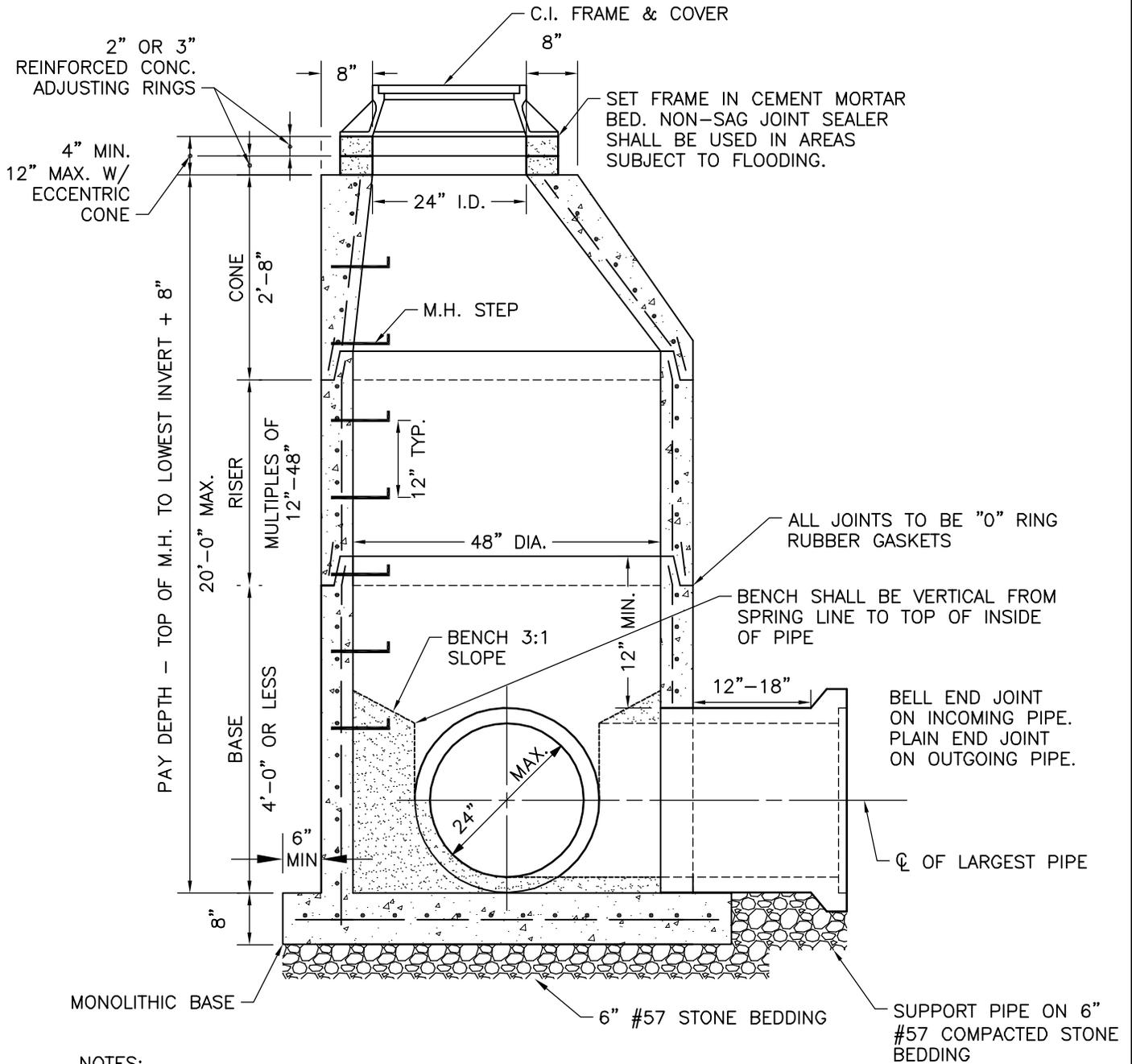
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4' INSIDE DIAMETER
STANDARD PRECAST CONCRETE MANHOLE

DRWG. NO.
MAN-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. BENCH MAY BE CONC. OR BRICK AND MORTAR.
2. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FUTURE CONNECTION BENCH SHALL BE FORMED.
3. DO NOT PLACE STEPS ON DOWNSTREAM SIDE OF MANHOLE.
4. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE.
5. 24" MAXIMUM PIPE SIZE.
6. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
7. INLET PIPE SHALL BE 0.10 MINIMUM ABOVE OUTLET PIPE UNLESS INDICATED GREATER ON DRAWING.

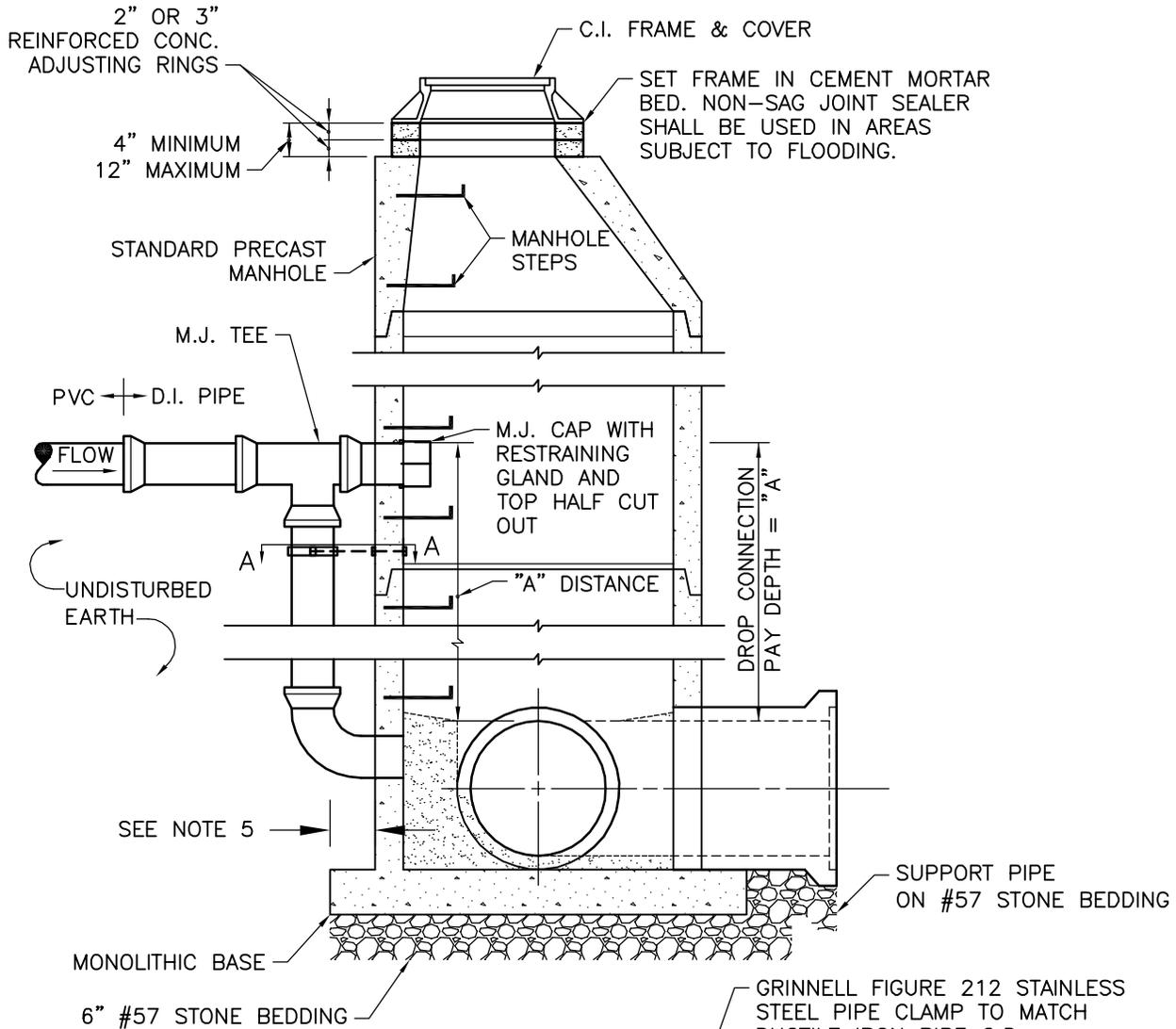
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STANDARD PRECAST CONCRETE MANHOLE
SEWERS 18", 21" AND 24"

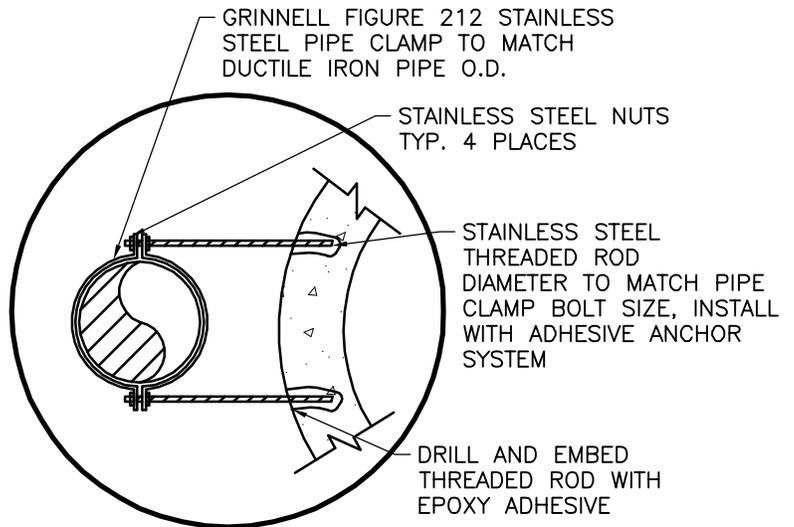
DRWG. NO.
MAN-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. WHERE "A" DISTANCE IS GREATER THAN 2'-6" USE STANDARD DROP CONNECTION.
2. ALL DROP PIPE SHALL BE DUCTILE IRON.
3. PAY DEPTH - TOP OF M.H. TO LOWEST INVERT + 8".
4. INLET PIPE SHALL BE 0.10 MINIMUM ABOVE OUTLET PIPE UNLESS INDICATED GREATER ON DRAWING.
5. DIMENSION IN INCHES = MANHOLE INSIDE DIAMETER IN FEET PLUS 2 INCHES
6. INSIDE TOP OF DROP PIPE SHALL BE EVEN WITH INSIDE TOP OF OUTLET PIPE



SECTION A-A

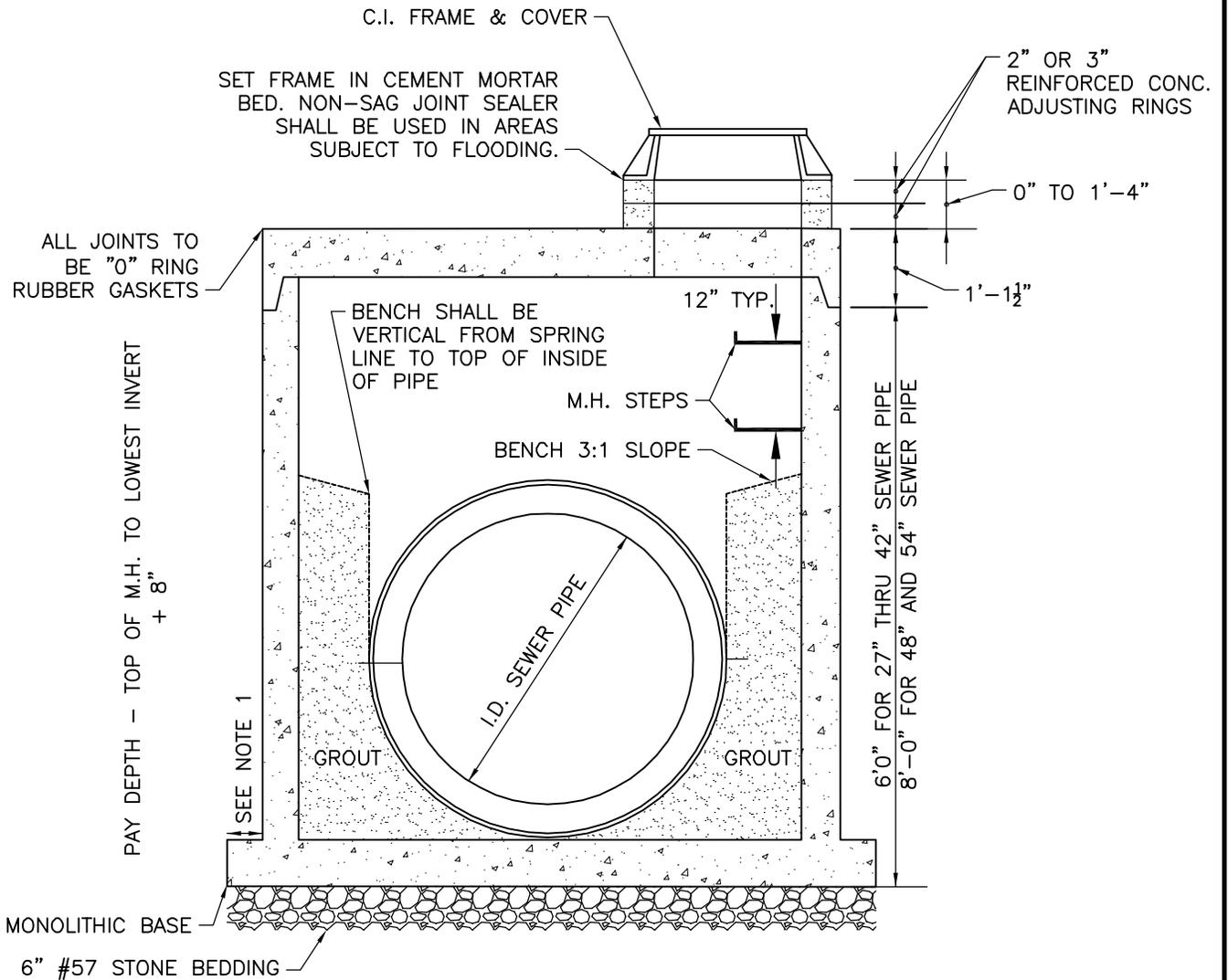
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OUTSIDE DROP CONNECTION

DRWG. NO.
MAN-4

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. DIMENSION (IN INCHES) = MANHOLE INSIDE DIAMETER (IN FEET) PLUS 2 INCHES
2. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
3. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FUTURE CONNECTIONS BENCH SHALL BE SO FORMED.
4. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE.

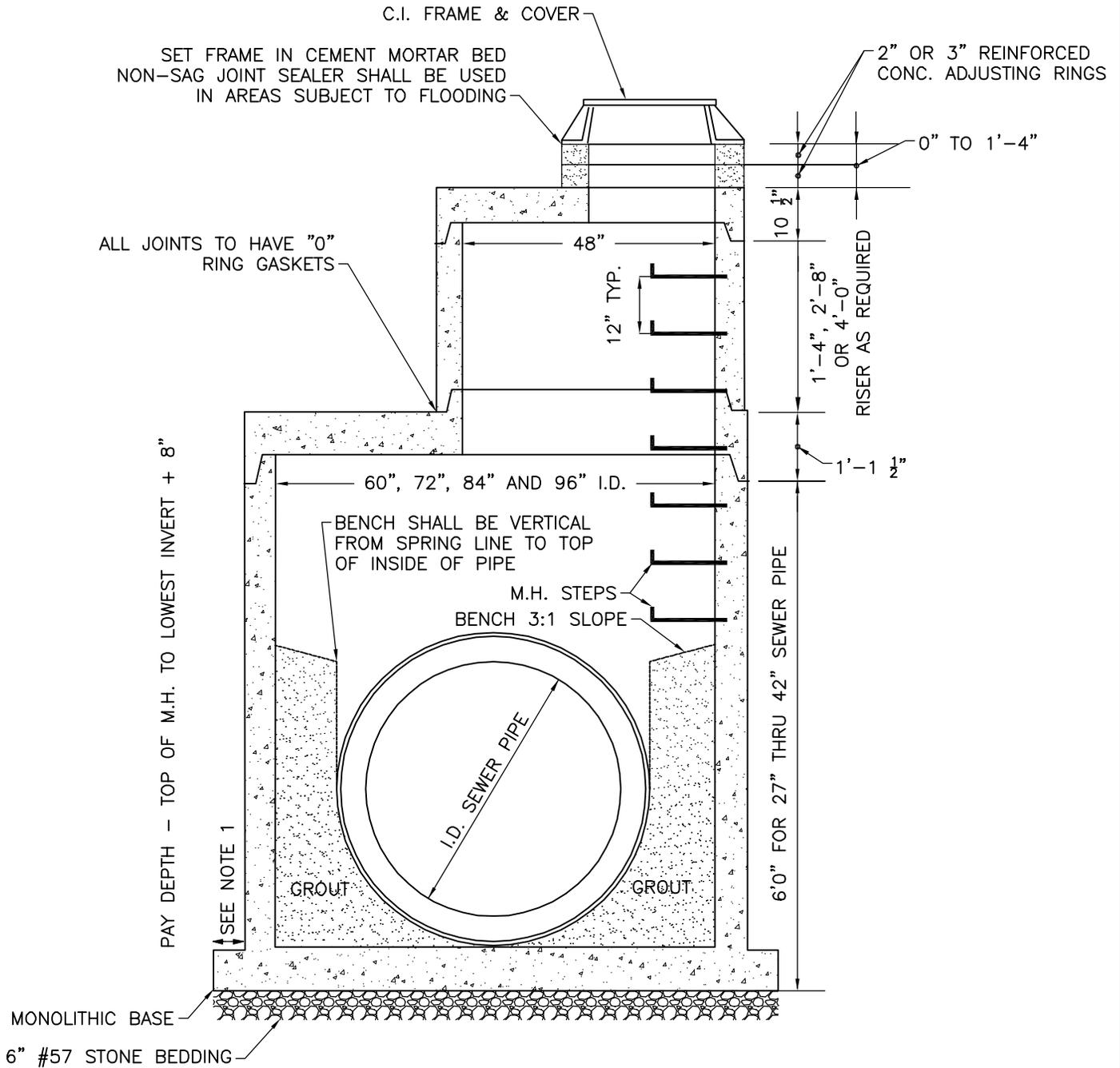
DATE:
OCT. 2014

REVISION:
OCT. 2014

60", 72", 84", AND 94" I.D. MANHOLE - 1

DRWG. NO.
MAN-5

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. DIMENSION (IN INCHES) = MANHOLE INSIDE DIAMETER IN FEET PLUS 2 INCHES
2. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
3. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FUTURE CONNECTIONS BENCH SHALL BE SO FORMED.
4. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE.

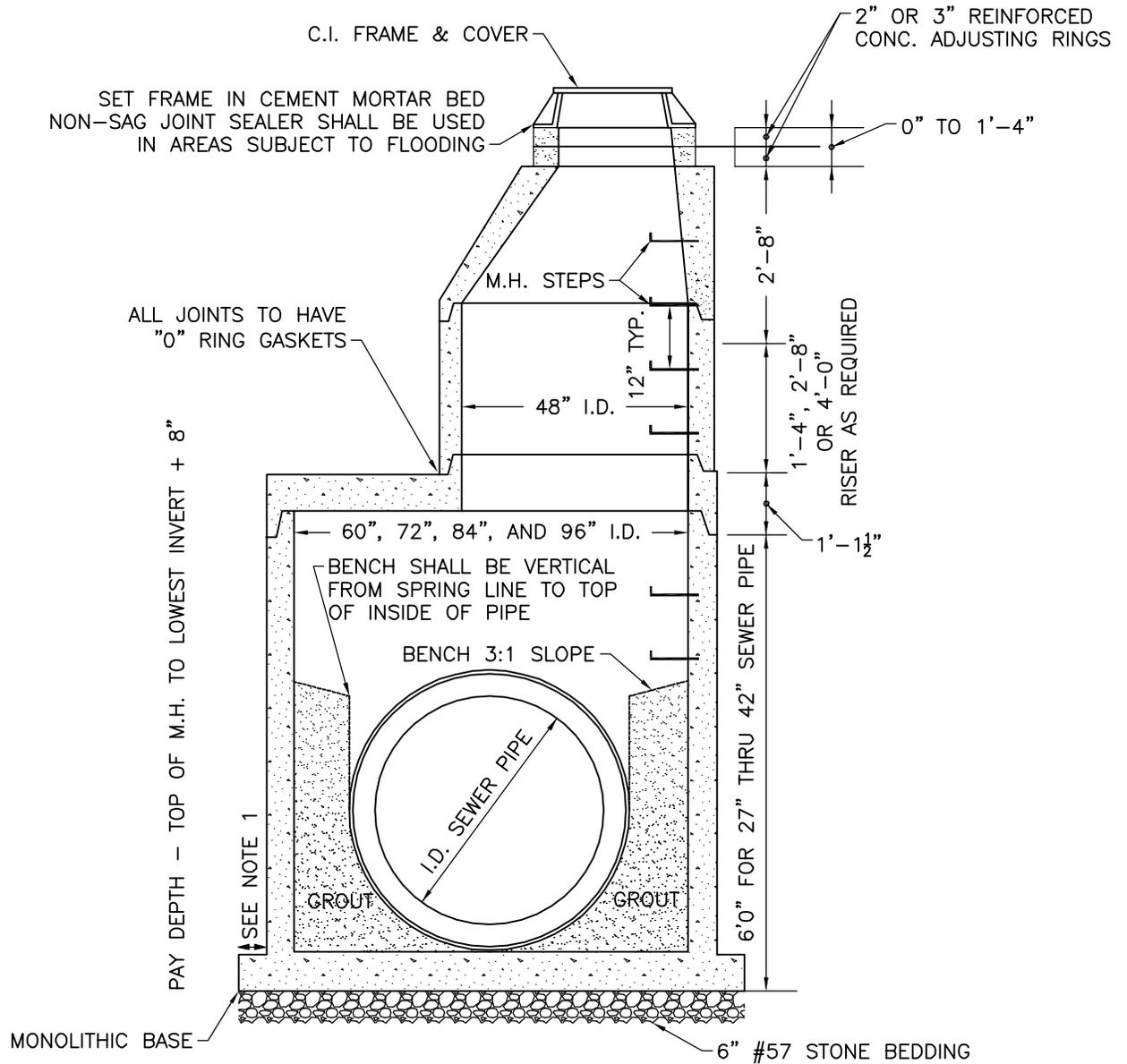
DATE:
OCT. 2014

REVISION:
OCT. 2014

60", 72", 84", AND 96" I.D. MANHOLE - 2

DRWG. NO.
MAN-6

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. DIMENSION (IN INCHES) = MANHOLE INSIDE DIAMETER IN FEET + 2 INCHES
2. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
3. WHERE STUBS OR KNOCKOUTS ARE PROVIDED FOR FUTURE CONNECTIONS BENCH SHALL BE SO FORMED.
4. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE.

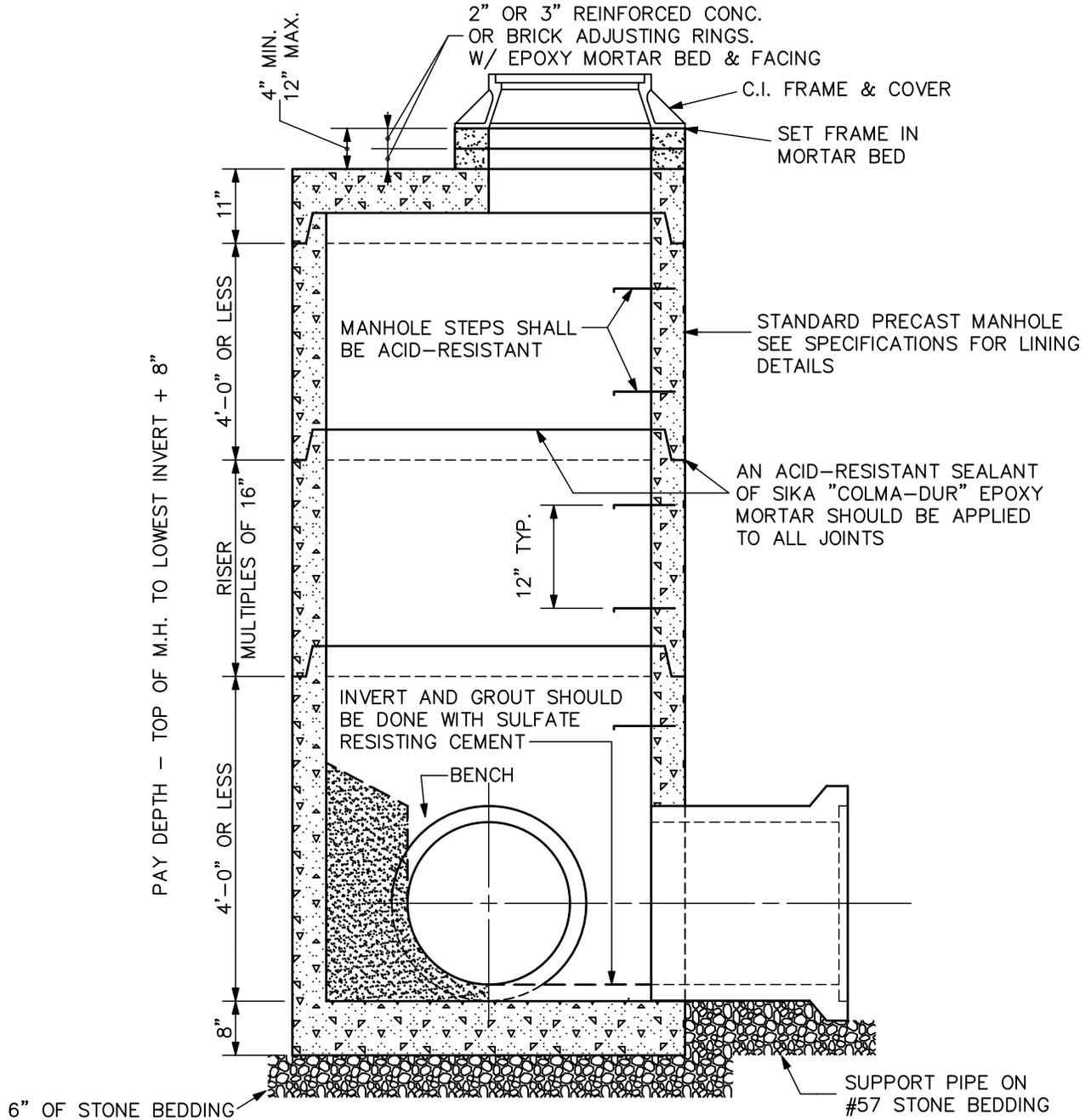
DATE:
OCT. 2014

REVISION:
OCT. 2014

60", 72", 84", AND 96" I.D. MANHOLE - 3

DRWG. NO.
MAN-7

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTE: ACID-RESISTANT MANHOLES SHALL BE USED WITHIN 1200 FT. DOWNSTREAM OF FORCE MAIN DISCHARGE. LINING SHALL BE IN ACCORDANCE WITH WRITTEN SPECIFICATIONS. JOINTS TO BE PACKED AND BRUSHED WITH SIKA "COLMA -DUR" EPOXY MORTAR. WHERE STUBS OR KNOCK-OUTS ARE PROVIDED FOR FUTURE CONNECTIONS BENCH SHALL BE SO FORMED. SEE DRWG. NO. MAN-1 FOR MANHOLE SIZING TABLE

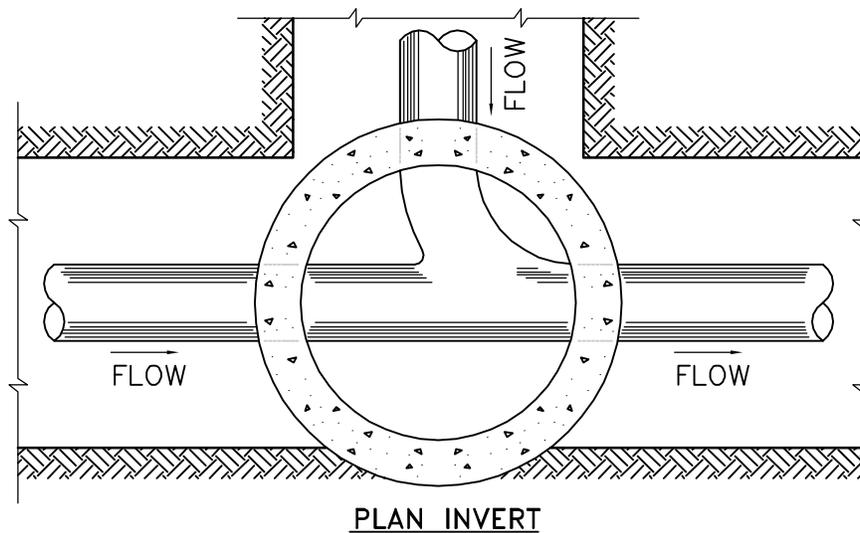
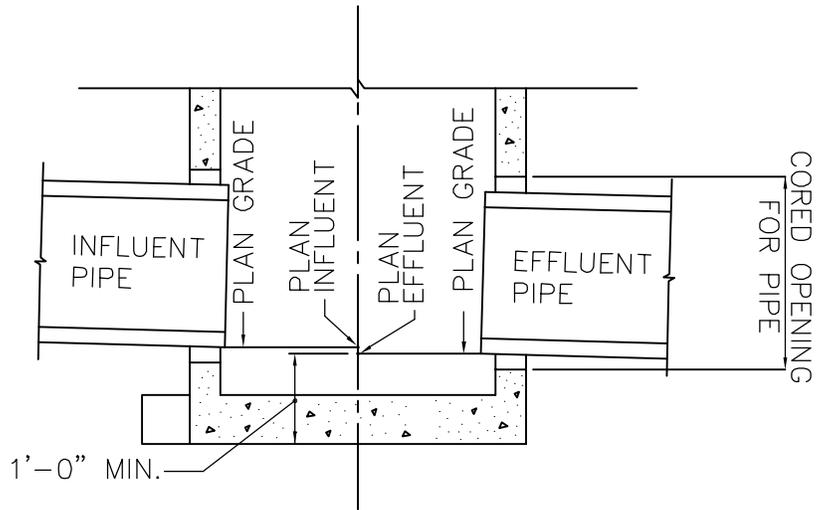
DATE:
OCT. 2014

REVISION:
OCT. 2014

SPECIAL ACID - RESISTANT LINING
ALL MANHOLES

DRWG. NO.
MAN-8

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



PLAN INVERT

NOTES:

1. THE EFFLUENT ELEVATION SHOWN AT A MANHOLE IS ESTABLISHED FROM THE INFLUENT ELEVATION OF THE MANHOLE IMMEDIATELY DOWNSTREAM BASED UPON PIPE SLOPE. ELEVATIONS SHOWN APPLY AT THE CENTERLINE OF MANHOLES AND ARE BASED ON THE HORIZONTAL DISTANCE, C.L. TO C.L. OF M.H., USING PERCENT OF GRADE INDICATED.
2. PIPE OPENINGS SHALL BE LOCATED TO BE CONCENTRIC WITH THE PIPE AT THE SPECIFIED INVERT
3. PIPE OPEN DIAMETER BE AS RECOMMENDED BY BOOT MANUFACTURER FOR THE PIPE OUTSIDE DIAMETER.
4. MINIMUM INVERT DROP SHALL BE 0.10 INCH UNLESS SPECIFIED OTHERWISE ON PLANS.

DATE:
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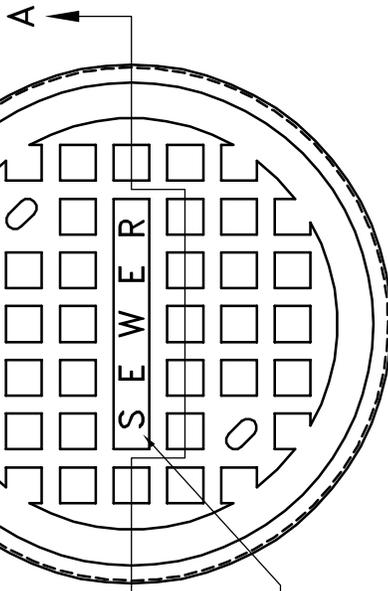
STANDARD INVERT DETAILS

DRWG. NO.
MAN-9

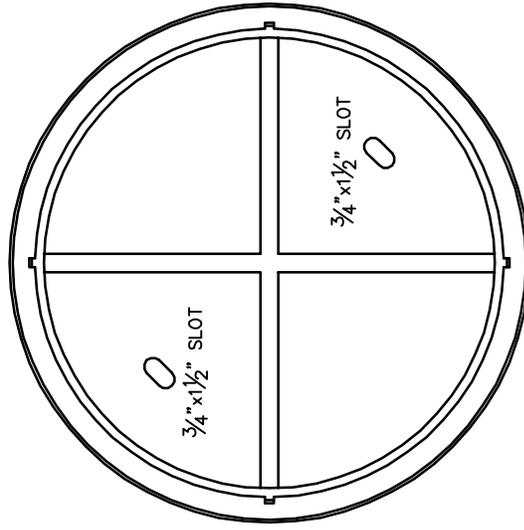
GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

FRAME AND COVER
SHALL BE CAST IRON
ASTM A-48 CLASS 30

NOTE:
MANHOLE COVER SHALL BE
PROVIDED WITH A CLEAR
OPENING OF 2'-0"

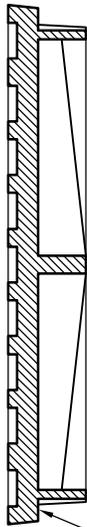


TOP



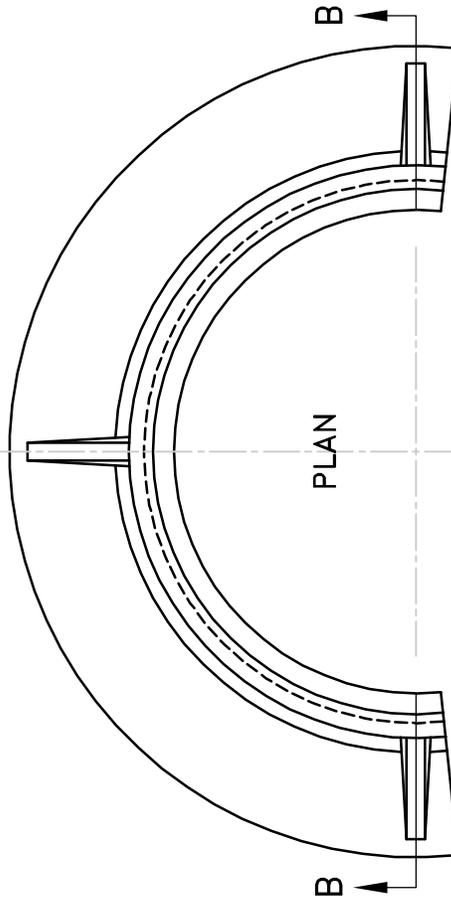
BOTTOM

THE LETTERS "SEWER" ARE TO BE
CAST IN THE DEPRESSION IN THE
TOP OF THE COVER, 1" WIDE AND
RAISED 3/8" HIGH AS SHOWN.



SECTION A-A

MACHINE



PLAN



SECTION B-B

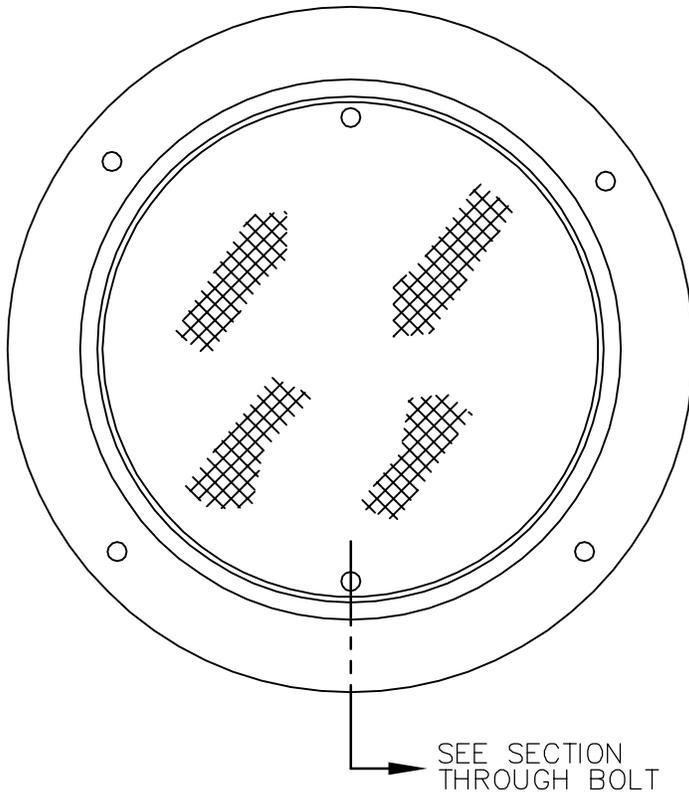
DATE:
OCT. 2014

REVISION:
OCT. 2014

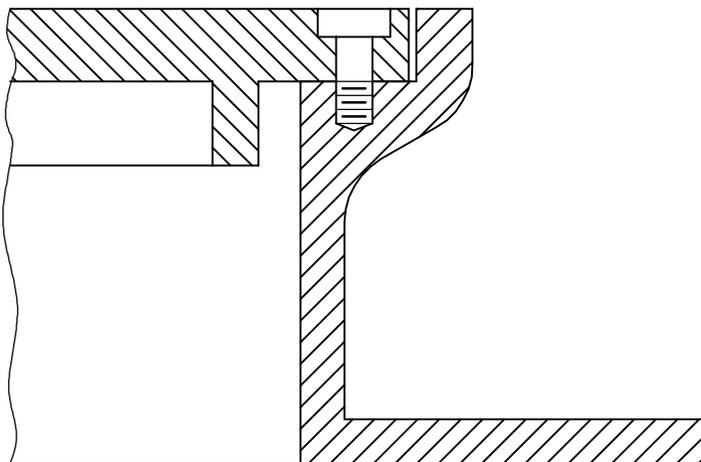
STANDARD MANHOLE FRAME & COVER

DRWG. NO.
MAN-10

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



COVER & FRAME



SECTION THROUGH BOLT

NOTES:

1. MANHOLE FRAME AND COVER SHALL BE SIMILAR TO CAPITOL FOUNDRY NO. MH1-S/VP, TYPE 1.
2. ALL HORIZONTAL BEARING AND VERTICAL DIAMETER SURFACES SHALL BE MACHINED.
3. FRAME SHALL BE SET IN 1/4" BED OF NON-SAG COLMA JOINT SEALER AND BOLTED TO THE MANHOLE CONE SECTION WITH 4 - 3/4" ANCHOR BOLTS & NUTS HOT DIPPED GALVANIZED.
4. VANDALPROOF MANHOLE COVERS SHALL BE USED IN EASEMENTS NOT IN FLOOD PLAIN AND WHERE SHOWN ON THE PLANS.

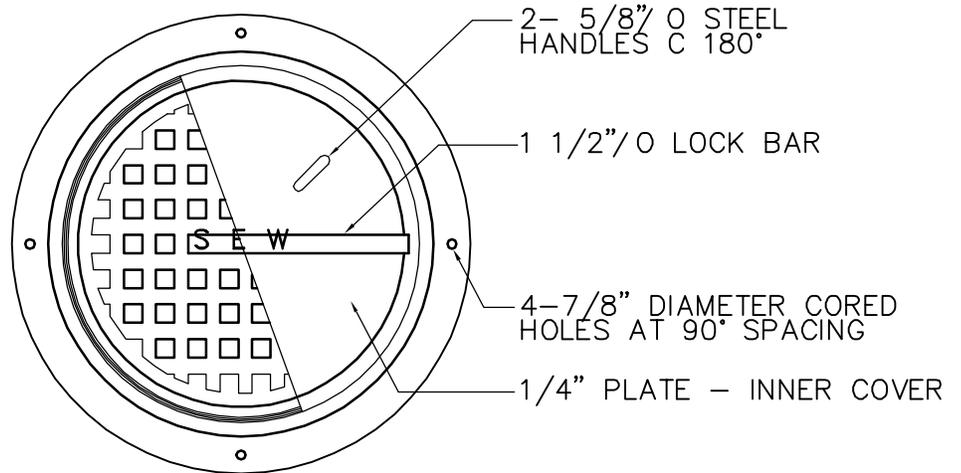
DATE:
OCT. 2014

REVISION:
OCT. 2014

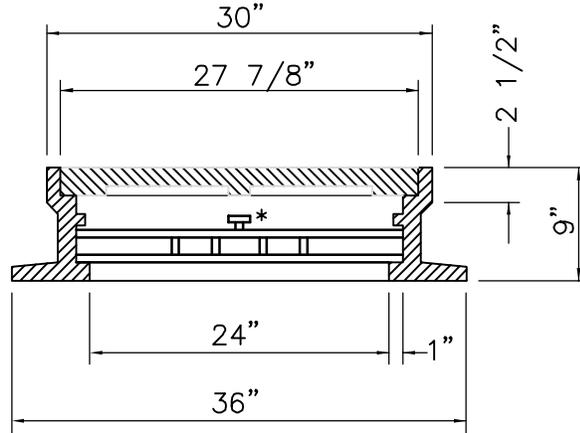
STANDARD VANDALPROOF
MANHOLE FRAME & COVER

DRWG. NO.
MAN-11

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



RECESSED PICK HOLE SHALL
NOT EXTEND CLEAR THRU
COVER



* BRONZE OR BRASS HEX.
HEAD BOLT WITH 5/8\"/>

STEEL INNER LOCK HANDLES
& LOCK BAR

1/4\"/>

MIN. WEIGHTS:	
FRAME	295 LBS.
COVER	230 LBS.
INNER COVER	46 LBS.
TOTAL	571 LBS.

NOTES:

1. FRAME SHALL BE SET IN 1/4\"/>
2. SEATING SURFACES BETWEEN FRAME & COVER SHALL BE MACHINED.
3. WATERTIGHT MANHOLE COVERS SHALL BE USED IN EASEMENTS SUBJECT TO FLOODING & WHERE SHOWN ON THE PLANS.
4. FRAME & COVERS SHALL BE SIMILAR TO CAPITOL FOUNDRY NO. MH1-S/WT TYPE 1.
5. COVER SHALL HAVE LETTERING AS SHOWN ON DRAWING NO. MAN-10.

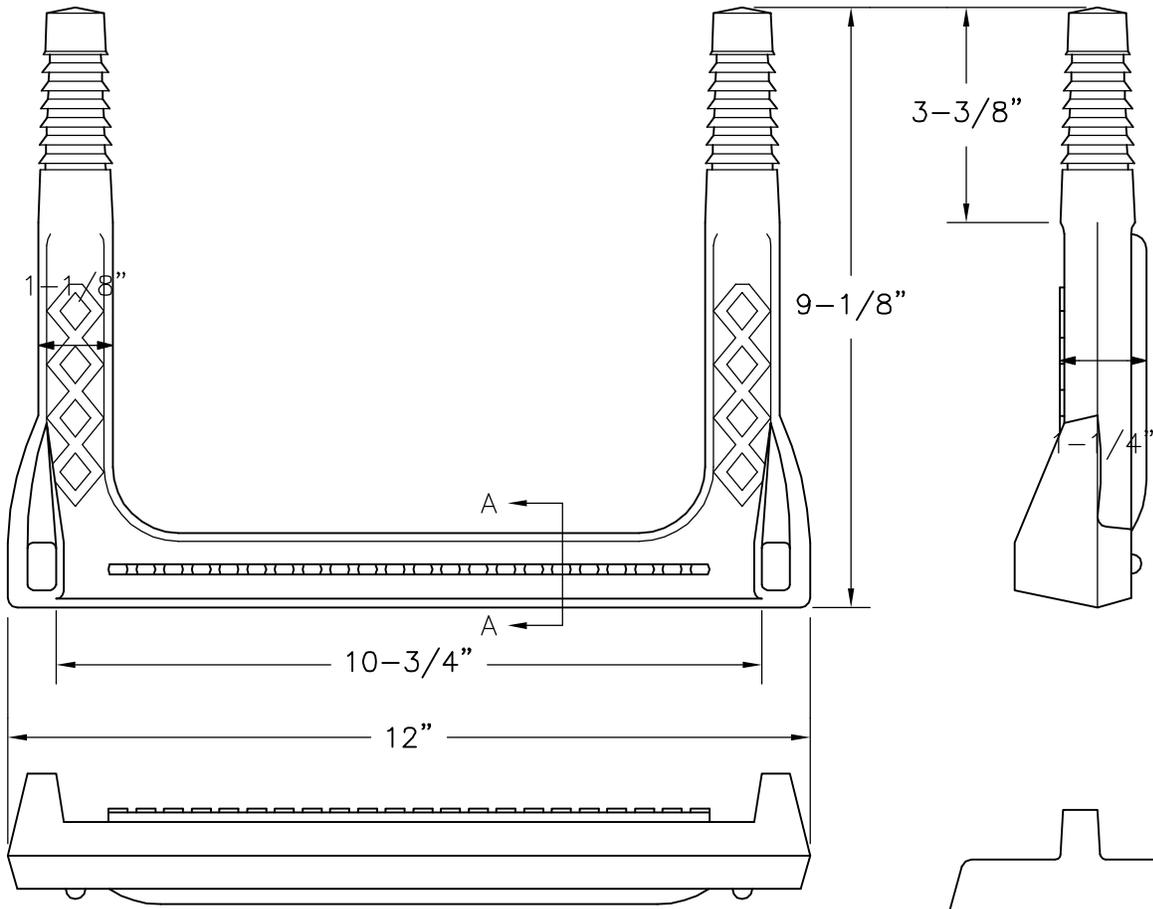
DATE:
OCT. 2014

REVISION:
OCT. 2014

CAST IRON
WATERTIGHT MANHOLE FRAME & COVER

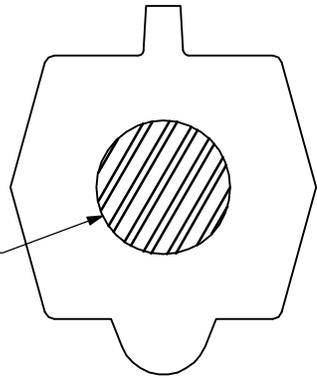
DRWG. NO.
MAN-12

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

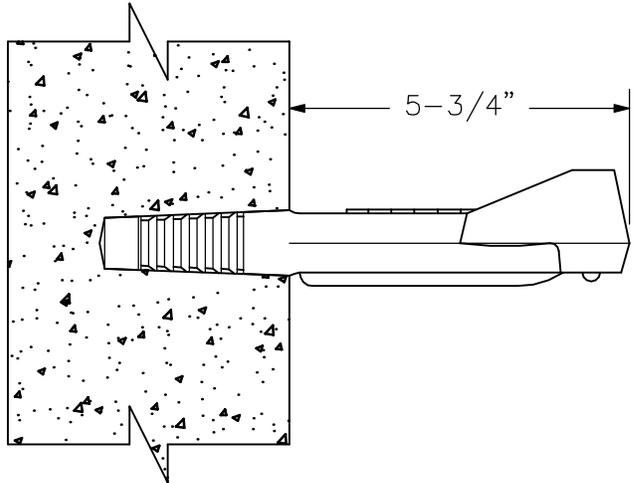


Copolymer Polypropylene Plastic

1/2" GRADE 60 STEEL REINFORCEMENT

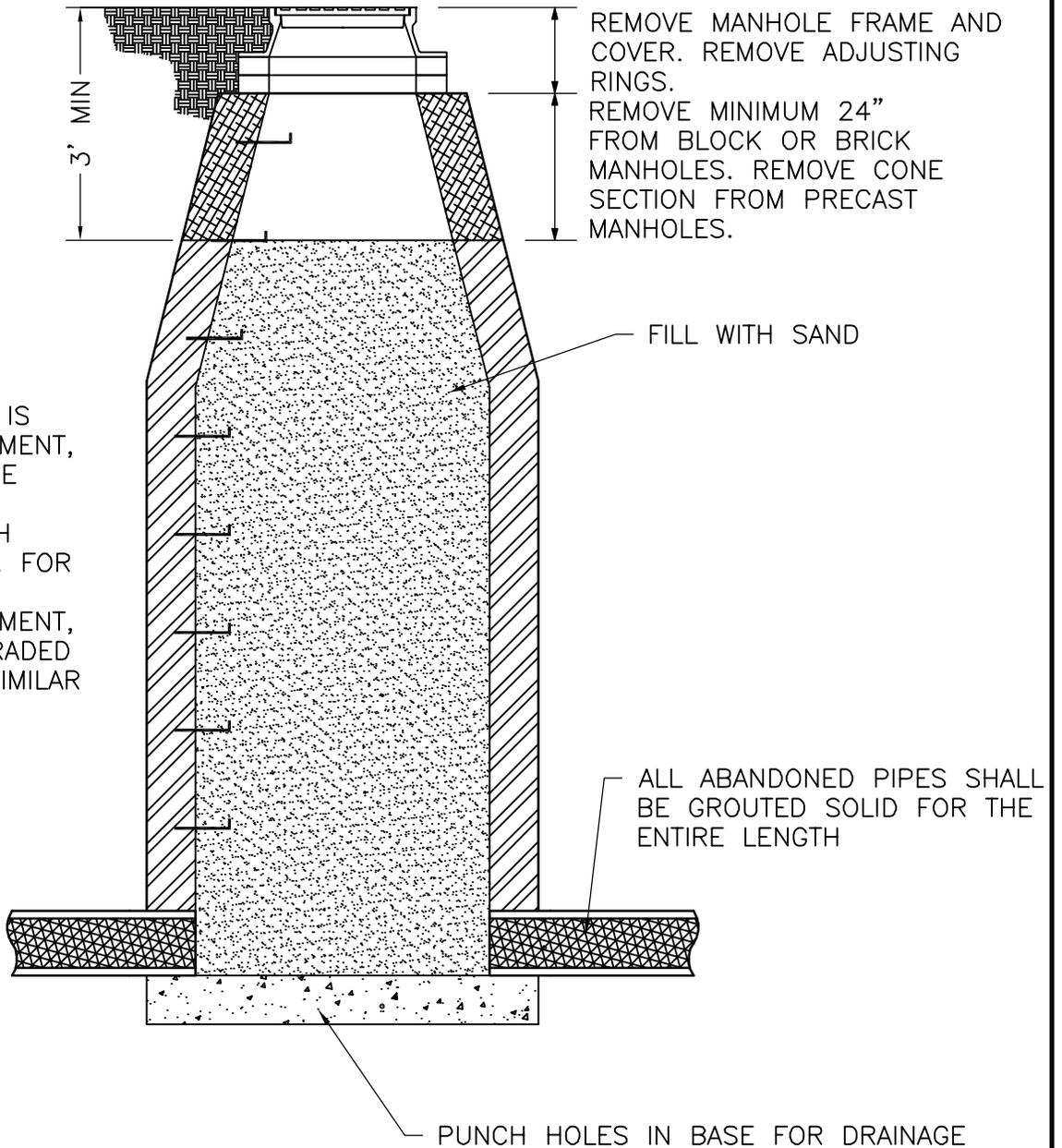


SECTION-A



DATE: OCT. 2014	STANDARD MANHOLE STEP	DRWG. NO.
REVISION: OCT. 2014		MAN-13

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



WHERE MANHOLE IS LOCATED IN PAVEMENT, PAVEMENT WILL BE RESTORED IN ACCORDANCE WITH VDOT STANDARDS. FOR MANHOLES NOT LOCATED IN PAVEMENT, AREA WILL BE GRADED AND RESTORED SIMILAR TO SURROUNDING CONDITIONS.

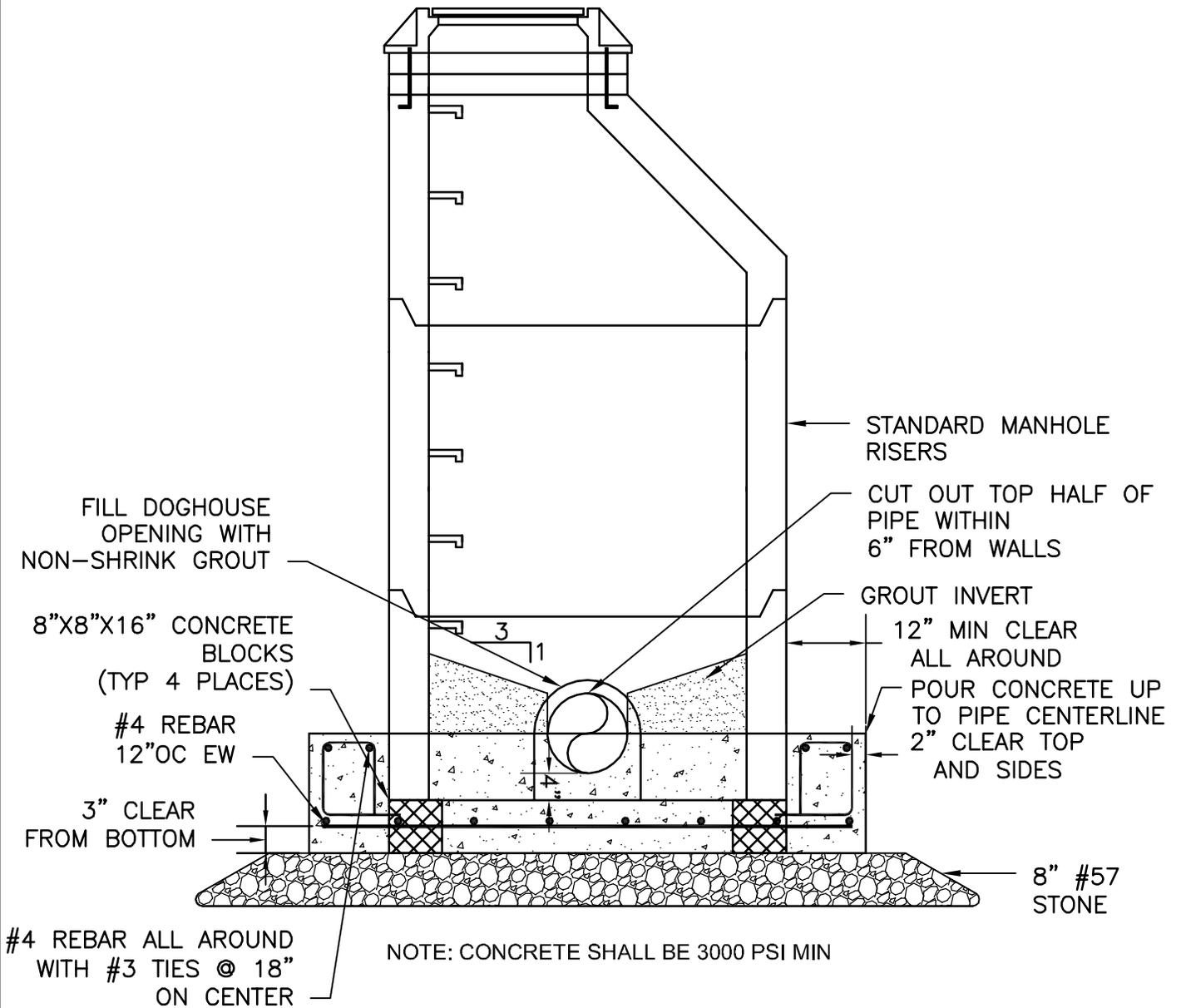
DATE:
OCT 2014

REVISION:
OCT 2014

ABANDONMENT OF MANHOLES

DRWG. NO.
MAN-14

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



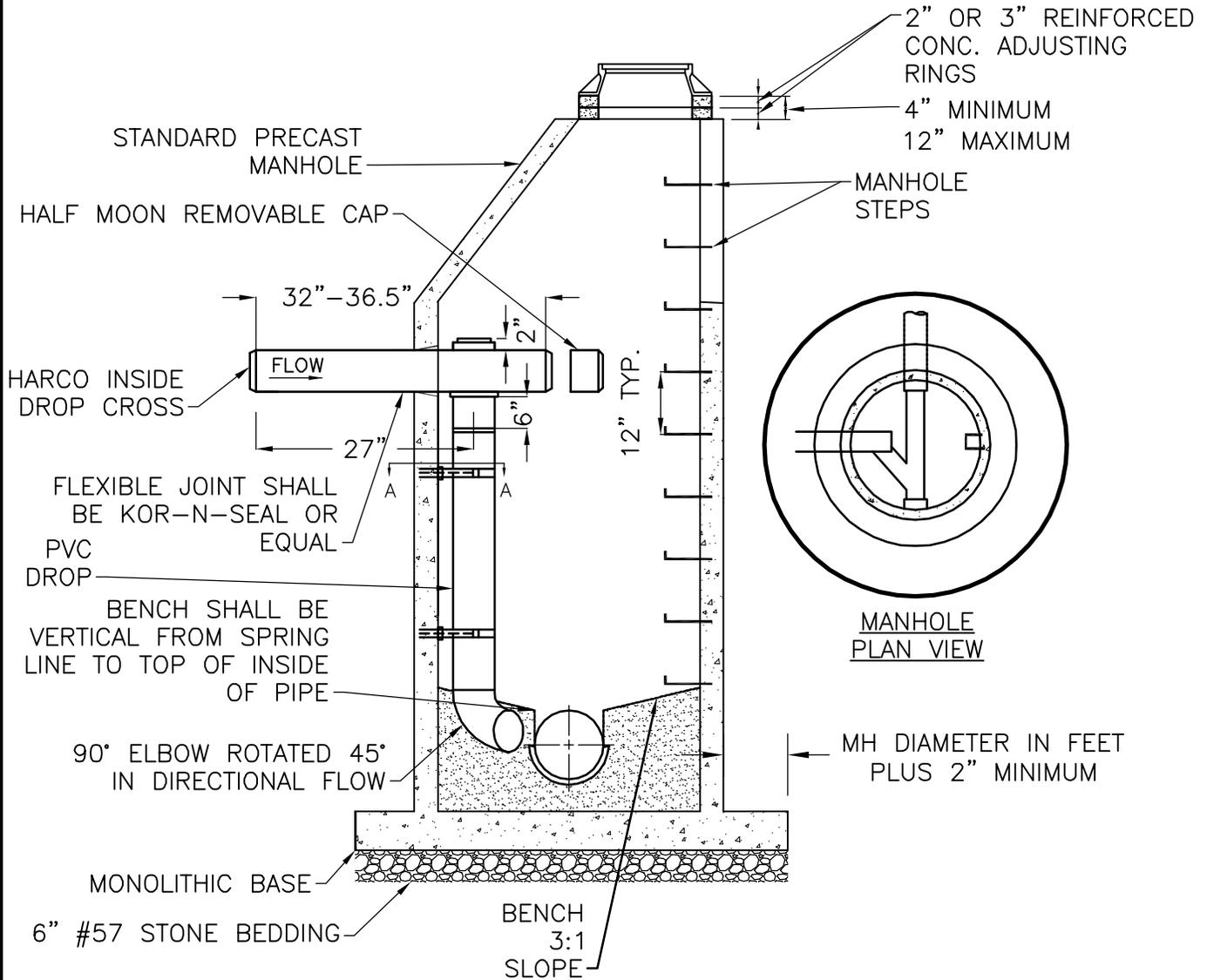
DATE:
OCT. 2014

REVISION:
OCT. 2014

DOGHOUSE MANHOLE

DRWG. NO.
MAN-15

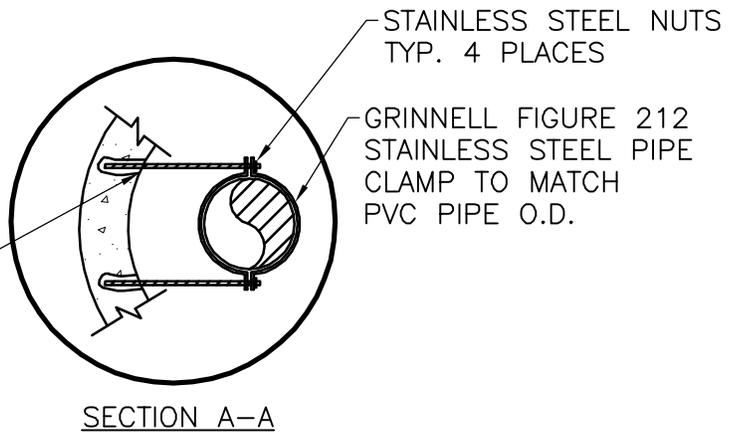
GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. PAY DEPTH - TOP OF M.H. TO LOWEST INVERT + 8".

DRILL AND EMBED STAINLESS STEEL THREADED ROD WITH EPOXY ADHESIVE. ROD SIZE TO MATCH GRINNELL FIGURE 212 BOLT SIZE



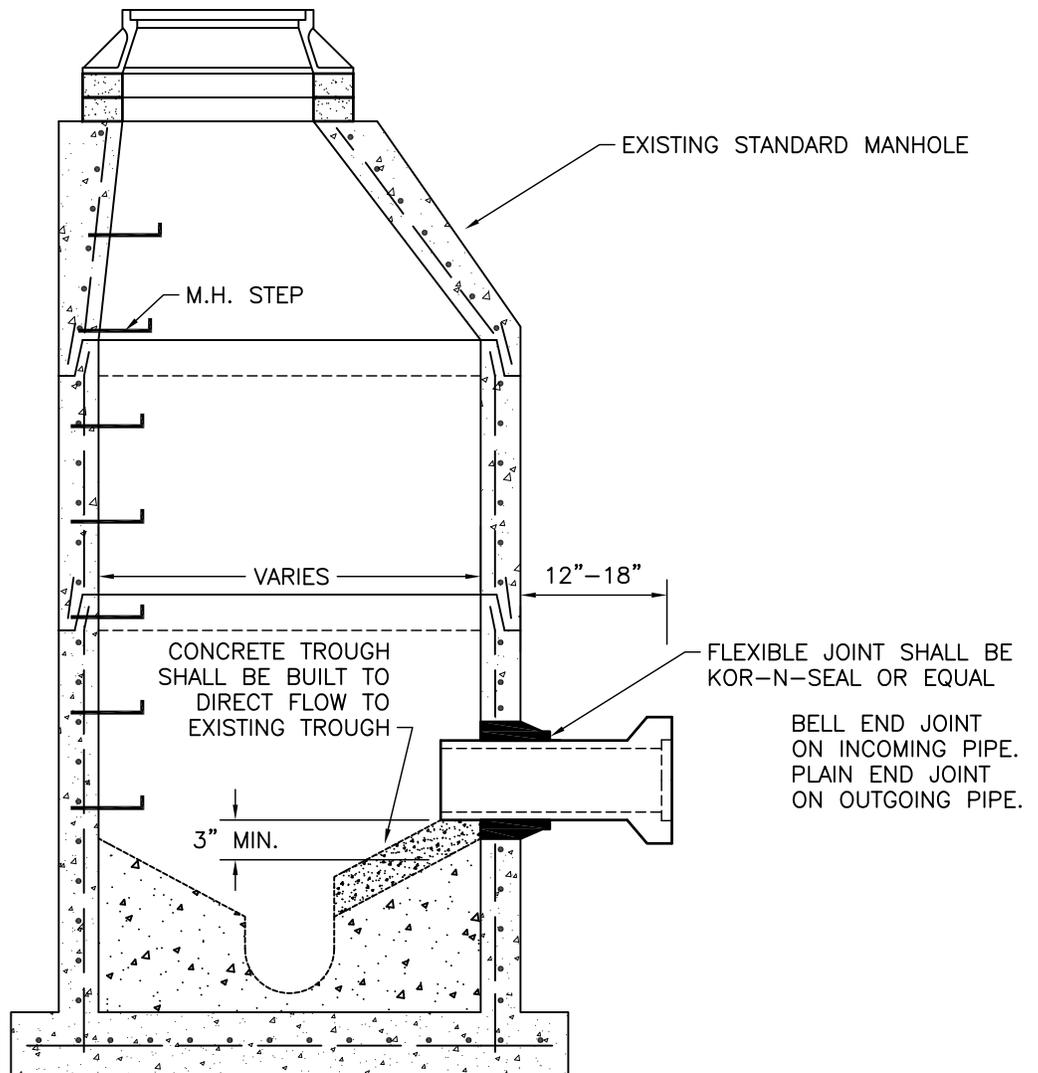
DATE:
OCT. 2014

REVISION:
OCT. 2014

PVC STANDARD INSIDE DROP CONNECTION

DRWG. NO.
MAN-16

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. KOR-N-SEAL FLEXIBLE CONNECTOR, OR EQUAL, SHALL BE INSTALLED PER MANUFACTURER'S STANDARDS.
2. INVERT ELEVATION OF THE INFLUENT LINE SHALL BE NO MORE THAN 30 INCHES ABOVE THE MANHOLE INVERT.
3. EXISTING MANHOLE SHALL NOT BE CORED AT ANY EXISTING RISER JOINT.

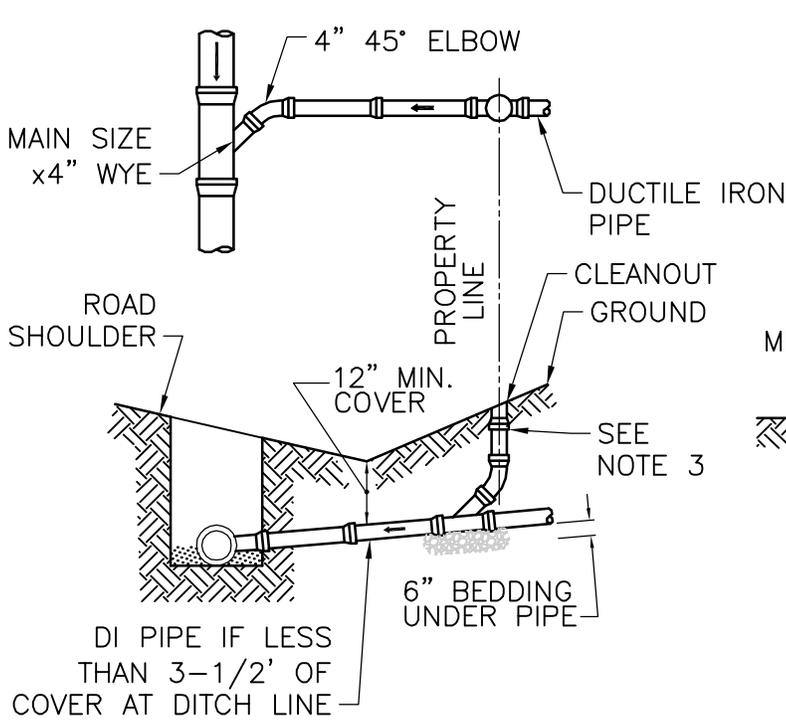
DATE:
NOV. 2015

REVISION:
NOV. 2015

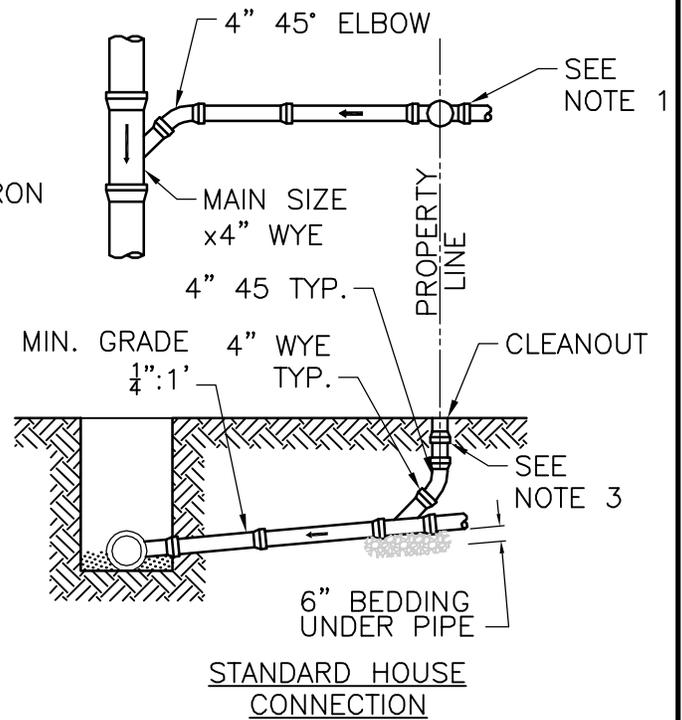
NEW SEWER LINE CONNECTION TO EXISTING MANHOLE

DRWG. NO.
MAN-17

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



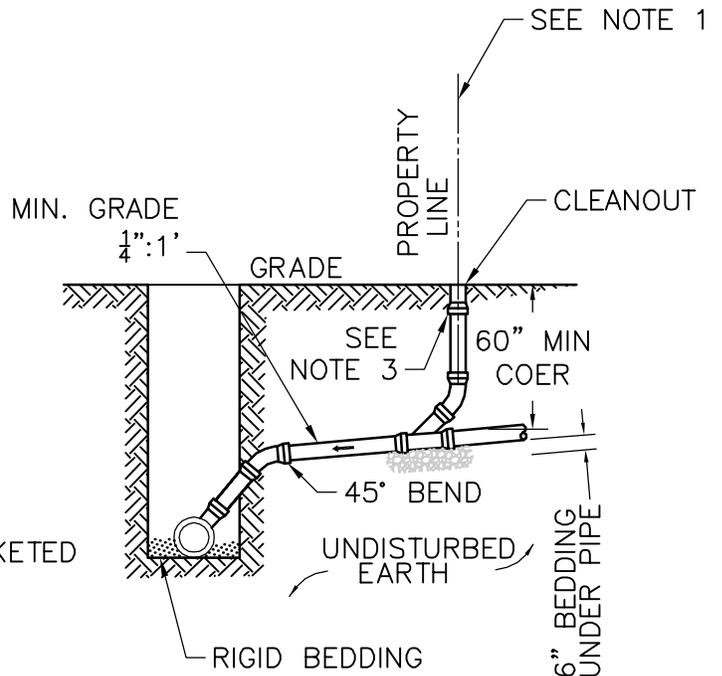
DITCH CROSSING



STANDARD HOUSE CONNECTION

SITE INSPECTION PORT (S.I.P.) NOTES

1. CLEANOUT SHALL BE INSTALLED ON PROPERTY LINE ON ALL HOUSE CONNECTIONS.
2. MATERIAL SHALL BE SDR-26 PVC, SCHEDULE 40 PVC/ABS, OR D.I.
3. CAST IRON BODY ADAPTOR WITH A GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG.



BRANCH CONNECTION WITH 45° BEND

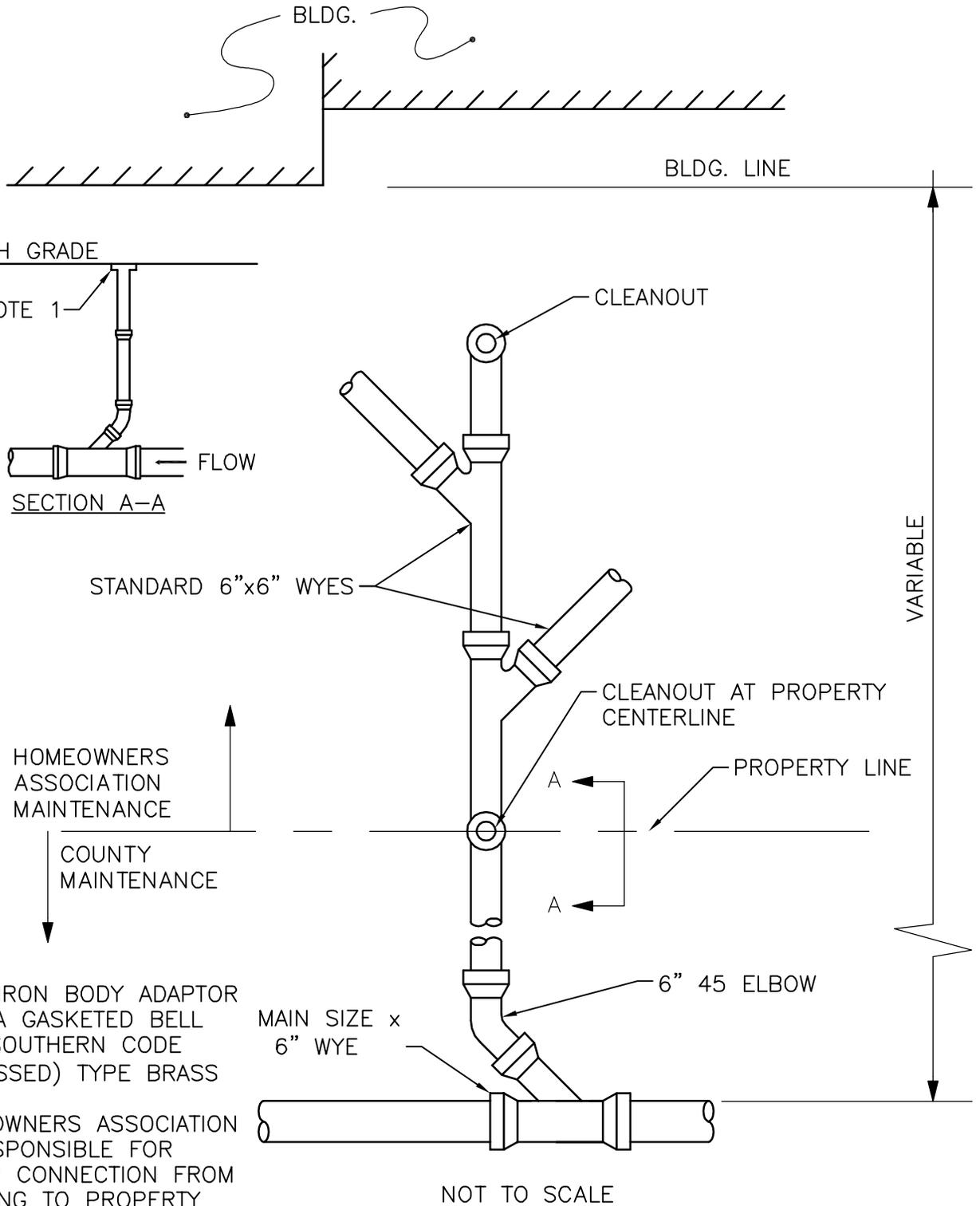
DATE:
OCT. 2014

REVISION:
OCT. 2014

HOUSE CONNECTION DETAILS

DRWG. NO.
SEW-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

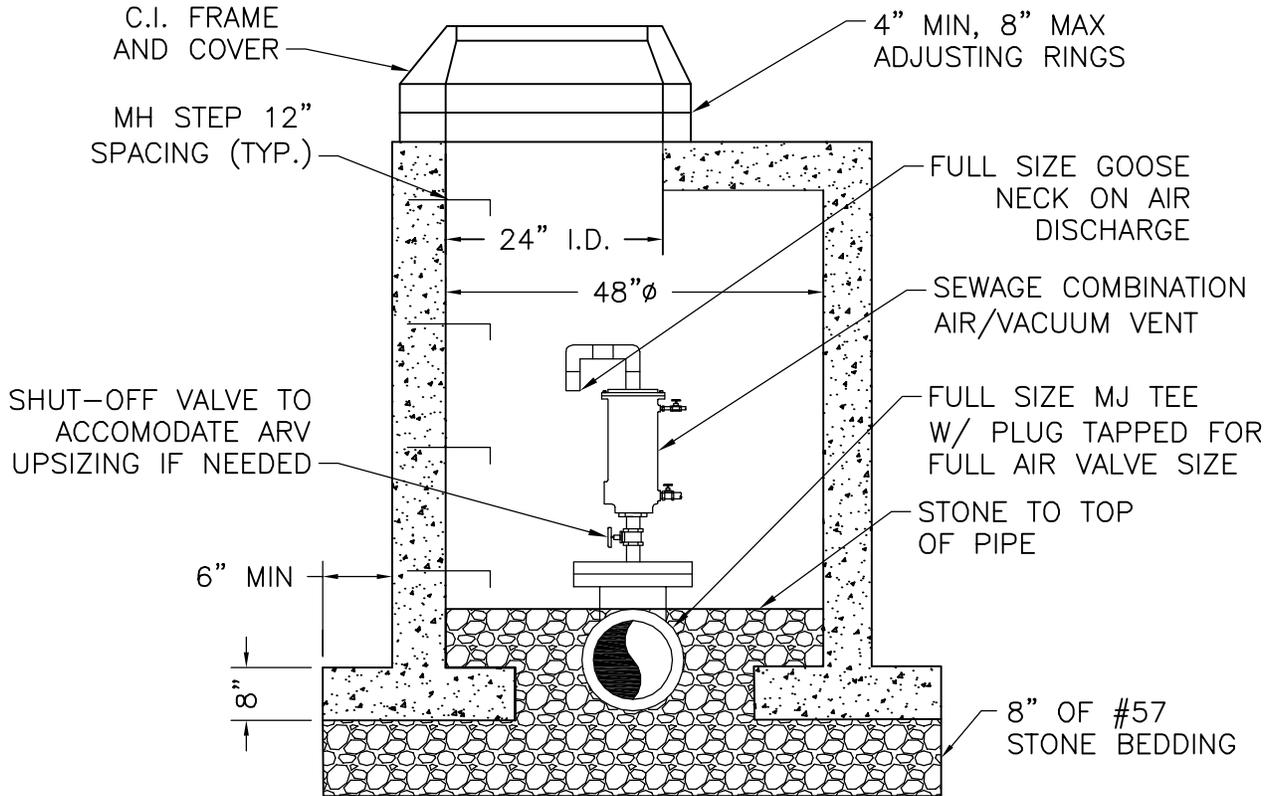
1. CAST IRON BODY ADAPTOR WITH A GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG.
2. HOMEOWNERS ASSOCIATION IS RESPONSIBLE FOR SEWER CONNECTION FROM BUILDING TO PROPERTY LINE IN ACCORDANCE WITH PLUMBING CODE.

DATE:	OCT. 2014
REVISION:	OCT. 2014

STANDARD CONDOMINIUM
DUAL CONNECTION DETAIL

DRWG. NO.
SEW-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. STONE BEDDING SHALL EXTEND TO THE OUTER BOUNDARY OF ALL UNDISTURBED AREAS SURROUNDING THE MANHOLE.
2. M.J. TEE SHALL HAVE RESTRAINED JOINTS ON EACH END.
3. INSTALL FULL PIPE LENGTH ON EACH SIDE OF TEE.

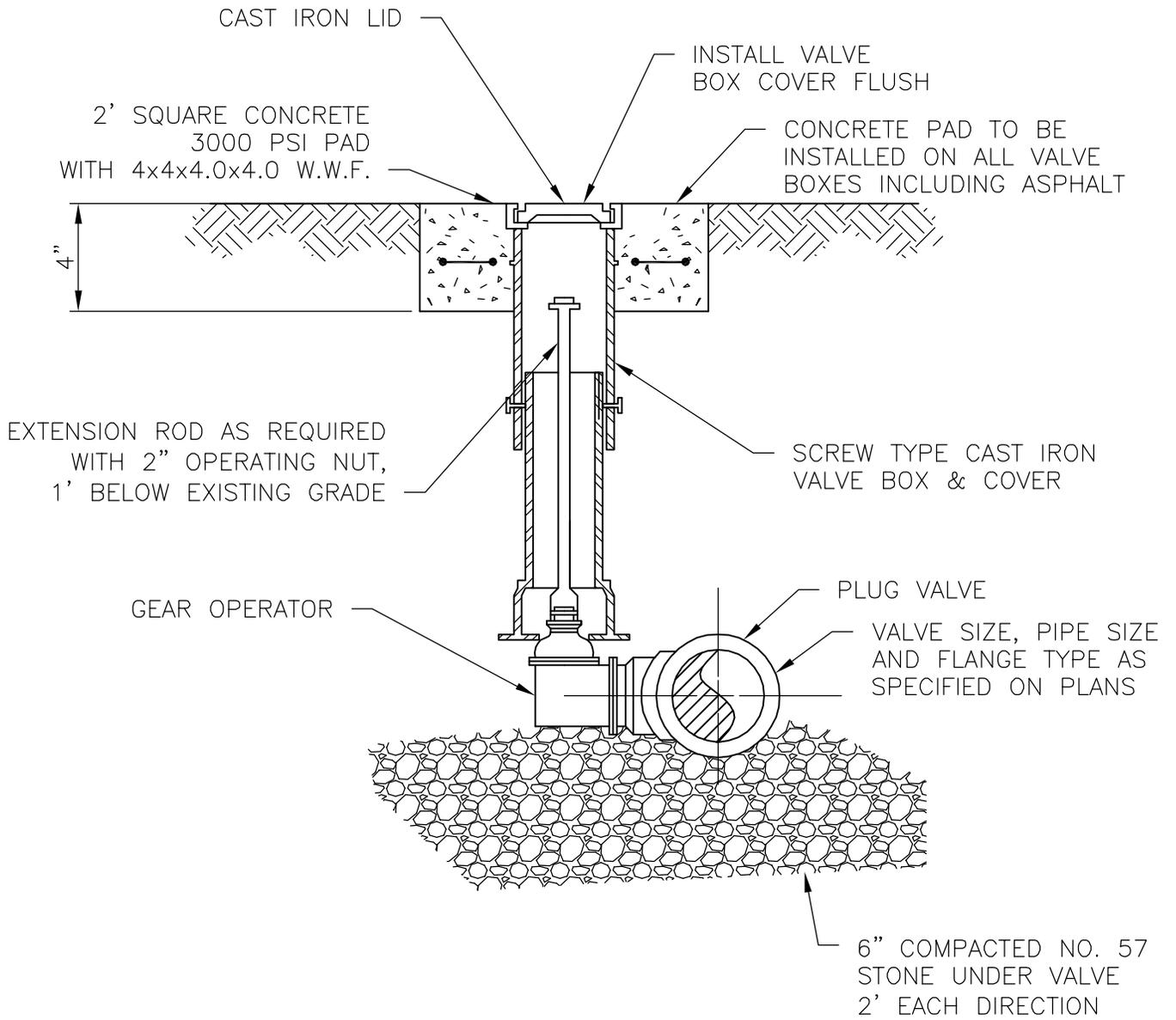
DATE:
OCT. 2014

REVISION:
OCT. 2014

SEWAGE COMBINATION AIR/VACUUM
VENT & MANHOLE

DRWG. NO.
SEW-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



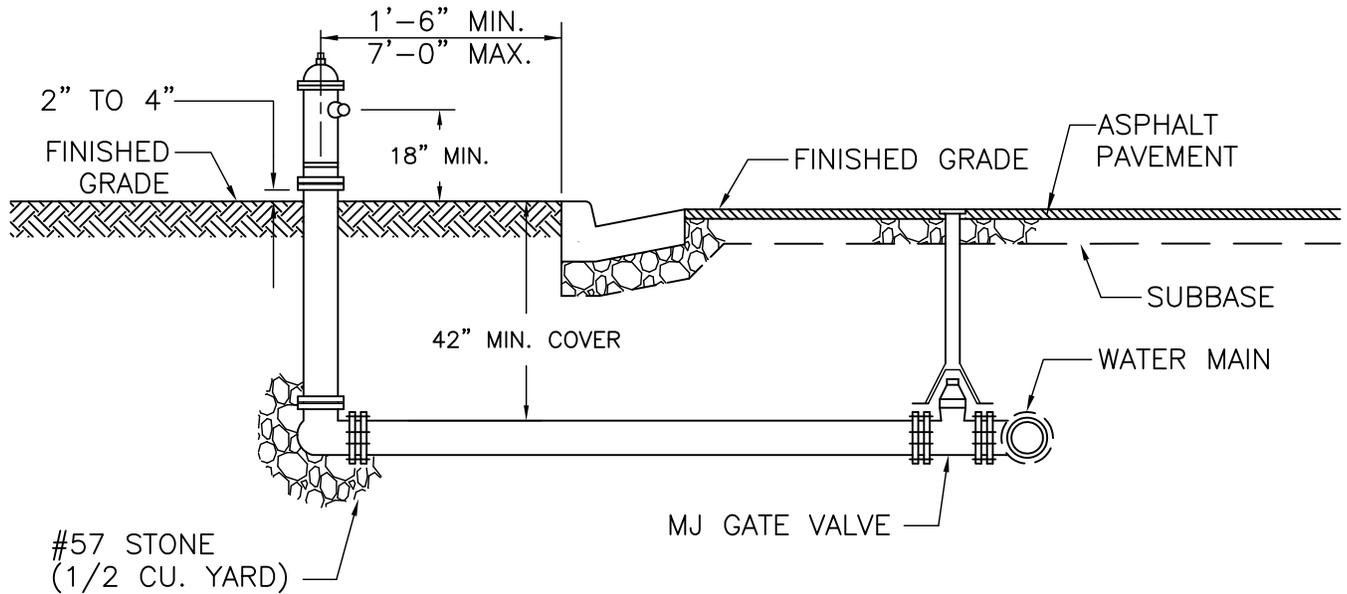
DATE:
OCT. 2014

REVISION:
OCT. 2014

PLUG VALVE DETAIL

DRWG. NO.
SEW-4

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. USE RETAINER GLANDS ON GATE VALVE, ALL FITTINGS, AND FIRE HYDRANT.
2. DUCTILE IRON PIPE IS REQUIRED FOR ALL PIPING FROM FIRE HYDRANT TO WATER MAIN.
3. HYDRANTS SHALL BE LOCATED A MINIMUM DISTANCE OF 50' FROM ALL STRUCTURES.
4. KEEP WEEP HOLES CLEAN TO ALLOW PROPER DRAINAGE.
5. WEEP HOLES ARE NOT PERMITTED IN AREAS SUBJECT TO SURFACE FLOODING, PONDING, OR A HIGH GROUNDWATER TABLE.
6. ON ROADS WITHOUT CURB AND GUTTER, VALVE SHOULD BE IN SHOULDER OF ROAD BETWEEN PAVEMENT AND DITCH. MINIMUM COVER AT DITCH MUST BE 3'6"

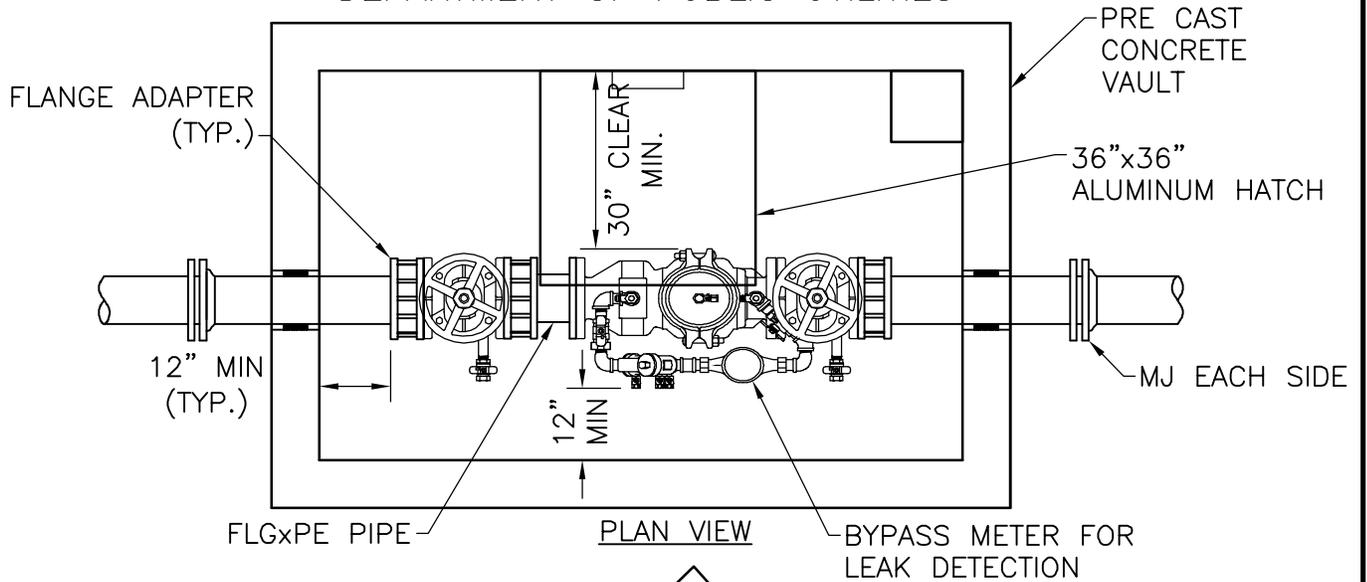
DATE:
OCT. 2014

REVISION:
OCT. 2014

TYPICAL FIRE HYDRANT DETAIL

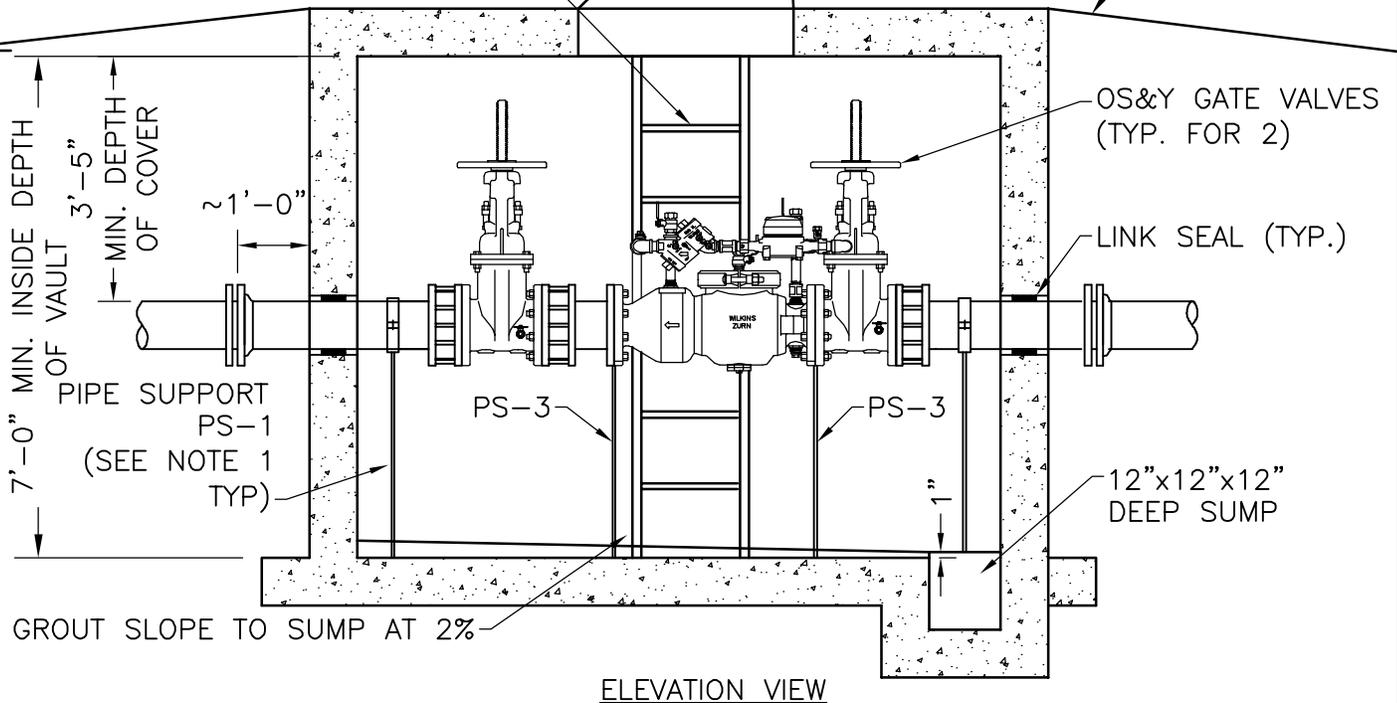
DRWG. NO.
FIR-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



ALUMINUM LADDER
WITH SAFETY
HAND RAIL

SLOPE AWAY
FROM VAULT



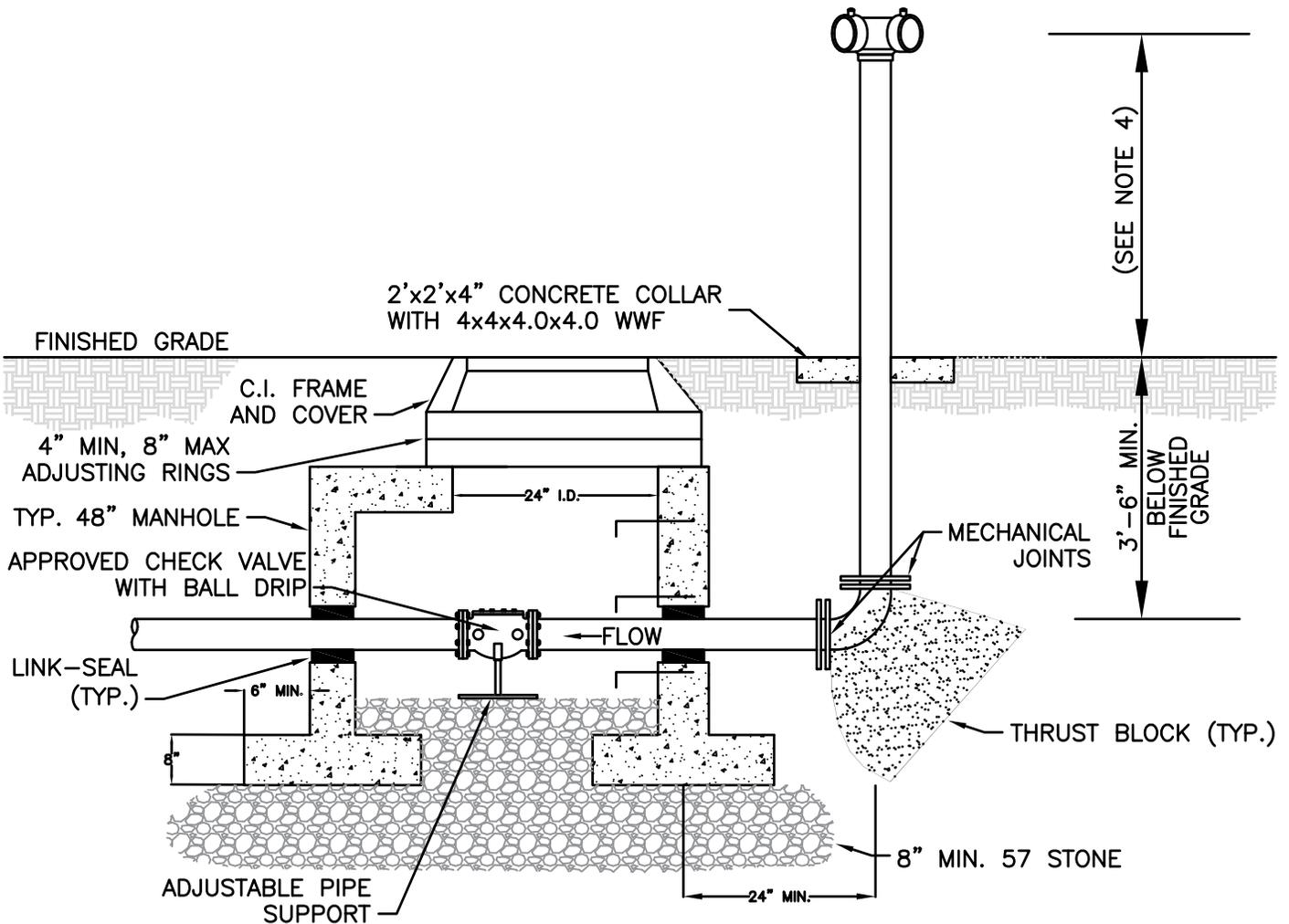
- NOTES:
1. PIPE SUPPORTS TO BE ANCHORED TO VAULT FLOOR NOT GROUT WITH STAINLESS STEEL ADHESIVE ANCHORS
 2. PIPE SUPPORTS TO BE IN ACCORDANCE WITH STANDARD DETAILS

DATE:
OCT. 2014
REVISION:
OCT. 2014

DOUBLE CHECK VALVE ASSEMBLY
FOR FIRE SERVICE

DRWG. NO.
FIR-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1.) ALL MATERIALS AND RELEVANT DIMENSIONS MUST BE IN CONFORMANCE WITH THE MOST RECENT NFPA STANDARDS AND SPECIFICATIONS. SHOP DRAWINGS SHALL BE SUBMITTED AND APPROVED BY THE GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS PRIOR TO ALL FDC INSTALLATIONS.
- 2.) STONE BEDDING SHALL EXTEND TO THE OUTER BOUNDARY OF ALL UNDISTURBED AREAS SURROUNDING THE MANHOLE FOR FOUNDATION STABILITY AND DRAINAGE.
- 3.) ALL M.J. FITTINGS SHALL BE RESTRAINED ON EACH END.
- 4.) THE HEIGHT OF STANDPIPE SHALL BE IN CONFORMANCE WITH THE MOST CURRENT NFPA STANDARDS.
- 5.) ALL THREADS SHALL BE NATIONAL STANDARD.

DATE:

MAY 2015

REVISION:

STANDARD YARD FDC INSTALLATION

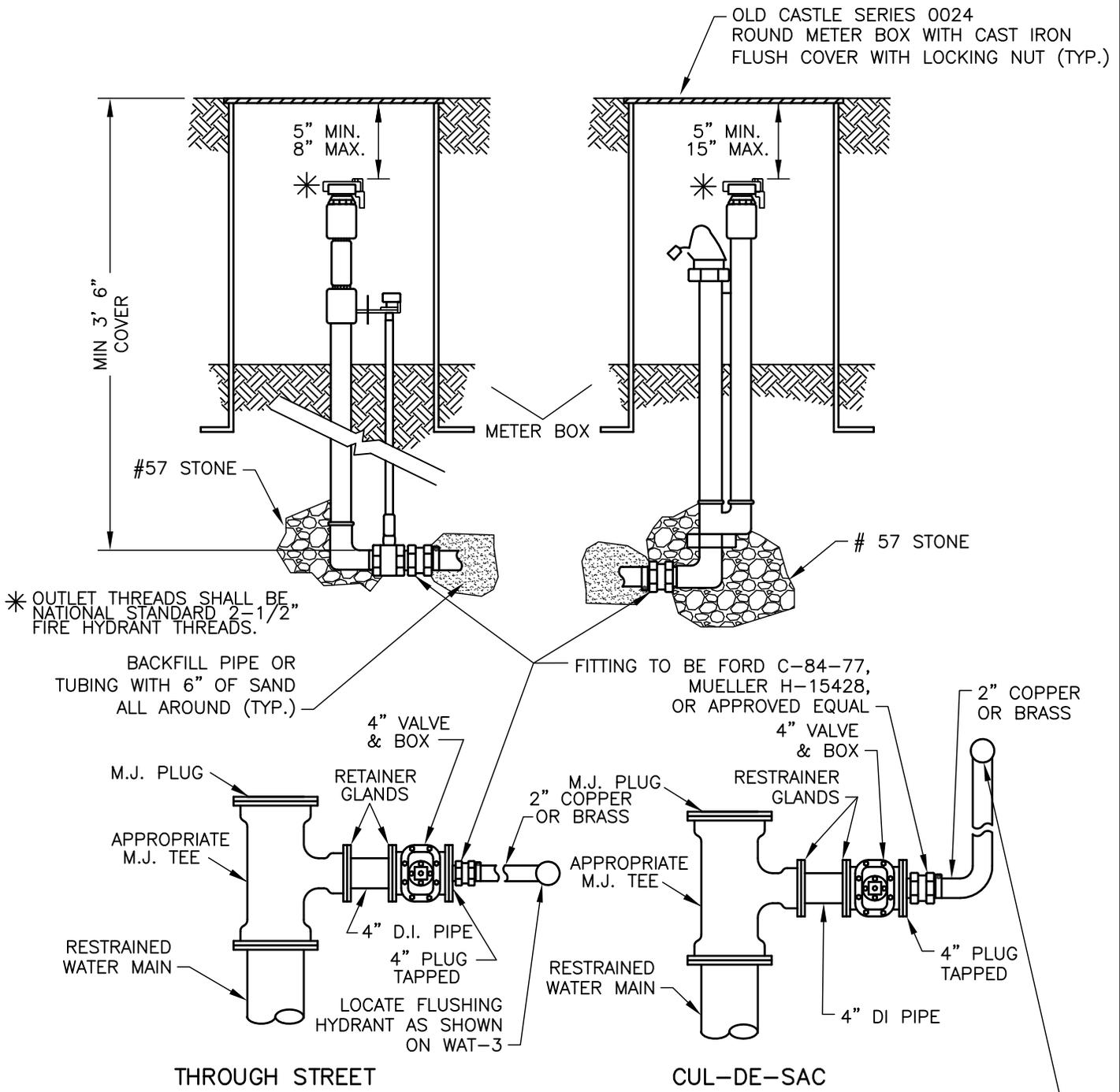
DRWG. NO.

FIR-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

2" AQUARIUS "ONE-O-ONE" HH

MAINGUARD MODEL # 78



* OUTLET THREADS SHALL BE NATIONAL STANDARD 2-1/2" FIRE HYDRANT THREADS.

BACKFILL PIPE OR TUBING WITH 6" OF SAND ALL AROUND (TYP.)

FITTING TO BE FORD C-84-77, MUELLER H-15428, OR APPROVED EQUAL

THROUGH STREET

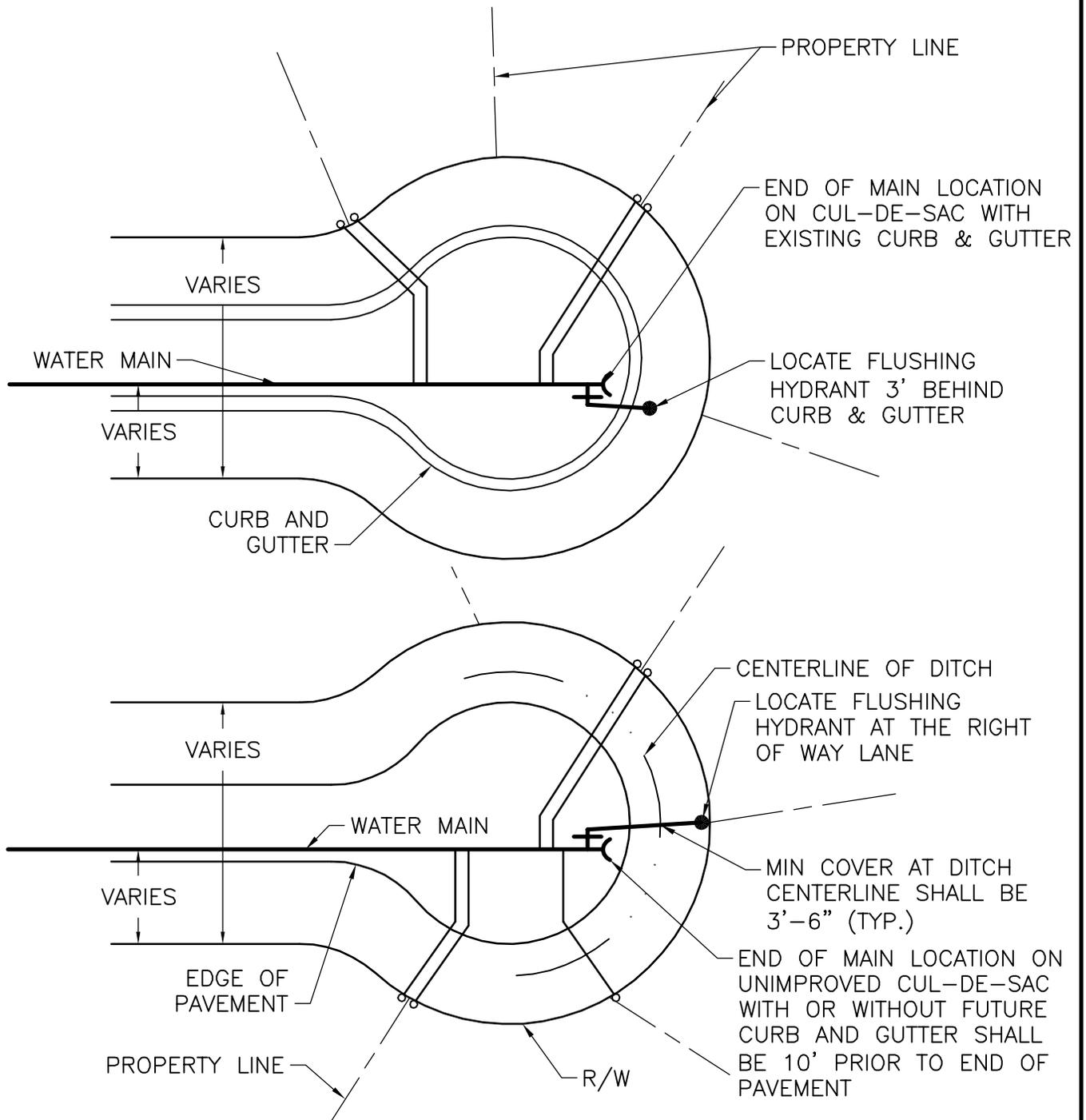
CUL-DE-SAC

NOTES: REFER TO STANDARD SPECIFICATIONS FOR MATERIALS

LOCATE FLUSHING HYDRANT AS SHOWN ON DRAWING WAT-2

DATE: OCT. 2014	FLUSHING HYDRANT	DRWG. NO.
REVISION: SEP. 2015		WAT-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



* IF THERE IS A DITCH BEYOND THE EDGE OF PAVEMENT, FLUSHING HYDRANT IS TO BE PLACED BETWEEN THE DITCH AND RIGHT OF WAY LINE ON LEVEL GROUND. IF THIS IS NOT POSSIBLE, CONSULT THE UTILITY CONSTRUCTION INSPECTOR.

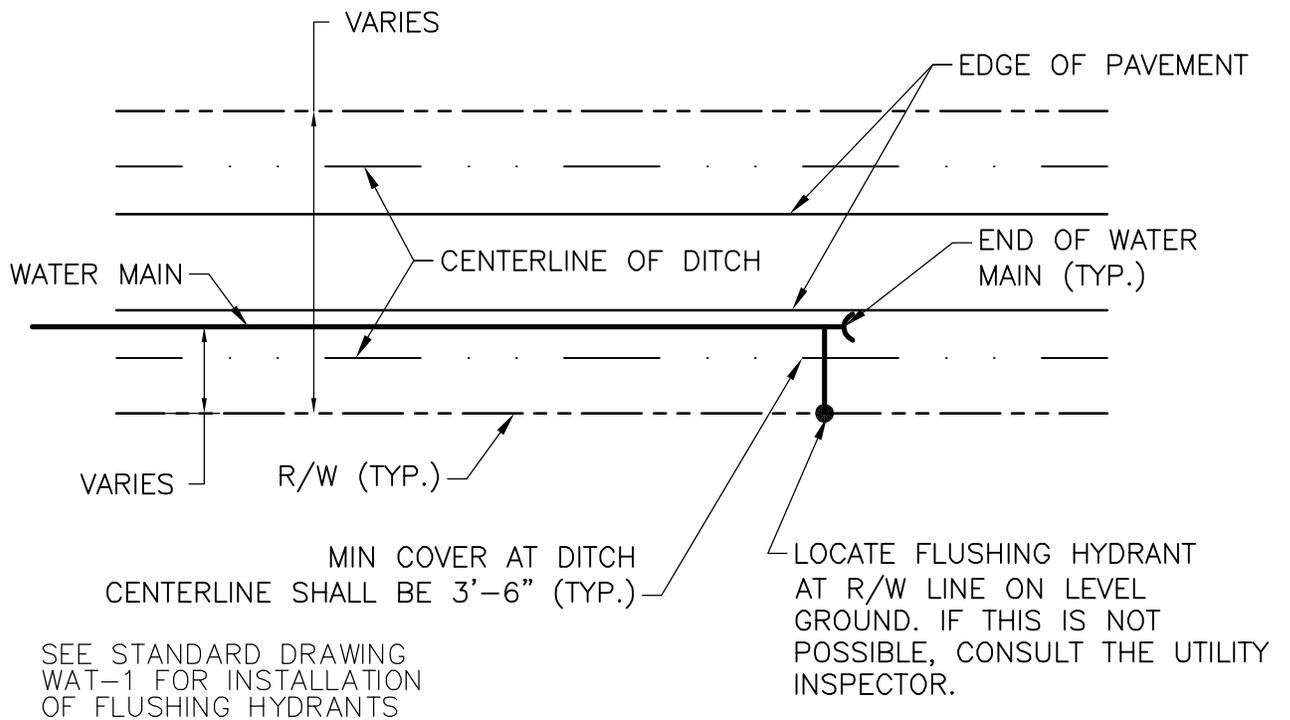
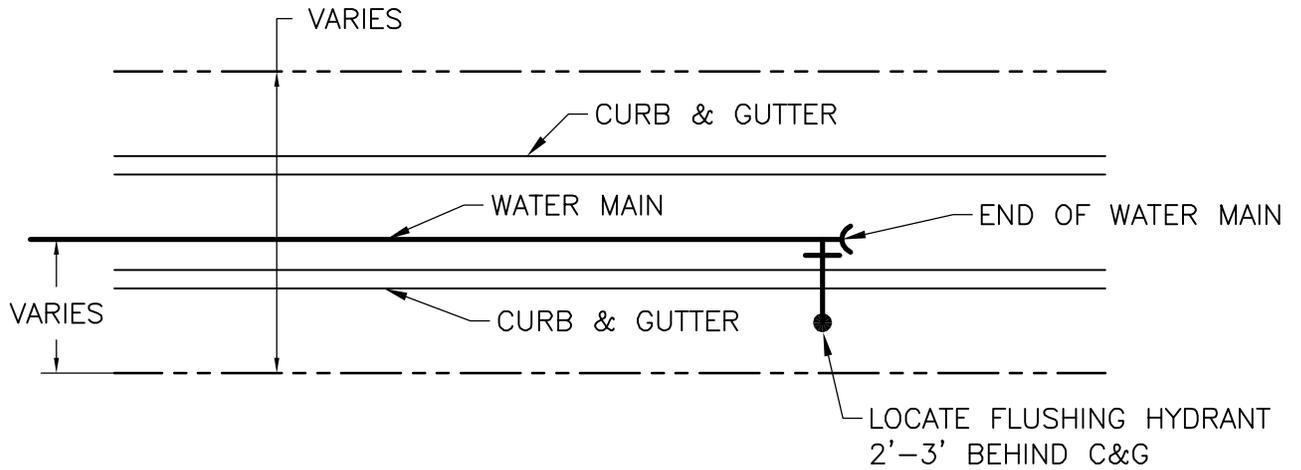
SEE STANDARD DRAWING
WAT-1 FOR INSTALLATION
OF FLUSHING HYDRANTS

DATE:
OCT. 2014
REVISION:
OCT. 2014

TYPICAL FLUSHING HYDRANT LOCATION
ON CUL-DE-SAC

DRWG. NO.
WAT-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

REVISION:
OCT. 2014

TYPICAL FLUSHING HYDRANT LOCATION
ON THROUGH STREET

DRWG. NO.
WAT-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

CAST IRON COVER TO
BE LABELED "WATER"

2'x2'x4" CONCRETE
COLLAR WITH
4x4x4.0x4.0 WWF

FINISHED GRADE

BASE MATERIAL

SUB-BASE

TOP SECTION

NOTES: SCREW-TYPE ADJUSTABLE
VALVE BOX SHALL BE
CAST IRON.

VERTICAL ADJUSTMENT MADE
BY SCREWING TOP SECTION
AND/OR REPLACEMENT OF
CENTER SECTION.

ROD EXTENSION TO 1'
BELOW GRADE. PIN TO
VALVE OPERATING NUT

CENTER SECTION

BOTTOM SECTION

BASE SECTION

GATE
VALVE

SOLID CONCRETE
BLOCK

DATE:
OCT. 2014

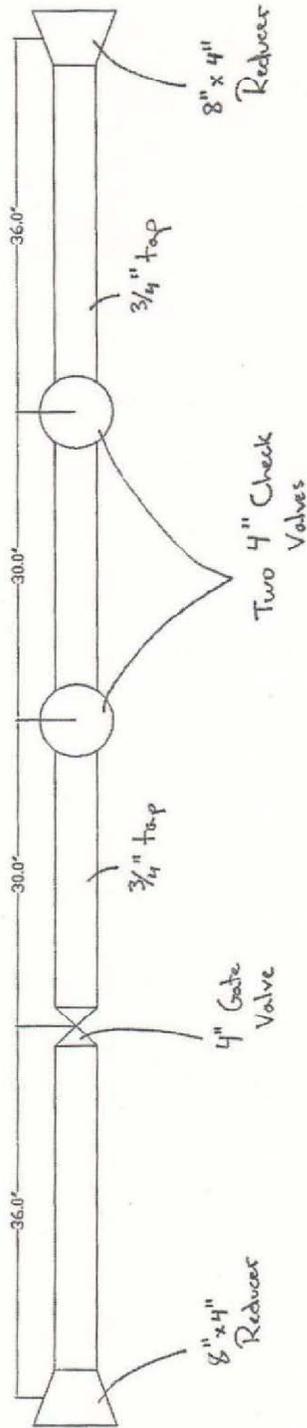
REVISION:
OCT. 2014

UNDERGROUND MECHANICAL JOINT
GATE VALVE DETAIL

DRWG. NO.

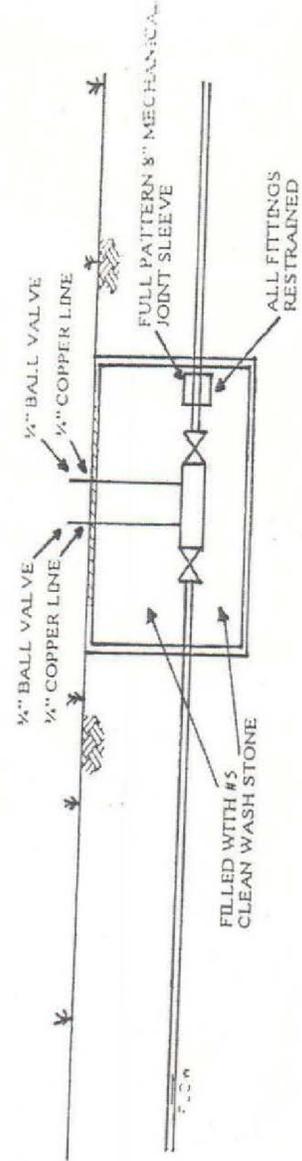
WAT-4

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



Note:

1. Contractor to use 8 in full pattern mechanical joint sleeves to connect temporary flushing apparatus to new waterline. The flushing sleeves will be left in place during the tie in.
2. The above double check valve is shown to be in one piece
3. This type connection must be used on any line over 100 feet.

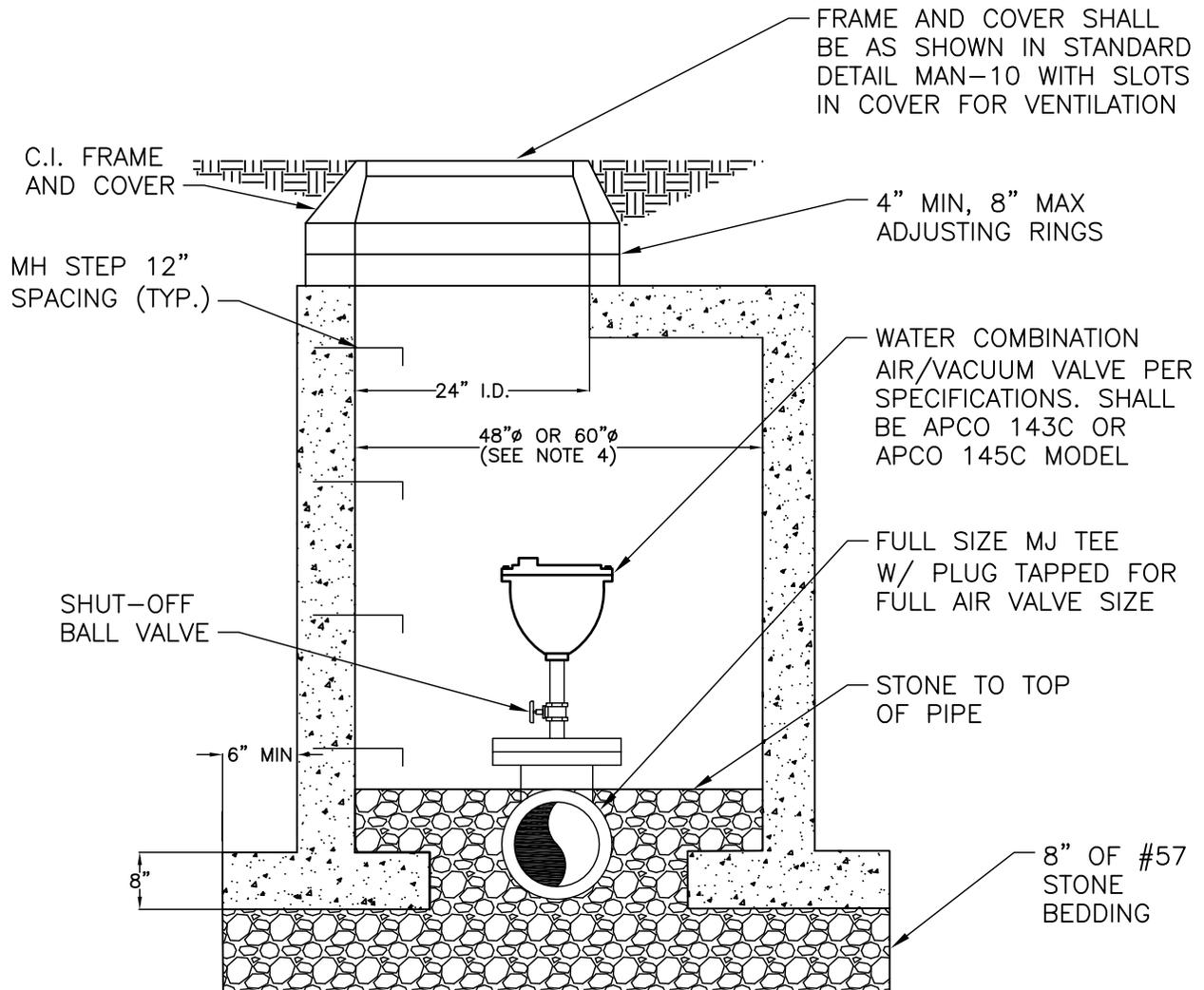


DATE:
OCT. 2014
REVISION:
OCT. 2014

TEMPORARY DOUBLE CHECK VALVE
FLUSHING APPARATUS

DRWG. NO.
WAT-5

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. STONE BEDDING SHALL EXTEND TO THE OUTER BOUNDARY OF ALL UNDISTURBED AREAS SURROUNDING THE MANHOLE.
2. M.J. TEE SHALL HAVE RESTRAINED JOINTS ON EACH END.
3. INSTALL FULL PIPE LENGTH ON EACH SIDE OF TEE.
4. 48" DIAMETER MANHOLES MAY BE USED FOR 12" AND SMALLER WATER MAINS. 60" DIAMETER MANHOLES SHALL BE USED FOR ANY WATER MAIN LARGER THAN 12".
5. GOOCHLAND RESERVES THE RIGHT TO REQUIRE COMBO VALVES TO PIPE SIZES SMALLER THAN 8 INCHES IF NEEDED.

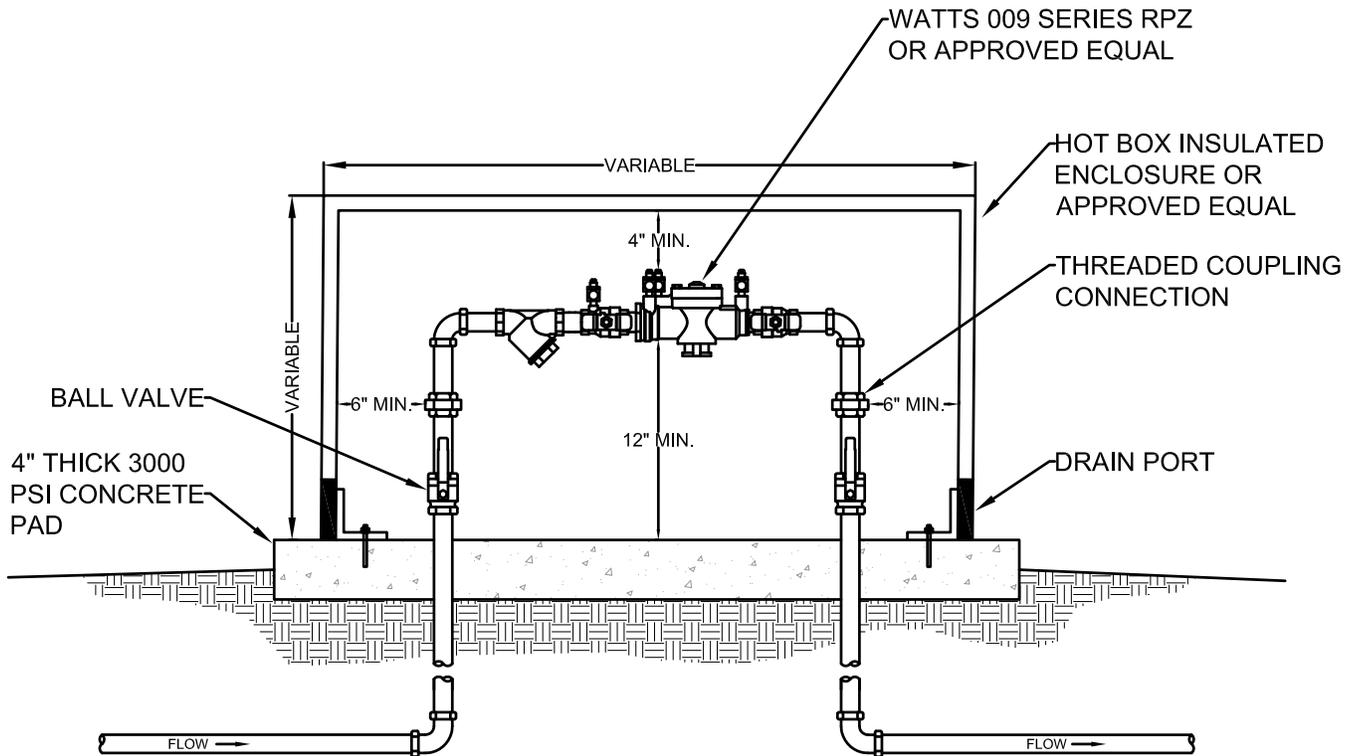
DATE:
MAY 2015

REVISION:

STANDARD COMBINATION AIR/VACUUM VALVE &
MANHOLE FOR 8"-24" WATER MAINS

DRWG. NO.
WAT-6

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1.) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS ALONG WITH THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES.
- 2.) ADEQUATE POSITIVE DRAINAGE AWAY FROM THE ENCLOSURE SHALL BE PROVIDED.
- 3.) CONCRETE FLOOR ELEVATION SHALL BE APPROXIMATELY 2 INCHES ABOVE FINAL GRADE.
- 4.) BACKFLOW PREVENTER ASSEMBLY SHALL NOT BE LOCATED IN ANY AREA PRONE TO PONDING OR FLOODING.

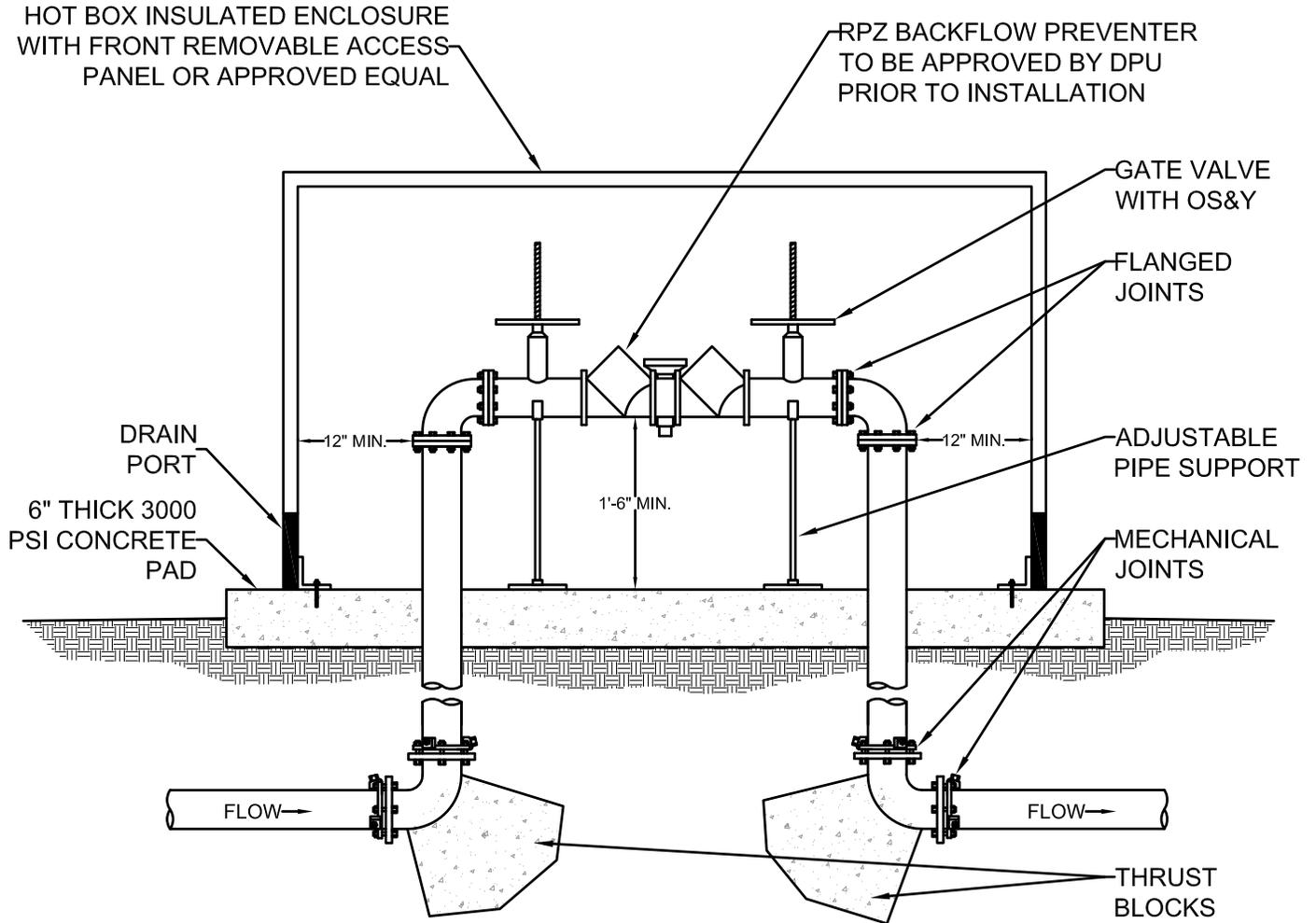
DATE:
JUNE 2015

REVISION:

1" TO 2" RESIDENTIAL/COMMERCIAL OUTDOOR
RPZ BACKFLOW PREVENTER ASSEMBLY

DRWG. NO.
WAT-7

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1.) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS ALONG WITH THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES.
- 2.) ADEQUATE POSITIVE DRAINAGE AWAY FROM THE ENCLOSURE SHALL BE PROVIDED.
- 3.) CONCRETE FLOOR ELEVATION SHALL BE APPROXIMATELY 2 INCHES ABOVE FINAL GRADE.
- 4.) BACKFLOW PREVENTER ASSEMBLY SHALL NOT BE LOCATED IN ANY AREA PRONE TO PONDING OR FLOODING.
- 5.) ALL BACKFLOW PREVENTER ASSEMBLY PIPING SHALL BE PRESSURE CLASS 350 DUCTILE IRON PIPE.

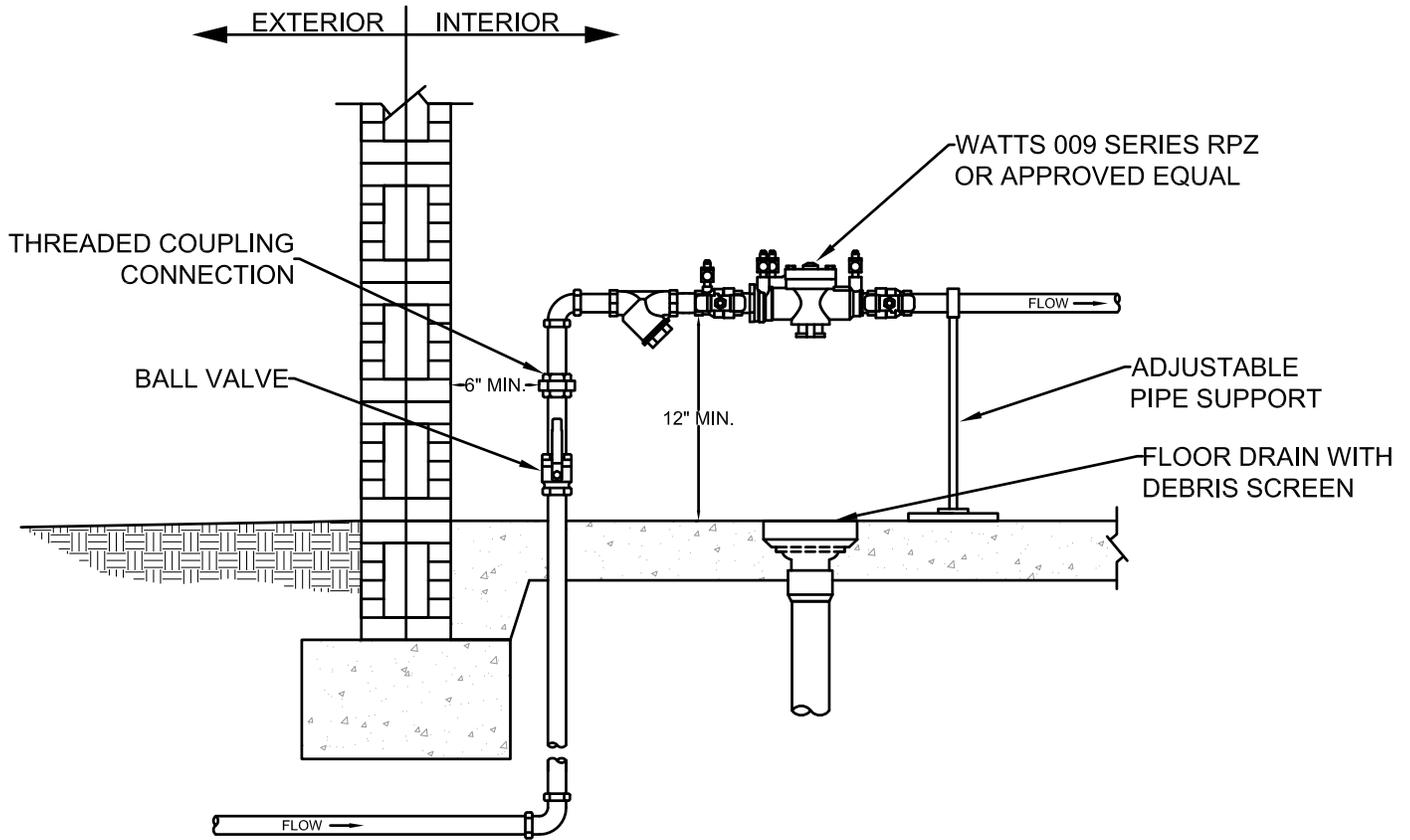
DATE:
JUNE 2015

REVISION:

2- $\frac{1}{2}$ " TO 10" COMMERCIAL OUTDOOR RPZ
BACKFLOW PREVENTER ASSEMBLY

DRWG. NO.
WAT-8

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1.) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS ,THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES, AND THE VIRGINIA STATE PLUMBING CODE.
- 2.) PROPERTY OWNER SHALL BE RESPONSIBLE FOR MAINTENANCE AND OPERATION OF BACKFLOW ASSEMBLY AND COMPLIANCE WITH REPORTING AND TESTING REQUIREMENTS.

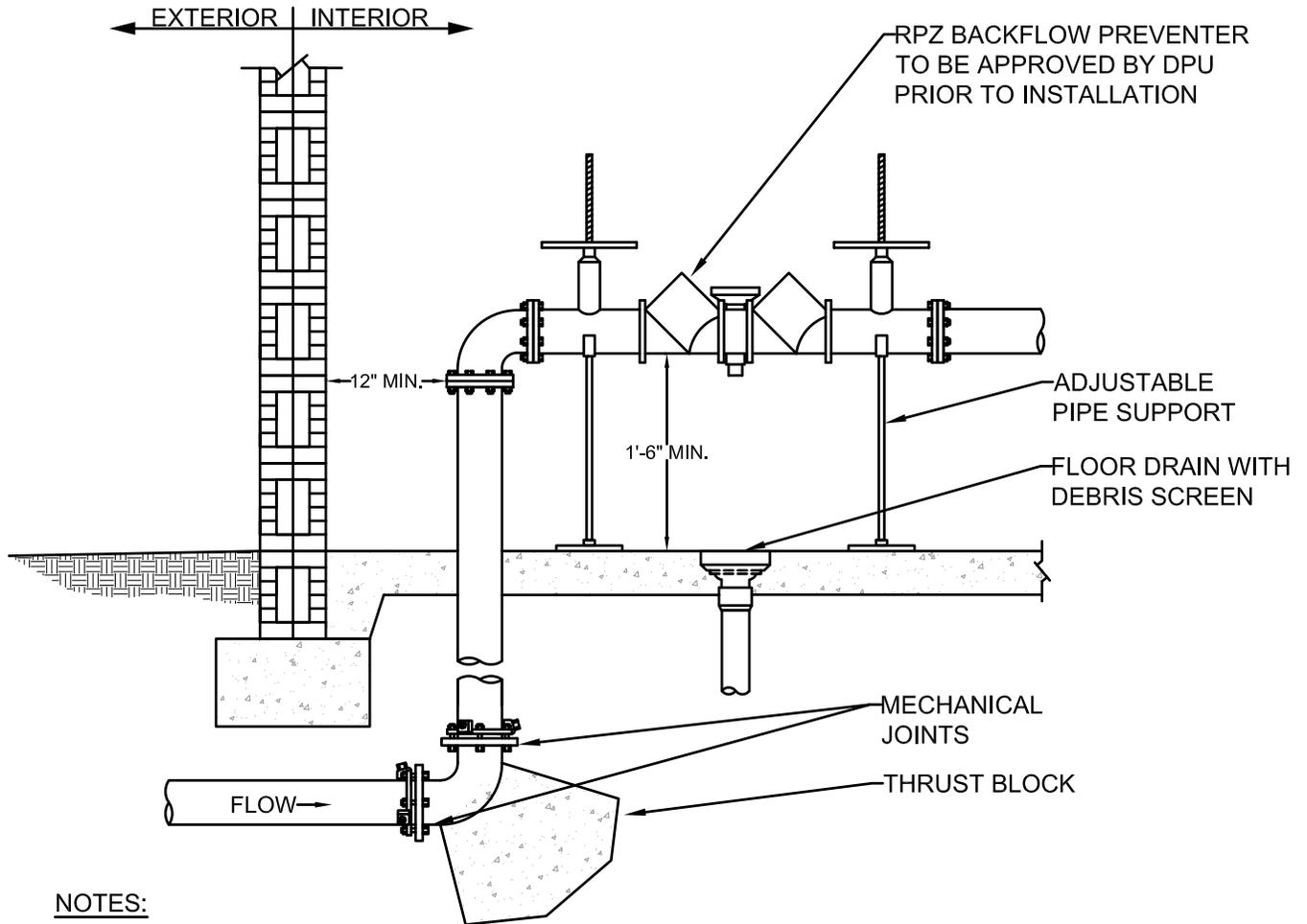
DATE:
JUNE 2015

REVISION:

1" TO 2" RESIDENTIAL/COMMERCIAL INDOOR RPZ
BACKFLOW PREVENTER ASSEMBLY

DRWG. NO.
WAT-9

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1.) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS, THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES, AND THE VIRGINIA STATE PLUMBING CODE.
- 2.) PROPERTY OWNER SHALL BE RESPONSIBLE FOR MAINTENANCE AND OPERATION OF BACKFLOW ASSEMBLY AND COMPLIANCE WITH REPORTING AND TESTING REQUIREMENTS.

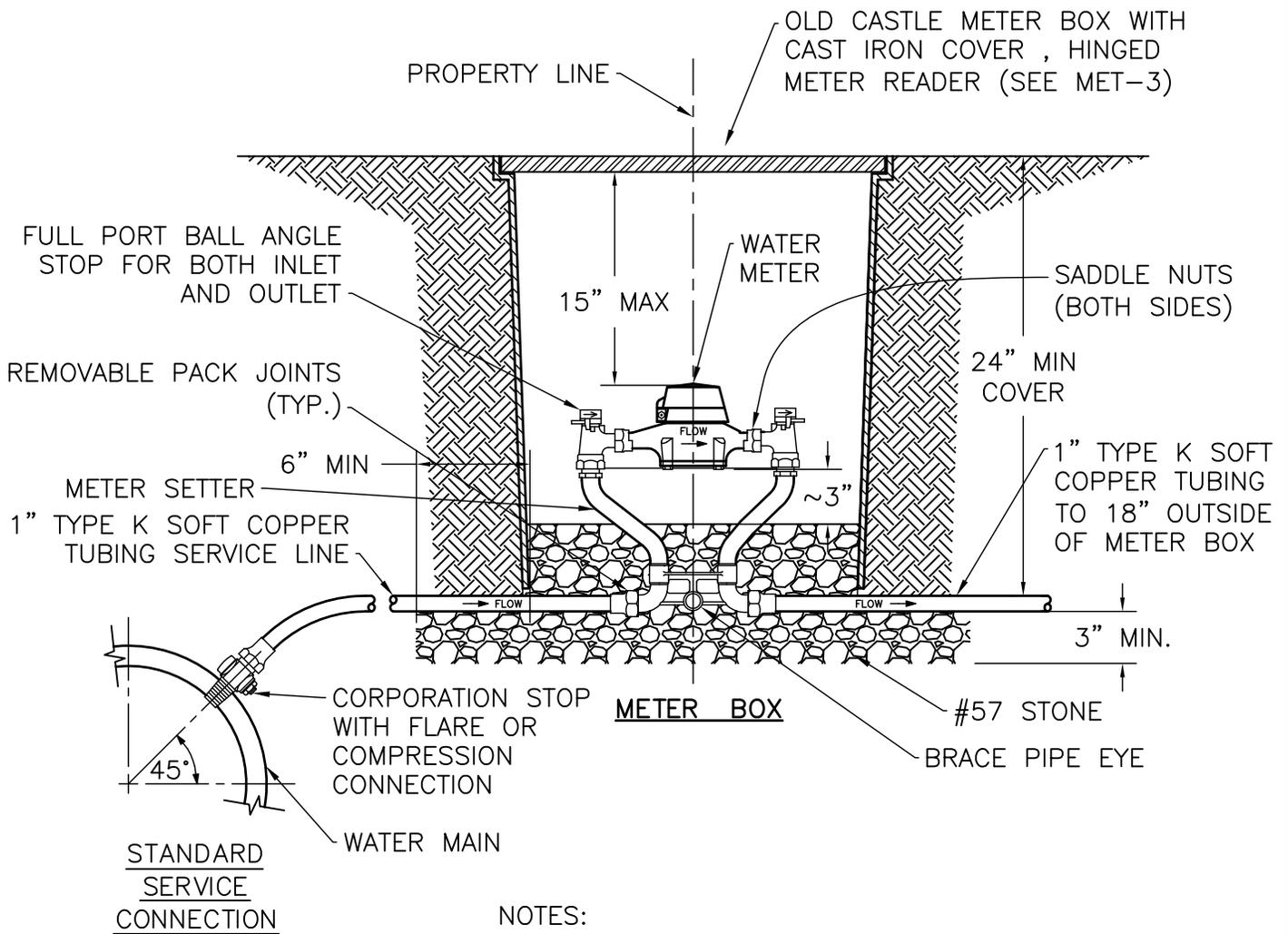
DATE:
JUNE 2015

REVISION:

2- $\frac{1}{2}$ " TO 10" COMMERCIAL INDOOR RPZ
BACKFLOW PREVENTER ASSEMBLY

DRWG. NO.
WAT-10

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. ALL WATER METERS TO BE FURNISHED & INSTALLED BY THE COUNTY
2. METERSSETTERS SHALL BE PROVIDED FOR $\frac{5}{8}$ " AND 1" METERS. EACH END SHALL HAVE REMOVABLE PACK JOINTS SUITABLE FOR COPPER TUBING. ALL METERSSETTERS SHALL HAVE SADDLE NUTS, PADLOCK WINGS AND SHALL BE SIMILAR TO FORD OR MUELLER.
3. PROVIDE 18" OF $\frac{1}{2}$ " SCH40 BRASS PIPE AND CENTER THROUGH BRACE PIPE EYE.
4. BACKFILL SERVICE LINE WITH 6" SAND ALL AROUND

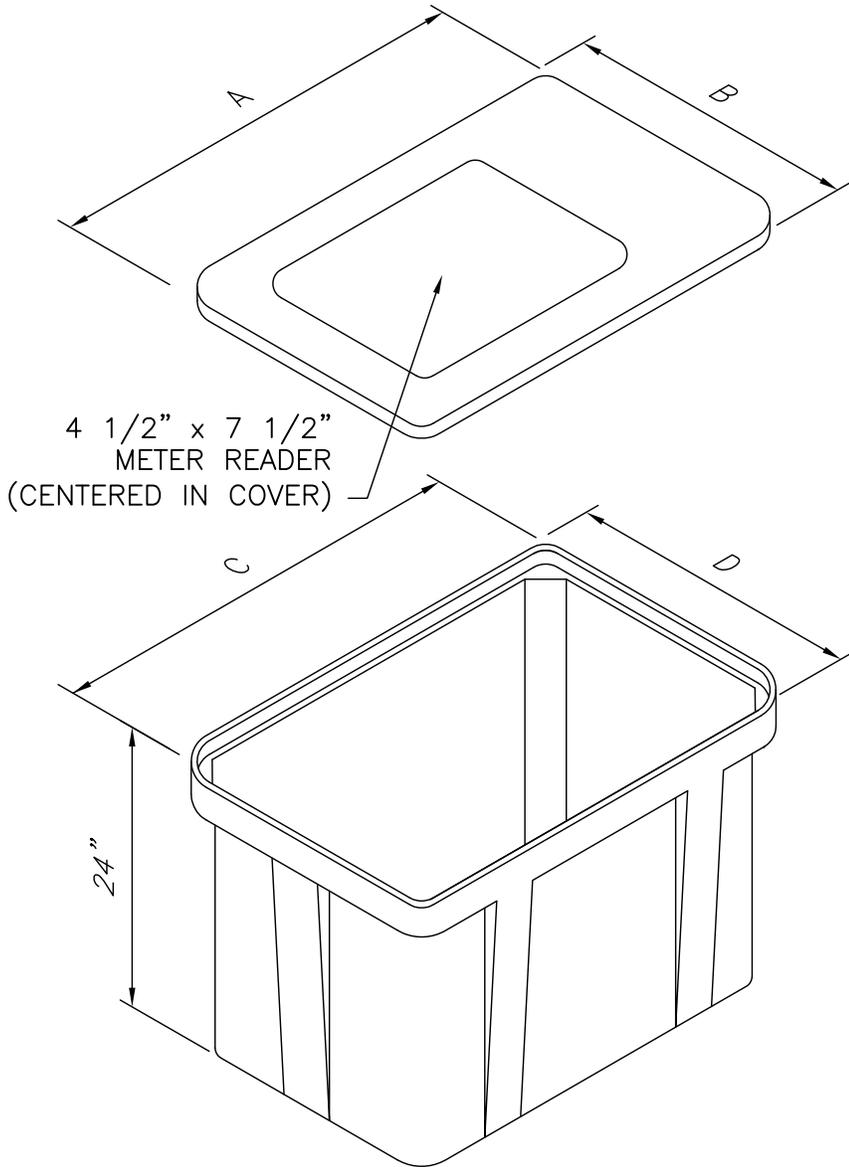
DATE:
OCT. 2014

REVISION:
SEP. 2015

STANDARD METER BOX INSTALLATION
FOR $\frac{5}{8}$ " AND 1" SERVICES

DRWG. NO.
MET-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



Meter Box Dimensions		
Meter Size	5/8" X 3/4"	1"
Box Model No.	1015	1118
DIM A	15.375"	18"
DIM B	10.125"	11.25"
DIM C	17.75"	20.5"
DIM D	13"	13.75"

NOTES:

1. ALL METER BOXES SHALL BE OLDCASTLE HEAVYWALL MODEL BC WITH DUCTILE IRON COVERS AND SHALL ONLY BE PLACED IN NON-DELIBERATE TRAFFIC LOCATIONS.
2. ANY METER BOX LOCATED WITHIN A PAVED DRIVE LOCATION SHALL BE A HEAVY-DUTY RATED OLDCASTLE H-SERIES MODEL 1118 POLYMER CONCRETE BOX, REGARDLESS OF METER SIZE.
3. METER BOX COVERS SHALL BE FLUSH MOUNTED DUCTILE IRON WITH HINGED METER READER DOOR.
4. METER BOXES SHALL HAVE A MINIMUM VERTICAL LOAD RATING OF 15,000 LBS AND HAVE A MINIMUM 1" ANTI-SETTLING FLANGE ON BOTTOM OF THE BOX.

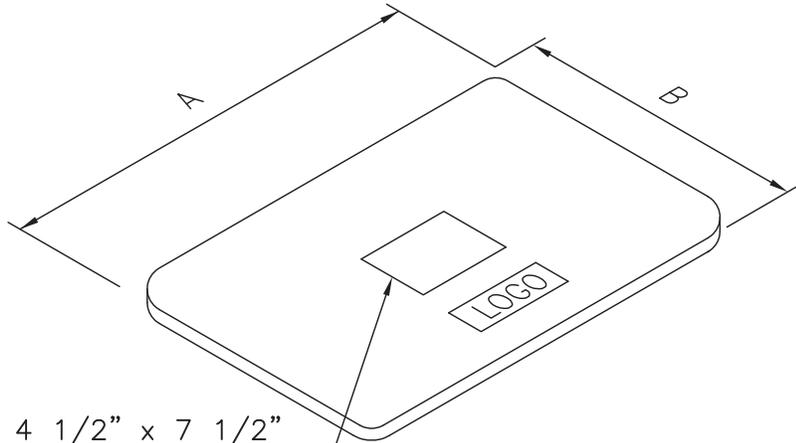
DATE:
OCT. 2014

REVISION:
OCT. 2014

STANDARD WATER METER BOX FOR
5/8" x 3/4", & 1" SERVICES

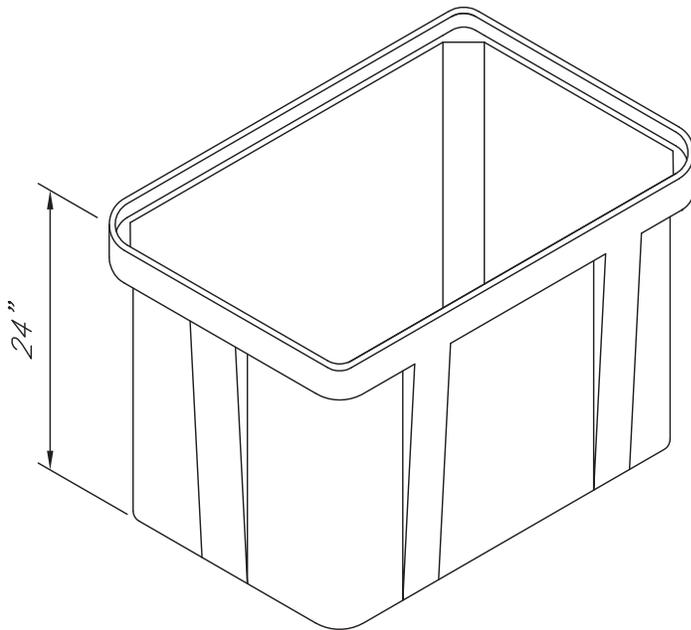
DRWG. NO.
MET-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



4 1/2" x 7 1/2"
HINGED METER READER
(CENTERED IN COVER)

Meter Box Dimensions		
Meter Size	1-1/2"	2"
Box Model No.	H Series	H Series
DIM A	36"	48"
DIM B	24"	30"



NOTES:

1. ALL METER BOXES SHALL BE OLDCASTLE SERIES H POLYMER CONCRETE.
2. ALL METER BOX COVERS SHALL BE OLDCASTLE SERIES H POLYMER CONCRETE WITH FLUSH MOUNT DUCTILE IRON HINGED METER READER DOOR.
3. ALL NON-DELIBERATE TRAFFIC WATER METER BOXES & METER BOX COVERS MUST COMPLY WITH ALL TEST PROVISIONS OF THE LATEST EDITION OF ANSI/SCTE 77 "SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY" AND MUST MEET THE TIER 22 APPLICATION. MARKINGS SHOWING THE TIER 22 RATING MUST BE LABELED OR STENCILED ON THE INSIDE AND OUTSIDE OF THE BOX.
4. ALL NON-DELIBERATE TRAFFIC WATER METER BOXES AND COVERS MUST BE TESTED AND CERTIFIED, MEETING ALL TEST PROVISIONS OF THE LATEST EDITION OF ANSI/SCTE 77.

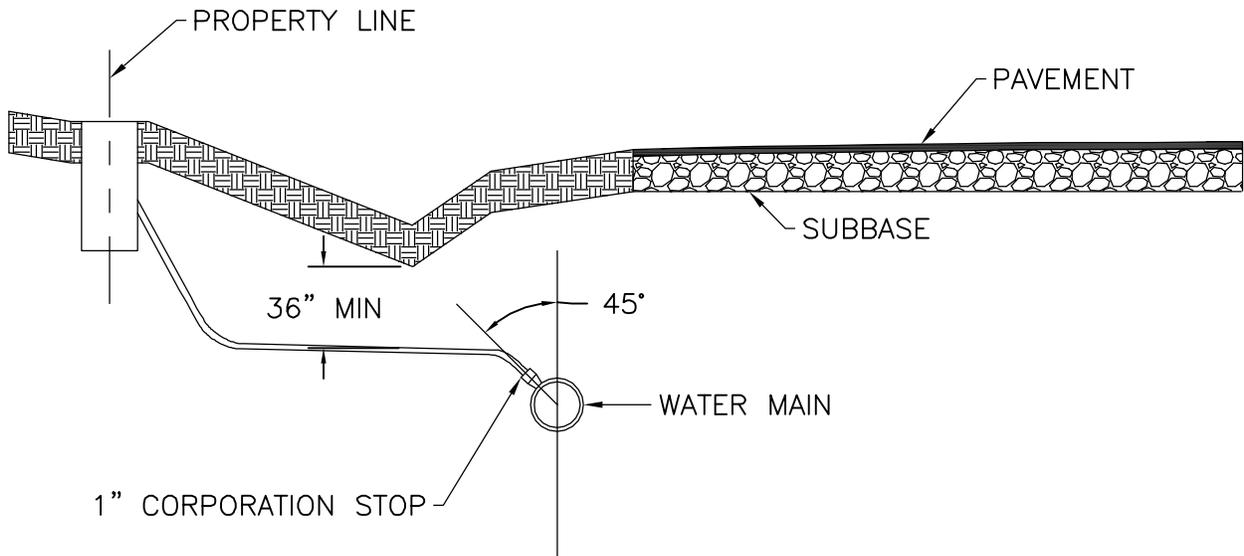
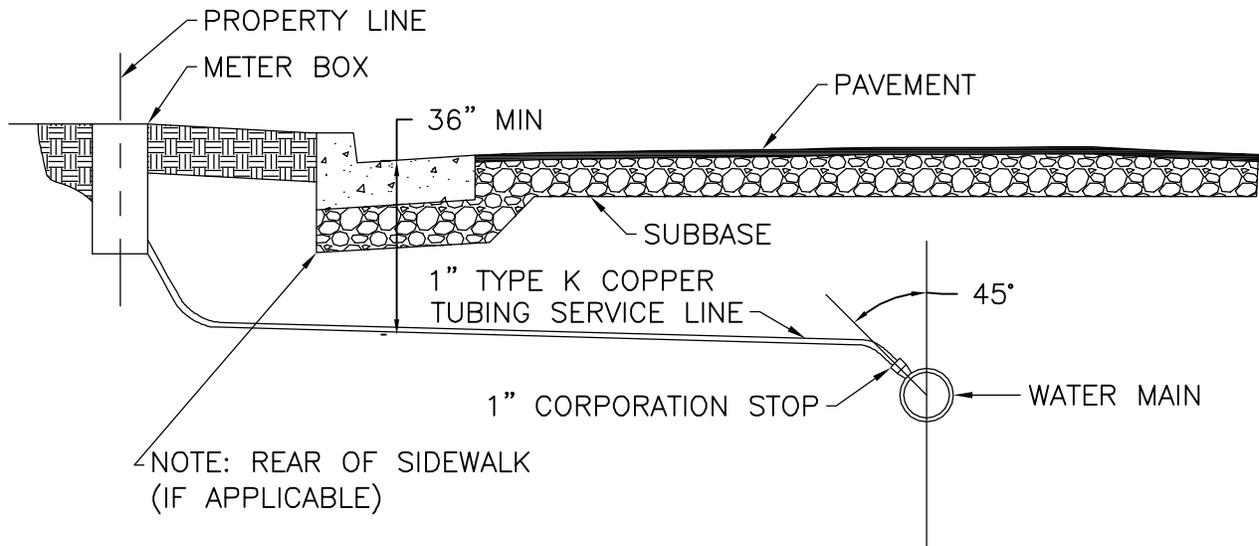
DATE:
OCT. 2014

REVISION:
OCT. 2014

STANDARD WATER METER BOX FOR
1-1/2" & 2" SERVICES

DRWG. NO.
MET-4

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTE: BACKFILL SERVICE LINE WITH 6" SAND ALL AROUND

DATE:
OCT. 2014

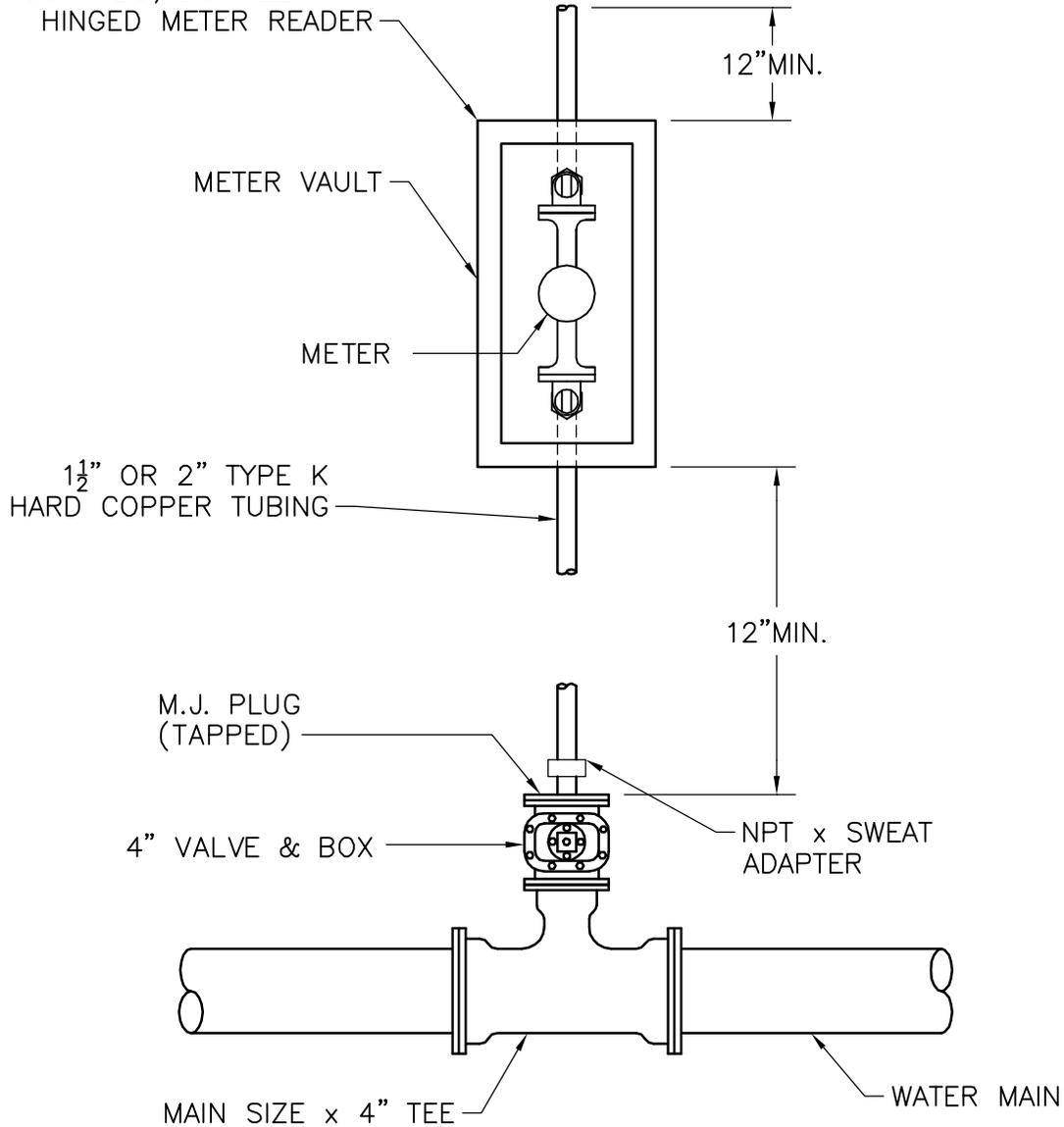
REVISION:
OCT. 2014

5/8" X 3/4", & 1"
METER INSTALLATION DETAILS

DRWG. NO.
MET-5

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

OLD CASTLE METER BOX
MODEL 1730-24 WITH HEAVY
DUTY LID, DUCTILE IRON
HINGED METER READER



PLAN VIEW

NOTE: SEE DWG MET-2 AND MET-4 FOR METER BOX AND METER
SETTING DETAILS

DATE:
OCT. 2014

REVISION:
OCT. 2014

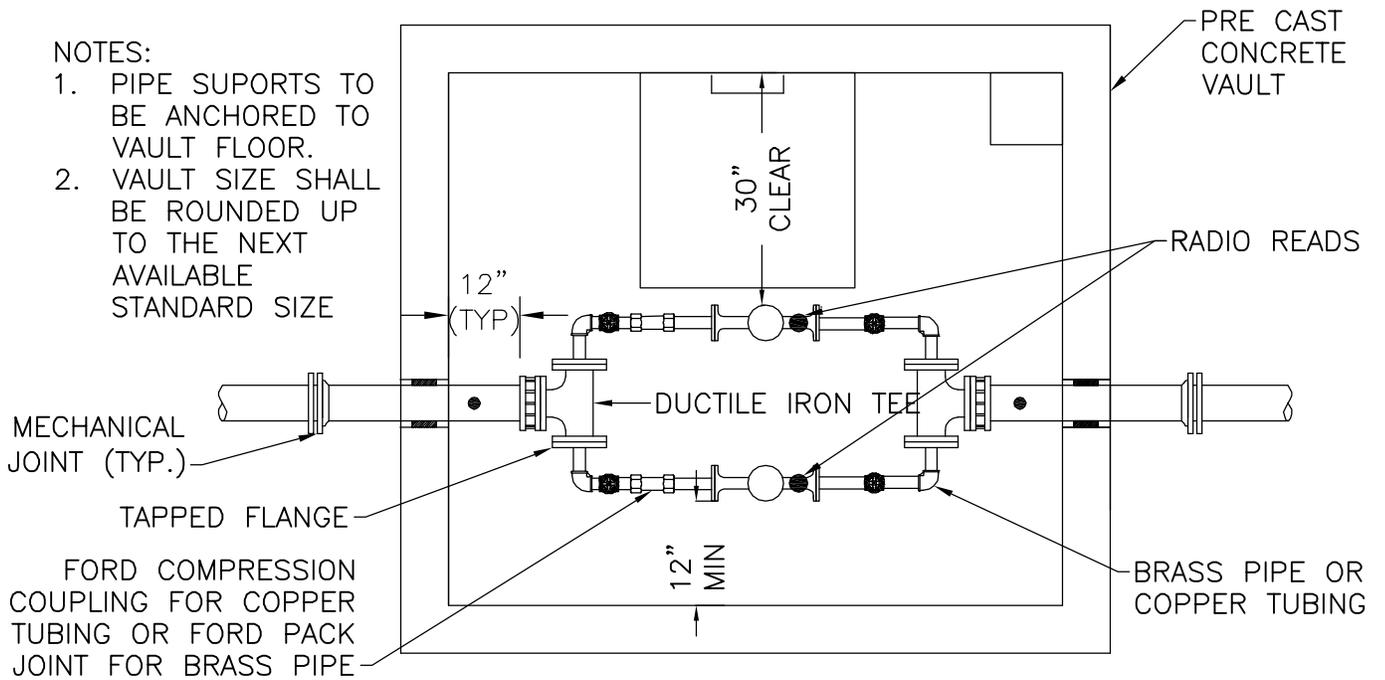
STANDARD WATER SERVICE CONNECTION FOR
COMMERCIAL AND MULTI-FAMILY PROPERTIES
WITH 1½" OR 2" METERS

DRWG. NO.
MET-6

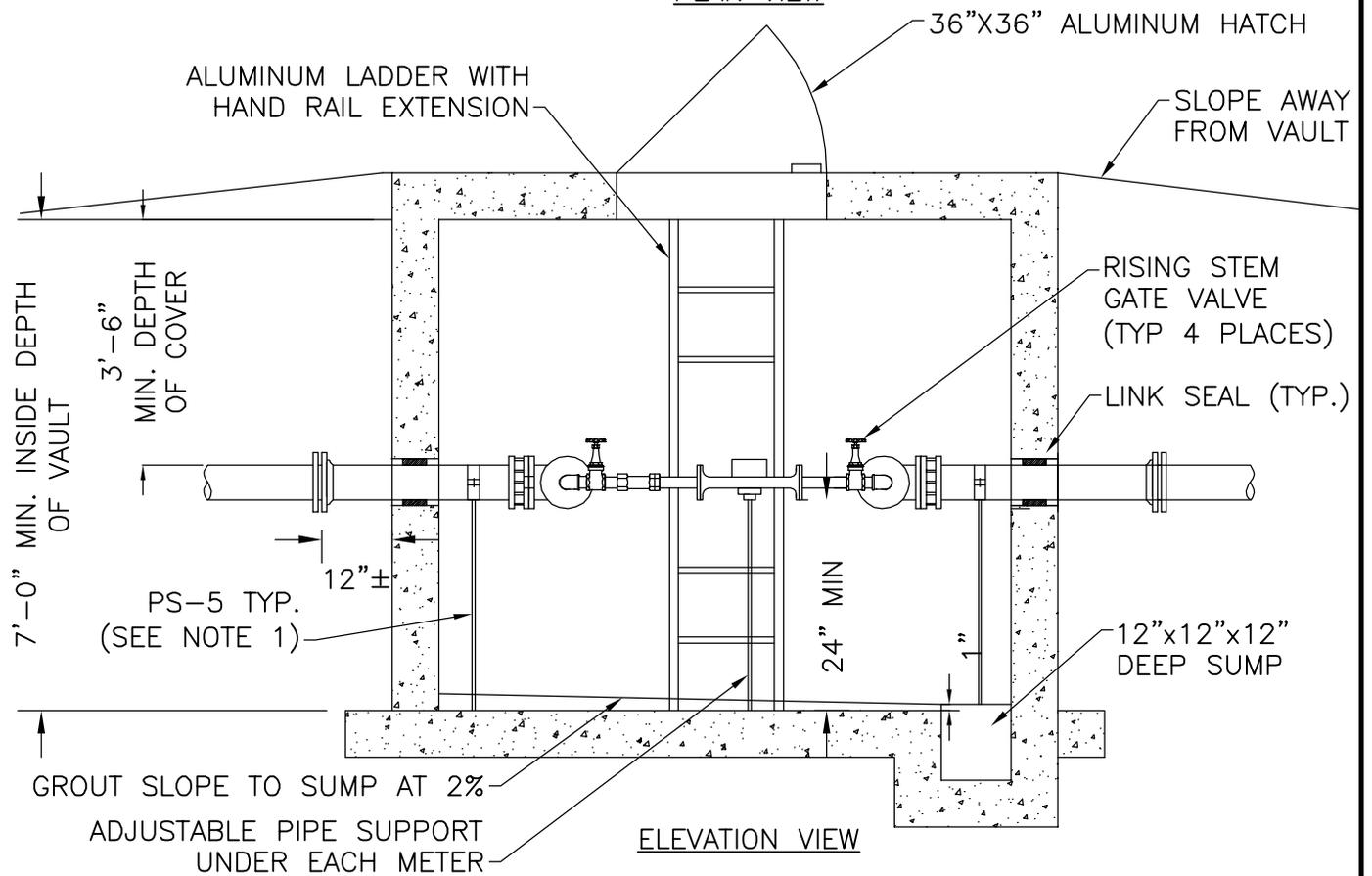
GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

NOTES:

1. PIPE SUPPORTS TO BE ANCHORED TO VAULT FLOOR.
2. VAULT SIZE SHALL BE ROUNDED UP TO THE NEXT AVAILABLE STANDARD SIZE



PLAN VIEW



ELEVATION VIEW

DATE:
OCT. 2014

REVISION:
OCT. 2014

DUAL 2" METER SETTING

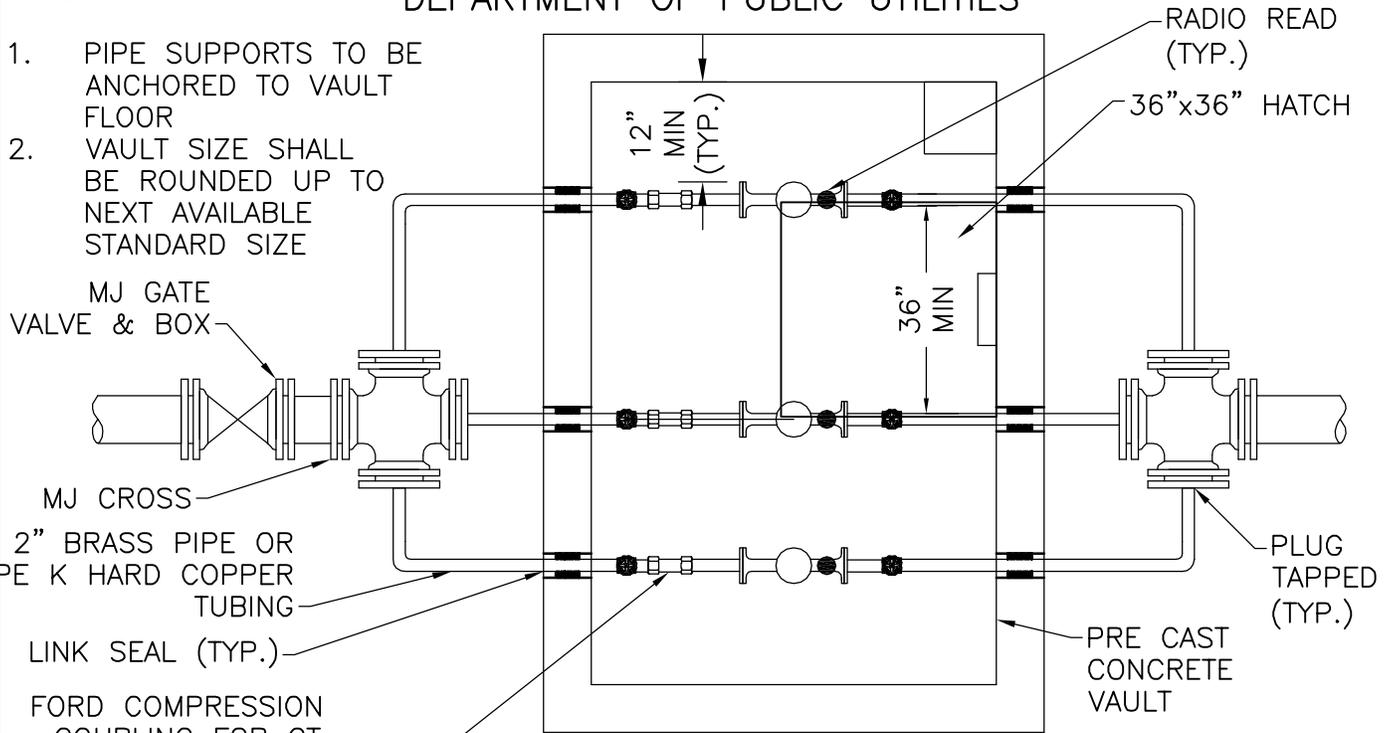
DRWG. NO.
MET-7

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

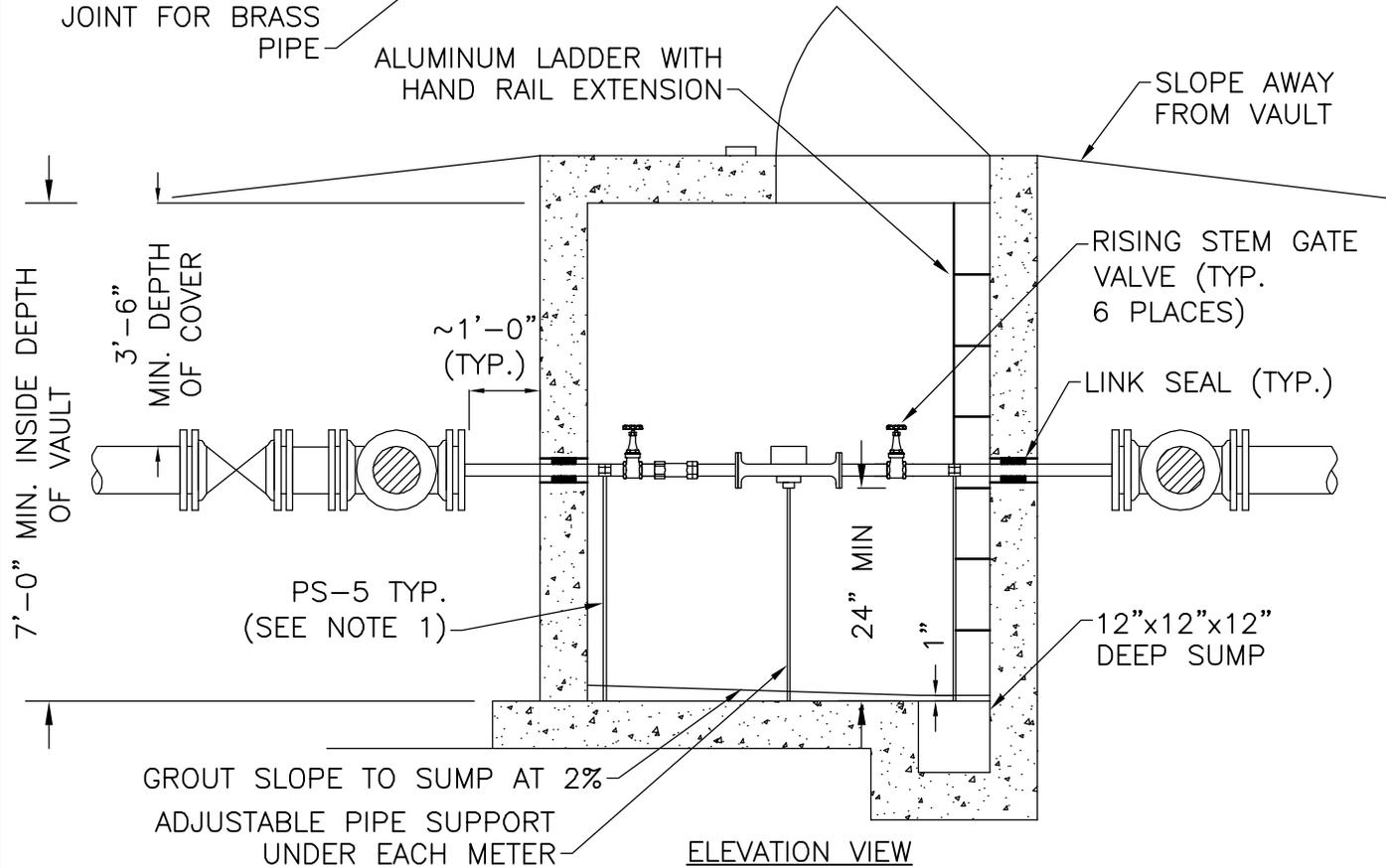
NOTE:

1. PIPE SUPPORTS TO BE ANCHORED TO VAULT FLOOR
2. VAULT SIZE SHALL BE ROUNDED UP TO NEXT AVAILABLE STANDARD SIZE

- MJ GATE VALVE & BOX
- MJ CROSS
- 2" BRASS PIPE OR PERK HARD COPPER TUBING
- LINK SEAL (TYP.)
- FORD COMPRESSION COUPLING FOR CT OR FORD PACK JOINT FOR BRASS PIPE



PLAN VIEW



ELEVATION VIEW

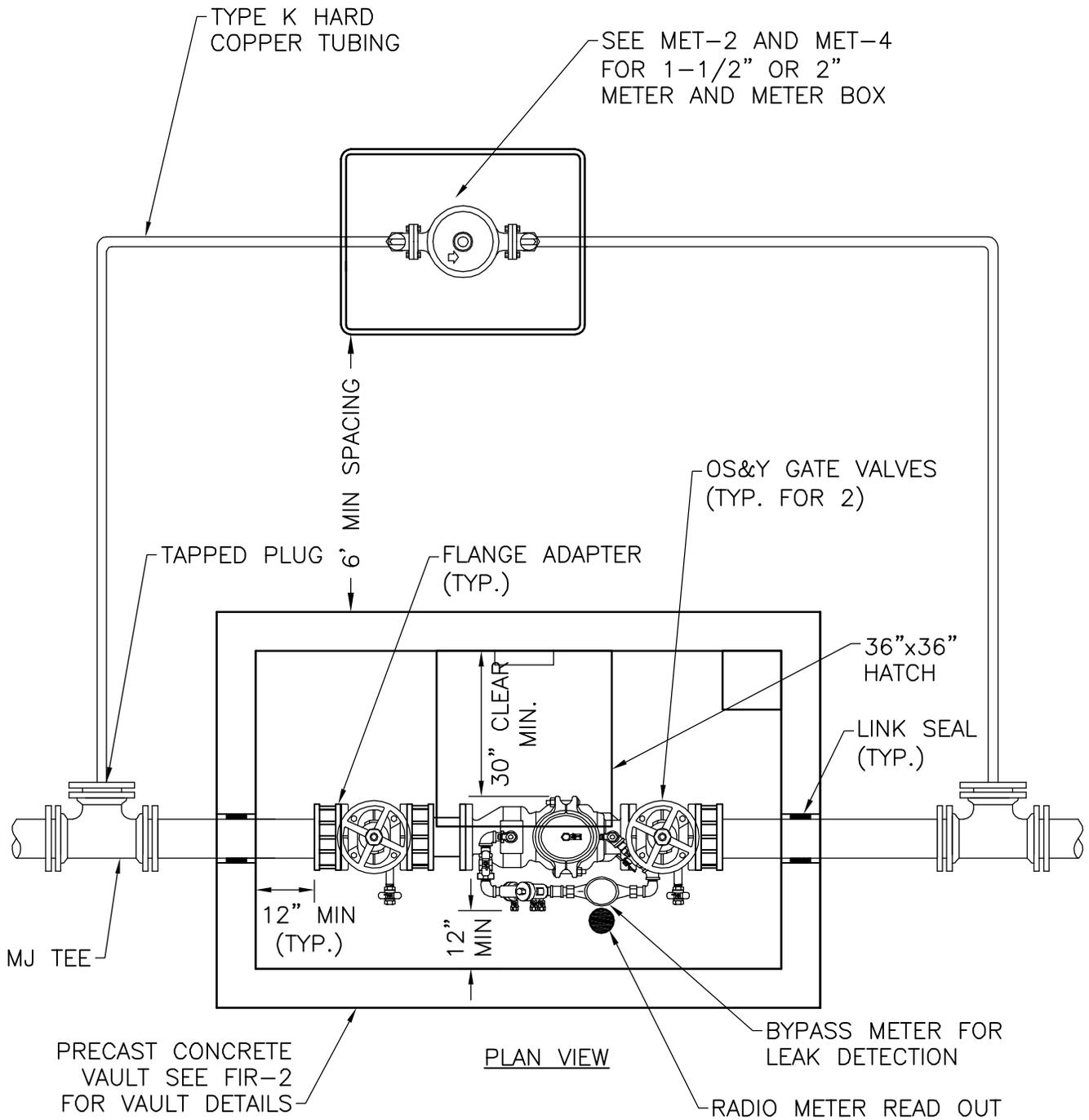
DATE:
OCT. 2014

REVISION:
OCT. 2014

TRIPLE 2" METER SETTING

DRWG. NO.
MET-8

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



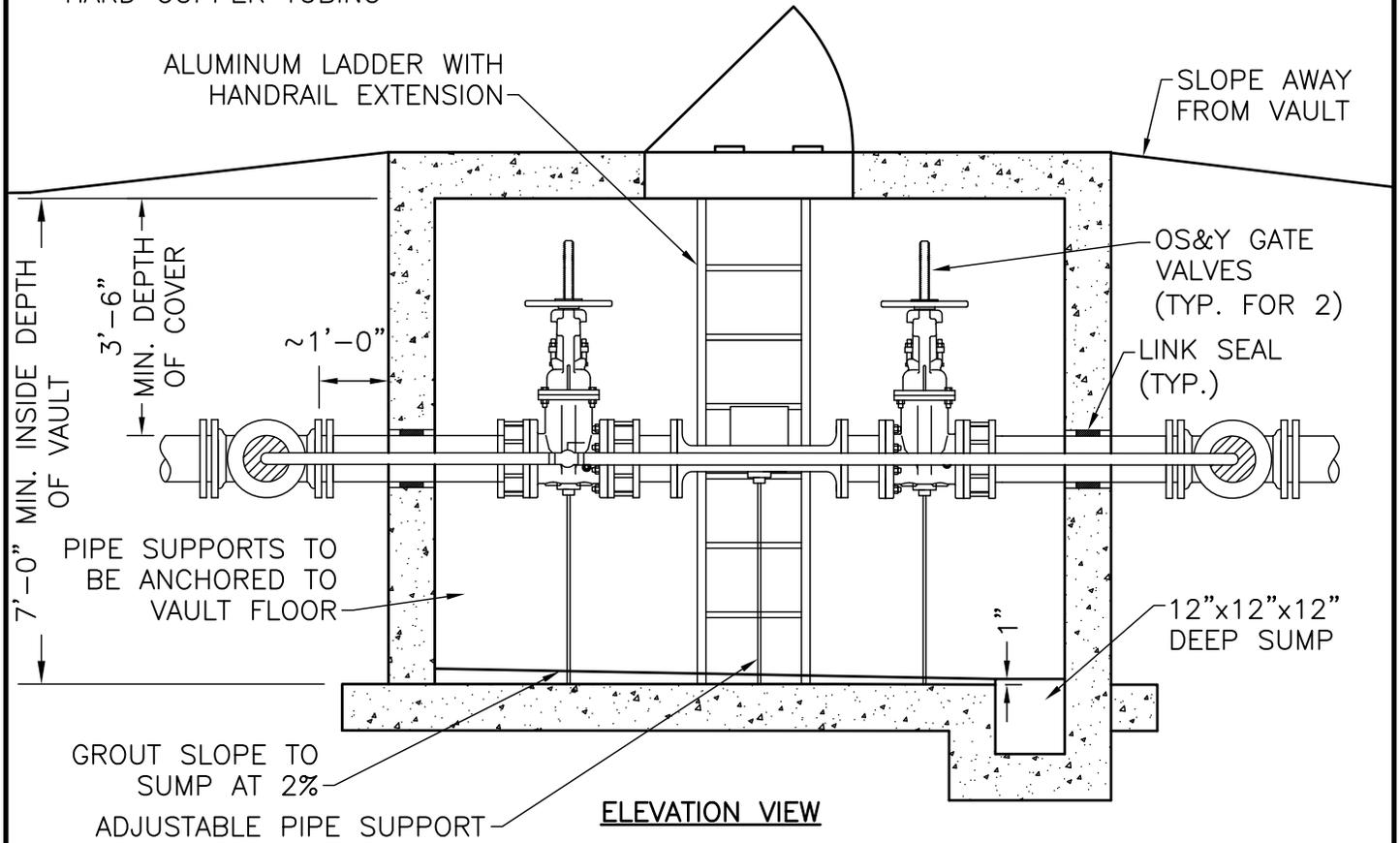
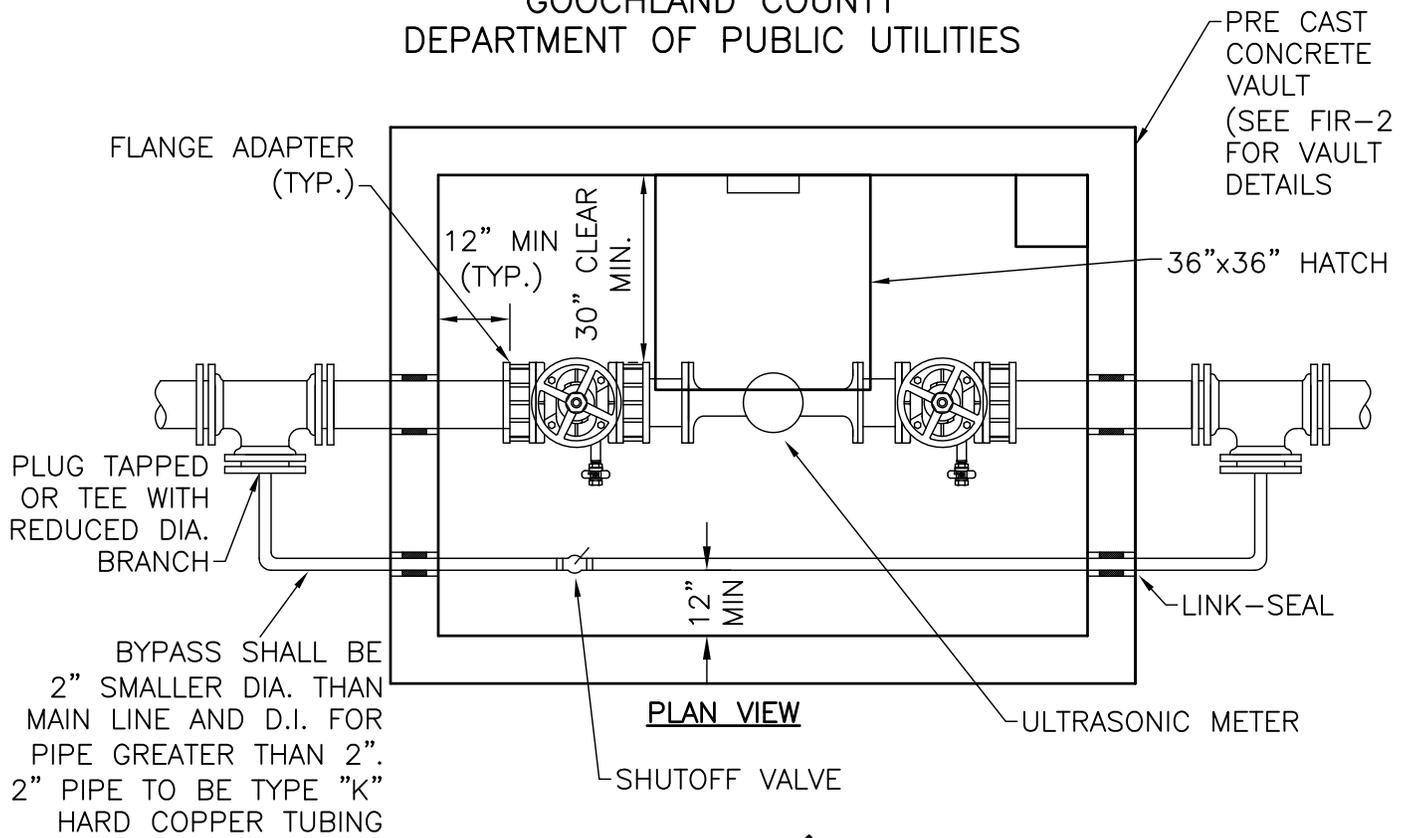
DATE:
OCT. 2014

REVISION:
OCT. 2014

1-1/2" OR 2" METER AND
DOUBLE CHECK VALVE ASSEMBLY

DRWG. NO.
MET-9

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

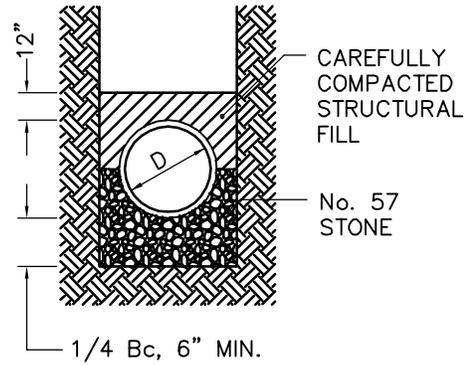


DATE:	OCT. 2014
REVISION:	OCT. 2014

4" THROUGH 10" ULTRASONIC METER SETTING

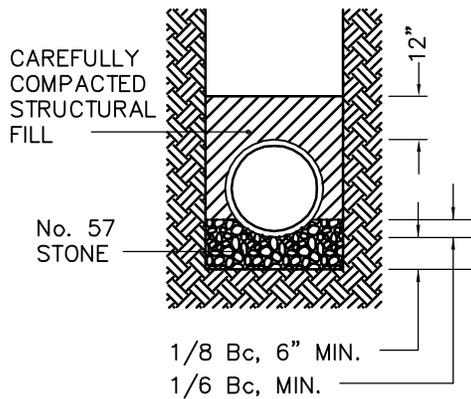
DRWG. NO.	MET-10
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GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

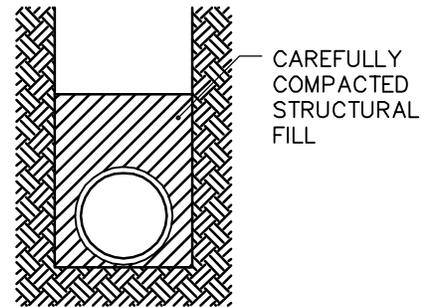


CLASS "B"
LOAD FACTOR = 1.9

Bc = O.D. OF PIPE
D = I.D. OF PIPE



CLASS "C"
LOAD FACTOR = 1.5



CLASS "C-1"
LOAD FACTOR = 1.5

NOTE: IN ROCK TRENCH, EXCAVATE AT
LEAST 6" BELOW THE BELL OF
THE PIPE.

NOTE: CLASS "C-1" BEDDING TO
BE USED ONLY FOR
DUCTILE IRON
PRESSURE LINES.

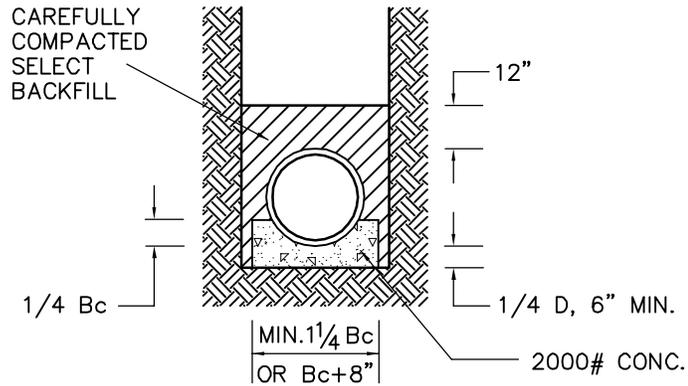
DATE:
OCT. 2014

REVISION:
OCT. 2014

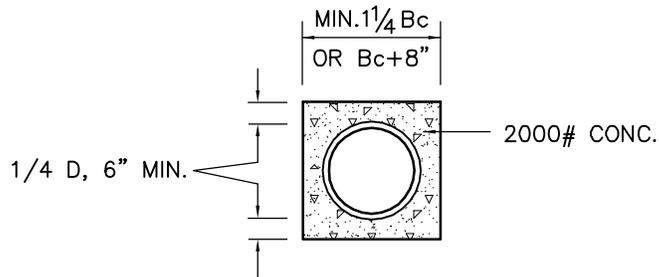
TRENCH BEDDING - 1

DRWG. NO.
TR-1

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



CLASS "A"
CONCRETE CRADLE
LOAD FACTOR = 2.8



CONCRETE ENCASEMENT
LOAD FACTOR = 4.5

Bc = O.D. OF PIPE
D = I.D. OF PIPE

DATE:
OCT. 2014

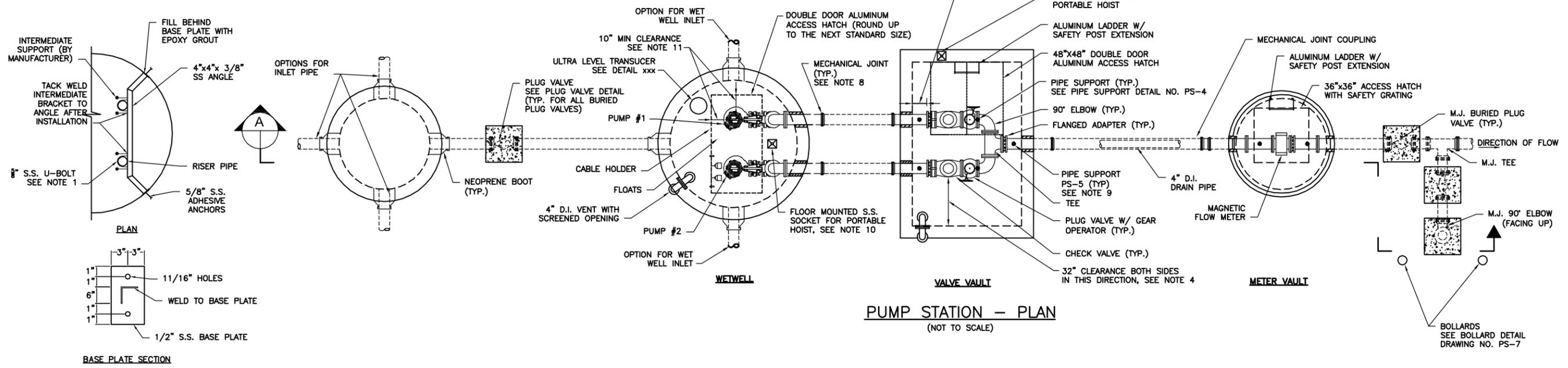
REVISION:
OCT. 2014

TRENCH BEDDING - 2

DRWG. NO.
TR-2

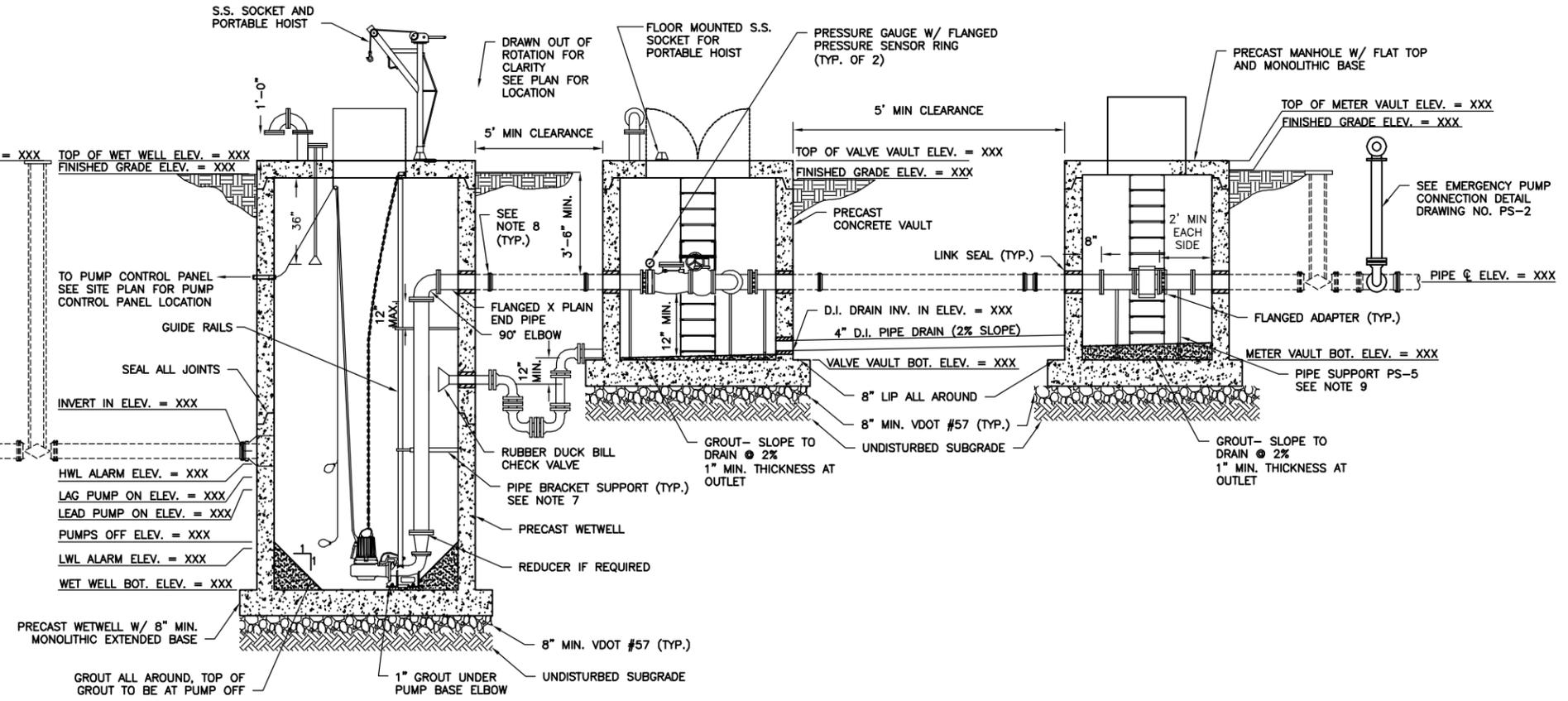
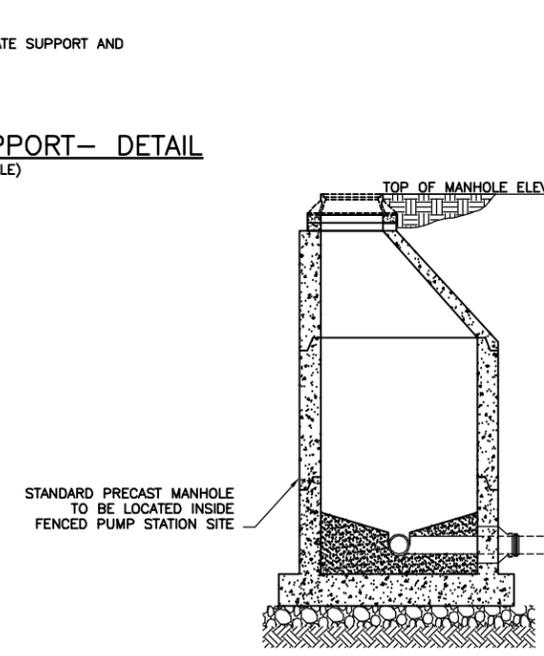
GOOCHLAND COUNTY
DEPARTMENT OF UTILITIES

DRWG. NO.
PS-1



NOTE:
1. U-BOLT TO GO THROUGH INTERMEDIATE SUPPORT AND ANGLE IRON WITH DOUBLE NUTS.

PIPE BRACKET SUPPORT- DETAIL
(NOT TO SCALE)



- NOTES:
1. PUMP STATION LAYOUT IS GENERIC AND IS TO DEPICT THE GENERAL ARRANGEMENT AND THE MINIMUM EQUIPMENT REQUIRED.
 2. PIPE AND VALVE SIZES WILL DEPEND ON DESIGN REQUIREMENTS.
 3. MINIMUM PUMP, VALVE, AND PIPING SIZE IS 4 INCHES.
 4. MINIMUM DIMENSIONS FOR THE VALVE VAULT AND THE METER VAULT ARE DETERMINED BY CLEARANCES INDICATED ON THE DRAWINGS. ROUND UP SIZES TO THE NEXT STANDARD SIZE.
 5. ALL PIPING INSIDE THE PUMP STATION FENCE AREA SHALL BE DUCTILE IRON WITH RESTRAINED JOINTS.
 6. SEE PUMP STATION SPECIFICATIONS FOR DESIGN REQUIREMENTS.
 7. INSTALL ONE PIPE BRACKET SUPPORT AT 90° ELBOW. INSTALL ADDITIONAL PIPE BRACKET SUPPORTS AT MAXIMUM 10' INTERVALS EQUALLY SPACED BETWEEN TOP SUPPORT AND PUMP BASE SUPPORT. INSTALL PUMP GUIDE RAIL INTERMEDIATE SUPPORT AT EACH PIPE BRACKET SUPPORT.
 8. INSTALL A RESTRAINED MECHANICAL JOINT OUTSIDE OF EACH STRUCTURE 12" FROM WALL.
 9. PIPE SUPPORTS TO BE ANCHORED TO CONCRETE BASE.
 10. PORTABLE HOIST SOCKET SHALL BE LOCATED TO ALLOW HOIST HOOK TO BE VERTICALLY CENTERED OVER PUMP PICK POINT.
 11. ACCESS HATCH SIZE SHALL BE ROUNDED UP TO HATCH STANDARD SIZE.
 12. VALVE VAULT AND METER VAULT MAY BE COMBINED INTO A SINGLE VAULT DEPENDING UPON SIZE AND SPACE AVAILABILITY AND LIMITATIONS OF THE PUMP STATION SITE.

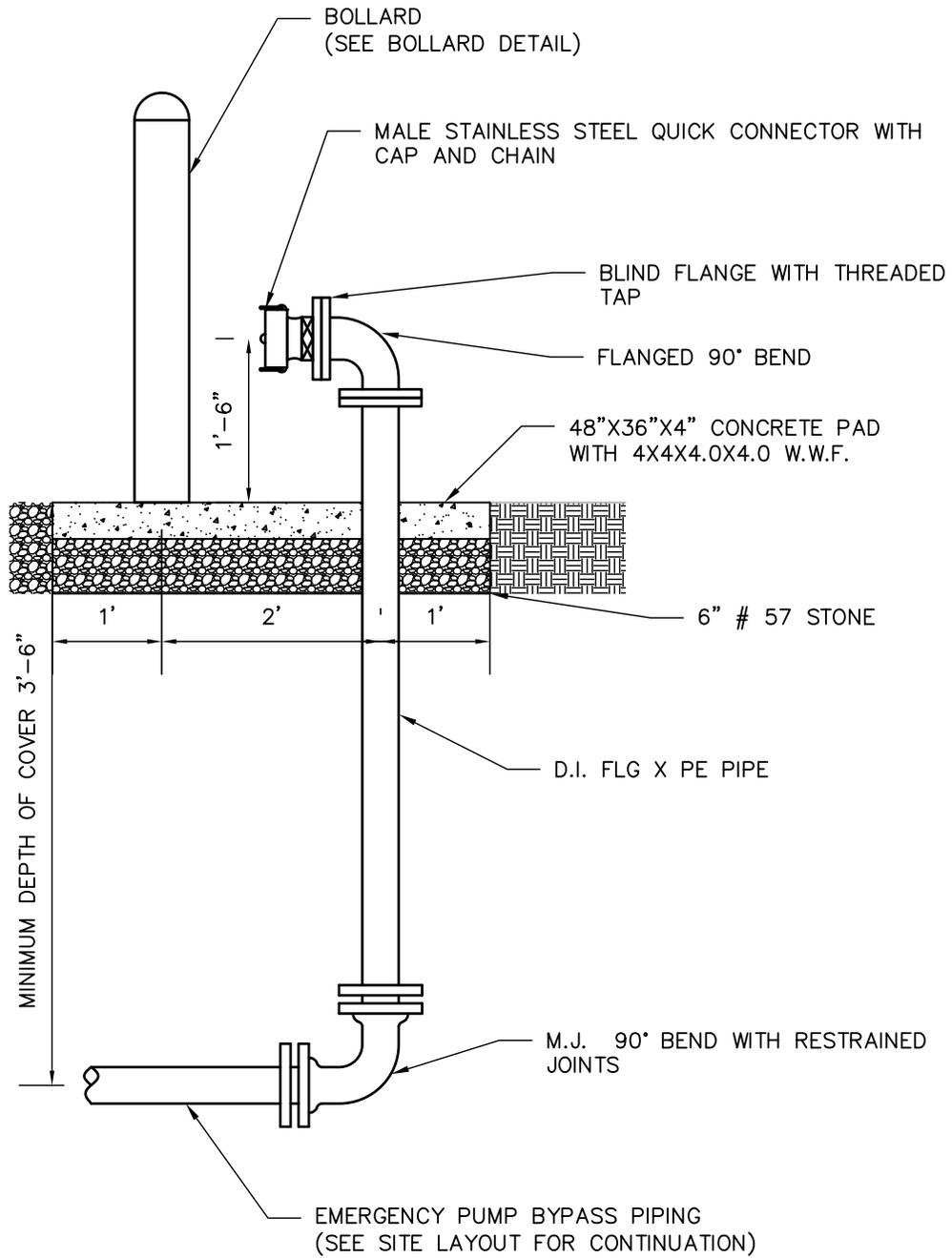
PUMP STATION - SECTION
(NOT TO SCALE)

* THIS DRAWING IS FOR PUMP STATION DESIGN GUIDANCE ONLY. EACH PUMP STATION DESIGN SHALL TAKE INTO CONSIDERATION ALL INDIVIDUAL AND UNIQUE SITE REQUIREMENTS.

STANDARD PUMP STATION

DATE: OCT. 2014
REVISION: OCT. 2014

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

1. PAINT ALL EXPOSED PIPING.
2. SEE SITE PLAN FOR PIPE SIZES.

DATE:
OCT. 2014

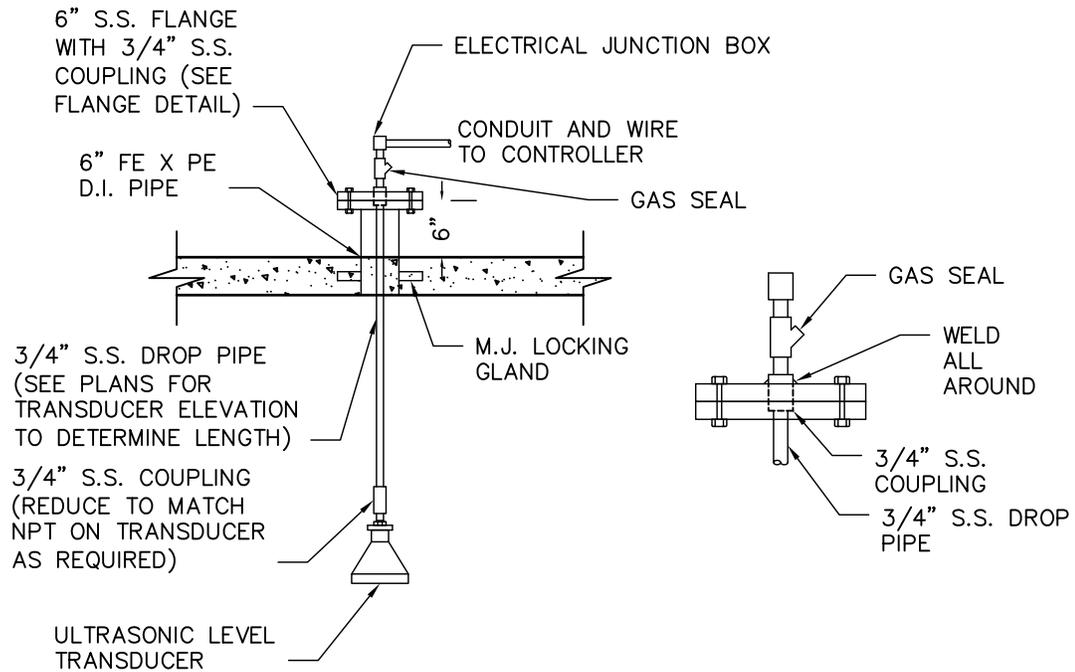
REVISION:
OCT. 2014

EMERGENCY PUMP CONNECTION

DRWG. NO.

PS-2

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

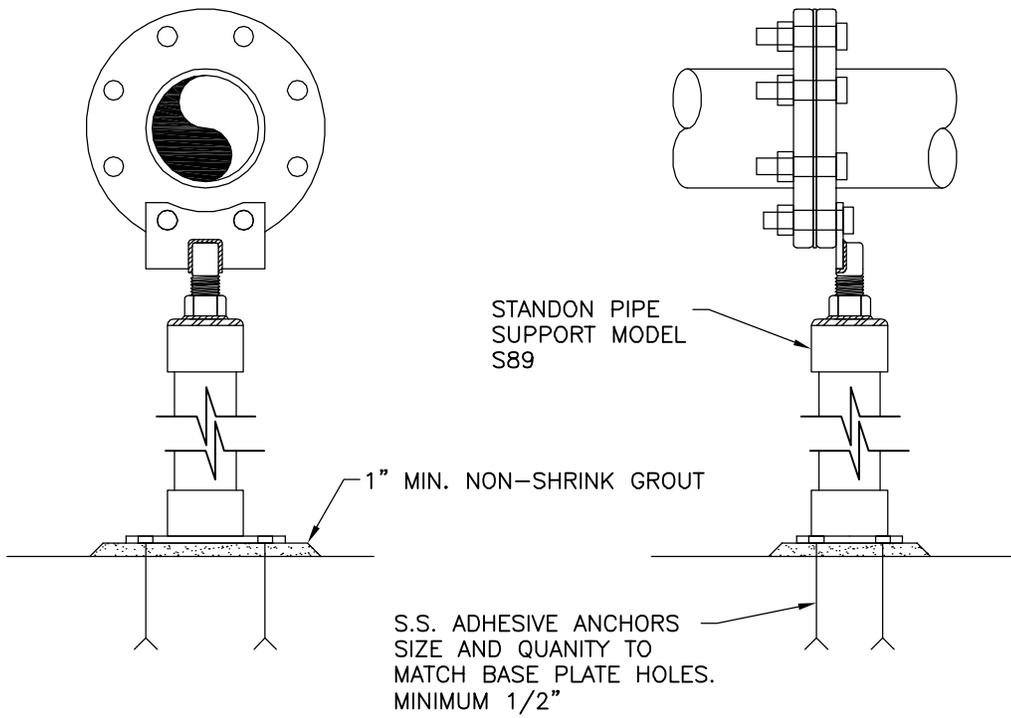
REVISION:
OCT. 2014

ULTRASONIC LEVEL SUPPORT

DRWG. NO.

PS-3

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

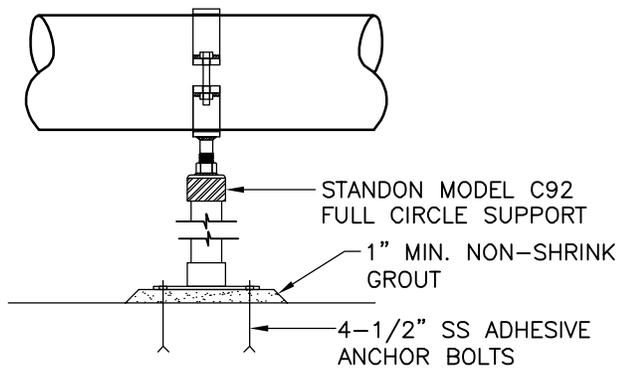
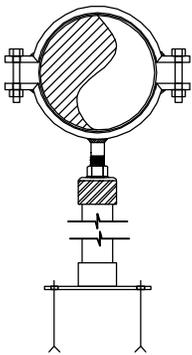
REVISION:
OCT. 2014

PIPE SUPPORT - 1

DRWG. NO.

PS-4

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

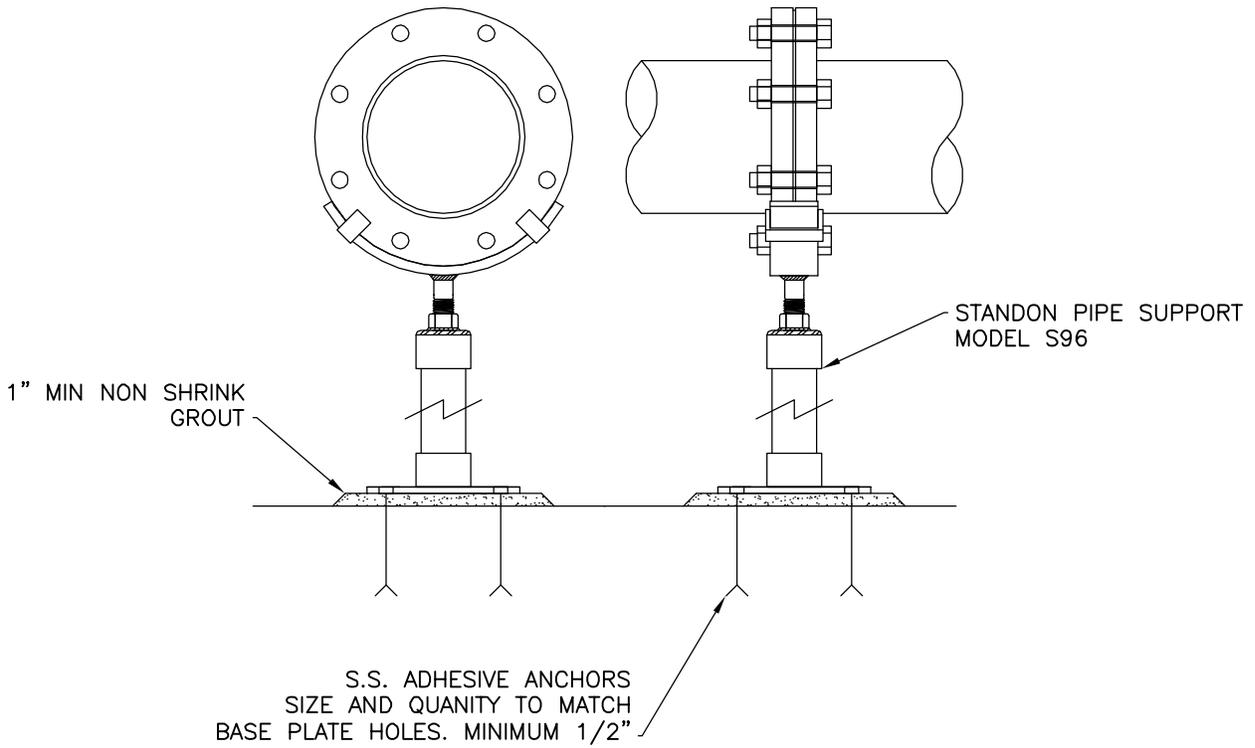
REVISION:
OCT. 2014

PIPE SUPPORT - 2

DRWG. NO.

PS-5

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

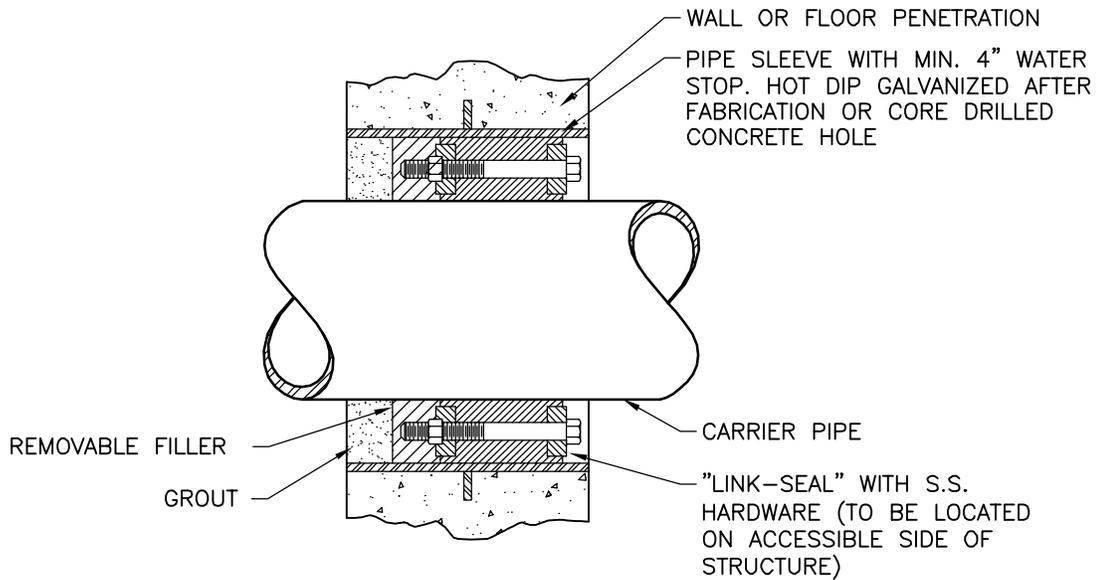
REVISION:
OCT. 2014

PIPE SUPPORT - 3

DRWG. NO.

PS-6

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTE: HOLE SIZE AND LINK SEAL SIZE TO BE COORDINATED AS PER MANUFACTURER'S REQUIREMENTS.

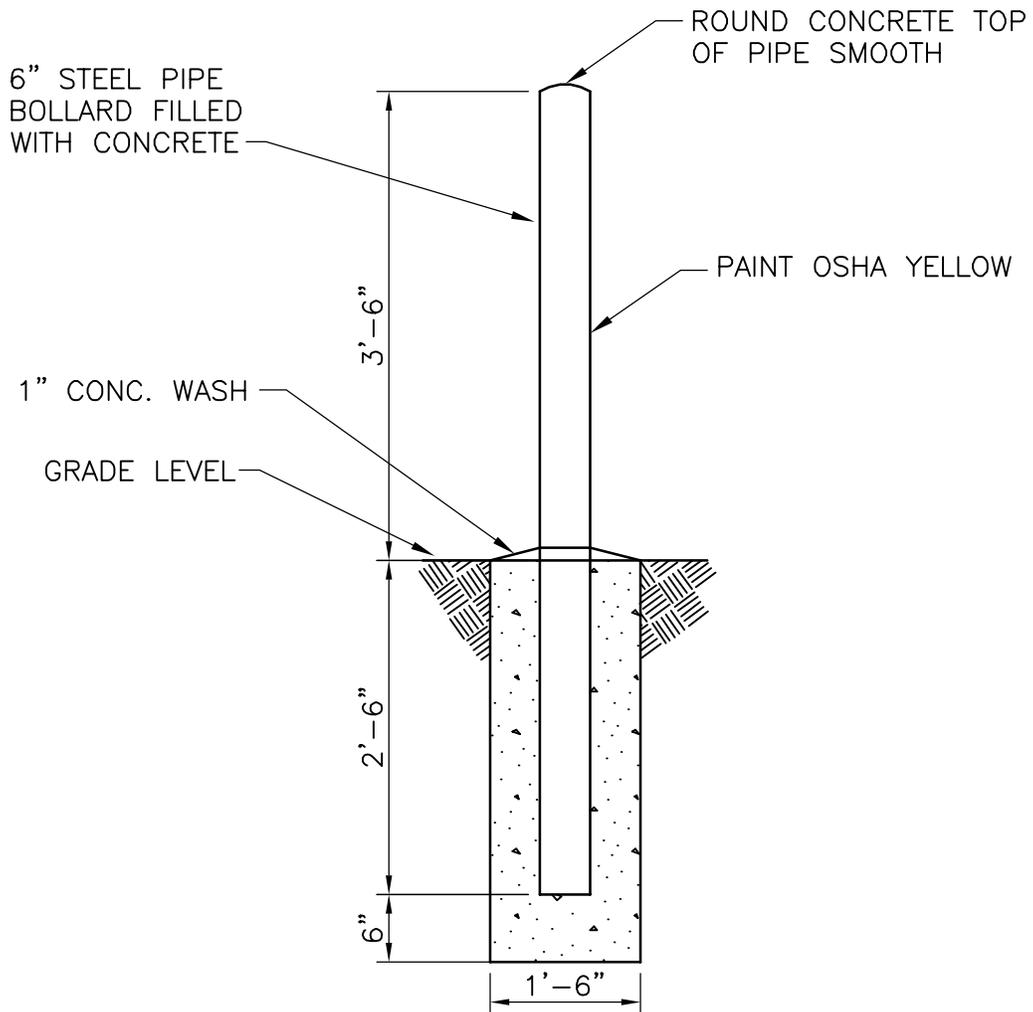
DATE:
OCT. 2014

REVISION:
OCT. 2014

LINK SEAL

DRWG. NO.
PS-7

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

REVISION:
OCT. 2014

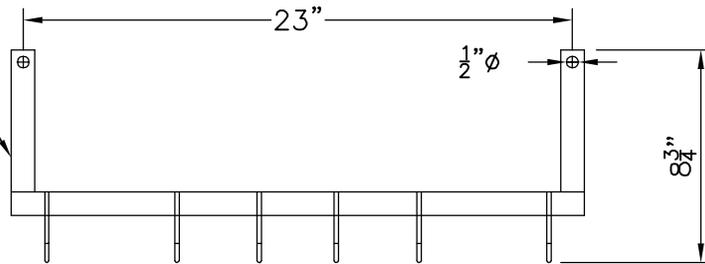
PIPE BOLLARD

DRWG. NO.

PS-8

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

$\frac{1}{4}$ " X $1\frac{1}{2}$ "
STAINLESS
STEEL



$\frac{3}{8}$ " STAINLESS STEEL
ROUND STOCK

NOTES:

1. 304 STAINLESS STEEL CONSTRUCTION
2. CONTRACTOR SHALL COORDINATE REQUIRED NUMBER OF HOOKS WITH NUMBER OF POWER CABLES AND NUMBER OF FLOATS. EACH CABLE SHALL HAVE ITS INDIVIDUAL HOOK.
3. EACH HOOK AND CABLE SHALL BE LABELED WITH A WATERPROOF TAG.

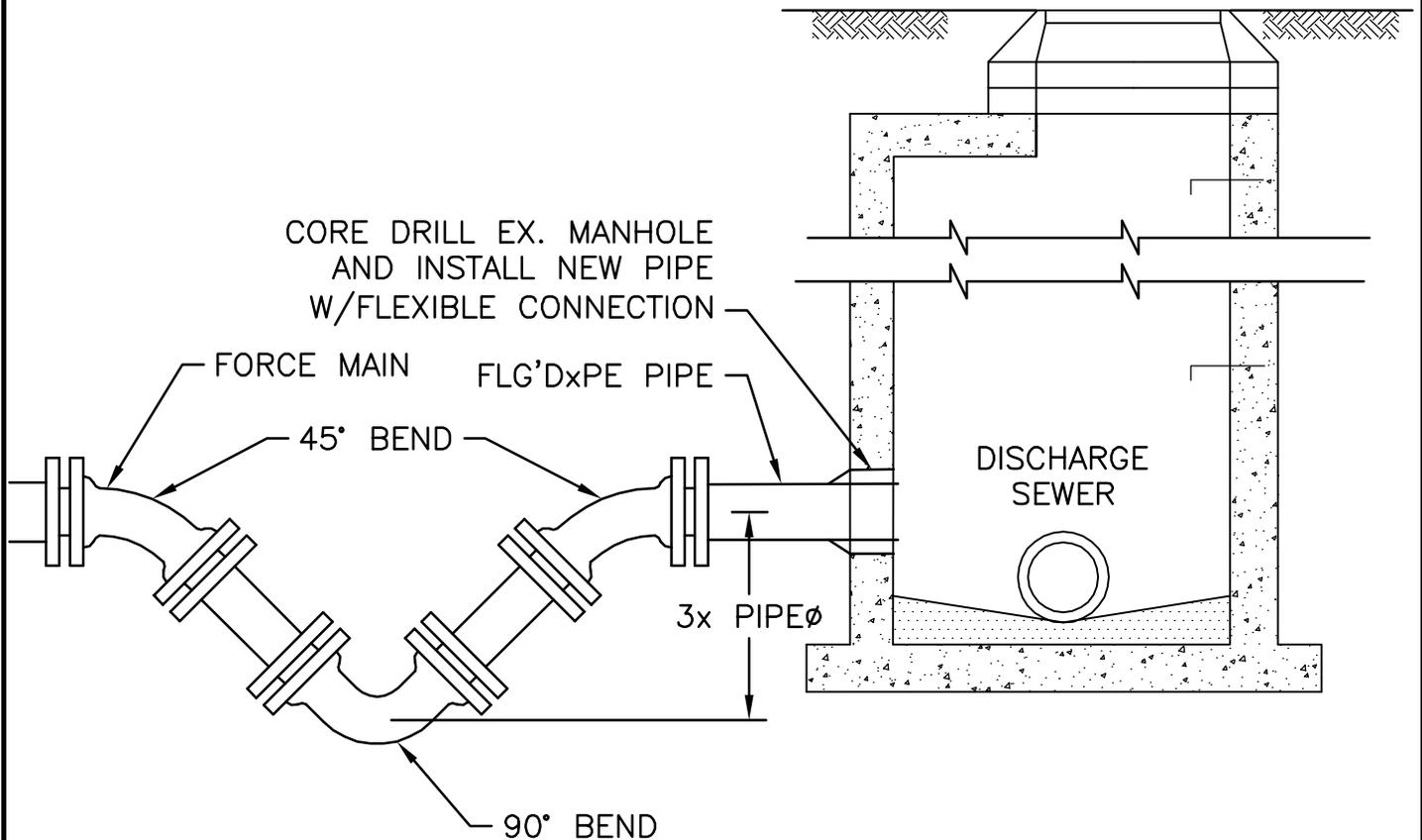
DATE:
OCT. 2014

REVISION:
OCT. 2014

CABLE HOLDER

DRWG. NO.
PS-9

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



DATE:
OCT. 2014

REVISION:
OCT. 2014

FORCE MAIN TERMINATION
AT EXISTING MANHOLE

DRWG. NO.
PS-10

SECTION 7 - GENERAL CONSTRUCTION STANDARDS

7.1.1 Summary of Work

- A. Work covered consists of providing all work indicated on Construction Drawings approved for the project.

7.1.2 Special Project Procedures

- A. Construction operations in public streets, roads or alleys, shall be confined to as small a space as is practicable and shall be subject at all times to the approval of the Virginia Department of Transportation (VDOT). Unless otherwise directed by the County Engineer or VDOT, the Contractor shall perform the proposed construction as follows:
 1. Contractor shall apply for and obtain all construction permits required. Contractor shall obtain same from the Virginia Department of Transportation.
 2. Notify the County Engineer not less than 48 hours before work is to start.
 3. Use proper warning signs and barricades at all times. Provide flagman on heavily traveled streets and roads and when required by the Virginia Department of Transportation. Drawings shall include traffic control drawings in accordance with VDOT requirements for traffic control.
 4. Maintain one-way traffic at all times unless otherwise permitted.
 5. Open no more than 100 feet of trench at any one time and block no more than one intersection. Allow not more than 15 feet of ditch to remain open overnight and then only when approved by the Virginia Department of Transportation.
 6. If, in the opinion of the Virginia Department of Transportation, the material taken from the trench is not suitable for backfilling, it shall be removed, and an acceptable material used for backfilling trenches within 1 foot of the edge of pavement. The top 9 inches of the trench shall be VDOT approved crushed stone material compacted and surface treated.
 7. All trenches crossing the pavement, trenches running parallel, or nearly so, and lines within a street intersection, shall be backfilled with VDOT approved crushed material. House lateral trenches shall be mechanically tamped.

8. Use calcium chloride to settle dust whenever necessary and required by the County Engineer.
9. Sweep all loose material from hard surface immediately after backfilling. All roadway surfaces shall be swept clean at the end of each work day.
10. Watch all trenches closely for settlement during rainy periods. If an emergency situation occurs, repairs will be made at the Contractor's expense.
11. Use only machines equipped with pneumatic tires for backfilling and cleaning up on surface treated or paved areas.
12. Provide VDOT approved base material to a minimum of 9 inches compacted depth on top of regular trench backfill when the trench is in the pavement, or is parallel to the pavement and disturbs the road shoulder within two feet of the pavement. Any trench dug parallel to the pavement which disturbs the road shoulder two or more feet from the pavement or is dug in graveled streets shall be backfilled with the same or equal material to that which was removed from the trench.
13. Notify the Virginia Department of Transportation prior to replacing bitumen surfaces. Either a plant mix or a double surface treatment of tar and gravel may be used except on roadways that are already surfaced with plant mix. On these roadways, plant mix shall be provided to the same or greater compacted depth as in the existing pavement. The entire disturbed area shall be resurfaced when the excavation disturbs the shoulder within one foot of the pavement. The approval of the Virginia Department of Transportation is required as to type of treatment, material, width and depth and method replacement.
14. All trenches and repaved areas shall be maintained for a period of 12 months, and shall be repaired upon request of the Virginia Department of Transportation.
15. The Contractor shall restore all street and road shoulders and ditches to their original side slopes and flow grades, and shall replace all stabilized materials and ditch linings disturbed or removed along the lines of construction. Any damage to or removal of grasses, plants or shrubs, and the like, that have been planted or landscaping or for the prevention of soil erosion shall be replaced by the Contractor. The Contractor shall also be responsible for maintaining such until the Virginia Department of

Transportation states its approval of the cleaning up and rebuilding of road shoulders and ditches. Property owners will be notified by the Contractor to remove all shrubs, etc., located within the limits of constructions. Contractor shall strip and restore sod on established lawns or replace with sod of equal quality.

- 16. The Contractor shall keep all private driveways, walkways and surface drains open for use of the property owner except when an agreement between the property Owner and the Contractor permits temporary closing. In any event, the driveways, walkways and drains shall be returned to their original condition. The backfill in driveways and walkways shall be tamped with mechanical equipment, from trench bottom to existing ground surface, to the same density as existed before removal. Surface treatments shall be replaced to original appearance and quality.
- 17. In the event that these conditions are not complied with after reasonable written notice has been given, the County will correct the defective work at the Contractor's expense.
- 18. VDOT approved crushed material of 9 inches of compacted depth shall be placed on top of regular trench backfills when any trench dug parallel with pavement disturbs the road shoulder within 2 feet from the edge of the pavement. Any trench dug parallel with the pavement which disturbs the road shoulder two or more feet from the edge of the pavement may be refilled with the same material, when determined to be suitable by the County Engineer and VDOT, that was removed from the trench and crushed material will not be required. When crushed material is required, VDOT Standard 21A, or approved equal, shall be used per the following gradation requirements:

<u>Sieve Designation</u>	<u>Percentage by Weight Passing Square Mesh Sieve</u>
2 inch	100 percent
1 inch	94-100 percent
3/8 inch	63-72 percent
No. 10	32-41 percent
No. 40	14-24 percent
No. 200	6-12 percent

- 19. Contractor shall maintain trenches for a period of 12 months from the completion of work unless sooner relieved by the County Engineer.

20. Contractor shall Video tape all work areas and adjacent areas before starting work. All walks, driveways, lawns shall be maintained and restored to their original condition by the applicant and maintained for the 12 month period unless sooner relieved by the County Engineer or the interested property owner.
21. All paving made necessary by the Construction work must be restored and approved by the County Engineer and VDOT as listed below. The installation of utilities within the roadway bed of any public street will require the roadway to be milled and repaved for the entire length of construction activities. This repaving would be completed under the following pavement criteria:
 - a) All paving shall be saw cut. All final pavement elevations shall match the existing pavement elevations prior to work starting. Pavement shall be milled as required to accomplish this. Where new pavement meets existing pavement the existing pavement shall be cut to a depth not less than 2". No feathering of the pavement shall be allowed.
 - b) All utilities which are installed within the paved surface parallel to the centerline will provide a pavement overlay for the entire length of construction activities and the entire width of the roadway unless the County Engineer or VDOT establishes alternative repaving.
 - c) Any multiple installation of utilities perpendicular to the roadway centerline will be required to provide repaving of the entire width of the roadway for the distance between the first and last multiple utility cut.
 - d) Installation of a single utility perpendicular to the roadway centerline will be required to provide repaving by placing the BM-2 asphalt even with the existing base pavement. The SM-2A asphalt will be extended 10 feet on each side of the pavement cut for the trench by milling to a minimum depth of 2" and rolled down so that no ridges or bumps remain.
 - e) If the subject street has curb and gutter and is an asphalt street, it will be necessary to remove two inches of asphalt prior to the repaving requirement of the permit.
 - f) This resurfacing required does not eliminate any other requirements such as full depth of BM and SM as required by the VDOT permit.

- g) Approval of the paving does not relieve the contractor of the responsibility of the damage due to settlement during the 12 month period.
- 22. All trenches within 1 foot of the edge of the pavement shall not only be backfilled as outlined above, but shall be surface treated to prevent weakening the original pavement using 0.40 gallons of CRS-2 liquid asphalt per square yard of surface covered with 28 lb. of #778 stone per square yard.
- 23. Pavement on plant mix streets shall be replaced with eleven inches of BM-2 and two inches of SM-2A or the depth of the existing pavement, whichever is greater.

7.1.3 Coordination

- A. Phases of the construction which involve the temporary interruption of essential services shall be scheduled in consultation with the Utility Provider, Property Owners or Utility Users and the County or their representative and shall not be of longer duration than essential to accomplish the purpose for such interruptions. Liaison in this matter shall be required before beginning any work. The Contractor shall notify the County not less than 48 hours in advance of commencing work. The Contractor shall give not less than 48 hours notice in advance of the time and date of making any connections to the existing water or sewer system. The County may disapprove the time and date of any and all connections and will advise the Contractor as to a suitable time and date.
- B. The contractor shall not operate any valves on the County system or make connections to existing sewer and water lines before proper notification is made to the County so that inspection of this work can be made.

7.1.4 Field Engineering

- A. Grades, Lines and Levels
 - 1. The Design Engineer shall established baseline and control points. From these points the Contractor shall furnish necessary personnel and equipment to establish line and grade as required for the work. The Contractor shall furnish detailed construction documents to the County before beginning construction. The data on the documents shall include all information as specified in these specifications but as a minimum shall include, but not be limited to, centerline elevations (existing and proposed), centerline cut, centerline invert, manhole locations, manhole top and invert elevations, grade

between manholes, and bench mark locations and elevations. Stationing intervals shall be every 50 feet.

2. The Contractor shall be responsible for the preservation of all stakes and marks established by the Design Engineer, and if any of the stakes and marks are carelessly or willfully disturbed, the cost of replacing them shall be charged against the Contractor.
3. Design Engineer shall certify that all streets, including curb and Gutter, are to the correct finish grade prior to acceptance of utility construction by the County.

7.1.5 Measurement and Payment Definitions

- A. For purposes of measurement and payment the following terms shall have the meaning assigned to each.
 1. Main Trench: A trench essentially parallel to rights-of-way or property lines and in which the proposed utility lines are to be installed.
 2. Service Trench: A trench essentially perpendicular to main trenches and in which the proposed utility service pipes are to be installed.
- B. Classified Excavation: The removal and disposal of earth, hardpan or rock materials according to the following:
 1. Earth Excavation: The removal and disposal of pavement, less than 4 inches thick, underground structures and utilities indicated to be demolished and removed, and all other materials encountered not classified as hardpan or rock excavation.
 2. Hardpan Excavation: The removal and disposal of material that cannot be removed from the trench without the use of an air spade or blasting. Indurated clay, shale or sand with cementitious materials is typical of this material.
 3. Rock Excavation: The removal and disposal of all solid rock that cannot be excavated without continuous and systematic drilling and blasting or continuous use of rock excavation equipment. Boulders 1/2 cu. yd. or more in volume, solid rock, and rock in ledges are typical of this material.
 4. Hand Excavation: Excavation made with hand tools when in the opinion of the Engineer such excavation is necessary. Hand

excavation where called for on the drawings will be considered part of the contract and will not be paid for under unit prices. Hand excavation shall be performed under the drip line of trees, at curb and gutters, pipe crossing utilities, sidewalks, driveways, utility poles and any other place where the contractor must hand dig to prevent damage to existing utilities or structures or for the safety of personnel.

5. Test Hole Excavation: Excavation made at the direction of the Engineer for any purpose related to work.
6. Concrete Paving Removal: Removal of paving greater than 4 inches thick, including concrete curbs, gutters and sidewalks.

C. Measurement and Payments for Excavation:

1. Hardpan and Rock: Main line trench and force main trench shall be computed and paid for according to the actual depth of the hardpan or rock to the invert of the pipe plus the 6 inch bedding material and the actual length of the trench, and, for main line trench and force main trench, the actual width of the trench not to exceed the nominal pipe diameter plus 24" for pipes up to 30 inches and less in diameter. The width of the service trench shall be 2 feet. For pipe 36 inches, or greater in nominal diameter, the trench width shall be the outside diameter plus 36 inches and trench depth shall be based on the depth of rock to the outside barrel of the pipe plus 6 inches. Where the trench width is not calculated to a foot or half-foot, the measurement shall be rounded to the next 6 inches. Manhole and structure excavation shall be for the depth encountered including the base and 6 inch cushion of bedding material. The horizontal dimensions shall assume a square extending 1 foot beyond the exterior walls of the structure when forming is not required and 2 feet when forming is required. Payment for rock excavation in the pipe trench will not be allowed for this distance.
2. Earth: Main line trench, force main trench and service trench, when payment is to be computed on a volumetric basis shall be computed as set forth for hardpan and rock, except that the depth shall be in accordance with the cut sheet, which is the bottom of the pipe for force mains and the invert of the pipe for gravity lines. When excavation payments are on a depth basis, measurements shall be from the ground surface at the centerline of the trench to the invert of the pipeline.

3. Bedding in rock, hardpan or earth: Bedding required for pipe laid in rock, hardpan, or earth shall be included in the unit excavation price for these items.
 4. For trenches, the pay width for single pipe excavation shall be the nominal diameter of the pipe, plus 12 inches or a minimum width of 24 inches. When two or more pipes are laid in the same trench, the trench width shall be the sum of the nominal diameters of the pipe plus 12 inches plus 6 inches for each space between the pipes. For lowering or raising mains, the trench width shall be 48 inches. When pay width is not an even foot or half foot it shall be increased to the nearest foot or half foot.
 5. Unauthorized excavation consists of removal of materials beyond indicated elevations or specified widths, without written approval of Engineer. Unauthorized excavation shall be replaced at Contractor's expense.
 6. Hardpan or rock excavation shall not be backfilled until Engineer has verified that such excavation was required and has determined the hardpan or rock profile.
- D. Lowering excavation: Excavation made to permit the lowering or raising of water main and accessories.
- E. Water main accessories shall consist of all valves, retainer glands, fittings, boxes and the like, other than pipe that are a part of the water system.
- F. Shoring consists of sheeting and/or braces used to prevent earth movement. The County or Property Owner reserves the right to require shoring to protect existing building or facilities.
1. Sheeting and braces left in place shall be paid for in accordance with unit price contained in "Force Account Items" included in the Project Manual and shall be cut off at least 18 inches below finished surface.
- G. Standard payment items shall be computed as follows:
1. Hardpan Excavation and Rock Excavation: Price per cubic yard of hardpan excavation defined under classified excavation above. Pay depth for water lines, force main, and gravity sewers shall be depth to invert plus 6 inches. The payment for hardpan excavation, whether in main or service trenches shall include the specified bedding of crusher run stone or gravel, furnishing and placing of

approved select backfill material, and disposal of unapproved material.

2. Hand Excavation: Price per cubic yard for hand excavation when specifically authorized by the Engineer. Work done under this item will be limited to unforeseen items not shown on the contract drawings that would otherwise be damaged or removed during the course of machine excavation. No allowance shall be made under this item for hand excavation necessary to locate or protect culverts and underground utilities.
3. Shoring Left in Place: Price per thousand board feet (MBM) for shoring ordered left in place. This item shall include all of the cost of furnishing, placing and cutting the sheeting as well as the braces. The entire cost of placing and removing ordinary sheeting and/or bracing installed primarily to protect workmen or existing structures and to facilitate construction, not ordered left in place shall be at the Contractor's expense.
4. Removal of Unstable Soil and Replacement with Select Material: Price per cubic yard of select material provided as directed by the Engineer. Payment under this item shall include the removal of unsuitable material and replacement with select material because of unstable foundation below the pipeline as well as material provided because the excavated material is unsuitable for proper backfilling of the trench. Surplus excavation from other portions of the project will be compensated for under this item only when the haul distance exceeds 1000 feet. Payment for select material required when pipe is laid in rock and/or hardpan and for backfill because of the inability to use hardpan or rock removed from the trench shall be included in the price bid for hardpan and/or rock. Payment shall be based upon the quantity of select material required for a trench with pay width as specified for hardpan excavation trenches for same depth and pipe diameter, and a select material depth as provided.
5. Replacement of Road Base: Price per linear foot of pipeline trench. Work under this item shall consist of providing 9 inches of compacted crushed road base material. The application of surface treatment is not a part of this item.
6. Crusher Run Stone on Road Shoulders, Private Entrances, and Driveways: Price per linear foot of pipeline trench, surfaced with approved crusher run stone. Stone shall be placed to the same depth as the original, with a minimum of 4 inches.

7. Replacement of plant mix pavement, State highways, and driveways: Price per linear foot of pipe line trench for the replacement of State highways and driveways surfaced with plant mix pavement in accordance with the conditions existing prior to construction.
8. Replacement of Plant Mix Pavement - County Roads: Price per linear foot of pipe line trench for replacement of roadway surfacing with plant mix pavement consisting of 11 inches of BM-2 and 1 inch of SM-2A or the depth of the existing pavement, whichever is greater.
9. Replacement of Surface Treated Pavement on Private Entrances and Driveways: Price per linear foot of pipeline trench for the restoration of surface treated pavement on private entrances and driveways. Price shall include the furnishing and installation of a double surface treatment.
10. Replacement of Cement Concrete Pavement: Price per linear foot of pipeline trench for the restoration of such pavement disturbed. Depth of pavement and of surfacing shall be in accordance with conditions existing prior to construction. Width of replacement shall extend 12 inches on each side of trench.
11. Concrete for Replacement of Sidewalks, Curbs, Gutters, etc.: Price per cubic yard of concrete furnished and used for replacing such structures removed during construction.
12. Concrete for Encasement, Trench Beds, and Utility Anchors: Price per cubic yard of concrete furnished and use for constructing such structures.
13. Furnish and Install (each size) Steel Casing Pipe: Price per linear foot to furnish and install steel casing pipe for the installation of pipe lines under State highways, railroads or other obstructions. Price per linear foot includes bore pit and receiving pit. Pipe shall be installed in strict compliance with applicable regulations. Payment shall be made under this item regardless of the method employed in placing the casing pipe.
14. Permanent Grading, Topsoiling, Seeding, and Strawing of Trenches: Price per linear foot of pipeline trench for permanent grading, topsoiling, seeding (including fertilizing and liming), and strawing. No separate payment will be made for temporary grading, topsoiling, seeding, and strawing. Topsoil and its

placement shall comply with the requirements of Section 10 – “Seeding.”

H. Water line payment items shall be computed as follows:

1. Furnish and Install (each size) Water Main Including Excavation and Accessories: Price per linear foot of water main furnished and installed, including excavation and backfill, testing and sterilization, and the furnishing and installation of all accessories, including valves, valve boxes and fittings. Excavation shall be unclassified unless stated otherwise in contract documents.
2. Locate and Connect to Existing Cast or Ductile Iron, PVC or HDPE Mains: Price for each connection made to existing mains. The price shall include the location of the line, as well as excavation necessary for making the connection. When the connection is made by means of a tapping sleeve and valve, the Contractor will receive all compensation for his work under this item. The tapping sleeve, valve, valve box and stem extension shall be furnished and installed by the Contractor.
3. Furnish and Install Fire Hydrants: Price for each fire hydrant furnished and installed, including the furnishing and installation of vertical extensions as required by the depth of bury. The 6 inch hydrant service line will be paid for under furnishing and installing pipe of this size. The furnishing and installing of concrete anchors will be paid for under “Concrete for Encasement, Trench Beds, and Utility Anchors.”
4. Furnish and Install Accessories for (each size) Water Services: Price for each water service accessory furnished and installed. Payment will include furnishing and installing the corporation stop, meter box and meter yoke.
5. Furnish and Install (each size) Water Service Pipe, Including Excavation: Price per linear foot for furnishing and installing service pipe, including excavation and backfill.
6. Furnish and Install (each size) Water Service Pipe Pushed, Directionally Drilled or Bored in Place: Price per linear foot of water service pipe furnished shall include steel casing pipe, (if used) and receiving pit and boring pit, and any other incidental work.
7. Casing pipe: Casing pipe where required shall be paid by the linear foot installed and shall include boring pit and receiving pit.

8. Directional Drilled pipe shall be paid for by the linear foot installed and shall include the boring rig and receiving pit.
- I. Sewer Line Payment Items Shall Be Computed as Follows:
1. Furnish and Install (each size) Sewer Pipe: Price per linear foot of sewer line for ductile iron, or PVC pipe, as specified, including furnishing, installing and testing the pipe. Payment for excavation and backfill shall be included.
 2. Furnish and Install (each size pipe) by 4- or 6-Inch Service Tees: Price for each service tee installed. Payment under this item shall be in addition to the footage payment for the main line pipe.
 3. Furnish and Install 4- or 6-Inch Pipe for Service Connections: Price per linear foot of service connections installed, including an adequate plug and marker at the upper end of the connection. The length of the connection shall be the horizontal distance from the centerline of the main sewer to the upper end of the connection, plus the length of vertical pipe installed for stacked connections. Payment for excavation and backfill shall be included.
 4. Excavation and Backfill for 8-Inch, 10-Inch, and 12-Inch Pipe: Price per linear foot of trench according to the actual depth classifications. Payment under this item shall include the bedding specified for sewer lines, since no additional payment will be allowed for bedding. Depth for payment shall be measured to the invert of the pipe.
 5. Excavation and Backfill for (each size) Pipe 15-Inch and Greater: Price per linear foot, with payment computed as set forth above for 8-inch, 10-inch, and 12-inch pipes.
 6. Excavation and Backfill for Service Connection: Price shall be for linear foot installed both horizontal and vertical including excavation and backfill Payment under this item shall include earth excavation and backfill; rock excavation or hardpan excavation will be paid for under appropriate item.
 7. Furnish and Install (each size) Ductile Iron Sewer Pipe: Price per linear foot of ductile iron sewer pipe furnished and installed in lieu of PVC pipe as specified. Price to include excavation and backfill.

8. Furnish and Install (each size) Ductile Iron Force Main: Price per linear foot of ductile iron pipe furnished and installed, including excavation, backfill, accessories, and testing.
9. Standard Manholes: Price per vertical foot of standard manholes. Depth for payment purposes shall be actual depth to the invert of the sewer line, plus the 8-inch concrete base. No extra payment shall be allowed for bedding when rock excavation is encountered, nor will an extra allowance be allowed for deep manholes requiring thicker walls.
10. Drop Connections: Price as shown in Standard Drawings.
11. Large Standard Manholes: Price per vertical foot for each diameter manhole, with payment as set forth above for standard manholes.
12. Special Design Manholes: Lump sum price for special design manholes in accordance with drawings and specifications, complete in place.
13. Casing pipe: Casing pipe where required shall be paid by the linear foot installed and shall include boring pit and receiving pit.
14. Directional Drilled pipe shall be paid for by the linear foot installed and shall include the boring rig and receiving pit.

7.1.6 Project Meetings

- A. A preconstruction conference with the County and the Contractor shall be scheduled before beginning any work.
- B. Progress meets shall be held at a minimum of once a month. County, Design Engineer, Contractor and all subcontractors shall be present as a minimum. Minutes shall be taken and distributed by the Design Engineer.

7.1.7 Submittals

- A. Construction Schedules
 1. Contractor shall submit a detailed construction schedule prior to the preconstruction conference. Construction schedule shall be reviewed at the monthly progress meeting and updated as required.
- B. Shop Drawings as Described Below in 7.1.8

7.1.8 Shop Drawings

- A. Shop drawings shall be submitted for all materials and equipment furnished and installed under the contract.
- B. The Contractor shall provide samples and shop drawings as requested under the specifications in accordance with the following requirements. When the Work of the Project is divided into separate Contracts, each Prime Contractor shall provide submittals directly to the Engineer. No materials shall be used in the work which do not equal the approved samples or shop drawings.
- C. Materials or appliances requiring approval must not be fabricated or incorporated into the work until approval has been given. The approval or acceptance of samples shall not preclude the rejection of any material upon the discovery of defects prior to the final acceptance of the complete work.
- D. After a material has been approved, no change in brand or manufacturer will be permitted unless satisfactory written evidence is presented to, and approved by the Engineer, that the manufacturer cannot make scheduled delivery of approved material, or that other conditions are apparent which indicate the approval of such substitute materials to be in the best interest of the Owner.
- E. Samples, shop drawings, material lists, manufacturers' literature, and other required information shall be submitted in sufficient time, and clearly marked, to permit proper consideration and action before any materials which such samples, shop drawings, and information represent are delivered to the site. The Contractor shall be held responsible for any delay in the progress of the Work which may be due to his failure to observe these requirements.
- F. Shop drawings and samples shall be submitted to the Engineer in sufficient quantity to permit the Engineer to retain four (4) copies and return the number of copies required by the Contractor.
- G. Any submittal which requires the selection of color by the Engineer shall be submitted such that all color selections can be made at the same time. Submittals shall be held by the Contractor for a single submittal of all items requiring color choice or sufficient time will be allowed for the Engineer to receive all submittals to prepare a comprehensive color selection.
- H. Shop drawings shall include installation instructions and long and short term storage requirements.

- I. No payment shall be made for unapproved materials or equipment purchased or installed by the Contractor even if the materials or equipment meet all the requirements of the specifications and/or is the named product or equipment.
- J. Submittal should include manufacturer's installation requirements and instructions.
- K. Submission of shop drawings shall comply with the following requirements:
 - 1. The shop drawings shall be clearly marked and submitted sufficiently in advance of the work which they cover to afford ample time for checking, correcting, and rechecking if necessary. No claim for delay will be granted to the Contractor if caused by his failure to comply with the requirements of this Section.
 - 2. Before submitting for approval, the Contractor shall check all shop drawings, including those submitted by subcontractors, for accuracy and to ascertain that all work contiguous with and having bearing on other work shown on the shop drawings is accurately drawn, and that the work shown is in conformity with the contract requirements.
 - 3. Shop drawings submitted for approval shall bear the Contractor's stamp of approval as evidence that such drawings and details have been checked by the Contractor. The submission of shop drawings (in either the original submission or when resubmitted with corrections) constitutes evidence that the Contractor has checked all information therein, and that he accepts and is willing to perform the work, as shown, in a workmanlike manner and in accordance with the best standard practices.
 - 4. No claim for an extra shall be based on work shown on the shop drawings, unless such claim is noted on the Contractor's transmittal letter accompanying the shop drawings.

5. The Contractor's approval stamp shall contain the following statement:

"The equipment and material shown and marked in this submittal is that proposed to be incorporated into this Project, and has been checked for and is in compliance with the Contract Documents unless otherwise shown in bold face type or lettering and listed on a page or pages headed "DEPARTURES FROM CONTRACT DOCUMENTS," and can be installed in the allocated spaces.

Checked By: _____

Date: _____

6. The person signing the stamp shall be one designated in writing by the Contractor as having that authority. The signature shall be handwritten in ink. Stamped signatures are not acceptable.
7. The Engineer's approval of shop drawings and schedules shall not relieve the Contractor from responsibility for deviation from drawings and specifications unless he has in writing called the Engineer's attention to such deviations at the time of submission. The Engineer's approval shall not relieve Contractor from responsibility for errors of any sort on shop drawings or schedules.

L. Engineer's Action:

1. Review is only for conformance with the design concept of the project. Markings or comments do not relieve the CONTRACTOR from compliance with the contract documents nor allows departure there from. The CONTRACTOR remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for technique of assembly, for coordination of the work with all trades, and for performing this work in compliance with the contract documents.
2. Where action and return is required or requested, ENGINEER will review each submittal, mark with "Action".
3. Final Unrestricted Release: Work may proceed, provided it complies with Contract Documents, when submittal is returned with the following marking:

"No Exceptions Taken"

4. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following marking:

"Make Changes Noted"

5. Returned for Re-submittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work:

"Revise and Resubmit"

6. Returned for Non-Compliance: Do not proceed with work. Product submitted does not comply with Contract Documents. Resubmit for product complying with the requirements of the Contract Documents. Do not allow submittals with the following marking to be used in connection with performance of the work:

"Not Approved" or "Rejected"

7.1.9 Samples

- A. Samples and mock-ups shall be submitted in duplicate except where a greater number is specifically required by the specifications.
- B. Samples and manufacturers' literature shall be forwarded (prepaid) to Engineer's office accompanied with a transmittal letter containing the following information: name of project, contractor, description of product, manufacturer, model number, ASTM or Federal Specification number where applicable. Catalogs shall be marked to indicate specific items submitted for approval.
- C. Samples which are rejected by the Engineer must be re-submitted as soon as possible after notification of rejection and shall be marked "Re-submitted Sample" in addition to other required information.
- D. The right shall be reserved to require submission of samples of any material or any material lists, whether or not particularly mentioned in the Specifications.

7.1.10 Quality Control

- A. Testing Laboratory Services: Tests called for other than public authorities shall be made by approved independent laboratories with the full cooperation of the Contractor. The laboratory charges shall be borne by the Contractor unless otherwise specified.
 - 1. Testing services other than those called for in these Contract Documents may be called for by the Owner to check compliance with specification requirements. When tests indicate compliance with specifications, the testing service charges will be borne by the Owner, but when non-compliance with specifications is indicated, the testing service charges will be deducted from the contract sum.

7.1.11 Temporary Facilities and Controls

- A. Temporary Electricity: The Contractor shall make all necessary arrangements for obtaining electric power for construction purposes. No separate payment for electric power for construction purposes or testing shall be made.
- B. Temporary Sanitary Facilities: Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees to comply with all governing laws and regulations.

7.1.12 Materials and Equipment

- A. Quality: Material and equipment incorporated into the work shall be new and unused and:
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, type and quality specified or as specifically approved in writing by the County Engineer.
 - 3. Manufactured and fabricated products:
 - a) Design, fabricate and assemble in accord with the best Engineering and shop practices.
 - b) Manufacture like parts of duplicate units to standard size and gages, to be interchangeable.
 - c) Two or more items of the same kind shall be identical, by the same manufacturer.

- d) Products shall be suitable for service conditions.
 - e) Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is designed or specified.
 5. Except as specifically indicated or specified, materials and equipment removed from the existing structure shall not be used in the completed work.
 6. For material and equipment specifically indicated or specified to be reused in the work:
 - a) Use special care in removal, handling, storage and reinstallation, to assure proper function in the completed work.
 - b) Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Pay all costs for such work.
 7. For all materials and equipment designated to be turned over to the County, the Contractor shall remove all items carefully, clean and transport to an area on site or to a storage facility designated by the County. All sewer service materials or equipment shall be disinfected before turning over to the County. This shall be done at no cost to the County.
 8. Manufacturer's Instructions
 - a) All installation of work shall comply with manufacturer's printed instructions. Obtain and distribute copies of such instructions to parties involved in the installation, including two copies to the County Engineer.
 - b) Manufacturer's installation instructions shall be on the project site and distributed to all concerned parts before the installation of said materials and equipment.
 - (1) Maintain one set of complete instructions at the job site during installation and until completion.

- c) Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.
 - (1) Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - (2) Do not proceed with work without clear instructions.
- d) Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted.

B. Transportation and Handling:

- 1. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 - a) Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - b) Immediately on delivery, inspect shipments to assure compliance with requirements and approved submittals, and that products are properly protected and undamaged.
- 2. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

C. Storage and Protections:

- 1. Store products in accordance with manufacturer's long and short term requirements with seals and labels intact and legible.
 - a) Storage products subject to damage by the elements in weather tight enclosures.
 - b) Maintain temperature and humidity within the ranges required by manufacturer's instructions.

2. Exterior Storage.
 - a) Store fabricated products above the ground on blocking skids, prevent soiling and staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - b) Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - c) Protect all products from sunlight when required by the manufacturer.
3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
4. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.
5. Payment for stored materials
 - a) No payment shall be made for materials stored offsite.
 - b) Materials stored on site will be paid for with the monthly project pay request. Materials must be stored in strict accordance with the manufacturer's long and short term requirements.
 - c) Contractor shall provide proof of payment for the materials before payment will be approved. Retainage will be held from the payment as per the terms of the Agreement.

7.1.13 Warranties and Guarantees

- A. Contractor shall provide Warranties and Guarantees on all materials, equipment, workmanship, installations, labor and operation items provided and /or installed by the Contractor or any of its subcontractors and /or suppliers.
- B. Warranties and Guarantees shall be for a period of one year after:
 - 1. Being placed in service by owner for the owner's use before substantial completion of the project.
 - 2. Date of substantial completion of the project.
 - 3. Being installed and put in service after substantial completion of the project.
 - 4. Equipment installed does not constitute being "in service".
- C. Guarantee: CONTRACTOR warrants the equipment and/or materials delivered and installed under the AGREEMENT are free from defects in design, material or workmanship, and against damage caused prior to final inspection.
- D. Prompt Repair: CONTRACTOR shall promptly repair or replace all defective or damaged items delivered under the AGREEMENT.
- E. CONTRACTOR may elect to have any replaced item returned to its plant at its sole expense.
- F. Owner's Option: In the event of equipment and/or materials failure, during such time or in such a location that immediate repairs are mandatory, CONTRACTOR shall respond promptly, regardless of time. If CONTRACTOR is not available, OWNER personnel or other contractors, secured by OWNER, will conduct repairs. CONTRACTOR shall then reimburse OWNER for parts and labor and/or other contractors costs necessary to correct deficiencies as defined within the warranty clause and time.
- G. This specification shall apply to all sections of the specifications as applicable whether mentioned in a specific specification or not. Should the specific specification section have additional requirements or more stringent requirements that this section the more stringent shall apply.

- H. The warranty shall not cover any item that has been subjected to external damage, disassembled and/or repaired by unauthorized persons, flooded or otherwise mistreated. Items normally consumed in service such as grease, oil, v-belts, fuses, filters, seals, etc., shall not be warranted.

7.1.14 Startup

- A. All equipment shall be inspected by the manufacturer's certified service personnel after installation and the manufacturer's service personnel shall supervise the equipment startup. Contractor shall provide a written document from the manufacturer on manufacturer's letterhead of all equipment installed and/or provided by the contractor that their equipment has been installed correctly and all warranties and guarantees are in effect. Sales representatives are not considered manufacturer's certified service personnel.
- B. Startup shall be performed under typical service operating conditions.
- C. Written documentation shall contain various check off items as recommended by the manufacturer and include but not be limited to:
 - 1. Ampere readings on all electrical motors
 - 2. Megger readings on all electric motors and circuits
 - 3. Correct lubrication
 - 4. Correct operating temperatures and pressures
 - 5. Correct vibration levels
 - 6. Coupling alignment
 - 7. Correct supports
 - 8. Correct flange loadings (equipment piping or attachments shall be disconnected from equipment and affirmed that the piping is supported independent from equipment).
- D. In the event one or more components fail to perform as specified or is proven defective in service during the guarantee period, the Contractor shall provide replacement parts and labor to make all repairs without cost to the Owner.

7.1.15 Training

- A. Contractor shall include manufacturer's training for all equipment. Training time duration shall be as reasonable required for the complexity of the equipment and shall be in accordance with the manufacturer's recommendations. Training times and requirements are usually specified in each equipment section in these specifications; however, if they are not specifically mentioned the contractor is still required to include training.
- B. Training shall be separate from startup and shall be scheduled separately from startup.
- C. Owner may, at his option, choose to video tape training.
- D. This specification shall apply to all sections of the specifications as applicable whether mentioned in a specific specification or not. Should the specific specification section have additional requirements or more stringent requirements that this section the more stringent shall apply.

END OF SECTION 7

SECTION 8 - SITE CLEARING

8.1 GENERAL

- 8.1.1 This section provides for general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.
- 8.1.2 Provide barricades, coverings, safety fence or other types of protection necessary to prevent damage to existing facilities and appurtenances not indicated to be removed, and improvements on adjoining properties.
 - A. Restore all improvements damaged by this work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction.
- 8.1.3 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing. Any excavations within the tree drip line shall be by hand.
- 8.1.4 Burning where allowed by local ordinances will be permitted.

8.2 EXECUTION

8.2.1 Clearing

- A. Remove from the site and permanent easements: trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.
- B. Clearing work shall be restricted to area within rights-of way or easements or within "Construction Limits" indicated on Drawings.
- C. Undisturbed stumps and roots which will be a minimum of 5 feet below finished grade, and will not be located under or within 10 feet of any structure or pipe line, may be left in place. Tops of stumps left in place shall not be more than 3 inches above original grade.

8.2.2 Existing Trees and Shrubs

- A. Trees and shrubs that are to remain within “Construction Limits” will be indicated on Drawings or conspicuously marked on site.
- B. Ownership to Trees: Unless otherwise noted, trees within the “Construction Limits” shall become the property of the Contractor and shall be removed from the site.

8.2.3 Grubbing

- A. Grub areas within and to a point 10 feet outside of all structures and pipe lines, areas to receive fill where finished grade will be less than 3 feet above existing grade, cut areas where finished grade will be less than 2 feet below existing grade, transitional areas between cut and fill, and any area to receive control fill.
- B. Remove from the ground to a depth of 18 inches, all stumps, roots ½-inch and larger, organic material and debris.
- C. Use only hand methods for grubbing inside the drip lines of trees which are to remain.

8.2.4 Clean up debris resulting from site clearing operations continuously with the progress of the work.

8.2.5 Remove all waste material from site.

8.2.6 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times. All paved areas shall be swept at the end of each workday.

END OF SECTION 8

SECTION 9 - TRENCHING & BACKFILLING

9.1 GENERAL

A. Work included in this section includes trenching and backfilling for underground pipelines and related structures only.

9.1.1 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials --- ASTM

B. American Association of State Highways and
Transportation Officials ----- AASHTO

C. Virginia Department of Transportation ----- VDOT

9.1.2 Store and use explosives in accordance with Federal, State and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.

9.1.3 Contractor shall provide compaction testing by a licensed, independent testing agency approved by Goochland County for Developer contracts. The testing shall be performed by agency personnel in the presence of the County Construction Inspector. The testing company shall submit the results to the County Engineer.

9.1.4 Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when location differs from those shown on Drawings, notify County Engineer for instructions before proceeding.

9.1.5 The Contractor shall contact the power company when working in the vicinity of overhead power line poles. The power company shall hold poles and shield/ground lines as required and all costs associated with this task shall be paid by the Contractor.

9.2 PRODUCTS

9.2.1 Pipe Bedding Fill

- A. Granular fill shall meet requirements for coarse aggregates, ASTM C3, size No. 57.

9.2.2 Select Backfill

- A. Select fill shall be in accordance with VDOT 2007 Road and Bridge Standards, Section 207.01, Table II-6
- B. Aggregate fill shall be an approved uniformly graded mixture of crushed stone, or crushed and uncrushed gravel with 100 percent passing a 1-1/2 in. sieve and not more than 5 percent passing a No. 4 sieve. ASTM D448, size No. 56.
- C. Clean earth fill shall be an approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than 1-1/2 inches in any dimension or other harmful, deleterious matter.
- D. All select fill shall be capable of being compacted to 100% in accordance with ASTM D698.
- E. Contractor shall submit a job mix for approval with Laboratory Testing Reports. Retesting will be by visual examination and at the discretion of the County Inspector.

9.2.3 Concrete for bedding, backfill or encasement shall be 3000 psi.

9.2.4 Riprap, where shown on the Drawings shall conform to VDOT Specification Sec. 414.03 Dry Riprap - as indicated on Drawings.

9.3 EXECUTION

9.3.1 Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements of Section 10 - "Seeding." Deposit in storage piles separate from other excavated material.

9.3.2 Where the trench width exceeds the allowable width, the Contractor at his own expense shall provide for increased loads on pipe as directed by the Engineer.

9.3.3 Unauthorized excavation consists of the removal of material beyond indicated subgrade elevations or side dimensions without specific approval of the County Engineer. Where unauthorized excavations occur, restore these areas to the elevations and dimensions shown on the Drawings with granular fill.

9.3.4 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, any work deemed necessary by the Engineer to correct the faulty condition shall be performed at no additional cost.

9.3.5 Excavation and Bedding

- A. Open trenches only so far in advance of pipe laying as permitted by the County Engineer.
- B. The width of the trench at and below the top of the pipe shall not exceed the width of the trench as defined in Section 7.
- C. Pressure Pipe
 - 1. Ductile Iron Pressure lines shall be installed with Class C-1 bedding as indicated in the Standard Drawings.
 - 2. PVC pressure lines 4" and larger shall be installed with Class C bedding.
 - 3. Pressure pipe 3" and smaller of PVC, polyethylene pipe and copper tubing shall be backfilled with 6 inches of sand all around.
 - 4. Excavate for bell holes at each joint so that entire barrel of pipe shall be fully supported the entire length.
 - 5. Where rock is encountered, excavate 6 inches below the bottom of the pipe for bedding in granular material or sand as appropriate.
- D. Gravity Pipe
 - 1. Ductile Iron gravity sewer lines shall be installed with a minimum of 6 inches of granular bedding (Class C).
 - 2. Bedding for PVC Pipe shall be Class B or better.
- E. All pipes shall be installed in a dry trench. Dewater excavation as necessary to provide proper protection. If deemed necessary, the Engineer may require continuous dewatering 24 hours per day by adequate pumpage or well-points until backfilling is completed. The method, and equipment used for dewatering shall be subject to the approval of the County Engineer and shall be at no cost to the County.
- F. All soil is unclassified unless indicated otherwise.

- G. All foundation soils and subgrades shall be tested by the Testing Agency to determine subgrade soil. Where unsuitable soil is encountered, excavate to depth determined by the County Engineer and replace with select backfill thoroughly and uniformly compacted.
- H. Where underground streams or springs are found, provide temporary drainage and notify County Engineer.
- I. Remove from project site and dispose of material unsatisfactory for backfill, trash, and all excess material continuously with the progress of the work.
- J. Remove shoring and all form materials, unless ordered to remain.
- K. Where rock is encountered so that a manhole, vault, or other structure will bear entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, excavate to an even depth of 8 inches below the entire structure and back-fill with aggregate fill and thoroughly compact. Provide a minimum of 8 inches between rock excavation and sides of structures.
- L. Compact select fill pipe bedding by tamping or rodding to prevent settlement.

9.3.6 Sheeting

- A. Maintain trench walls in a safe condition at all times. The Engineer reserves the right to require the use of sheeting and/or shoring at any time the Engineer deems it necessary.
- B. Sheeting and shoring left in place shall be cut off to a depth of not less than 18 inches below grade.

9.3.7 Compaction

- A. Refer to Section 1, paragraph 1.1.34 D. for the compaction requirements.
- B. Where compaction 90 percent or greater is required, test reports shall be submitted to the Department prior to Substantial Completion (e.g., for private development projects, prior to Tentative Acceptance).
- C. Test reports are not required where the trench is completely backfilled with select stone backfill.

9.3.8 Backfill

- A. Backfill trench to a compacted depth of 1 foot over the pipe with clean select fill. Backfill shall be properly placed uniformly on each side of the pipe and compacted as required. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.
- B. Backfill trench from 1 foot above the pipe to grade with clean earth fill free of stones larger than 3 inches or 1/2 the layer thickness, whichever is smaller. Layers shall not exceed 12 inches, except that under road shoulders and under existing or future paved areas, layers shall not exceed 8 inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil. Settlement may be achieved by puddling mechanical tamping, or other means as determined by the Contractor, which shall satisfy the compaction requirements.
- C. Excavation depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill and compact as specified.
- D. Around and adjacent to structures, backfill shall be of material of suitable stability and perviousness. Backfill shall be placed in 6-inch layers, each layer being compacted by approved means. No backfill shall be placed against a structural wall until all connecting structural members are in place. It shall be the Contractor's responsibility to provide compaction to such a degree that the resultant subsidence after placing shall not be detrimental to the stability or appearance of the structure or adjacent areas. The Contractor shall provide adequate protection to all structures during backfilling and use every precaution to avoid damaging or defacing them.
- E. Compact soil materials using equipment suitable for materials to be compacted and work area locations.
- F. Compact aggregate fill placed under manholes and other structures to required density.

9.3.9 Grading

- A. Uniformly grade all areas within the limits designated on the Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.
- B. Finish all surfaces free from irregular changes.
- C. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.

- D. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.
- E. Shape subgrade under pavement to line, grade, and cross-section to within ½-inch of required subgrade elevations.
- F. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.
- G. Where compacted areas are disturbed by subsequent construction or adverse weather scarify the surface, reshape and compact to the required density. Use hand tamper for recompaction over underground utilities.

9.3.10 Utilities to be Abandoned or Removed

- A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the “Construction limits” or at points shown.
- B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified. Plug, cap, or seal utilities with concrete, at the construction limits or at points shown.
- C. All abandoned underground pipe shall be removed or filled with flowable fill.

9.3.11 Erosion Control

- A. Comply with local erosion control ordinance and with the latest edition of the “Virginia Erosion and Sediment Control Handbook” by the Virginia Soil and Water Conservation Commission to control erosion and sedimentation.
- B. All applicable erosion and siltation control measures shall be taken prior to work starting.
- C. No more than 100 feet of trench shall be open at any one time without the approval of the County Engineer. At the end of end of the day all but the last length of pipe installed shall be backfilled.
- D. All utility lines, not in streets, shall be mulched with hay or straw and seeded as soon as possible after backfill.
- E. Any disturbed area, not paved, sodded or built upon by November 15 is to be seeded on that date with oats, abruzzi rye, or equivalent and mulched with hay or straw.

- F. Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.
- G. Repair after cleanup: Upon completion of construction work after spoils and debris have been removed, regrade any areas disturbed by operations.

9.3.12 Clean Up

- A. Keep area of work cleaned up at all times and promptly remove all materials and debris not intended for incorporation in the Work. Broom clean the surfaces of all paved areas immediately after backfilling operations.
- B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the Contract and for a period of one year following Final Acceptance of the Work.
- C. In the event the Contractor fails to satisfy these requirements to the satisfaction of the County, or otherwise prosecute the Work in a reasonable or proper manner, and after a reasonable period of time has elapsed after notification by the County of unsatisfactory conditions, the Owner reserves the right to employ outside services to take such corrective action as deemed necessary by the County Engineer. The cost incurred in taking corrective actions will be deducted from any monies due the Contractor by the Owner or such other means of collection as may be available to the Owner.

9.3.13 Preparation for Final Inspection

- A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipe lines as necessary prior to final inspection by County Engineer.

END OF SECTION 9

SECTION 10 - SEEDING

10.1 GENERAL

10.1.1 Reference Specifications are referred to by abbreviation as follows:

- A. American Society for Testing and Materials ----- ASTM

10.1.2 Submit two copies of following.

- A. Seed Test Report
- B. Fertilizer Analysis

10.1.3 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

10.1.4 Seed only when wind velocity is less than 15 miles per hour.

10.2 PRODUCTS

10.2.1 Topsoil shall be the top 6 inches of original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2 percent by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1/2 diameter, stones larger than 1/2-inch diameter and other material toxic or harmful to growth.

10.2.2 Fertilizer shall meet requirements of Federal Specification O-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.

- A. Proportions of fertilizer nutrients shall be the following:
 - 1. 5 lbs. of actual nitrogen
 - 2. 10 lbs. of actual phosphate
 - 3. 5 lbs. of actual potash

10.2.3 Grass seed, tested within 6 months of sowing, shall have the following characteristics.

A. Permanent Seeding shall be in accordance with Table 3.32 D. from the Virginia Erosion and Sediment Control Handbook:

	<u>Total Lbs. Per Acre</u>
<u>Minimum Care Lawn</u>	
- Commercial or Residential	175-200 lbs.
- Kentucky 31 or Turf-Type Tall Fescue	95-100%
- Improved Perennial Ryegrass	0-5%
- Kentucky Bluegrass	0-5%
<u>High-Maintenance Lawn</u>	
- Kentucky 31 or Turf-Type Tall Fescue	200-250 lbs.
	100%
<u>General Slope (3:1 or less)</u>	
- Kentucky 31 Fescue	128 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop*	<u>20 lbs.</u>
	150 lbs.
<u>Low-Maintenance Slope (Steeper than 3:1)</u>	
- Kentucky 31 Fescue	108 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop*	20 lbs.
- Crownvetch**	<u>20 lbs.</u>
	150 lbs.

*Use seasonal nurse crop in accordance with seeding dates as stated below:

February 16 th through April	Annual Rye
May 1 st through August 15 th	Foxtail Millet
August 16 th through October	Annual Rye
November through February 15 th	Winter Rye

**Substitute Sericea lespedeza for Crownvetch east of Farmville, VA. (May through September use hulled Sericea; all other periods, use unhulled Sericea). If Flatpea is used in lieu of Crownvetch, increase rate to 30 lbs./acre. All legume seed must be properly inoculated. Weeping

Lovegrass may be added to any slope or low-maintenance mix during warmer seeding periods; add 10-20 lbs./acre in mixes.

- B. Temporary Seeding shall be in accordance with Table 3.31 B. from the Virginia Erosion and Sediment Control Handbook:

Seeding Dates	Species	Percentages (Min.)			Rate Lb..Acre
		Weight	Purity	Germ.	
Sept. 1-Feb. 15	50/50 Mix of Annual Ryegrass & Cereal (Winter) Rye	100	98	85	100
Feb. 16 – April 30	Annual Rye Grass	100	96	85	100
May 1-Aug31	German Millet	100	98	80	50

- C. For seeding of wetlands or other specific applications, the Engineer shall submit a site specific seeding schedule.

- 10.2.4 Lime shall be ground agricultural grade limestone containing not less than 85 percent calcium and magnesium carbonates. Fineness shall be such that 100 percent will pass a No. 20 sieve, not less than 50 percent will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.
- 10.2.5 Type I mulch shall be “Hold/Gro” erosion control fabric manufactured by Gulf States Paper Corporation, P. O. Box 3199, Tuscaloosa, Alabama 35401. The fabric shall be manufactured of materials which degrade in 6 to 8 months under outdoor exposure.
- 10.2.6 Type II mulch composed of threshed straw of cereal grain, pipe needles or wood fiber shall be free of objectionable weed seeds or other harmful material.
- 10.2.7 Asphalt adhesive for use with Type II mulch shall be emulsified asphalt meeting requirements of ASTM D977, Grade SS-1.
- 10.2.8 Synthetic mulch binder for use with Type II Mulch: Curasol, DCA-70, Petroset, or Terra Tack.
- 10.2.9 Sod shall be composed of at least 70 percent of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2 inches. Vegetation more than 5 inches in height shall be cut to 3 inches or less before sod is lifted.

10.3 EXECUTION

10.3.1 Temporary Seeding

- A. Use in areas when final grading has not been completed or when permanent seeding cannot be done due to the specified permanent seeding dates. Also use in easements where no permanent seeding is required as shown on Drawings.
- B. Apply fertilizer at a rate of 15 lbs. of 10-20-10 per 1000 sq. ft. (600 lbs. per acre) or equivalent.
- C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.
- D. Seed only between February 15 and November 15. Use mulching or sodding between November 15 and February 15.
- E. For lawn areas, the permanent seed mix shall be used for temporary seeding during the specified planting periods. Any areas receiving temporary seeding shall be reseeded with permanent seed in accordance with these specifications.

10.3.2 Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1-1/2 inches and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth and drainable surface.

- A. Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate of 100 lbs. per 1000 sq. ft. to achieve a pH of 6.0 to 7.5. Apply fertilizer at the rate of 50 lbs. of 5-10-5 per 1000 sq. ft. or 25 lbs of 10 - 20-10 per 1000 sq. ft. Rates should be adjusted for other grades of fertilizer.

10.3.3 Sow permanent grass seed between dates of March 1 and April 15 or September 1 and October 15.

10.3.4 Sow permanent seed by mechanical seeder as follows:

- A. Mix seed thoroughly with clean dry sawdust and broadcast at a rate of 6 lbs. of seed per 1000 sq. ft. in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 lbs. per foot of width.
- B. Apply either Type I or Type II mulch uniformly leaving not more than 10 percent of the soil surface exposed.
 - 1. Type I mulch.
 - a) Apply in accordance with manufacturer's instructions.
 - 2. Type II mulch.
 - a) Apply uniformly to depth of approximately 1-1/4 inches uniformly leaving not more than 10 percent of the soil surface exposed.
- C. Anchor mulch by the following methods.
 - 1. Apply light tack coat of asphalt emulsion:
 - 2. In residential areas, apply synthetic mulch binder at rate recommended by manufacturer.
 - 3. On slopes steeper than 4 horizontal to 1 vertical fasten heavy jute mesh to wooden stakes.

10.3.5 Remove all soil or staining of finished walks, drives and parking areas resulting from seeding work. Maintain paved areas in clean condition.

10.3.6 Establishment and Acceptance of Seeding

- A. The Contractor shall maintain all seeded areas until final acceptance of the project and shall restore or replace any portion of the seeding work that is found defective or which becomes damaged prior to final acceptance. Restoration or replacement work shall include the reestablishment of the grade or profile of the area, replacement of topsoil, refertilization, reseeding, and remulching as directed by the Engineer. When the damage consists only of the displacement of mulch, the mulch shall be replaced within 7 days.

- B. Water as required to keep soil moist during germination period.
- C. If mowing is required to properly maintain all seeded areas until final acceptance, the following criteria shall apply:
 - 1. When grass reaches height of 3 ½ to 4 inches, mow to height of 2-½ inches.
 - 2. Maintain grass height between 2 ½ and 4 inches.
 - 3. Do not remove more than 33 percent of total height of grass in one mowing.
- D. Reseed and mulch all spots without a uniform stand of grass.
- E. Final project inspection shall not be scheduled until the vegetation is acceptable to the Engineer.
- F. Correct or repair all undue settling as evidenced by complaints received within one year after final inspection.

END OF SECTION 10

SECTION 11 - WATER DISTRIBUTION SYSTEM

11.1 GENERAL

- A. Work in this Section includes all water system piping including all valves, hydrants, fittings, anchors, air vents and other related equipment or material as indicated on the construction plans.

11.1.1 Reference Specifications are referred to by abbreviation as follows:

- A. American National Standards Institute ----- ANSI
- B. American Railway Engineering Association ----- AREA
- C. American Society for Testing and Materials ----- ASTM
- D. American Water Works Association ----- AWWA

11.2 PRODUCTS

- A. Submit shop drawings on all products supplied and installed for the project in accordance with submittals procedures.
- B. Provide certified test results of pipe testing.

11.2.1 Underground Pipe

- A. Ductile Iron Pipe
 - 1. Ductile iron pipe shall meet the requirements of AWWA C151 and AWWA C150. Rubber-gasket joints shall meet the requirements of AWWA C111. 3” through 24” pipe shall be, at a minimum, class 52 with a working pressure of 350 psi. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.
- B. PVC Pipe
 - 1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 200) for sizes up to 8 inches in diameter. Joints shall be in accordance with manufacturer’s instructions and ASTM D2564, D2464, D2467, D319, and F477. If working pressures over 150

psi are encountered, ductile iron pipe shall be used. Cell classification for water pipe shall be 12454-B

C. Polyethylene pipe

1. 3 Inches and Smaller –Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350-02 with a cell classification of PE 345464C. Pipe shall have a manufacturing standard of ASTM D2737 (copper tubing size), ASTM D2239 (iron pipe size, controlled inside diameter) and ASTM D 3035 (iron pipe size, controlled outside diameter). Pipe shall have a pressure class as specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 14.
2. 4 Inches and Larger - Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of PE 345464C. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall be pressure class as indicated on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61, and per AWWA C906. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft/sec or the actual velocity whichever is greater shall be used in the hydraulics engineering design.

D. Copper Tubing

1. 1 inch and smaller for underground services shall be seamless, annealed copper tubing Type K, in conformance with ASTM B88. Fittings shall be case bronze with flared joints.
2. Copper Tubing 1-1/4 through 2” for underground services shall be seamless hard copper tubing Type K, in conformance with ASTM B88. Fittings shall be wrought copper with soldered joints.

3. Solder shall be 95-5 lead free solder meeting the requirements of NSF 61.

11.2.2 Underground fittings

A. Ductile Iron Fittings

1. Fittings for PVC pipe and DI pipe shall be ductile iron. Ductile iron fittings shall be in accordance with AWWA C110 or AWWA C153. Pressure ratings shall be a minimum of 350 psi for fittings 24-inch and smaller and 250 psi for 30-inch. All fittings shall have a single cement mortar lining on the interior and a bituminous seal coating on the exterior. Fittings shall have mechanical joints conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength, corrosion resistant low alloy steel with hexagon nuts having a minimum yield point of 45,000 psi in accordance with AWWA C111. Mechanical joint bolts shall be torqued with a torque wrench as per manufacturer's recommendations.
2. Couplings for underground or buried service shall be ductile iron mechanical joint in accordance with underground ductile fittings in this section.

B. Polyethylene Pipe Fittings

1. Fittings for polyethylene pipe shall be manufactured specifically for the intended use and be approved by the piping manufacturer to be compatible with their product. All fittings shall have a working pressure rating equal to or greater than the pipe, and shall meet all requirements of NSF 61.
2. Butt Fusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).
3. Electro-fusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electro-fusion

Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electro-fusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR).

4. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261.

C. Thrust Restraint

1. Contractor shall install concrete thrust blocks at all tie in points and as indicated on the contract drawings or as directed by the Project Representative based upon field conditions. Thrust blocks shall be sized as indicated on the thrust block Standard Details. Concrete shall have 3,000 psi strength at 28 days, and shall meet the requirements of ASTM C94.
2. All pipe fittings, plugs, caps, tees, and bends in underground ductile iron or PVC piping shall be restrained utilizing Megalug Series 1100 retainer glands by EBAA Iron Sales, Inc. (or approved equal) for ductile iron pipe and Megalug Series 2000PV retainer glands by EBAA Iron Sales, Inc. (or approved equal) for PVC pipe. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
3. All ductile iron bell and spigot pipe joints shall be restrained using US Pipe Field Lok 350 type gaskets or harness type restraints utilizing Megalug Series 1700 retainer glands by EBAA Iron Sales, Inc. (or approved equal). If all joints are not required to be restrained the minimum restrained lengths and locations shall be indicated on the drawings. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.
4. PVC pipe bell and spigot joints shall be restrained on either side of valves and fitting for a length to be indicated on the drawings.

Harness type restraining devices shall be used on bell and spigot pipe joints utilizing Megalug Series 2800 restraint harness by EBAA Iron Sales, Inc. (or approved equal).

11.2.3 Above Ground or Exposed Piping

A. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings or underground vaults, shall be flanged ductile iron pipe class 53 in accordance with ANSI A21.15 (AWWA C115). Unless indicated otherwise on the drawings pipe shall have Class 125 flanged joints utilizing factory installed screwed flanges (no uniflange type flanges are permitted) meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8" thick full face red rubber. All steel flanges mating to flat face flanges shall have the raised face machined off. Pipe shall have a single cement mortar lining with asphaltic seal coat meeting the requirements for AWWA C104.

B. Ductile Iron Fittings

1. Fittings for ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110/ANSI A21.10. Fittings up to 30" diameter shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8" thick full face red rubber. Fittings shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.
2. Couplings for above ground or exposed service shall be Dresser Style 38 or approved equal. Transition couplings shall be Dresser Style 162 or approved equal. All couplings shall be rodded unless otherwise noted.
3. Flange adaptors shall only be used for final connections to equipment or to allow for disassembly of pipe for equipment maintenance in approved locations. Flange adaptors are not to be used to make up for misaligned pipe. Flanged Adaptors shall be JCM flanged coupling adaptors model 301R or approved equal. Uniflanges are not permitted.

C. Copper Tubing

1. Copper tubing for exposed services shall be seamless, hard copper tubing Type L, in conformance with ASTM B88.
2. Fittings shall be wrought copper with soldered joints.
3. Solder shall be 95-5 lead free solder meeting the requirements of NSF 61.

11.2.4 Pipe Insulation and Heat Tracing

A. Pipes exposed to freezing temperatures shall be heat traced and insulated.

B. Pipe Insulation

1. Manufacturers: Johns Manville or approved equal.
2. Glass Fiber: Micro-Lok meeting ASTM C 547, Type I; rigid molded, noncombustible.
 - a) 'K' ('ksi') Value: 0.23 at 75 degrees F Mean Temperature.
 - b) Maximum Service Temperature:
0 degrees F to 850 degrees F.
3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples coated with vapor barrier mastic as needed.
4. Field Applied Jackets
 - a) Field applied Jackets shall be aluminum 0.016 inch (0.045 mm) thick sheet, smooth finish, with longitudinal slip joints and 2 inch (50 mm) laps, die shaped fitting covers with factory applied moisture barrier.
 - b) Sheet metal screws shall be aluminum or stainless steel.
 - c) Jackets shall be secured with 0.020 by 3/4 inch type 304 stainless steel expansion bands.
5. Insulation Covers

- a) Aluminum covers shall be constructed of smooth finish aluminum sheet conforming to ASTM B209, alloy 5005, temper H16, with integral vapor barrier. Covers shall be 0.016 inch thick.

C. Heat Tracing

1. All pipes, valves, equipment, and appurtenances shall be provided with heat tracing where shown; or, where not shown, heat tracing shall be provided in all cases where such items could be endangered by freezing. Such heat tracing shall consist of spiral wrapping with electrical heating cables as recommended by manufacturer and subsequent installation of insulation. The heating cables shall be controlled from thermostats installed in representative locations and accessible for adjustment. The heat tracing systems shall be installed complete, including heating elements, power connections, end seals, and controlling thermostats in accordance with the manufacturer's printed installation instructions.
2. Materials
 - a) Heating Cable: The electrical heat tracing system shall consist of a flat, flexible, low heat density, electrical heating strip of parallel construction, consisting of a continuous inner core of conductive material between two parallel copper bus strips. The electrical insulation of the heater strip shall be polyester and rated for 140 degrees F temperature, and its width shall be a minimum of ½-inch. It shall be suitable for operation on 120 volts.
 - b) Thermostats: A thermostat with a range of 40 degrees to 120 degrees F shall be provided for each heat pipe. It shall be double-pole, single-throw and mounted in a weatherproof NEMA 4X enclosure.
 - c) The capillary bulb shall be mounted on the pipe under the insulation. Heating strips for pipes over 2 inches in size shall be rated at 8 watts per foot; for pipes 2 inches and smaller they shall be rated at 4 watts per foot.
 - d) All heat tracing circuits shall be provided with indicating lights at the beginning and end of all heat tracing runs for a visual indication that the heat tracing is on for the complete run.

- D. Manufacturers: Electric heat tracing systems and components shall be as manufactured by Chromalox or approved equal.

11.2.5 Temporary Above Ground Pipe and Fittings

- A. Temporary above ground piping used for bypass piping, hydrant jumping or other temporary services shall be manufactured from high tensile strength, abrasion-resistant steel that is hot-dipped galvanized and is available in 3 foot, 6 foot, 10 foot, and 20 foot lengths. Pipe and fittings shall be joined with quick connections with degree of articulation on coupling joints as indicated in the table below. Working pressure shall be as indicated in the following table.

Pipe diameter	Working pressure (psi)	Deflection (degrees)
2"	290	30
3"	290	30
4"	175	30
6.25"	175	20
7.625"	175	20
10"	99	10

- B. Pipe and fittings shall be Bauer QD pipe and fittings or approved equal.

11.2.6 Gate Valves

- A. Gate valves 3" through 12" shall open counter-clockwise, have a resilient seat and meet the requirements of AWWA C509 or AWWA C515. Body shall be of ductile iron with a 250 psig maximum working pressure and hydrostatically tested to 500 psig. Wedge shall be constructed of cast iron or ductile iron, bonded in synthetic rubber in accordance with ASTM D2000. Valve shall be coated inside and out with a fusion epoxy coating of a nominal 10 mil thickness on all exposed iron surfaces in compliance with AWWA C550 and be NSF 61 certified. Valves shall be bi-directional flow and have a ten year limited warranty.
- B. Above ground valves or exposed valves in vaults shall utilize outside screw and yoke (OS&Y) with rising stems and have flanged ends meeting the requirements of ANSI B 16.1, Class 125.
- C. Underground valves shall utilize non rising stems, mechanical joint ends with a 2" operating nut in accordance with AWWA C111.
- D. Gate valves 3" and larger when located 6ft. or more above the finish floor or operating platform shall have chain operators.

- E. Valves shall be Mueller series 2361, Kennedy series KS-RW, M & H Valve Company series 7000 or approved equal.
- F. Gate valves 14” through 24” shall: open counter-clockwise, have a resilient seat and meet the requirements of AWWA C515. Body shall be of ductile iron. Valves 14”-24” shall have a 250 psi working pressure and be hydrostatically tested to 500 psig. Wedge shall be constructed of ductile iron and bonded in synthetic rubber in accordance with ASTM D2000. Valves shall be coated inside and out with a fusion epoxy coating of a nominal 10 mil thickness on all exposed iron surfaces in compliance with AWWA C550 and be NSF 61 certified. Valves shall be bi-directional flow and have a ten year limited warranty.
- G. Underground valves shall utilize non rising stems, mechanical joint ends with a 2” operating nut in accordance with AWWA C111.
- H. Valves shall be Mueller series 2361, Kennedy series KS-RW, M & H series 7000 or approved equal.
- I. Buried gate valves 2” in size shall utilize a non-rising stem, open counter-clockwise, resilient seat and meet the requirements of AWWA C509. Valve shall be equipped with a 2-inch square AWWA operating unit. Valve ends shall be NPT connections. Valves shall be Mueller series 2360, or approved equal.
- J. Above ground gate valves 2” and smaller shall be 150 lb. bronze body union bonnet, rising stem gate valves with threaded connections. Valves shall be Crane Figure 431UB or approved equal.

11.2.7 Butterfly Valves

- A. Butterfly valves shall have a ductile iron body, seat in body design, ductile iron disk with a 316 stainless steel disc edge (3” and 4” valves to have 316 disk), symmetrical disc, nonmetallic bearings, chevron self-adjusting “V” type packing and have a 250 psi working pressure. Valves shall meet or exceed all the requirements of AWWA C504 standard class 250B and be NSF 61 certified. Exposed piping shall have flange ends Class 125 and underground valves shall have mechanical joint ends. Valves 4” and larger shall have gear operators. All exposed valves with gear operators shall have a position indicator.
- B. Butterfly valves shall be Mueller Linesal XP, Kennedy series 4500, M & H CL250 or approved equal.

11.2.8 Ball Valves - Above Ground

- A. Ball valves 2" and smaller shall be 150 lb rated, threaded ends, bronze or stainless steel body (stainless steel valves are to be used on stainless steel pipe), full port, lever operated, ball valves, with stainless steel ball and stem, and Teflon seats. Ball valves shall be Crane figure 9201 (bronze body), 9231 (stainless steel) or approved equal.

11.2.9 Check Valves

- A. Swing check valves
 - 1. 3 inch and larger
 - a) Check valves 3" and larger shall be Class 125 flanged ends, ductile iron body, bronze mounted, bronze disc facing, swing type lever and weight check valves in accordance with AWWA C508. Flanged end dimension and drilling shall comply with ANSI B 16.1, Class 125. Check valves 3" through 24" shall have a 250 psig maximum working pressure.
 - b) Check valves shall have an adjustable air decelerator (air cushion) installed on the outside of the valve to control valve closing.
 - c) All check valves shall have a factory installed limit switch to indicate close position for flow confirmation.
 - d) Valves shall be Apco series CVS 250, Val-Matic series 7900S-S, Milliken Series 8501 or approved equal.
 - 2. Check valves 2" and smaller shall be class 150 bronze or stainless steel y-pattern swing check valves with threaded ends. Valves shall be Crane figure 137 (bronze), Crane Aloyco figure 49 or approved equal.
- B. Silent check valves
 - 1. Silent check valves shall be the globe type with a spring loaded disk. Valve shall have a ductile iron body, bronze plug, 316 stainless steel spring and a working pressure rating of 250 psig. Valves shall be flanged in accordance with ANSI B 16.1 class 125.

2. Valves shall be APCO globe style series 600 or Milliken series 821A or approved equal. Wafer type check valves shall not be permitted.

11.2.10 Corporation Stops and Tapping Saddles for Underground Service

- A. Corporation stops shall be Ford Ballcorp or approved equal with corporation thread by flared or compression end for 1" copper tubing or; removable 1.50 inch NPT or removable 2" inch NPT for hard tubing adaptors. All corporation stops shall be installed with a tapping saddle. Saddles shall be double strap epoxy coated ductile iron with stainless steel straps, bolts and nuts. Saddles shall be Ford Style FC202 or approved equal.

11.2.11 Above Ground or Exposed Taps

- A. All taps on exposed pipe. Flanged pipe or above ground pipe shall be made on fitting bosses. No tapping saddles or tapping of pipe will be allowed. All taps shall have a shutoff valve at the tap.

11.2.12 Valve Boxes

- A. Valve boxes for buried valves shall be cast iron, screw adjustable shaft boxes, with a minimum shaft diameter of 5-1/4 inches, unless otherwise specified on the Drawings. Valve box covers shall be marked with the word "WATER". Valves with valve boxes shall have an extended shaft pinned to the 2" operating nut and terminate 12" below finish grade. Valve box shall have a 24" x 24" x 4" concrete collar around top of valve box as per Standard Details.

11.2.13 Air Release Valves

- A. Air release valves shall have a minimum of a 1" N.P.T. inlet for pipe sizes 16" and smaller with a 3/32" minimum size outlet orifice and a 2" N.P.T. inlet for pipes 18" and larger with 3/16" minimum size outlet orifice. Valves shall have a cast iron body and cover, stainless steel float, Buna -N seat, Delrin lever frame and all other internal part shall be stainless steel or bronze. Air release valves shall be suitable for 150 psi working pressure at a minimum. 1" size air release valves shall be Apco model 143C or approved equal. 2" size air release valves shall be Apco model 145C or approved equal.
- B. All air release valve installations shall contain an isolation valve to allow removal of the air release valve while the line is under pressure and to remove air release valve for maintenance and upsizing if required.

- C. Air release valve shall have a manual valve on the body to allow manual venting of the pipeline without removal of the air release valve.

11.2.14 Reduced Pressure Zone (RPZ) Backflow Preventer

- A. Reduced Pressure Zone Backflow Preventer assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks, a protective bronze wye strainer with a 20-mesh screen and an air gap drain fitting.
- B. The assembly shall meet the requirements of the latest available American Water works Association (AWWA) standards including Std. C511; hold current University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC) approval, and hold the American Society of Sanitary engineers (ASSE) listing.
- C. All RPZ backflow preventers shall be installed in strict accordance with the manufacturer's instructions.
- D. The RPZ backflow preventer shall be a Watts Regulator Co. Series 009QT-S or approved equal and shall be sized as indicated on the construction drawings.

11.2.15 Sample Taps

- A. All sample taps shall be threadless.

11.2.16 Wall Pipes and Sleeves

- A. Pipes through concrete walls and slabs shall be provided with wall pipes or penetration seals. Wall pipes shall comply with cast iron fittings specification and shall have flanged joint connections unless otherwise noted on the drawings. Penetration seals shall be Link-Seal as manufactured by Thunderline Corporation of Wayne, Michigan, or approved equal. All hardware shall be stainless steel. Sleeves inside diameters shall be sized to fit the outside diameter of the penetrating pipe and the link seal. Sleeves shall be of a thickness to maintain their shape and shall be manufactured by the seal manufacturer. All Sleeves shall have waterstops and be hot dipped galvanized after fabrication. Where pipe penetrations are in existing concrete structures, core drilling is acceptable provided the hole size is coordinated with the seal manufacturer.

- B. Core drilling shall be coordinated with structural drawings, ground penetrating radar or other methods to determine the location of the steel reinforcement bars or post tensioning cables within the concrete walls or slabs as to avoid any damage to the structural integrity of the concrete walls or slabs.

11.2.17 Flushing Hydrants

- A. Flushing hydrants shall comply with AWWA C502 standards for “dry barrel” compression type hydrants that open against pressure. Hydrants shall have a working pressure rating of 150 psi and a test pressure of 300 psi. They shall meet all the requirements of fire hydrants regarding operating nuts, stems, working parts, stem design, full 360 rotation, body castings, and repairs without dismantling. Flushing hydrants shall be equipped with a threaded or mechanical joint inlet of the size as indicated on the plans and have one 2-1/2 inch outlet with cap and chain. Outlet thread type will be as required by owner.
- B. Flushing hydrants shall be 2” Aquarius “One-O-One” HH or 2” Main Guard Model #78 as manufactured by Kupferle Foundry Company, Mueller model A-411 or approved equal.

11.2.18 Water Service Accessories

- A. The corporation stop shall be as described in paragraph 11.2.10 A.
- B. Meter coppersettors shall be provided for all 5/8” thru 1” meters. Each shall have removable pack joints suitable for copper tubing. All coppersettors shall have saddle nuts, padlock wings, and two valves and shall be similar to the Ford series 270, the Mueller coppersetter, the A.Y. McDonald series 27 & 28, or approved equal. Meters and copper settors shall be installed in accordance with Standard Drawings.
- C. Meter coppersettors shall be provided for all 1-1/2” thru 2” meters. Each shall have removable NPT connections for hard copper tubing adaptors. All coppersettors shall have saddle nuts, padlock wings, and two valves and shall be similar to the Mueller 300 Ball Angle meter valve with setter B-2423, or approved equal. Meter settors for 1.50 inch and 2 inch meters shall have a lockable bypass. Meters and copper settors shall be installed in accordance with the Standard Drawings.
- D. The meter box shall be in accordance with Standard Drawings.

11.2.19 Detector Double Check Valves

- A. Detector Check Valves shall be epoxy coated UL and FM approved, fusion epoxy coated ductile iron with brass by-pass meter trim. Valves shall be FEBCO Model 800, Zurn Model 350 DA or approved equal.

11.2.20 Hydraulic Operated Control Valves

- A. Hydraulic operated control valves shall consist of pressure reducing valves, pressure sustaining valves, altitude valves, pump control valves, surge relief valves, surge anticipator valves, flow control valves or other similar type hydraulically controlled valves.
- B. The main valve shall be pilot-controlled, hydraulically operated, differential piston actuated and full ported.
- C. The control valve shall be “self-contained” and incorporate a system of pilot controls, factory assembled to and tested with the main valve. The valve shall be operated by line pressure and utilize the pilot system to open, close or throttle the differential piston main valve to perform the specified function(s).
- D. The main valve body shall be [globe][angle] style, constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125.
- E. The valve shall be “full-ported” so that when fully open the flow area through the valve is no less than the area of its nominal pipe size. Globe body valves shall have an integral bottom pad or feet to permit support directly beneath the body.
- F. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.
- G. The valve piston shall be fully guided on its outside diameter and all guiding and sealing surfaces shall be bronze. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself. Sawtooth attachments or other add-on devices are not permitted.
- H. Valves shall be provided with an anti-cavitation ring or similar device to prevent cavitation in the valve if required by the operating conditions.

- I. The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator shall be provided.
 - J. The main valve shall be serviceable in the line through a single flanged top cover that provides easy access to all internal components.
 - K. The valve shall be shop coated with NSF-61 certified epoxy on internal surfaces in accordance with American Water Works Association Standard C550 (latest revision).
 - L. The valve shall be operated by a system of pilot controls necessary to perform the specified function(s).
 - M. The pilot system shall be factory pre-piped, installed on the main valve and tested as an assembly.
 - N. In addition to the necessary pressure regulating and/or electrically operated pilots, the system shall incorporate a wye-strainer and opening and/or closing speed control valves.
 - O. Sufficient isolating valves and pipe unions shall be provided to facilitate removal and maintenance of the pilot system without disturbing the main valve.
 - P. Pilots, controls, piping and fittings shall be corrosion resistant copper, bronze or brass.
 - Q. Valves shall be manufactured by GA Industries, Cla-Val or approved equal.
- 11.2.21 Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the Drawings. Sleeves shall be built in two sections and shall be mechanical joint type with flanged outlet or two part stainless steel, bolted tapping sleeves furnished with stainless steel bolts and nuts as manufactured by JCM Industries. The tapping sleeve shall be for the size and type of pipe shown on the construction drawings.
- 11.2.22 Bolted, sleeve-type couplings, reducing or transition couplings, and flanged coupling adapters for above ground or exposed service used to join plain-end pipe shall meet the requirements of AWWA C219. Each coupling shall have similar components: a center sleeve (sometimes called a “middle ring”), end rings (sometimes called “followers”), and threaded fasteners (bolts and nuts), that, when tightened, pull the end rings together. These components compress elastomeric gaskets in the space formed between the end rings, center sleeve, and pipes being joined, thereby sealing the coupling/pipe combination. They

shall be manufactured from ductile iron and are intended for use in systems conveying water. All couplings shall be rodded. Couplings shall be manufactured by Dresser Manufacturing Division of Dresser Industries, Smith-Blair, Ford Meter Box Company, Cascade Waterworks Manufacturing Company (styles CRC and CRCA), or approved equal.

11.2.23 Fire Hydrants

- A. Fire hydrants shall be of the safety, flange, breakaway top type, meeting requirements of AWWA C502. Hydrants shall have a barrel diameter no smaller than 6 inches. The hydrant valve diameter shall be 4-1/2 inches and shall be equipped with two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper connection. Hose and pumper outlet threads shall be National Standard. The fire hydrant base shall be coated with fusion bonded epoxy and all hardware below grade shall be ASTM F593/F594 rated stainless steel. Fire hydrant tees shall be used.
- B. Per the Goochland County code, fire hydrants shall be "Fire Hydrant Red" in color with the tops painted reflective silver.
- C. Paint shall be as manufactured by Tnemac, Rustoleum or approved equal.

11.2.24 Tracer Wire

- A. Copper tracer wire shall be THHN, 12 gage, insulated with a blue colored insulation. Tracer wire access boxes are to be utilized and spaced no more than 1000 feet apart. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes.
- B. Tracer wire access boxes shall be installed adjacent to all fire hydrants.

11.2.25 Wire Connectors

- A. Connector, Wire, Set Screw Pressure type for use with No. 12 stranded wire size.
- B. Holub Industries MA-2 or equivalent
- C. Ideal Industries Model 30-222 or equivalent
- D. Wire nuts shall not be allowed underground.

11.2.26 Tracer Wire Access Boxes

- A. Tracer wire access boxes shall be made of cast iron with a permanently attached 3" x 12" ABS tube with a flared end to secure it in the ground. Its

tamper-resistant cast iron locking lid has stainless steel terminal connectors on the bottom side to which tracer wires are attached. Lid is opened using a standard AWWA pentagon key. Enough slack shall be coiled inside the box to allow the removal of the lid. Lid shall be marked water.

11.2.27 Marking Tape

- A. Tape shall be 3.5 mil polyethylene tape, 3” in width, with a 14 gage metallic core, with the continuous printed message “Caution – Waterline Buried Below.” Tape shall be style 48288 as manufactured by the Seton Safety and Identification or approved equal.

11.2.28 Bore Casing Pipe

- A. Steel casing pipe shall be welded or seamless or smooth wall, consisting of Grade “B” steel as specified in ASTM A-139. Minimum yield strength shall be 35,000 psi, and pipe thickness shall be as specified on the construction plans. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. Welds shall be a full penetration welds subject to visual inspection. All burrs at pipe ends shall be removed. Encasement pipe must be approved by the appropriate controlling agency (V.D.O.T., R.R., etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

11.2.29 Pressure Gages

- A. Pressure gauges shall be of all stainless steel construction, 3.5 to 4 inch case size, accuracy of 1% over the entire dial arch and a ¼” NPT bottom connection, Pressure range shall be as indicated on the drawings.
- B. Pressure gages shall be Ashcroft stainless steel case 1009 pressure gauges or approved equal.
- C. All pressure gages shall be installed with a ¼” stainless steel ball valve and stainless steel nipples.
- D. Gages shall be graduated so the system operating pressures are in the middle third of the scale.
- E. All pressure gages shall be mounted with fittings or on fitting bosses. **NO TAPPING OF PIPE OR SADDLES WILL BE ALLOWED.**

11.2.30 Pipe Supports

- A. Pipes shall be supported by steel pipe hangers, clamps, brackets, rods and inserts as required to support the imposed pipe loads. Hangers in general shall be new, manufactured of carbon steel and hot dipped galvanized after fabrication or 304 stainless steel.
- B. Pipes 2 ½ inches and larger shall be supported with adjustable floor stand type pipe supports as detailed on the drawings. Pipe supports shall be Standon Model S89 flange support, Standon Model S96 cradle support as manufactured by Material Resources, Inc. or approved equal.
- C. Pipes 2” and smaller shall be supported from the floor, walls or ceiling depending on the type of building construction. Pipe supports for these size pipes shall be as manufactured by Unistrut Building Systems, B-Line or approved equal. Supports shall consist of floor stands, wall brackets or clevis type hangers. Strut and appurtenances shall be stainless steel. Clips for copper tubing shall be copper coated. Minimum threaded rod size shall be 3/8 inch.
- D. Ductile Iron and steel pipe supports shall be spaced in accordance with the following schedule:

Pipe sizes (inches)	½ - 3/4	1- 1 1/4	1 ½ - 2	3 – 4
Max spacing (feet)	4	6	8	10

- E. Copper tubing pipe supports shall be spaced in accordance with the following schedule:

Nominal tubing size (inches)	1/2 - 3/4	1- 1 1/4	1 1/2 - 2
Max spacing (feet)	4	5	6

- F. PVC pipe supports shall be spaced in accordance with the following schedule:

Nominal pipe size (inches)	1/2 - 3/4	1- 1 1/4	1 1/2 - 2	3-4
Max spacing (feet)	2.5	3	4	6

- G. Maximum spacing between pipe supports shall be 10 feet for all pipes 6” and above. This is a maximum spacing and does not take into account

valves, fittings, flow meters, risers, drops and other devices. Locations where these are installed will require additional supports.

H. In addition to the above, pipe supports shall be located as per the following:

1. Maximum spacing as indicated above.
2. Maximum of 12 inches from all horizontal and vertical changes in direction.
3. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
4. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
5. On the inlet and outlet piping to the water meter to allow the removal of the water meter.
6. At the location of valves, fittings or other devices that cause additional weight to the piping.
7. Additional pipe supports as indicated on the drawings.

11.2.31 Air and Vacuum Valves

- A. Air and vacuum valves shall be constructed with cast iron or stainless steel bodies, type 304 stainless steel floats, bronze trim and Buna-N seats. Valves shall be of the size and at the locations indicated on the Drawings. Valves shall be of the combination type to relieve large volumes of air as the lines are filled or emptied and also release small quantities of entrained air under pressure. Valves shall be for working pressures indicated on Drawings. Valves shall be installed with a full size gooseneck on the outlet.

11.2.32 Service Saddles

- A. Service saddles shall be stainless steel with stainless steel double straps and bolts, and tapped for AWWA threads. Service saddles shall be as manufactured by Cascade, Mueller, Romac, or approved equal.

11.3. EXECUTION

11.3.1 Pipe Laying

- A. Take all precautions necessary to ensure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.
- B. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.
- C. Bed pipe as specified in Section 9 - Trenching & Backfilling.
- D. Do not lay pipe when trench bottom is muddy or frozen, or has standing water.
- E. Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.
- F. Lay pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, lay pipe uphill with bell ends upgrade.
- G. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health Regulations.

11.3.2 Joining Mechanical Joint Pipe

- A. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with Blue Lube pipe lubricant or as supplied by the pipe manufacturer suitable for potable water. Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.
- B. Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and screw nuts up finger tight. Then tighten all nuts to torque listed below with a calibrated torque wrench:

- | | | |
|----|-------------------------|--------------------------|
| C. | <u>Bolt Size-Inches</u> | <u>Torque Ft. - Lbs.</u> |
| | 1. 5/8 | 40 - 60 |
| | 2. 3/4 | 60 - 90 |
| | 3. 1 | 70 - 100 |
| | 4. 1-1/4 | 90 - 120 |
- D. Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.
- E. Join lock-type mechanical joint pipe according to manufacturer's recommendations.
- F. Permissible deflection in mechanical joint pipe shall not be greater than 1/2 of that listed in AWWA C600 or as allowed by the pipe manufacturer.
- G. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

11.3.3 Joining Push-On Joint Pipe

- A. Thoroughly clean inside of the bell and 8 inches of the outside of spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of approved gasket lubricant (Blue Lube), to the gasket and the spigot end of the joining pipe. (Note: Use of any unapproved lubricant other than Blue Lube has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The County will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.) Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end of the bottom of the socket with a forked tool or jack-type device. File the end of field cut pipe to match the manufactured spigot end.
- B. No joint deflection is allowed in PVC push on joints. All pipe deflections shall be by bending of the pipe in accordance with manufacturers instructions.

11.3.4 Setting Valves and Valve Boxes

- A. Install gate valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Install valves with gear operators with the operating nut in the vertical plane. Locate valves where shown on Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.

- B. Provide all underground valves with valve boxes where shown on the Drawings. Set valve boxes in accordance with Standard Drawings. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. PVC extensions shall not be permitted.
 - C. All underground valves shall have valve stem extensions. Extension shall be pinned to the operating nut and terminate 1 foot below grade with a 2" operating nut.
- 11.3.5 Locate Fire Hydrants as shown on Drawings and in accordance with Standard Drawings.
 - 11.3.6 Provide combination air/vacuum valves at locations shown on Drawings. Install gate valve or ball valve between water main and combination air/vacuum valves. Construct manholes for air and vacuum relief valve as shown in the Standard Drawings.
 - 11.3.7 Use sleeves where pipes, valve stem extensions or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be either cast iron or schedule 40 steel of sufficient size to allow sealing around pipes and clearance for valve stems or equipment. Extend vertical sleeves through slabs 2 inch above top surface.
 - 11.3.8 Use cast iron sleeves with intermediate collars to anchor and provide a water stop on outside of sleeves that go through exterior walls below grade. Seal pipe using link-seals.
 - 11.3.9 Provide "link-seal" pipe to wall closures manufactured by Thunderline Corp., Wayne, Michigan where shown on Drawings. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening to provide watertight seal between pipe and wall opening.
 - 11.3.10 Provide reaction anchors of concrete blocking, metal harness, retainer gland type or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Drawings. Always restrain the joints at bends, valves and fittings.
 - 11.3.11 Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape shown on the Standard Drawings.
 - 11.3.12 Use metal harness restraints as specified elsewhere in this section.

- 11.3.13 Where retainer glands are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.
- 11.3.14 Encase water pipelines crossing under highways and railways in a casing pipe. The casing pipe shall be of the diameter and wall thickness indicated in the Standard Drawings. Joining of steel casing pipe shall meet requirements of AWWA C206. Install casing pipe by jacking or boring.
- A. The installation shall meet requirements of AREA Standards for installation of pipelines carrying nonflammable substances under railway tracks. Install as per standard drawings or as required by the railroad. Casing ends shall be sealed to protect against foreign matter entering casing. Prior to beginning work, notify the Railway Company or VDOT and acquire the necessary permits.
- 11.3.15 Installation of Tapping sleeves and Tapping Valves
- A. All tapping sleeves shall be set to avoid interference with existing pipe joints.
- B. After all tapping sleeves and valves have been set in place, a pressure test of 150 psi shall be made to ensure that there are no leaks around the sleeve or through the valve. All leakage shall be corrected.
- C. The actual tap shall be made in presence of a representative of the Owner. The Owner shall be notified 48 hours in advance of making the tap.
- 11.3.16 Detectable tracer tape shall be installed in utility trenches directly above all water mains approximately 18-inches directly above the pipe but no less than 18-inches below finished grade and in accordance with manufacturer's recommendations. The detectable tape shall comply with the product specifications and as specified herein.
- 11.3.17 Tracer wire shall be installed with all water mains and attached to fittings in addition to metallic tape installed above the pipe. The tracer wire shall comply with the product specifications. The tracer wire shall be taped directly to the top of the pipe at a maximum spacing of 8 ft and on each side of fittings, and be installed in a continuous traceable manner. When non-metallic water lines have metallic service lines attached, the conductive tracer wire shall be attached to the corporation stop. The tracer wire shall be brought up in valve boxes to within 6 inches of the surface and left in a coil. The tracer wire shall also be adequately connected to tracer wire access boxes as described herein.

11.3.18 Acceptance Tests

- A. Owner will supply water at no cost, for testing potable water lines only.
- B. A temporary RPZ Backflow Preventer flushing apparatus is required if a direct connection to public water is used to fill the line.
- C. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C600, except as modified herein. Fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1.5 x the working pressure or 150 psi whichever is greater. Test pressures shall:
 - 1. Not be less than 1.25 x the working pressure or 125 psi at the highest point along the test section.
 - 2. Not vary by more than plus or minus 5 psi.
 - 3. Not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves.
 - 4. Not exceed rated pressure of valves if resilient-seated gate valves or butterfly valves are used. Thrust restraint shall be designed for the test pressure Measure pressure at the low point on the system compensating for gage elevation.
 - 5. Maintain this pressure for two hours. If pressure cannot be maintained, determine cause, repair and repeat the test until successful.
- D. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water.
- E. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

In which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested, in feet; D is the nominal diameter of the pipe, in inches;

and P is the average test pressure during the leakage test in pounds per square inch gage.

- F. All visible leaks shall be repaired regardless of the amount of leakage.

11.3.19 Disinfection

- A. Disinfect, flush and test water mains and accessories in accordance with the procedures listed below. The water used in the disinfection process shall be potable water from an approved supply. If water is to be transported to the subject site, then the tank trucks must also be properly disinfected prior to transporting water. Disinfection of the vehicle should also include all appurtenances used such as valves, hoses, etc.
- B. Preliminary Flushing: The main shall be flushed prior to disinfection. Flushing shall be at a velocity of not less than 3.0 ft/sec. Adequate provisions shall be made for drainage of flushing water.
- C. Form of Chlorine for Disinfection:
 - 1. Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.
 - 2. Calcium hypochlorite contains 70 percent available chlorine by weight. It shall be either granular or tabular form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water. A chlorine-water solution shall be prepared by dissolving the granules in water in the proportion requisite for the desired concentration.
 - 3. Sodium hypochlorite is supplied in strengths from 5.25 to 16 percent available chlorine. The chlorine-water solution shall be prepared by adding hypochlorite to water. Product deterioration shall be reckoned with in computing the quantity of sodium hypochlorite required for the desired concentration.
- D. Application: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically-powered chemical feed pump designed for feeding chlorine solutions. For small applications the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be

checked for tightness before the hypochlorite solution is applied to the main.

E. Methods of Chlorine Application:

1. Continuous Feed Method: Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 MG/L available chlorine. To assure that this concentration is maintained, the chlorine residual shall be measured at intervals not exceeding 1,200 feet in accordance with the procedures described in the current edition of "Standard Methods" and AWWA M12 - "simplified procedures for water examination". In the absence of a meter, the rate may be determined either by placing a pitot gage at the discharge or by measuring the time to fill a container of known volume. Table I gives the time to fill a container of known volume. Table I gives the amount of chlorine required for each 100 feet of pipe of various diameters. Solutions of one percent (1%) chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately 1 lb. of calcium hypochlorite in 8.5 gallons of water.

TABLE I

CHLORINE REQUIRED TO PRODUCE 50 MG/L CONCENTRATION
IN 100 FT. OF PIPE - BY DIAMETER

<u>PIPE SIZE</u> <u>(IN.)</u>	<u>100 PERCENT</u> <u>CHLORINE</u> <u>(LB.)</u>	<u>1 PERCENT CHLORIDE</u> <u>SOLUTIONS</u> <u>(GAL.)</u>
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
16	0.430	5.12
20	0.675	8.00

2. During the application of chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 MG/L chlorine throughout the length of the main.
3. As chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.
4. Final flushing: After the applicable retention period the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 MG/L.
5. Chlorinated water shall be de-chlorinated before disposal. Do not allow flow into a waterway without neutralizing disinfectant residual. See the appendix of AWWA C651, C652, and C653 for acceptable neutralization methods.
6. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

11.3.20 Bacteriologic Tests:

- A. After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriologic quality and shall show the absence of coliform organisms. At least 2 samples shall be collected at least 24 hours apart at intervals not exceeding 1,200 feet and tested by a State Health Department approved laboratory and results submitted to engineer.
- B. In the case that trench water and/or excessive soil or construction debris has entered the new water main as determined by the contractor, owner, or county inspector, bacteriological samples shall be collected at approximately every 200 feet along the water main from water that has stood within the water main for at least 16 hours after final flushing.
- C. The Developer may have an independent testing laboratory collect and test samples in accordance with these specifications. The samples shall be taken by laboratory personnel in the presence of the County Construction Inspector. The testing laboratory shall submit the results to the County Engineer.

- D. Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory and disinfection shall be repeated until the samples are satisfactory. Cleaning, disinfection and testing will be the responsibility of the contractor. Water for these operations will be furnished by the owner, but the contractor shall include in his bid the cost of loading, hauling and discharging the water.
 - E. A sampling tap consisting of a corporation cock with metal pipe shall be installed within two feet of valves. The corporation stop inlet shall be male one inch in size and the outlet shall have one inch I.P. threads and a cap. After bacteriological testing is completed the piping shall be removed and the corporation cock shall be closed and capped
- 11.3.21 Testing and disinfection of the completed sections shall not relieve the contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at the contractor's expense.

END OF SECTION 11

SECTION 12 - SANITARY SEWER SYSTEM

12.1 GENERAL

- A. Work included in this Section consists of all gravity sanitary sewers, force mains, manholes, valves, air vents and all related equipment or material as indicated on the construction plans.

12.1.2 Reference Specifications are referred to by abbreviation as follows:

- A. American National Standards Institute ----- ANSI
- B. American Society for Testing and Materials ----- ASTM
- C. American Water Works Association ----- AWWA
- D. American Railway Engineering Association -- ---- AREA

12.2 PRODUCTS

12.2.1 Submit shop drawings on all products supplied and installed in the project in accordance with submittals procedures.

12.2.2 Provide certified test results of pipe testing.

12.2.3 Underground Pressure Pipe

E. Ductile Iron Pipe

- 1. Ductile iron pipe shall meet the requirements of AWWA Class 52 and rubber-gasket joints shall meet the requirements of AWWA C111 3" through 24" pipe shall be, at a minimum, class 52 with a working pressure of 350 psi. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked. Pressure class of pipe shall be increased if the specific installation warrants it.

F. Polyvinylchloride (PVC) Pipe

- 1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 200) for sizes up to 12". Joints shall be in accordance with manufacturer's instructions and ASTM D2564, D2464, D2467, D319, and F477. If working pressures over 150 psi are encountered ductile iron pipe shall be used. Cell classification for water pipe shall be 12454-B

G. Polyethylene pipe

1. 3 Inches and Smaller –Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350-02 with a cell classification of PE: 345464C. Pipe shall have a manufacturing standard of ASTM D2737 (copper tubing size), ASTM D2239 (iron pipe size, controlled inside diameter) and ASTM D 3035 (iron pipe size, controlled outside diameter). Pipe shall have a pressure class as specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 14.
2. 4 Inches and Larger - Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350 with a cell classification of PE: 345464C. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall be pressure class as indicated on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, listed as NSF 61, and per AWWA C906. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe. Peak flow water velocity of 5 ft/sec shall be used in the hydraulics engineering design.

12.2.4 Gravity Pipe

H. Polyvinylchloride (PVC)

1. For pipes sized 4-inch through 15-inch, pipe shall meet requirements of ASTM D3034 type PSM SDR-26 or of ASTM F1760 DR-26 having reprocessed-recycled content.
2. For pipe sized 18-inch through 27-inch, pipe shall meet requirements of ASTM D3212.

I. Ductile Iron

1. Ductile Iron Pipe shall meet the requirements of ductile iron pressure pipe minimum Class 52 or as recommended by the pipe manufacturer for the depth of bury whichever is greater.

12.2.5 Pressure Pipe Underground fittings

J. Ductile Iron Fittings

1. Fittings for PVC pipe and DI pipe shall be ductile iron. Ductile iron fittings shall be in accordance with AWWA C110 or AWWA C153. Pressure ratings shall be a minimum of 350 psi for fittings 24-inch and smaller and 250 psi for 30-inch. All fittings shall have a single cement mortar lining on the interior and a bituminous seal coating on the exterior. Fittings shall have mechanical joints conforming to the requirements of AWWA C111. Bolts for mechanical joint fittings shall be high strength, corrosion resistant low alloy steel with hexagon nuts having a minimum yield point of 45,000 psi in accordance with AWWA C111. Mechanical joint bolts shall be torqued with a torque wrench as per manufacturer's recommendations.
2. Couplings for underground or buried service shall be ductile iron mechanical joint in accordance with underground ductile fittings in this section.

K. Polyethylene Pipe Fittings

1. Fittings for polyethylene pipe shall be manufactured specifically for the intended use and be approved by the piping manufacturer to be compatible with their product. All fittings shall have a working pressure rating equal to or greater than the pipe, and shall meet all requirements of NSF 61.
2. Butt Fusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).
3. Electrofusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electrofusion

Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR).

4. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261.

L. Thrust Restraint

1. Contractor shall install concrete thrust blocks at all tie in points and as indicated on the contract drawings or as directed by the Project Representative based upon field conditions. Thrust blocks shall be sized as indicated on the thrust block Standard Details. Concrete shall have 3,000 psi strength at 28 days, and shall meet the requirements of ASTM C94.
2. All pipe fittings, plugs, caps, tees, and bends in underground ductile iron or PVC piping shall be restrained utilizing Megalug Series 1100 retainer glands by EBAA Iron Sales, Inc. (or approved equal) for ductile iron pipe and Megalug Series 2000PV retainer glands by EBAA Iron Sales, Inc. (or approved equal) for PVC pipe. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
3. All ductile iron bell and spigot pipe joints shall be restrained using US Pipe Field Lok 350 type gaskets or harness type restraints utilizing Megalug Series 1700 retainer glands by EBAA Iron Sales, Inc. (or approved equal). If all joints are not required to be restrained the minimum restrained lengths and locations shall be indicated on the drawings. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.
4. PVC pipe bell and spigot joints shall be restrained on either side of valves and fitting for a length to be indicated on the drawings. Harness type restraining devices shall be used on bell and spigot

pipe joints utilizing Megalug Series 2800 restraint harness by EBAA Iron Sales, Inc. (or approved equal).

12.2.6 Above Ground or Exposed Pressure Pipe

M. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings or underground vaults, shall be flanged ductile iron pipe class 53 in accordance with AWWA C115 (ANSI A21.15). Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints utilizing factory installed screwed flanges (no uniflange type flanges are permitted) meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8" thick full face red rubber. All steel flanges mating to flat face flanges shall have the raised face machined off. Pipe shall have a single cement mortar lining with asphaltic seal coat meeting the requirements for AWWA C104.

N. Ductile Iron Fittings

1. Fittings for ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110. Fittings up to 30" diameter shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, pipe shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1, outside coating shall be red primer, and gaskets for flanged pipe shall be 1/8" thick full face red rubber. Fittings shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.
2. Couplings for above ground or exposed service shall be Dresser Style 38 or approved equal. Transition couplings shall be Dresser Style 162 or approved equal. All couplings shall be rodded unless otherwise noted.
3. Flange adaptors shall only be used for final connections to equipment or to allow for disassembly of pipe for equipment maintenance in approved locations. Flange adaptors are not to be used to make up for misaligned pipe. Flanged Adaptors shall be JCM flanged coupling adaptors model 301R or approved equal. Uniflanges are not permitted.

O. PVC Pipe and Fittings

1. PVC pipe shall only be used for chemical piping in sizes 1" and smaller without special approval by the County Engineer.
2. All PVC pipe and fittings shall be socket weld schedule 80.

3. When transitioning from metal to PVC, the PVC adaptor shall always be a male NPT fitting inside of a female NPT metal fitting. Should the metal fitting be a male thread, a metal coupling shall be installed to provide a female thread for the PVC adaptor.

P. Stainless Steel Pipe and Fittings

1. All stainless steel pipe shall be Schedule 40 type 304 unless specified by equipment manufacturers or for chemical compatibility to be 316.
2. Stainless steel pipe shall be threaded with threaded fittings.

12.2.7 Plug valves

- Q. Plug Valves shall be the non-lubricated eccentric type with resilient faced plugs. Port area shall be at least 80 percent of the full pipe area. Bodies shall be cast iron with welded nickel, raised seats. Valves shall have permanently lubricated corrosion resistant bearings in the bonnet and body.
- R. Packing and packing glands shall be accessible without having to disassemble valves. Packing shall be adjustable.
- S. Valves shall have resilient plug facings suitable for the service intended and shall provide dead-tight shutoff. Opening the valve shall cause the plug to be raised off the seat without scraping the seat or body walls.
- T. Plug valves shall be gear operated unless otherwise shown or specified, and shall open counter-clockwise. Exposed plug valves (located above ground, inside buildings, valve vaults, etc.) shall be flanged and provided with gear operated hand wheel actuators complete with valve position indicators.
- U. Plug valves for direct burial service shall be provided with right angle worm gear operators. Buried valves shall be provided with adjustable cast-iron valve boxes and extension stems to grade.
- V. A tee wrench shall be provided for operation of the buried valve.
- W. Inside iron or steel surfaces of valves and exterior surfaces of valves which are to be buried in the ground shall be given two coats of asphalt varnish meeting the requirements of Fed. Spc. TT-V-51a. Exterior iron or steel surfaces of other valves shall be painted as specified for the pipelines in which they are installed.
- X. 4" plug valves must pass a 3" spherical solid.
- Y. Plug valves shall be Dezurik, Milliken or approved equal.

12.2.8 Check Valves

A. Swing check valves

1. 3 inch and larger

- a) Check valves 3” and larger shall be Class 125 flanged ends ductile iron body bronze mounted, bronze disc facing, swing type lever and weight check valves in accordance with AWWA C508. Flanged end dimension and drilling shall comply with ANSI B 16.1, Class 125. Check valves 3” through 24” shall have a 250 psig maximum working pressure.
- b) Check valves shall have an adjustable air decelerator (air cushion) installed on the outside of the valve to control valve closing.
- c) All check valves shall have a factory installed limit switch to indicate close position for flow confirmation.
- d) Valves shall be Apco series CVS 250, Val-Matic series 7900S-S, Milliken Series 8501 or approved equal.

2. Check valves 2” and smaller shall be class 150 bronze or stainless steel y-pattern swing check valves with threaded ends. Valves shall be Crane figure 137 (bronze), Crane Aloyco figure 49 or approved equal.

12.2.9 Tracer Wire

A. Copper tracer wire shall be THHN, 12 gauge, insulated with a green colored insulation. Wire shall be secured to the pipe every 8 feet and within 12 inches on either side of fittings.

B. Tracer wire access boxes shall be installed no more than 1000 feet apart and adjacent to all inline valves on force mains. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes.

C. Wire Connectors

1. Connector, Wire, Set Screw Pressure type for use with No. 12 stranded wire size.
2. Holub Industries MA-2 or equivalent
3. Ideal Industries Model 30-222 or equivalent

- D. Wire nuts shall not be allowed underground or in electric manholes or pull boxes.

12.2.10 Tracer Wire Access Boxes

- A. The tracer wire access boxes shall be made of cast iron with a permanently attached 3" x 12" ABS tube with a flared end to secure it in the ground. Its tamper-resistant cast iron locking lid has stainless steel terminal connectors on the bottom side to which tracer wires are attached. Lid is opened using a standard AWWA pentagon key. Enough slack shall be coiled inside the box to allow the removal of the lid. Lid shall be marked sewer.

12.2.11 Marking Tape

- A. Tape shall be 3.5 mill polyethylene tape 3" in width with a 14 gauge metallic core, with the continuous printed message, "Caution – Sewer Line Buried Below." Tape shall be style 48288 as manufactured by the Seton Safety and Identification or approved equal.

12.2.12 Steel Casing Pipe

- A. Steel casing pipe for boring or jacking under highways and railroads shall meet the requirements of ASTM A139, Grade B. Nominal pipe diameter and wall thickness shall be as indicated on the Standard Drawings. No protective coating or lining will be required. Casing pipe laid in an open cut shall be, steel pipe.

12.2.13 Manholes

- A. Precast reinforced concrete manholes shall be constructed in accordance with Standard Drawings for the type and size of manhole indicated on the Drawings.
- B. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.
 - 1. Gasket shall comply with requirements of ASTM C361.
 - 2. Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.
- C. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester (FRP) or polyvinylchloride (PVC) or high-density polyethylene (HDPE) construction and shall be installed to protect the precast manhole sections from the inside base of the manhole to the base of the manhole frame. The connection of the pipe to the manhole shall be sealed with the liner in a

manner to eliminate any exposed concrete surfaces that could be subject to damage by corrosive gases.

1. FRP liners shall consist of a 3/16-inch thick fiberglass reinforced polyester with a 15 mil gel coat interior surface. The polyester resin shall be similar to Dion No. 6694. Joints between sections of the liner shall be sealed with joint sealant.
 2. PVC liners shall consist of polyvinylchloride plates, not less than 0.060-inch thick, with integral bonding ribs and shall be similar to Amercoat "T-Lock Amer-Plate". Joints between sections of liner shall be welded in accordance with the manufacturer's instructions by T-Lock certified welders.
 3. HDPE liners shall be AGRU "Sure Grip" HDPE Concrete Protective Liner. Joints between sections of the liner shall be welded in accordance with the manufacturer's instructions by Agru certified welders. Minimum liner thickness shall be 0.078 inches.
- D. Manhole steps shall be corrosion-resistant and shall be one-inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Standard Drawings. Manhole steps shall be aligned to minimize conflicts with future connections to manhole. For sewers up to 15 inches in diameter, steps should be placed over the bench. Manhole steps shall not be placed on the downstream side of the manhole. Steps shall be installed at a maximum spacing of 12 inches.
- E. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 6 -Standard Drawings.
- F. Manhole frame and covers shall be manufactured by Capitol Foundry, Neenah Foundry, or approved equal. Manhole covers shall be labeled "SEWER"
- G. Manholes shall be supplied with flexible connectors to allow connection of sewer pipes to the manholes. The manholes shall be cored at the factory and supplied with the appropriate flexible connectors. The connector shall be Kor-N-Seal, Press-Seal with a stainless steel expander ring, or approved equal.
- H. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Series 1A.

12.2.14 Surge Analysis

- A. A Surge Analysis shall be performed on sewer force mains under the following conditions:
 - 1. Pumping systems with a total dynamic head greater than 50 ft if the flow is greater than about 500 gal/min.
 - 2. High lift pumping systems with a check valve
 - 3. Any system in which column separation can occur including:
 - a) Systems with high points.
 - b) A force main that needs automatic air venting or air vacuum valves.
 - c) A pipe line with a long (more than 300 ft) steep gradient followed by a long, shallow gradient.
 - d) Force mains larger than 8 inches when longer than 1000 ft.

12.2.15 Pressure Gauges

- A. Pressure gauges shall be mounted on a wafer pressure isolator ring (sensor ring) by the sensor ring manufacturer.
- B. Pressure gauges shall be of all stainless steel construction, 3.5 to 4 inch case size, accuracy of 1% over the entire dial arc and a ¼" NPT bottom connection, Pressure range shall be as indicated on the drawings.
- C. Gauges shall be graduated so the system operating pressures are in the middle third of the scale.
- D. Pressure gauges shall be Ashcroft stainless steel case 1009 pressure gauges or approved equal.

12.2.16 Wafer Pressure Isolators Ring (Sensor Ring)

- A. Wafer pressure isolator rings shall be designed to permit pressure measurement on slurries and other hard-to-handle fluids without compromising gauge function. Isolation ring shall consist of a metal ring with an elastomer inner tube filled with silicone instrument oil. Center section of isolator ring shall be carbon steel. End plates shall be Acetal Homo Polymer (or 316 stainless steel, Kynar, Teflon) and elastomeric sleeve shall be Nitrile (or EPDM, Viton).
- B. Wafer pressure isolator rings shall fit inside the bolt circle of 150# ANSI

flanges (or shall be provided with appropriate spacers for 300# or 600# flanges). Face to face length of the wafer pressure isolator ring shall conform to specification MSS-SP67. Wafer pressure isolator ring shall be flow through design with flexible rubber sleeve around full circumference. The center section shall have a cavity behind the rubber sleeve filled with silicone fluid to transfer pressure to the gauge.

- C. All pressure instruments attached to the wafer pressure isolator ring shall be rigidly supported by a post at least 0.875 inches diameter welded to the isolator. On wafer pressure isolator rings with more than one instrument, all connections shall be 1/2" NPT as a minimum. 1/4" NPT fittings are not acceptable. The wafer pressure isolator ring shall not have a fill plug that can be inadvertently removed with the resultant loss of fill fluid.
- D. The wafer pressure isolator ring shall be vacuum filled and permanently sealed at the factory with a modular seal consisting of a rubber membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. The needle fitting shall have both 1/4" NPT(F) thread and 1/2 NPT(M) threads. The wafer pressure isolator ring shall be capable of operating under pressure with all instruments removed with no loss of fill fluid, without isolating valves. Pressure instruments shall be attached to the wafer pressure isolator ring with a hand tightened lock ring. It shall be possible to remove, rotate or attach pressure instruments to the wafer pressure isolator ring without requiring the use of any tools. The wafer pressure isolator ring shall be permanently filled with high viscosity silicone instrument oil to damp out surges or pressure spikes without a separate snubber.
- E. Max operating pressure without leakage: 1,000 psig
- F. Wafer pressure isolator ring shall be Onyx Valve Co model PSW, Red Valve Company Series 40 or equal.

12.2.17 Pipe Supports

- A. Pipes shall be supported by steel pipe hangers, clamps, brackets, rods and inserts as required to support the imposed pipe loads. Hangers in general shall be new, manufactured of carbon steel and hot dipped galvanized after fabrication or 304 stainless steel.
- B. Pipes 2 ½ inches and larger shall be supported with adjustable floor stand type pipe supports as detailed on the drawings. Pipe supports shall be Standon Model S89 flange support, Standon Model S96 cradle support as manufactured by Material Resources, Inc. or approved equal.
- C. Pipes 2" and smaller shall be supported from the floor, walls or ceiling depending on the type of building construction. Pipe supports for these size pipes shall be as manufactured by Unistrut Building Systems, B-Line or

approved equal. Supports shall consist of floor stands, wall brackets or clevis type hangers. Strut and appurtenances shall be stainless steel. Clips for copper tubing shall be copper coated. Minimum threaded rod size shall be 3/8 inch.

- D. Ductile Iron and steel pipe supports shall be spaced in accordance with the following schedule:

Pipe sizes (inches)	1/2 - 3/4	1 - 1 1/4	1 1/2 - 2	3 - 4
Max spacing (feet)	4	6	8	10

- E. PVC pipe supports shall be spaced in accordance with the following schedule:

Nominal pipe size (inches)	1/2 - 3/4	1 - 1 1/4	1 1/2 - 2	3 - 4
Max spacing (feet)	2.5	3	4	6

- F. Maximum spacing between pipe supports shall be 10 feet for all pipes 6” and above. This is a maximum spacing and does not take into account valves, fittings, flow meters, risers, drops and other devices. Locations where these are installed will require additional supports.

- G. In addition to the above, pipe supports shall be located as per the following:

1. Maximum spacing as indicated above.
2. Maximum of 12 inches from all horizontal and vertical changes in direction.
3. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
4. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
5. On the inlet and outlet piping to the water meter to allow the removal of the water meter.
6. At the location of valves, fittings or other devices that cause additions weight to the piping.
7. Additional pipe supports as indicated on the drawings.

12.3 EXECUTION

- 12.3.1 Take all precautions necessary to ensure that pipes, valves, fittings, and related items are not damaged in unloading, handling and placing in trench. Examine each

piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

- A. Keep pipes clean. Exercise care to keep foreign material and dirt from entering pipes during storage, handling and placing in trench. Close ends of in-place pipes at the end of any work period to prevent entry of animals and foreign material.
- B. Bed pipe as specified in Section 9 - Trenching & Backfilling.
- C. Do not lay pipe when weather or trench conditions are unsuitable.
- D. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health Regulations.

12.3.2 Gravity Sewer Pipe

- A. Lay gravity sewers so as to maintain a true alignment and grade as indicated on Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.
- B. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.
- C. Pipe joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Section 9 - Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade and sufficient backfill to prevent floating.
- D. All sanitary sewer gravity mains buried underground shall have a detectable tracer buried in the trench approximately 18 inches above the conduit but no less than 18 inches below grade.
- E. Complete backfilling as specified under Section 9 - Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid. Provide ductile iron pipe where cover over main line sewer pipe is less than 5.5 feet in public roads and 3.5 feet in easements.

12.3.3 Sewer Force Main

- A. Install force main with a minimum depth of cover of 42 inches over the top of the pipe where no grades are shown on the drawings.

- B. Where grades on the force main conflict with existing pipes or structures, lay force main to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation. Provide allowance for expansion as directed by County Engineer.
- C. Lay force main pipe with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade.
- D. All sanitary sewer force mains buried underground shall have a detectable tracer buried in the trench approximately 18 inches above the conduit but no less than 18 inches below grade. The detectable tape shall comply with the product specifications as detailed in the previous Section 12.2.17.
- E. Copper tracer wire shall be taped directly to the top of the pipe and be installed in a continuous traceable manner. The tracer wire shall be connected to any air-release valves (ARV) along the force main alignment. The tracer wire shall comply with the product specifications as detailed in the previous Section 12.2.18.

12.3.4 Joining Pipe

- A. Join mechanical joint pipe as follows:
 - 1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.
 - 2. Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed finger tight, then tighten all nuts to torque listed below.

<u>Bolts Size- Inches</u>	<u>Torque Ft. - Lbs.</u>
5/8	40 - 60
¾	60 - 90
1	70 - 100
1 1/4	90 - 120

3. Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.
4. Permissible deflection in mechanical joint pipe shall not be greater than ½ of that listed in AWWA C600.

B. Join push-on joint pipe as follows:

1. Thoroughly clean inside of the bell and 8 inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant, supplied by pipe manufacturer, to the gasket and the spigot end of the joining pipe.
2. Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.
3. Permissible deflection in push-on joint pipe shall not be greater than 1/2 of that listed in AWWA C600.

12.3.5 Thrust Restraint

- A. Provide reaction anchors of concrete blocking at all points of tie-in to existing pressure pipe lines, Provide mechanical joint retainer glands at all fittings, valves, plugs, caps and other changes in directions or dead ends of pressure pipelines.
- B. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape indicated on the contract drawings.
- C. Use metal harness restraints for bell and spigot piping where as indicated on the contract drawings to be restrained.
- D. Use Mechanical Joint restraining glands for all Mechanical joint pipe as indicated on the drawings to be restrained.
- E. All pressure pipe joints at pump stations with-in the fence boundaries shall be restrained.
- F. On sewer force mains, restraint calculations shall be provided on the drawings and length of restrained joints shall be indicated on the drawings.

12.3.6 Encase sewer pipe lines crossing under highways and railways in a steel casing pipe. The casing pipe shall be of the diameter and wall thickness indicated on the

Standard Drawings. Installation of the steel casing pipe shall be by jacking, boring or open cut if permitted.

- A. The installation shall meet the requirements for installation of pipelines carrying nonflammable substances under railway tracks. All permits shall be obtained prior to beginning work, from the Railway Company or VDOT. Copies of the permits shall be submitted to the County engineer for approval.
- B. Casing and carrier pipe shall be installed in accordance with the Standard Details.

12.3.7 Construct service connections from sewer main to property line as follows:

- A. Service connections shall be in accordance with the Standard Drawings.
- B. Place a wye and 45 degree fittings of the required size in accordance with the Standard Details where a service connection is to be constructed. Lay pipe from the connection to the property line on a grade of not less than 1/4 in. per foot for 4" pipe or 1/8 in. per foot for 6" pipe. Close service connection at the property line with a watertight plug.
- C. Install service connections on existing 12" and smaller sewer mains with a compression type wye cast iron saddle as manufactured by Geneco or approved equal. Secure saddle to the pipe with a 24 gauge stainless steel strap and two nickel-bronze T bolts. Make connections of this type by machine tapping or cutting the pipe. Use O-ring type gasket to ensure a watertight connection. On pipe larger than 12" a straight cast iron saddle may be used.
- D. Service connections from manholes shall be ductile iron or PVC pipe.
- E. Determine the depth of service connections by the deepest of the following:
 - 1. Provide 5 foot cover at the edge of the road paving or 15 feet from the centerline of the street.
 - 2. Provide 36 inches of cover at the bottom of highway ditches.
 - 3. Provide 5 feet of cover at the property line when property is above street.
 - 4. Where the above conditions cannot be met for a 4" pipe at 1/4" per foot slope, the line shall be changed to a 6" pipe at 1/8" per foot. If the 6" pipe cannot meet the above conditions the pipe shall be 6" ductile iron and incased in concrete where the depth of cover is less than 36 inches.

- F. Place a 2-inch x 4-inch solid piece of lumber at the end of each service connection. The 2-inch x 4-inch marker shall be set vertically and extend from the invert to six inches above grade.
- G. Provide ductile iron pipe where cover over service connections is less than 5.5 feet in public right of way and 3.5 feet in easements.

12.3.8 Testing Gravity Sewer Lines and Manholes.

- A. All gauges used for testing shall be calibrated gauges with a minimum of a 4-1/2" dial with a mirrored back.
- B. Sanitary sewer lines 24 inches in diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C828. Sewer lines larger than 24 inches in diameter and manholes shall be tested by infiltration or exfiltration as hereinafter detailed. All sewer manholes shall be tested by a vacuum test in the presence of the County Inspector. Tests shall be conducted on short sections of sewer line, i.e., between manholes, or at the end of each day's work. Provide all labor, materials, tools, and equipment necessary to make the tests. All equipment and methods used shall be acceptable to the County Engineer.
- C. Testing of Gravity Sewer Pipes
 1. Testing: All structures required to be watertight and all piping and appurtenances shall be tested for leakage by CONTRACTOR under the direction of County.
 2. Gravity sewer pipes testing shall be done by air pressure test as specified herein.
 3. Air Test: CONTRACTOR shall plug the pipe and shall conduct a low pressure air test to determine the acceptability of the completed work. CONTRACTOR shall furnish all men, materials, and supplies necessary to assist in the conducting of this test. This air test shall conform to UNI-BB-6-79 or latest revision.
 4. The air testing equipment shall be Air-Lock, as manufactured by Cherne Industrial, Inc., or approved equal. All air used shall pass through a single control panel. Individual air hoses shall be used from control panel to pneumatic plugs; from control panel to sealed line for introducing low pressure air; and from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.
 5. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe tested. The plugs shall resist internal test pressures without requiring external bracing or blocking. Plugs shall be tested prior to installation in the pipe run. A joint of pipe

shall be sealed at both ends with the plugs to be used in the sewer test. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall then be pressurized to 9 psi. The plugs shall withstand this pressure without bracing or movement. The tested line segment shall be plugged and pressurized to 4.0 psi greater than the ground water back pressure but not to exceed 9 psi. The line shall be allowed to stabilize for 2 minutes after pressurization. After the pressure has stabilized, the air pressure shall be decreased slowly to 3.5 psi (greater than ground water back pressure) and the timing shall commence. The time for the pressure to drop 1 psi from 3.5 psi shall be recorded. The minimum acceptable time durations are shown on Table I. If the elapsed time to drop 1 psi is less than that shown on Table I, then the air loss shall be considered excessive and the section of pipe has failed the test.

6. Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.
7. Preparation of the sewer line: Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.
8. Ground Water Determination: Install a one-half inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
9. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828. The pressure-holding time is base on an average holding pressure of 3.0 psi gauge or a drop from 3.5 psi to 2.5 psi gauge.

TABLE I**SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED Q=.0015****PART 1A**

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)			
				100'	150'	200'	250'
4	3:46	597	.380 L	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12

PART 1B

Pipe Diameter (in.)	Minimum Time (min:sec)	Length for Minimum Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)			
				300'	350'	400'	450'
4	3:46	597	.380 L	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	86:32	100:57	115:22	129:48
030	28:20	80	21.366 L	106:57	124:38	142:26	160:15
33	31:10	72	25.852 L	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	153:50	179:29	205:07	230:46

10. Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gauge. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.
11. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gauge, commence the test. Before starting the test, the pressure may be allowed to drop to the 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 1.0 psi gauge during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 1.0 psig drop has not occurred.
12. The test procedure may be used as a presumptive test which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.
13. If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.
14. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

15. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250 lb./f. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
16. As a safety precaution, pressurized equipment shall include a regulator or relief valve set slightly over the test pressure to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.
17. Table: The air test table above has been prepared utilizing applicable formulas from ASTM C828-76T. It is based on an allowable air loss of 0.0015 cu. ft/minute per square foot of internal pipe surface, a maximum air loss per test section of 3.5 cu. ft/minute and a minimum significant air loss per test section of 1.0 cu. ft/minute. It applies when testing one pipe diameter only and for convenience ignores 4 inch and 6 inch lateral sewers, which in most instances create only insignificant differences in test time.

12.3.9 Manhole Negative Air Pressure (Vacuum) Test

- A. Vacuum Test shall be in accordance with ASTM C1244.
 1. All lift holes and any pipes entering the manhole are to be plugged. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole.
 2. The values recorded are applicable only to the manhole being tested and at the time of testing.
- B. Preparation of the Manhole.
 1. All lift holes shall be plugged.
 2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
- C. Procedure.
 1. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
 2. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum

pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.

3. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in Table 2.
4. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

**TABLE 2
MINIMUM TEST TIMES FOR VARIOUS DIAMETER MANHOLES.**

Depth (ft.)	Diameter (in.)		
	48	60	72
	Time (sec.)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97

5. For manholes less than 8 feet in depth the minimum value listed shall be used. For other manhole diameters or greater depths, refer to ASTM C1244.

- D. Test for leakage of gravity sewers using either the infiltration or exfiltration test. Allowable leakage shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2400 gallons per mile per 24 hours.

1. Use infiltration test when ground water is at least 4 feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.
 2. Ground water determination: Use same procedure as “low pressure air test” above.
 3. Use exfiltration test when ground water is less than 4 feet above the pipe crown. Plug the pipe at the lower manhole. Fill the line and manhole to 4 feet above pipe crown or top of manhole whichever is less. Let the water stand until pipe as reached maximum absorption and until all trapped air has escaped, 4 hours minimum. After maximum absorption is reached, refill manhole to original level. After 30 minutes, record difference in level and convert to gallons. Subtract manhole loss to obtain pipeline loss. Manhole loss is found by plugging inlet and outlet and filling manhole with water to 4 feet above pipe crown or top of manhole whichever is less. Let water stand one hour to reach maximum absorption. Refill to original level. After 30 minutes, check difference in level and convert to gallons. Manhole leakage shall not exceed 1/2 gallon per hour.
- E. All gravity sanitary sewers are to be CCTV'd prior to acceptance into the county system.

12.3.10 Force Main tests shall be as follows:

- A. Supply the pumps, water, calibrated gauges and meters, and all the necessary apparatus. Notify the Owner and County Engineer or his representatives at least 48 hours in advance of the test date and perform tests in presence of County Engineer or his representative.
- B. Hydrostatic pressure test. After the line has been backfilled and at least seven days after the last concrete anchor block was poured, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 1-1/2 times the working pressure or 150 psi, whichever is greater. Measure the pressure at the lowest point in system with the gauge compensated for elevation. Maintain the pressure for at least two hours. If pressure cannot be maintained, determine the cause, repair and repeat the test until successful.
- C. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain

a pressure with 5 psi of the specific test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed the amount calculated by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

In which **L** is the allowable leakage, in gallons per hour; **S** is the length of pipeline tested, in feet; **D** is the nominal diameter of the pipe, in inches; and **P** is the average test pressure during the leakage test in pounds per square inch gauge.

- D. All visible leaks shall be repaired regardless of the amount of leakage.
- E. No leakage will be allowed for welded steel pipe. If leaks are revealed by test, make repair by re-welding. Peening of leaks will not be allowed.

12.3.11 Manhole Connections

- A. Existing Manhole Tie-In: A flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked-up openings (B.U.O.) do not exist.
- B. The connector shall be installed by coring the manhole wall. Acceptable connectors shall be as specified. Connectors are to be installed in strict accordance with the manufacturer's recommendations.
- C. The connection shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connection manufacturer.
- D. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project.
- E. This provision shall apply to both main line and service connections.

12.4 CCTV INSPECTION

12.4.1 Work included in this Section consists of all gravity sanitary sewers and all related equipment or material as indicated on the construction plans.

12.4.2 Required Deliverables:

- A. Submit a letter of CCTV completion.
- B. Submit a CD of the information as discussed below.

- 12.4.3 For new installations, the Contractor shall, following construction, conduct a final video inspection of all gravity pipes and a visual inspection of all manholes and wet wells) Copies of reports of this inspection shall be submitted to the County Engineer for approval.
- 12.4.4 The Contractor shall be responsible for all traffic control related items. This shall include flagging, all applicable signage, and/or detours as designated by the more stringent authority in the design plans, the Goochland County Standards and Specifications, and the VDOT MUTCD design manual (latest editions of all.)
- 12.4.5 After cleaning, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled as specified. All CCTV inspections shall be performed in accordance with PACP standards including the specific date and time of inspection.
- 12.4.6 The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative; and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.
- 12.4.7 The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. If, again, the camera fails to pass through the entire manhole section, the inspection shall be considered complete noted as Survey Abandoned and no additional inspection will be required.
- 12.4.8 Camera head shall rotate at all joints and lateral connections to show a 360 degree picture.
- 12.4.9 When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.
- 12.4.10 The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole,

will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Owner's Representative. Documentation of the television results shall be as follows:

- A. Television Inspection Logs: Electronic media location records shall be kept by the Contractor and will clearly show the location, by distance in 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, cracks, fractures, broken pipe, presence of scale and corrosion, and other discernible features, as defined in the PACP defect codes, will be recorded on electronic media and a copy of such records will be supplied to the Owner.
- B. Digital photographs of the pipe condition and all defects shall be taken by the Contractor. Photographs shall be located by distance in 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole.
- C. Electronic media recordings: The purpose of electronic media recording shall be to supply a visual and audio record of problem areas of the lines that may be replayed by the Owner. Each original electronic media recording of conditions and defects will be delivered to the Customer upon completion of a specific line section.
- D. All CCTV Inspection be performed by CCTV personnel who are trained and certified in the use of NASSCO's Pipeline Assessment and Certification Program (PACP)©.

12.4.11 Payment

- A. Only the linear foot for each existing pipe segment will be measured for payment. No additional payment will be made for measurements made from the center of manholes or by using the CCTV footage if the footage starts recording prior to entering the pipe segment or after exiting the pipe segment.

12.4.12 No reimbursement will be made by Goochland County for any delays caused by others.

END OF SECTION 12

SECTION 13 – RECORD DRAWINGS

13.1 GENERAL

This Section specifies requirements for providing the Owner with a post-construction Record drawing and electronic file.

13.2 SUBMITTALS

13.2.1 After the completion of the project, the contractor shall supply the Owner with one (1) hard copy of the Record plan and one (1) copy of the Record file electronically. Electronic submittals shall include a PDF version of the Record construction plans and a geo referenced AutoCAD (.dwg) file of the overall Record site and utility plans.

13.2.2 The contractor shall obtain a set of plans for the Record from the design engineer.

13.2.3 The submitted plans shall be black and white with all Record data in red. The plans shall have the following information located via GPS according to NAD83 Virginia State Plane South (horizontal) and NGVD 29 (vertical) and called out in a legible format:

- A. For gravity pipes: size, type (material), length, alignment, and slope.
- B. For pressure pipes: size, material, alignment, valves, and tie-in locations (if needed).
- C. For manholes (existing and proposed): northing and easting, rim elevations, verification that the frame and cover are standard or bolted or gasketed, diameter, and inverts in and out of all pipes.
- D. For cleanouts (existing and proposed): northing and easting, top elevations, and inverts.
- E. For bends and tie-in points: size, angle (22.5, 45, etc.), direction (vertical, horizontal), material, northing and easting, and inverts.
- F. For oil/water separators and grease traps: rim(s) elevations, top of slab elevations, northing and easting of the rims and corners of the structure, internal piping elevations, callouts on the plan detail where the installed structure differs from the plan detail, manufacturer, model number, length, width, total volume of unit, baffle wall location, and location of the orifice in the baffle wall.
- G. For pump stations: top/rim elevation, distance above ground for the top of the station, total depth from top of slab to base section inside of wet well, float elevations, invert in elevations, and wet well inside diameter. This shall also

include a statement that all other pieces of equipment (i.e. guide rails) as shown on the plan and specifications are present and installed correctly.

- H. Water Lines: size, type material, length, depth to top of pipe, and alignment. This shall also include northing and easting locations of all valves, bends, and other appurtenances.
- I. Fire Hydrants and Blow-offs: northing, easting, elevation of the base of the hydrant, make, model, and year.
- J. For Record notes: All sheets shall have a minimum of 3 northing/easting cross points and provide the coordinate system used. Typically, the datum used is Virginia State Plane South, NAD 83 (horizontal) and NGVD 29 (vertical). The accuracy of the data shall be to the nearest 0.01 feet.
- K. All plan sheets shall have the appropriate UTL, POD, or LDP number on them.
- L. To supplement the labeling mentioned above, the Record shall also label all pipe, fittings, structures and other appurtenances not mentioned above on the plan sheet.
- M. The Record cover sheet shall provide separate Pipe Schedule and Structure Schedule charts showing a comprehensive materials list.

13.3 PRODUCTS – Not used

13.4 EXECUTION – Not used

END OF SECTION 13