

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



Design and Construction Standards

March 2024

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1.1 GENERAL DESIGN REQUIREMENTS

1.1.01 Definitions

- A. **COMPLETION:** Completion of the Work. Indicates that all sewer pipe, manholes, water pipe, valves, appurtenances, buildings, equipment, and any other required items have been installed and appropriately tested in accordance with the plans, and specifications. All submittals including any Operations and Maintenance (O&M) manuals have been accepted by the Department. All Punch List items, right-of-way, easement, property, and pavement restoration work have 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 this definition have been satisfied.
- B. **CONTRACTOR:** The Developer/Owner's Agent, acting directly or through his agents, who has been contracted by the developer to perform the work.
- C. **COUNTY:** The Board of Supervisors of Goochland County, Virginia, acting through the County Administrator and the Director of Public Utilities and/or other duly authorized agents.
- D. **DEPARTMENT:** The Goochland County Department of Public Utilities. May also be referred to in these Standards as “DPU” or “Department”.
- E. **DEVELOPER/OWNER:** The Party who enters into a Utility Agreement with the County to install public water and/or sewer utilities to serve a subdivision or other development or project, and his heirs, assigns and agents. The terms “Developer” and “Owner” are used together, separately, and interchangeably throughout these Standards.
- F. **DEVELOPER’S ENGINEER/DESIGN ENGINEER:** The Consulting Engineer who has been designated by the Developer as his Engineer of Record in relation to the project, whether acting directly or through properly authorized agents, inspectors, or representatives. May also be referred to in these Standards as “Engineer”.
- G. **DIRECTOR:** The Director of Public Utilities or his duly authorized agents.
- H. **TENTATIVE INSPECTION:** An inspection performed by the Inspector, at which the Contractor must be present, of all items covered by the Utility Agreement. During the Tentative Inspection, the Inspector will determine whether construction of the Project meets the requirements of the Plans and Specifications. The Contractor shall demonstrate that the Work has been brought

to final configurations and finished grades, and restoration initiated. All items of deficiency noted for correction shall be completed before the Final Inspection is scheduled. The Inspector will present a Punch List to the Contractor enumerating all deficiencies to be corrected and other items to be completed prior to Tentative Acceptance.

- I. **TENTATIVE ACCEPTANCE:** A written statement from the County to the Developer/Owner stating that as of a certain date all Punch List items from the Tentative Inspection have been corrected.
- J. **FINAL INSPECTION:** An inspection performed by the Inspector, with the Contractor present, of all items covered by the Utility Agreement. Final Inspection is performed upon notification by the Owner or his Contractor that all Work is complete. Final Inspection may result in the issuance of a Punch List enumerating deficiencies to be corrected and other items to be completed prior to Final Acceptance.
- K. **FINAL ACCEPTANCE:** A written statement from the County to the Developer/Owner stating that as of a certain date, all deficiencies have been corrected, all Punch List items have been addressed, that all necessary submissions have been made to the Department, and the conditions of the Utility Agreement have been satisfied. The Warranty Period commences on the date of Final Acceptance.
- L. **INSPECTOR:** The person or persons assigned by the County's Director of Public Utilities to inspect the materials used by and the work performed by the Contractor.
- M. **PROJECT:** A subdivision or other property development project for which a Developer/Owner needs approval from Goochland County.
- N. **PUNCH LIST:** A list of deficiencies and/or incomplete items related to construction work. A Punch List is prepared by the Inspector and presented to the Owner or his Contractor so that the items listed may be corrected to the satisfaction of the Department. A Punch List is typically prepared following both Tentative and Final Inspections.
- O. **STANDARD DETAILS:** The detailed drawings of materials and appurtenances included in Section 3 of these Standards or otherwise adopted by the Department. At the discretion of the Director, Standard Details may be periodically added, deleted, corrected and/or updated independently of the Standards as a whole. The latest versions of Standard Details are available on the County's website, or from the Department upon request.
- P. **STANDARDS AND SPECIFICATIONS:** This document and all the standards, specifications, and requirements contained herein, as adopted by the County for use and enforcement by the Department, and which define and describe the

technical requirements and administrative processes by which water and sewer facilities in Goochland County, Virginia, shall be designed and constructed. May also be referred to as “Standards” or “these Standards”.

- Q. SUBCONTRACTOR: Any individual, firm, or corporation having a direct contract with the Contractor for the performance of any part of the work.
- R. UTILITY AGREEMENT: A legal agreement entered into by the Developer/Owner of a Project and the County describing the conditions under which the County will accept ownership of public water and/or sewer infrastructure constructed by the Developer/Owner to provide public water and/or sewer service to the Project.
- S. UTILITY ENGINEER: The Director of Public Utilities or his designee.
- T. WARRANTY PERIOD: The period of time, typically one-year, following Final Acceptance by the County of newly constructed water and sewer utilities infrastructure, during which the Developer/Owner of said infrastructure shall be wholly and entirely responsible for completing repairs to and/or replacement of any portion of said infrastructure which may become damaged or broken, or which otherwise fail(s) to perform as intended.
- U. WATER AND SEWER PLANS: All the required engineered plans, profiles, details, computations, digital data, documents, specifications, and other pertinent information necessary to construct the water and/or sewer infrastructure associated with a Project. These must be prepared in accordance with these Standards and bound together as a complete set of construction plans. May also be referred to in these Standards as “Plans” or “the Plans”.
- V. WORK: The entirety of the services, labor, materials, and equipment necessary and appropriate for the Developer/Owner to complete the design and construction of the water and/or sewer infrastructure needed to serve a Project. May also be referred to in these Standards as “the Work”.
- W. OTHER DEFINITIONS: Other applicable definitions may be found within these Standards and in the County's latest utilities, subdivision and zoning ordinances.

1.1.02 General System Design

- A. Prior to designing a system or an extension to an existing system, the Owner shall tabulate the number of people served or proposed to be served by the systems or extension. Analysis of the county’s Comprehensive Plan, Utility Master Plan, and existing/proposed zoning shall be used in preparing the tabulation.

- B. The Owner shall prepare and submit an Engineering Report to the Department prior to submission of Plans. The Engineering Report shall be prepared in accordance with Section 6.1.05.A.3 of these Standards.
- C. Average and maximum flow projections shall be developed for areas and sub-areas, tabulated in spreadsheet form, and submitted to the Department for review.
 - 1. Where development is existing or proposed, average sewer flows within the sewer shed shall be calculated using actual (existing) or proposed population densities and flow rates cited in the Virginia Department of Environmental Quality *Sewage Collection and Treatment (SCAT) Regulations (9VAC25-790)* or other published data as appropriate.
 - 2. For undeveloped acreage where no specific development has been proposed, the following average flow rates should be used for both water and sewer line capacity design:

a. Single Family Residential	800 gpd/ac
b. Multi-Family Residential	3,000 gpd/ac
c. Commercial	1,400 gpd/ac
d. Industrial	2,300 gpd/ac
e. Public/Government	600 gpd/ac
- D. When sizing proposed water and sewer lines, the Design Engineer shall address all present and projected future flows and shall assess the capacities of the existing infrastructure to which the lines connect.
- E. The design shall be based on ultimate development and shall present such data as deemed necessary by the Department for a sound evaluation of the information contained in the report.
- F. Where an alternate design is proposed that would incorporate interim or staged construction, the report shall include both the alternate design and the ultimate design and shall present a thorough investigation and justification for consideration of the interim or staged construction.
- G. Water and Sewer lines shall be located in public rights-of-way wherever possible. Should extenuating circumstances prevent this, the Director may allow for deviation(s) from this portion of the Standards. Such deviations will be permitted on a case-by-case basis and must receive approval prior to final system design.
- H. In subdivisions containing lots smaller than 1.00 acre, no public water line, sewer line, or utility easement may be located on a lot. Where water lines and/or sewer

lines must be located outside a public right-of-way, they shall be located within easements in common areas. In such cases, the entity which owns and controls the common area shall be responsible for mowing and ground maintenance within the easement(s).

- I. Within subdivisions, water and sewer lines in public rights-of-way or private roadways shall be configured in substantial conformance with the Department's *Water and Sewer Geometry Standard*.
- J. As determined by DPU, water and sewer utilities shall be designed and constructed to the limits of the development so that future extensions to adjoining properties will not disrupt existing improvements.

1.1.03 Separation of Water Lines & Sewer Lines

- A. All water and sewer system designs shall comply with Virginia Department of Health *Waterworks Regulations* (12VAC5-590) for separation of water mains and sewer lines.
- B. Parallel Installation
 - 1. Normal Conditions: Water lines shall be aligned at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured outside edge to outside edge ("edge-to-edge").
 - 2. Unusual Conditions: When conditions prevent normal horizontal separation, the water line may be located closer than 10 feet to a sewer or sewer manhole provided that:
 - a. The bottom edge of the water line shall be at least 18 inches above the top edge of the sewer line.
 - 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. Pipe Crossings
 - 1. Normal Conditions - Water lines shall be designed to cross over sanitary and storm sewers with 42-inches of cover and at least 18-inches of vertical edge-to-edge separation between pipes. If necessary to accommodate a particular water line crossing, and with written approval from the Department, cover over the water line may be reduced to 36-inches and

vertical edge-to-edge separation between pipes reduced to 12-inches at the crossing point, but this shall not be the design standard.

2. Unusual Conditions - When conditions prevent water lines from crossing over sewer lines, or the vertical separation described in the previous paragraph cannot be met, the following construction shall be used:
 - a. Sewer lines passing over or under water lines shall be constructed of AWWA approved water pipe which shall be pressure-tested in place without leakage prior to backfilling.
 - b. Water lines passing under sewers shall be constructed as follows:
 - (1) Vertical edge-to-edge separation of at least 18 inches must be provided between the bottom of the sewer and the top of the water line.
 - (2) Adequate structural support must be provided for the sewer line to prevent excessive deflection of joints and/or settling over the water line.
 - (3) Bends shall be used to divert the water line under the sewer. Upper bends shall be placed at least 10 feet on either side of the sewer line. Water line shall be CL 52 DIP restrained in accordance with Standard Detail WAT-13.
- D. No water line shall pass through or touch any part of a sewer or sewer manhole.

1.1.04 Sewer in Relation to Streams, Estuaries, Lakes, and Reservoirs

- A. Location of Sewer in Relation to Streams, Estuaries, Lakes, or Reservoirs
 1. All sewer pipes entering or crossing streams shall be ductile iron or PVC C900, DR14 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 submitted to the Director.
 2. In paved channels, the top of the sewer line shall be placed at least one foot below the bottom of channel pavement. Sewers must remain fully operational during 25-year flood/wave action.

3. Sewers and their appurtenances located near or 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 and sufficiently away from the edge of the stream to provide for future channel widening. Requests to locate sewer within stream beds must be provided in writing to the Director.
4. All sewer lines in the vicinity of the Waters of the United States shall be approved by authorities having jurisdiction and all required permits shall be obtained before construction.

B. Sewers 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 against erosion and impact.
2. 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.

1.1.05 Road and Railroad Crossings

A. Casing Pipe

1. Steel casing pipe shall be sized in accordance with the appropriate Standard Detail or as otherwise required by the authority having jurisdiction.
2. Steel casing pipe shall have minimum yield strength of 35,000 psi and a minimum internal diameter at least 4 inches greater than the largest external diameter of the carrier pipe and its appurtenances.
3. The wall thickness of a casing pipe shall be sufficient to resist loads to which it will be subjected, but in no case less than 0.500 inches. Steel casing shall be ASTM A139, Grade B with sufficient corrosion protection.
4. Standard installation detail shall be as shown in VDOT Road and Bridge Standards except that the leak detector pipe shall be eliminated.

5. For a casing pipe crossing a road, pipe thickness shall be as required by VDOT for State Roads, or the requirements in these standards, whichever is more stringent.
6. For a casing pipe crossing a railroad, casing requirements shall be as specified in the permit issued by the affected railroad, or the requirements in these standards, whichever is more stringent.

1.1.06 Protection of Water Supplies

A. Water Supply Interconnections

1. There shall be no physical 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, 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.
2. Sewer designs shall identify and adequately address the protection of all potable water supply structures within 100 feet of the proposed project.

END OF SECTION 1.1

1.2 WATER AND SEWER PLANS

1.2.01 Drawing Organization

- A. Water and Sewer Plan Sets (Drawings) shall consist of the following sheets, as needed, arranged in order:
 - 1. Cover Sheet
 - 2. Overall Layout Sheet
 - 3. Utility Notes and Computation Sheets
 - 4. Utility Plan and Profile Sheets
 - 5. Detail Sheets
 - 6. Other sheets related to utilities design and construction of the project (as needed)

- B. General Requirements for Water and Sewer Plans
 - 1. Plans shall be prepared on 36-inch by 24-inch paper.
 - 2. Each sheet in the Plans shall include a suitable title block containing the name of the project, sheet title, sheet number, name of the county, the district in which the project is located, the date of the plans, revision dates and descriptions, and the name and design firm of the licensed professional who prepared the plans.
 - 3. Plans shall be produced in NAD 83 State Plane Coordinate System. Horizontal control shall be established by a minimum of two coordinate points.
 - 4. Vertical datum shall be NAVD88.
 - 5. A North Arrow shall be included on each plan view.
 - 6. A Graphic Scale shall be provided on each plan view.
 - 7. The scale shall be correctly depicted on all plans and profiles as well as other applicable sheets.
 - 8. The seal and signature of the Professional Engineer (the Design Engineer) who prepared the plans shall be on each plan set.
 - 9. Adequate benchmarks shall be provided along the lines of construction and shown on all plan views.

10. All manholes, clean-outs, structures, pipes, hydrants, valves, meter boxes and other appurtenances must be georeferenced.
11. All manholes and structures shall be labeled with Northing and Easting coordinates.
12. Plans shall be prepared using computer aided drafting (CAD) in a black-line and grayscale format and in substantial accordance with the drafting conventions contained in these Standards and Specifications.

1.2.02 Format and Content Requirements

- A. Cover Sheet: A cover sheet shall be provided for all Water and Sewer Plans. If the Water and Sewer Plans are part of a set of plans prepared for a Plan of Development (POD) or Land Disturbance Plan (LDP), a separate cover sheet for utilities plans is not required.

At a minimum, the cover sheet shall contain the following items and information:

1. Project name in large, distinctive letters.
 2. Name, design firm, and contact information of the licensed professional engineer who prepared the plans.
 3. Owner's name and contact information.
 4. A vicinity map on a scale no larger than 1-inch equals 2,000 feet and with a sufficient level of detail to identify the area of the county in which the project is located, including nearby roads. The vicinity map shall include a north arrow and scale.
 5. An index listing all the sheets included in the plan set.
 6. The stamp of the design engineer or principal of the engineering firm which prepared the plans, with original signature.
 7. The name and credentials of the Responsible Land Disturber for the project.
 8. A detailed list of estimated quantities needed to construct the public utilities shown on the plans.
- B. Overall Layout Sheet: For Water and Sewer Plans containing multiple utility plan sheets, a single plan view sheet shall be provided at a scale no larger than 1" = 600', or as specifically permitted otherwise, to show all proposed water lines, sewer lines, and related facilities to be constructed with the project.

The overall layout sheet shall, at a minimum, contain the following items and information:

1. An index map of all utility plan sheets in the drawing set, showing the layout and extent of each utility plan sheet and the match lines between sheets.
2. All proposed water and sewer utilities with line sizes and manhole numbers labeled.
3. Existing water and sewer utilities on and adjacent to the project parcel(s), with clear labeling of line sizes and manhole numbers.
4. All connections to existing water and sewer utilities.
5. Existing roads, parcel lines, buildings, utilities, etc. in the project area, including parcel information for adjacent parcels.
6. All existing and proposed easements, labeled with size and type. Instrument Number shall be provided for existing easements. If an Instrument Number is not available, then the Deed Book and Page Number may be used.

C. Utility Notes and Computations Sheet: The utility notes and computation sheet shall include the following items and information. Multiple sheets may be used if needed:

1. DPU *Water and Sewer Utility Construction Notes* as contained in the latest revision of Form F-09.
2. DPU *Linear Utility Project Erosion & Sediment Control and Stormwater Management Notes* as contained in the latest revision of Form F-14.
3. All engineering calculations performed during the design of the water and sewer utilities for the project. This includes but is not limited to the Sanitary Design Table (Form F-04), water system hydraulic analysis layout and results, restrained joint computations for pressure pipe, and Domestic Meter Sizing Form (Form F-07).
4. A table of Northing and Easting coordinates, in NAD 83 coordinate system, for each sanitary manhole included on the plans.

D. Water and Sewer Plan and Profile Sheets: Plan and profile sheets shall be provided for all proposed water and sewer lines. Plan and profile shall be shown on the same sheet with plan view(s) in the upper portion of the sheet and accompanying profile(s) presented below. Scale shall be Horizontal: 1" = 50' and Vertical: 1" = 5' unless specifically permitted otherwise. Plan views shall clearly show all proposed water lines, sewer lines, manholes, related appurtenances, and

all associated labeling, highlighted or bold. Other items related to construction including, but not limited to, roads, rights of way and property lines, easements, setback lines, lot numbers, property owner information, building locations, driveways, curb and gutter, sidewalk, ditch-lines, storm sewer lines and structures, and grading, must be clearly shown, but shall be screened/grayscale to accentuate the water and sewer utilities. Stationing shall be along the centerline of the pipe and shall be complete and consistent in all views.

In addition to the items and information listed above, water and sewer plan and profile sheets shall meet the following requirements:

1. For waterlines (and other pressure pipes), complete callouts, stationing, size and type of all pipes, separation distances, valves, hydrants, bends, tees, service connections, and other fittings, along with all other information necessary for construction of the lines shall be clearly shown on the plan and profile views. Waterlines (and other pressure pipes) running parallel to streets may be profiled and stationed on the road profile. Separate profile sheets shall be provided for waterlines which run outside a right-of-way.
2. For gravity sewer lines, stationing, lengths, slopes, pipe size and material, pipe crossings, vertical separation distances, manholes, inverts, manhole top elevations, manhole labels, service connections and all other related information necessary for construction of the sanitary sewer lines shall be clearly shown on the sanitary sewer profiles. Sewer lines, manholes, pipes sizes, lengths and materials, horizontal separation distances, deflection angles, flow direction arrows, service laterals and cleanouts shall be clearly shown on the plan view. Manhole top elevations shall be provided on the profile view and shall be shown as spot-shots in the plan view. Separate profiles shall be provided for all gravity sewer lines.
3. All pipe crossings of both water and sewer lines shall be shown, stationed, and labeled in both plan and profile views. Minimum cover and minimum edge-to-edge vertical clearance shall be noted on the profile view.
4. All lot numbers, property lines, property owner information, easements and rights of way shall be clearly shown on water and sewer plan views.
5. All stream crossings, road crossings, bores and jacks, and crossings of other utilities by proposed water and/or sewer lines shall be clearly shown and labeled in both the plan and profile views for those lines.
6. The locations of Erosion and Sediment Control devices shall be shown on the plan view.
7. Plan and profile views shall be consistent from sheet to sheet across Match Lines.

8. Drop manholes shall be labeled in both plan and profile views.
 9. Utility lines which are not to be owned by the county shall be clearly labeled "Private" in both plan and profile views.
 10. Grease traps and oil/water separators shall be shown in the plan view and shall be located by dimensioning from buildings, or other permanent structures. These shall be labeled "Private".
 11. All existing water and sanitary sewer facilities and easements within and immediately adjacent to the project shall be clearly shown and labeled on the plans. Ownership information for parcels adjacent to the project shall be provided on the plans. Existing facilities shall be shaded gray on the plans.
 12. Details of all proposed connections to existing water and sewer utilities shall be provided. These shall be clearly shown and labeled on the plan and profile views, with appropriate test-pit locations shown and labeled on the plan view.
 13. Profiles of existing water and sewer lines shall also be included if cover is to be increased or decreased over the lines, or if new connections are proposed to them.
 14. All information shall be consistent between plan and profile views.
- E. Detail Sheets: Separate sheet(s) shall be provided which include the appropriate Standard Details from these Standards and Specifications for the items, materials and construction associated with the project. Detail sheets shall also include any details of special items, materials and/or construction proposed as part of the project.
- F. Other Plan Sheets: Additional drawings and/or details required for construction of public water and sewer utilities associated with the project. Examples include Demolition Plans for existing utilities to be abandoned or replaced, Bypass Pumping and/or Maintenance of Service Plans, Erosion and Sediment Control Plans and Details on projects for which the water and sewer plans are not part of a Plan of Development (POD) and plans for ancillary or adjacent construction which may affect the project.

1.2.03 Drafting Conventions and Drawing Standards

- A. All drawings shall be prepared using computer aided drafting (CAD).
- B. Symbols and abbreviations used on the plans shall be substantially as shown on Standard Detail (DES-01) and shall be consistent throughout the plan set. A

Key/Legend to the symbols and abbreviations used on the Plans shall be included on the Notes and Computation Sheet.

- C. Existing facilities and other elements shall be shaded gray. New work shall be dark lines and of sufficient linewidth to easily distinguish new work from existing. Line widths should be varied between different items on the plans.
- D. The minimum text height shall be 0.10 inches for notes, general text, and dimensions. Plan, profiles, section, and detail labels shall be a minimum of 0.20 text height and of a heavier line weight.
- E. All plans submitted for review shall comply with the minimum format and quality control requirements of these Standards. Plans which do not substantially meet these criteria will not be accepted for review.
- F. Plans submitted for review shall be AutoCAD blackline and grayscale format.
- G. Drawings shall be clear and legible. Text shall be clearly legible with no overlap or interference with other text and shall be readable when drawings are reduced to half size.
- H. All drawings must be capable of producing legible second generation prints after being reduced to half size.
- I. 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.
- J. Shading shall not be used on the Plans if it hides or obscures information when the drawing is photocopied or scanned.
- K. Screening and hatching shall be in accordance with conventionally accepted standards and shall not block text or other pertinent information.
- L. A digital version of the complete plan set shall be prepared by plotting AutoCAD plan sheets to a digital file. The digital file shall be submitted in addition to the specified number of paper plan sets. The file shall be .pdf or compatible and shall be clear and legible.

END OF SECTION 1.2

1.3 EASEMENT AND PLAT REQUIREMENTS

1.3.01 Survey Requirements

- A. Surveys for utility easement plats shall be made, and easement plats prepared in all cases where proposed construction limits exceed the limits of public rights-of-way or existing easements.
- B. These surveys shall meet minimum accuracy standards and tie the lines of proposed construction to existing property lines and property corners.
- C. Where readily identifiable corners cannot be found, fence lines and corners, and other indications of property lines may be used.
- D. 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.

1.3.02 Easement Widths

- A. Permanent utility easements shall be a minimum of 20 feet in width.
- B. Wider easements will be required where more than one facility may occupy the easement, where line sizes, depths, or access requirements make wider easements desirable, or where wider easements are required by these Standards.
- C. Buildings, other permanent structures, and trees shall not be placed in utility easements.

1.3.03 Temporary Construction Easements

- A. Temporary construction easements may be needed to accommodate construction of utilities. Facilities constructed on the Owner's property are not required to have temporary construction easements.
- B. Temporary construction easements shall be of sufficient width to provide a minimum working width of 30 feet, including the 20-foot permanent easement, unless otherwise approved or required.
- C. It is typically desirable to provide a wider construction easement on one side of the permanent easement than the other. This allows room for construction traffic and material storage.

1.3.04 Offsite Easements

- A. All required offsite easements shall be recorded before DPU will issue plan approval or a utility permit (UTL). The Deed Book and Page Number(s) and Instrument Number(s) of the recordation shall be included on the Water and Sewer Plans.

1.3.05 Easement Extensions

- A. Utility easements shall be extended to adjacent parcels to allow adjoining properties to connect to the public water and sewer system as required by DPU.

1.3.06 Other Installations Within Easements

- A. The installation of trees, structures, buildings, SWM/BMP facilities, constructed wetlands, berms, or other obstruction which may prevent the proper installation, maintenance, rehabilitation, operation, inspection or removal of water or sewer facilities shall not be allowed within any permanent utility easement unless approved by the Director in writing.

1.3.07 Plat Preparation Requirements

- A. All Utility Easement Plats shall meet the following requirements:
 1. Easement centerline(s) shall be shown on the plat, together with the limits of all proposed permanent and temporary easement(s).
 2. Easement widths shall be referenced to the centerline of the easement.
 3. Bearings and distances shall be provided on the centerline of the easement and on any right-of-way or property lines which intersect the easement.
 4. Distances shall be shown from fixed points on both the centerline and the property lines to the intersection of the two.
 5. Bearings, distances, and closures shall be to the degree of accuracy of 1 in 8,000.
 6. The body of the plat shall show the name of the property owner and the Deed Book or Will Book reference for the source of title.
 7. The names of all adjacent property owners shall be shown on the plat.
 8. Street names or highway route numbers shall be shown where applicable.

9. Existing easement(s) with Instrument Number(s) shall be shown on the plat. Deed Book and Page Numbers may be used where Instrument Numbers are not available.

1.3.08 Acceptable Sheet Sizes for Utility Easement Plats:

- A. 8-1/2" x 11"
- B. 8-1/2" x 14"
- C. 11" x 17"
- D. 18" x 24"

1.3.09 Other Plat Requirements

- A. The following information shall be included on all utility easement plats:
 1. Title Block with title of plat and name of Engineering/Survey Firm.
 2. Date
 3. Revision Dates, as applicable.
 4. Scale, both written and graphical.
 5. North Arrow
 6. Page Number(s)
 7. Name of property owner with Deed information and Parcel Number and GPIN shall be displayed in the top, left corner of the plat.
 8. Note(s) or table providing the total area in acres and square feet of each permanent and temporary easement depicted on the plat, as well as the overall total area in permanent and temporary easements.
 9. A note with the following wording and information: "PLAT SHOWING THE LOCATION OF EASEMENTS FOR UTILITIES HEREBY RECORDED ON THE PROPERTY OF [OWNER NAME] IN THE [DISTRICT NAME] MAGISTERIAL DISTRICT, COUNTY OF GOOCHLAND, VIRGINIA".
 10. The Seal of the Professional Engineer or Licensed Surveyor certifying the plat, with original signature and date.

END OF SECTION 1.3

1.4 GRAVITY SANITARY SEWERS

1.4.01 General Requirements

- A. Sanitary sewers shall be designed solely for the collection and transport of sanitary waste flows. Under no circumstances shall any sanitary sewer system be designed to accept flows from storm drains, roof drains, floor drains, foundation drains, surface drains, or subsurface drains.
- B. Sanitary sewers shall be designed to serve the entire sewer shed. This necessitates consideration of property beyond the development or subdivision in question. The sewer shall be properly sized and at an appropriate location to permit future extensions. Elevation of the sewer system must be designed such that future extensions can serve the entire area which naturally drains towards the system.

1.4.02 Technical Design

- A. System Layout
 - 1. The layout and design of sewage collection and conveyance systems shall conform to the parameters set forth in these Standards and the approved Engineering Report.
 - 2. A System Layout Plan shall be prepared for projects involving the construction of sewer lines, sewage pumping stations, and/or sewage force mains. The System Layout Plan shall delineate sewer shed area boundaries and clearly defines the areas pertinent to interim and ultimate development of the area proposed to be served.
 - a. The System Layout Plan shall show existing utilities, indicating those impacted by the proposed project.
 - b. Existing and proposed ground elevations shall be shown on the System Layout Plan at contour intervals not exceeding 2 feet unless otherwise approved by the Director.
 - c. Proposed utilities necessary to serve adjacent properties, connections to existing utilities, and associated easements shall be shown.
 - d. The scale shall be no smaller than 1" = 500' or as specifically approved otherwise.
 - e. The System Layout Plan shall show the entirety of the drainage area(s) involved, the location(s) of existing and proposed line(s) in

the system, and points of entry of flows, including any flows being received from other areas.

- f. The System Layout Plan shall be keyed to the Sanitary Sewer Design Table (Form F-04) for the project. Computations and maps shall be submitted to DPU for review and must be approved prior to final plans approval.
3. All sanitary sewers must be accessible for operations and maintenance:
 - a. Sanitary sewer branch lines and mains shall be located in legally established road rights-of-way wherever possible.
 - b. Where public sewers cannot be located in established rights of way, the sewer shall be installed in existing or proposed permanent utility easements that are legally established for such purpose.
 - c. Sewers shall be located outside of jurisdictional wetland areas whenever possible.
 - d. Stormwater Management (SWM) and BMP facilities shall not encroach on the sanitary sewer, nor shall sanitary sewer be routed through any easement for such facilities.
 4. Gravity sanitary sewer lines in two lane subdivision streets shall be run near the center of one travel lane with water lines located near the center of the other lane. Layout shall be in substantial conformance with the Department's *Water and Sewer Geometry Standard*. Gravity sewer lines in easements shall be located along the centerline of the easement unless the easement is to be shared with a water line. Exceptions must be approved in writing by the Director and will be permitted only when it has been established that it is not practical to adhere to the standard locations.
 5. All sewers shall be designed and constructed on continuous grades between manholes.
 6. For sewer depths up to 12 feet, sewer mains and manholes shall be located a minimum of 15 feet horizontally from any part of a building, structure, or foundation. Where the depth of sewer is greater than 12 feet, the sewer mains and manholes shall be located a minimum of 20 feet from any part of a building, structure, or foundation, or a distance equal to the depth of the excavation, whichever is greater. In no event shall a sewer line be located so that future excavation of the line will jeopardize or damage an adjacent building, structure, or foundation.
 7. Easement widths for sewer lines greater than 10 feet deep shall be twice the depth of the line, rounded up to the nearest five feet.

B. System Design

1. The overall design shall be in accordance with the provisions of the approved Engineering Report.
2. Design carrying capacities of branch, main, 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.
3. The design shall provide calculations of present and ultimate flows and demonstrate that capacity is provided in existing and proposed facilities. For existing facilities, the Engineer shall provide an analysis of the downstream system to the extent determined by the Department to determine the adequacy of the system for existing and future flows.
4. Equivalent flow from motels, schools, hospitals, etc. shall be based upon that of the Virginia Department of Environmental Quality (DEQ) *Sewage Collection and Treatment Regulations (SCAT)*.
5. In the absence of information on densities or equivalent flows, the Engineer shall supply sufficient information, substantiated by sound engineering judgment to verify the design. This information must be approved by the Department.

C. Capacity Design

1. Branch and main sewers shall be designed to carry the ultimate tributary population with a 50-year projection as an upper limit.
2. Proper allowances for peak flow shall be included. Designer shall consult the County Master Plan for future flow projections.
3. Peak flow shall be calculated using the following formulas:

$$Q_P = 3.511Q_A^{0.8121}$$

$$\text{For } Q_A \leq 0.0125 \text{ MGD, } Q_P = 8.0Q_A$$

$$\text{For } Q_A \geq 6.0 \text{ MGD, } Q_P = 2.5Q_A$$

Where: Q_A = Average Flow (MGD)

Q_P = Peak Flow

4. Trunks and interceptors shall be designed on the same basis as branch and main lines, except in cases where capacities of the system(s) or parts thereof can be readily increased by future relief, allowing for shorter capacity design life of initial lines.
5. The hydraulic design computations for all gravity sewer lines shall be shown on a Sanitary Sewer Design Table similar to that included in these Standards as Form F-04. The Sanitary Sewer Design Table shall be included on the Plans.
6. Computations shall be accompanied by a System Layout Plan as defined in 1.4.02.A.

D. Hydraulic Design

1. Minimum grades for gravity sanitary sewers shall not be less than those required to produce a velocity of approximately two (2.00) feet per second when the pipe is flowing full or half full. Pipe sizes shall not be arbitrarily increased in order to take advantage of a flatter grade.
2. The minimum pipe diameter to be used in a gravity sewer collection system shall be 8 inches.
3. The minimum allowable design slopes for gravity sewer lines are as follows:

<u>Sewer Size (Inches)</u>	<u>Minimum Slope in Feet/100 Feet</u>
8	0.50
10	0.30
12	0.25
14	0.20
15	0.17
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06
36 (and larger)	0.05

Use of design slopes less than those listed above must be specifically approved by DPU. In no event may design slopes be less than those included in the table at Section 4.6.02.G.

4. As determined by DPU, design slopes greater than the minimum may be required.
5. Uniformity of design slope shall take priority over individual manhole depths.
6. Computations for velocity of flows shall be based on the Manning formula, where "n" equals 0.013.
7. Velocities in each pipe shall be computed, and shown in the Sanitary Sewer Design Table, for the following flow conditions:
 - a. Pipe Capacity.
 - b. Average Daily Flow.
 - c. Peak Flow.
8. In no case shall the velocity in a pipe be less than 1.3 feet per second at peak design flow. Improvements to velocity shall be achieved by increasing the slope of the pipe, not by decreasing pipe diameter.
9. The sizes of pipe shall continually increase as contributing tributary areas increase. Any deviation from this standard must be approved by the Director in writing.
10. Miscellaneous head losses at manholes shall be accounted for by providing a minimum 0.10-foot drop between the influent invert and effluent invert. At the discretion of the Director, computation of manhole head losses may be required when unique design conditions exist.
11. Where there is an increase in pipe size at a manhole, pipe inverts shall be set so that the crowns of the influent and effluent pipes are at the same elevation.
12. 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.

E. Structural Design and Materials

1. Structural requirements must be considered in the design of all sewers and appurtenances.

2. 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. Refer to the Standard Details for bedding requirements.
3. In deep cuts, it is generally preferable to change pipe strengths to obtain proper design rather than vary bedding conditions. In such cases, pipe strength or class shall be shown on plans with stations to indicate the location.
4. No change in pipe strength or material shall be made between manholes without written approval from the Director.
5. Gravity systems receiving pumped flows shall be protected against sulfide attack for a minimum distance of 1,200 feet downstream from the 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. The receiving manhole and manholes within 1,200 linear feet downstream shall be internally coated with an approved sulfide resistant lining or coating.
6. Where odor may be a problem, chemical addition or other odor control method approved by the Director may be required at the pump station or the receiving manhole.
7. Ductile iron pipe or C900, DR14 PVC pipe shall be used where sewers enter or cross streams, estuaries, lakes or reservoirs, or cross jurisdictional wetland areas. The carrier pipe within any bore or tunnel crossing shall be ductile iron.
8. The maximum allowable slope for a gravity sewer line is 20%.
9. Clay or concrete dams shall be utilized where the possibility exists that ground or surface water will follow the sewer trench, causing damage, or undermining of pipe bedding.
10. A minimum 30-foot-wide public utility easement shall be provided where sanitary sewer lines are installed between buildings.
11. Ductile iron pipe (DIP) or C900, DR14 PVC pipe shall be used in other areas where, in the opinion of the Department, the sanitary sewer is not easily accessible for maintenance.

12. All manholes, service connections and other appurtenances shall be designed in accordance with these Standards and all applicable Standard Details.

F. Manholes

1. Manholes shall be installed at the end of each line at all changes in grade, size, or alignment, and at all sewer line intersections.
2. 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.
3. Spacing of up to 400 feet may be permitted in sewers larger than 30 inches at the discretion of the Director.
4. Watertight manhole frames and covers shall be used on all manholes not located in paved streets.
5. At the upstream manhole in a cul-de-sac, the maximum number of sewer connections allowed into the manhole is 3.
6. Manholes shall not have stub-out sections of sewer pipe, nor shall they have bricked-up or partially scored openings for future sewers. Connection to manholes shall be made in accordance with standards and specification in effect at the time the sewer is extended.
7. A minimum slope of 1% shall be used for any sanitary line flowing from a terminal manhole (e.g., the upstream manhole in a cul-de-sac) from which no future extension is contemplated.
8. Manholes over 18 feet deep shall have a polyethylene or epoxy lining specifically designed to resist hydrogen sulfide corrosion. Depth is measured from manhole top to lowest invert in the manhole.
9. Manholes more than 18 feet deep shall be minimum 60 inches diameter. Manholes more than 24 feet deep shall be minimum 72 inches diameter.

G. Sewer Appurtenances

1. Sewer connections serving more than one building shall be made by construction of a manhole on the County sewer and an appropriately sized sewer line terminating in another manhole at the uppermost building

connection. Such construction shall be in accordance with County Standards.

2. Sewer lines shall be protected from flood by raising manhole tops a minimum 12 inches above the FEMA 100-year flood plain elevation and 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.
3. Grease traps are required for all restaurants, bakeries and other facilities involved in preparation of food that has the potential to discharge oil and/or grease to the sanitary sewer system. 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 the limits included in the latest version of Section 14-125 of the County Code. Grease traps shall be inspected annually by the County, and shall comply with the requirements of the County Plumbing Code
4. 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.
5. 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 may have the potential to be, non-domestic in nature. All waste from such a facility shall flow through a monitoring manhole, which shall be part of the public sewer system. Any facility with an Oil/Water separator or grease trap shall discharge to a monitoring manhole.
6. For multi-use buildings such as shopping centers, the public sewer must be sufficient distance from the building to allow installation of a monitoring manhole as well as oil/water separators and/or grease traps on each sewer lateral.
7. For individually metered facilities, a sewer lateral is required for each meter. Enough space to accommodate installation of the monitoring manhole shall be provided.
8. If the facility is master metered, a monitoring plan is required for the entire facility. A monitoring manhole shall be provided.
9. The minimum inside diameter of a monitoring manhole shall be sixty inches.

10. In easements not subject to regular mowing or landscape maintenance, manhole covers shall be 18-24 inches above final grade. Where required by the Department, flat top manholes shall be provided.
11. Sewer laterals for non-residential connections shall be a minimum diameter of 6 inches. Connections shall typically be made at an angle of 90-degrees to the main. Six-inch sanitary laterals shall be installed at a minimum grade of 1/8 inch per 1 foot.

H. Depth of Sewers

1. Minimum design depth of cover over sewers shall be 5.5 feet in rights-of-way and 4.5 feet in easements; however, a greater depth may be required to account for future extension or possible future lowering of existing road grade or utilities. Where the minimum design depth requirement cannot be met, DIP or C-900, DR-14 PVC pipe shall be used. In no case may cover over a gravity sewer line be less than 3.5 feet (42 inches).
2. Except as otherwise permitted by the Department, all gravity sewers shall be designed with sufficient depth to provide service to the lowest finished floor elevation of the lowest building or structure to be served, allowing for future upgrades to service connections.
3. The Design Engineer shall certify that all proposed sites can be served by gravity with sewer service lateral connections installed at the applicable minimum slope unless a pumped connection has been approved for the site by the Department. The depth of service connections shall be in accordance with these Standards, the applicable Standard Details, and the applicable Plumbing Code.
4. 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, sewer service connections shall be ductile iron pipe of adequate thickness.
5. Sewer pipes with greater than 18 feet of cover shall be of ductile iron. Class of pipe shall be as recommended by the pipe manufacturer.
6. Sewer pipes with greater than 18 feet of cover shall have a polyethylene or epoxy lining specifically designed to resist hydrogen sulfide corrosion. Manufacturer's data shall be submitted prior to plan approval.
7. Sanitary sewers crossing under storm sewers shall maintain a minimum separation of 18 inches, outside edge to outside edge. Where this

separation is not possible, the sewer line shall be Ductile Iron pipe. Concrete supports may be required for the storm sewer. A full length of pipe shall be installed with its center at the crossing.

8. Manholes more than 18 feet deep shall be minimum 60 inches in diameter. Manholes more than 24 feet deep shall be minimum 72 inches in diameter. Sewers and manholes more than 24 feet deep require special permission from the Director.

1.4.03 Drawings

- A. In addition to requirements in Section 1.2 of these Standards, the Drawings shall also include:
 1. Stationing, pipe size, material, bearings, direction of flow, deflection angles, slope, grade, and distance between centerlines of manholes.
 2. All manholes shall be numbered, with drop manholes identified and top, influent invert and effluent invert elevations clearly shown.
 3. The following information shall be included on the plans:
 - a. Lowest finished floor elevation for each existing structure to be served with public sewer.
 - b. Street address of each existing structure to be served with public sewer.
 - c. First floor elevation of each proposed structure to be served with gravity sewer, and elevation of lowest floor to be served.
 - d. Spot elevations showing proposed final grade at the corners of the buildable area on parcels/lots less than 1 acre in size.
 - e. The lowest finished floor elevation which can be served by gravity sewer for each parcel/lot.
 - f. All existing utilities, with elevations.
 4. Each lot or parcel which requires a pump in order to receive public sewer service shall be identified on the plans.
 5. Water mains shall be shown, and profiles shall indicate points where crossings occur, clearly indicating vertical clearance between utilities.

6. The location of erosion control devices shall be shown on the plans. These devices shall be in conformance with the Virginia Erosion and Sediment Control Handbook.
7. The Department's Standard Water and Sewer Utility Construction Notes (Form F-09). shall be included on the drawings.
8. A drop manhole shall be provided when the elevation difference between the invert in of the upstream sewer line and the invert out of the downstream sewer line in a gravity sewer manhole must be greater than or equal to 2.00 feet.
9. Straight alignments between manholes shall be provided for all sewers of all diameters, unless otherwise approved in writing by the Director.
10. A fifty-foot minimum separation distance between sewer lines and wells or other drinking water sources or as otherwise required by the Virginia Department of Health.
11. Watertight (AWWA) pipe with mechanical joints and zero infiltration shall be specified where sewer lines cross under streams or other bodies of water.
12. Sewer lines not to be owned by the County shall be clearly identified as "Private."
13. All off-site easements with Instrument Number. Deed Book and Page Number may be used where Instrument Number is not available.
14. 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 1.4

1.5 WASTEWATER PUMP STATIONS AND FORCE MAINS

1.5.01 General Requirements

- A. This section provides the minimum requirements for design of wastewater pump stations and force mains intended for ownership by Goochland County.
- B. Sewage pumping stations and force mains are to be provided solely for the conveyance of sanitary wastewater. Under no circumstances shall flow from any storm drain, roof drain, foundation drain, floor drain, surface drain, subsurface drain or any other form of storm drainage be allowed to flow to, or pass through, the proposed facilities.
- C. The design of sewage pumping stations and force mains is a complex engineering process and is not subject to blanket requirements. For this reason, the specific requirements for each proposed pump station will be handled on a case-by-case basis.
- D. Prior to starting design of any wastewater pump station intended for ownership by Goochland County, the person or entity proposing to design and construct the station (the Developer) must submit detailed documentation of the need for a pump station to the Department for review. Written approval from the Director is required for any privately constructed pump station.
- E. Following approval of a sewage pump station by the Director, the Developer shall submit a detailed Preliminary Engineering Report (PER) for the station to the Department for review. This report shall fully comply with all requirements for an Engineering Report contained in Section 6.1.05. It shall evaluate the proposed sanitary sewer service area, the overall effect of the proposed station on downstream County facilities and shall justify the proposed station peaking factor. The PER shall provide preliminary hydraulic and mechanical design for the pump station, including preliminary pump specifications, and shall be sealed and signed by a Professional Engineer registered in Virginia.
- F. The design must conform to the minimum standards set forth in the Virginia Department of Environmental Quality *Sewage Collection and Treatment (SCAT) Regulations* for a Reliability Class 1 sewage pumping station. County requirements for specific equipment and submittals will be detailed during preliminary engineering review.
- G. The Developer shall prepare an Operations and Maintenance (O&M) Manual for the station. The O&M Manual shall be prepared in accordance with the Virginia Department of Environmental Quality *SCAT Regulations* and approved by the State (if required) 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 record drawings and one complete electronic (PDF) copy of the O&M Manual and record plans shall be submitted to the County prior to Final Acceptance. Refer to Record Drawing requirements in Section 4.7.

- H. Plats for the property occupied by the pump station and force main shall be prepared and submitted to the Department. The pump station property must be transferred to the County, and all applicable utility easements for the station and the force main must be recorded prior to Final Acceptance of the pump station by the County.
- I. All federal, state, and local permits and approvals must be obtained prior to approval of plans and specification by the County.

1.5.02 Technical Design

A. System Layout

1. 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.
2. 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.
3. For sewage pumping stations with an ultimate firm rated capacity of 1.0 MGD or less, the Department will consider design and construction of permanent pumping stations using wet-well(s) and submersible pumps in substantial accordance with Standard Detail PS-01. For stations with a capacity greater than 1.0 MGD, only a wet well/dry well configuration will be accepted.
4. Submersible pump stations shall use centrifugal, non-clog submersible pumps capable of handling 3” spherical solids, with 3-phase motors unless otherwise approved in writing by the Department. Submersible pumps shall be designed specifically for pumping sewage.
5. Each pump motor shall be rated for inverter duty and controlled by a

variable frequency drive (VFD).

6. Wet-well(s) for submersible pump stations shall be a minimum 6-feet in diameter.
7. 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.
8. An ample, all-weather road, including surface treatment, storm drainage and parking, shall be provided for easy access to the pumping station.
9. The architecture of the pumping station shall be consistent with the zoning and general appearance of the surrounding area.
10. Buildings shall be precast concrete as manufactured by Smith-Midland or approved equal. The minimum interior dimensions for the building shall be 10 feet x 12 feet. A larger building may be needed depending upon the layout, size and space requirements of equipment in the building.
11. 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.
12. Approved fencing with gates shall be provided 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 20-foot sliding gate or as otherwise approved by DPU.
13. The Design Engineer shall determine the availability of electric service to the proposed pump station site and coordinate with the power company to provide service to the pump station. The Design Engineer shall evaluate the need for a primary service extension and advise the Department if an extension is necessary. The standard power service for a sewage pump station to be owned by Goochland County is 480 Volt, 3-Phase. Provision of service which does not meet this requirement must be approved in writing by the Director.
14. All pump stations shall be Reliability Class 1 in accordance with the Virginia Department of Environmental Quality *SCAT Regulations* and shall comply with the requirements thereof.
15. Each pumping station shall have a permanently installed emergency

generator and automatic transfer switch sized to power the entire station. The transfer switch shall be installed inside the pump station building. The fuel storage tank shall be sized to operate the entire station with all pumps running for 48 hours continuous operation. Generator shall be mounted outside in a sound-attenuated weatherproof enclosure. Sound attenuation shall be 68 to 70 dB(A) at 23 feet under full load.

16. 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.
17. 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.
18. 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. The building and/or control cabinets shall have HVAC as required for temperature and humidity control.
19. 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.
20. All pumping station wet wells shall be considered explosion hazards. 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). Intrinsically safe controls shall be specified in accordance with National Electric Code (NEC) requirements.
21. For submersible pump stations, local disconnects for each pump motor and a wet well junction box for level controls shall be provided adjacent to the wet well. No junction boxes shall be installed inside the wet well. Conduits between wet well and junction box shall have gas seals or a

means of venting gases.

22. Adequate provision for differential settlement between wet well and valve vault shall be incorporated by means of flexible pipe joints consisting of a minimum of at least two restrained mechanical joint bell connections or restrained couplings.
23. In all sewage pumping stations over 1.0 MGD an adequate headworks structure, a wet well and a dry well shall be provided. The following items shall also be provided: a control building with 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.
24. All handrails, ladders, and grating shall be aluminum.
25. 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.
26. 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.
27. Force main locations shall conform to Section 1.1. 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 release valves wherever feasible. Every effort shall be expended to maintain the force main below the hydraulic gradient. When this is not possible, all high points shall have a combination air/vacuum release valve installed. Where a release valve is required, an automatic valve shall be provided and installed inside a standard manhole with adequate means of drainage. Adequate access to the manhole must be provided.
28. Every effort shall be made to maintain a full force main under operating conditions. The Design Engineer shall identify and design provisions for any flow away conditions.
29. Isolation valves (plug or resilient seat gate) shall be provided on both sides of all road, rail, and creek crossings, at maximum intervals of 2,000 feet,

and at connection points to other force mains.

30. Sizing of force main shall be such that velocity shall be a minimum of 2.5 feet per second for self-scouring velocity. Maximum velocity shall be 6 feet per second unless otherwise allowed by the Director.
31. Force mains shall be 4 inches in diameter or larger.
32. All force mains shall be cement-lined ductile iron pipe or DIPS DR-9 HDPE pipe. Where Hydrogen sulfide could be present ductile iron pipe shall be epoxy lined.
33. The Design Engineer shall consider ground conditions in the case of metallic conduits and provide suitable cathodic protection and polyethylene bagging where necessary.
34. 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.

B. Capacity Design

1. Capacity design for the pumping station and force main shall be based on Section 1.1 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.
2. Pump selection and force main sizing shall be based on a hydraulic analysis of the required flows, pipeline velocities and receiving gravity sewer capacities.
3. Pumping into a common force main (manifold condition) shall be avoided if possible. When the use of a common force main is permitted, the overall operational characteristics of, and interactions between/among all connected pumps and force mains shall be analyzed as a system. Any necessary upgrades to existing pump stations and/or force mains must be designed and constructed as part of the pump station project.
4. System curves shall be calculated and a chart and graph prepared showing static head and total dynamic head for both single and multiple pump operation. Pump performance curves for both single and multiple pump operation shall be plotted over the system curve to determine pump

operating points. 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 indicative of potential operating conditions. The system curves shall illustrate the effect of wet well level and potentially varying pipe roughness coefficients on the total dynamic head. Particular attention shall be given to the available versus required net positive suction head (NPSH).

5. 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.

C. Structural Design

1. In addition to conventional design procedures, there are several specific areas that must be considered.
 - a. The effect of hydraulic thrust must be countered by the use of thrust blocking, pipe anchorage, mechanical joint restraints or other suitable means to prevent movement of pumping equipment and pipelines.
 - b. 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, bedding methods, and operational pressures. 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.
 - c. Surge analysis may be required at the discretion of the Director and surge relief valves installed at the pump station.
 - d. All pipe joints at the pump station within the fenced in area, and at the discretion of the County Engineer, shall be restrained.

1.5.03 Drawings

A. Drawing Requirements

1. Drawings for pumping stations and plan and profiles for force mains shall be prepared in accordance with Section 1.2 and the requirements of this Section.

2. Drawings shall include:
 - a. Complete pump information with manufacture's name, model numbers, serial numbers, horsepower, voltage, phase, calculation summary sheet, pump curve, impellor size with specifics of any proposed impellor trimming, and all other pertinent pump information.
 - b. Provisions for anti-floatation as required based on the buoyancy calculations for wet well, valve vault, and manholes.
3. 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 components and equipment shall be specifically approved. No deviation from the approved manufacturers will be permitted.
4. A Theory of Operation shall be provided on the plans describing pump cycling for both normal and high flow conditions, alarms, and operating pressures. The Theory of Operation shall include a detailed list of initial settings for pumps on/off, high/low level alarms and other relevant operational information.
5. Drawings shall include mechanical details, architectural details, structural details, electrical one-line diagrams, instrumentation and controls plans (P&ID drawings, panel board schedules, points list, etc.), flow diagrams, and all other pertinent information.
6. Drawings for pumping stations shall include a site layout and grading plan which shows all relevant geometric information as well as, existing and proposed grading using a 1-foot contour interval. A sufficient number of spot-elevations shall be included to demonstrate positive surface drainage away from all structures as well as the routing of storm water off the site. The boundaries of the site shall be clearly shown on the plan. Permanent monumentation shall be installed at the corners of the parcel prior to completion of construction. Site and grading plan(s) shall be drawn to a scale of not less than 1-inch equals 20 feet.
7. Architectural drawings for buildings and structures shall be drawn on a scale of not less than ¼ inch equals to 1 foot. Drawings required to clarify construction details shall be drawn on an appropriately larger scale.

8. Drawings for force mains shall show stationing, pipe size, bearings, direction of flow, deflection angles and curve data.
9. Profiles for force mains shall show the ground line, force main profile, existing and proposed underground utility lines and existing and proposed structures that might affect force main depth. It shall also show areas where additional depth will be required, any required vertical curve data and locations of all isolation valves, combination air/vacuum valves, fittings, utility crossings and all other appurtenances. All crossings of existing and proposed water mains shall be shown and shall clearly indicate vertical clearance between utilities.
10. Details shall be shown for all blocking, pipe restraints, buried valves and combination air/vacuum valves.
11. A complete erosion and sediment control plan shall be prepared for the project and included in the plan set. The design shall be in conformance with the *Virginia Erosion and Sedimentation Control Handbook* and shall be subject to review by the County's Environmental Division.

1.5.04 Miscellaneous Components

- A. In addition to the design requirements in this Section, all wastewater pump station and force main designs shall include the following:
 1. All junction boxes shall have finger proof terminal strips equal to Allen Bradley 1492-J series.
 2. 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 so that it is accessible for maintenance and does not interfere with pump removal. The transmitter shall be located in the pump control panel with a readout on the cabinet front. Set points shall be field adjustable.
 3. 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.
 4. Aluminum or stainless-steel access hatches shall be cast into the wet well

and valve vault tops with reinforced doors able to withstand a uniform live load of 300 lb. psf. Additional door load capacity shall be provided in areas subject to vehicular traffic or other significant loads, as determined by the Department. Doors shall close flush with the frame. Hatches shall be of sufficient size to allow convenient access and adequate clearance for equipment removal. All access hatches shall come equipped with a locking system and hold open arm. Protective grating shall be provided in areas requiring additional fall protection. Grating shall be hinged with positive latch to maintain upright position with provisions for a padlock and safety orange powder-coated finish. The load rating of the grating shall be equal to or greater than the load rating of the door.

5. Tracer wire and test stations shall be provided as indicated in Section 5.2.
6. Permanent monumentation shall be installed at the corners of the pump station parcel prior to completion of construction.

END OF SECTION 1.5

1.6 WATER DISTRIBUTION FACILITIES

1.6.01 General Requirements

- A. Public water distribution facilities are to be designed solely for the purpose of supplying potable water and fire protection. Under no circumstances shall cross-connections be allowed to unapproved water facilities. The design parameters included in these Standards are to be used in the design of water distribution facilities. Water transmission facility design parameters are not included herein. Design criteria for water transmission facilities will be established by the Department on a case-by-case basis.

1.6.02 Technical Design

- A. System Layout
 - 1. The overall layout and general design shall conform to the parameters set forth in the approved Engineering Report and Section 1.1 of these Standards.
 - 2. In general, main line valves are required at intervals of 1,000 feet and at tees to allow adequate control of the system without major system shutdowns.
 - 3. Sufficient isolation valves are required for all water main extensions to allow adequate isolation of the system for testing and flushing. A minimum of two valves will be located at each tee, one on the branch and one on the main.
 - 4. Typically, butterfly valves may only be used on lines larger than 16" diameter. A butterfly valve may be used on a 16" line only where depth of cover does not permit the use of a gate valve.
 - 5. Public water lines shall be located in accordance with the requirements contained in Section 1.1.02.G, H & I of these Standards, and as follows:
 - a. In paved areas of non-residential lots, in permanent utility easements established for that purpose.
 - b. Under the pavement in subdivision streets where lot size is less than 1 acre. Lines shall be configured in substantial conformance with DPU geometric standards for water and sewer in subdivision streets (Standard Details G-01 and G-02).

- c. In other areas as specifically permitted by the Department.
 - d. Wherever a water line is located outside a public right of way, an appropriately sized Utility Easement must be dedicated to the County as described elsewhere in these Standards.
6. It is not acceptable to run water lines “cross country” in unpaved areas where normal vehicle access for inspection, testing, and maintenance is not practical.
 7. 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.
 8. Water lines shall be installed a minimum of 15 feet from any part of any structure, building, or foundation.
 9. The use of cross fittings at four-way intersections of water lines is prohibited. Such intersections shall use two opposing tee fittings aligned as shown on Standard Detail WAT-11.

B. System Design

1. 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.
2. 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*.
3. 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.
4. 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.

5. For each building in a commercial, industrial and/or multi-family residential project, domestic meter sizing calculations shall be performed using Form F-07 and shall be provided on the plans.
6. Fire protection flow requirements shall be shown on the plans.
7. The system shall be designed to maintain a minimum residual pressure of 40 psi in the distribution system at all service connections at the maximum day demand. Where existing conditions prevent this, the Department shall determine an acceptable minimum pressure requirement for the project.
8. The system shall be designed to maintain an absolute minimum residual pressure of 20 psi at all points in the system during the design flow. Design flow shall be defined as the greater of maximum day demand plus applicable fire flows or maximum hour demand.
9. Where the pressure at a service connection exceeds 80 psi, a pressure reducing valve (PRV) shall be installed on the service line in accordance with the provisions of the Uniform Statewide Building Code. The PRV shall be installed on the downstream side of the water meter. Maintenance of the PRV shall be the responsibility of the property owner.
10. Where deemed appropriate and practical by the Director, the system shall be designed with looping to allow water to be supplied to the system from two different points.
11. In residential subdivisions, Bac-T Sampling Stations shall be provided as follows:
 - a. One sampling station per 100 lots (or fraction thereof) shall be provided.
 - b. Sampling stations must be placed at least 1,000 feet apart.
 - c. Sampling stations shall be installed within a road ROW or utility easement.
 - d. Wherever practical, sampling stations shall be located at street intersections, adjacent to Open Space. If this cannot be achieved, then they may be aligned with a departing property line between two lots.
 - e. Sampling stations shall not be located in cul-de-sacs or at water line dead ends.
 - f. Sampling stations shall be installed as described in these Standards and as shown on Standard Detail TST-02.

g. Sampling stations shall not be connected to fire hydrant laterals.

12. For non-residential projects, a Bac-T Sampling Station shall be provided and located as required by the Department. Installation requirements shall be the same as for sampling stations in residential subdivisions.

C. Hydraulic Design

1. 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.
2. Hydraulic calculations shall show system pressure during static (no flow), average, maximum daily, maximum hourly, and fire flow scenarios.
3. The Design Engineer shall consult with the Department on the variability of supply pressures at the proposed connection point(s) and account for this variability in the hydraulic calculations.

D. Demand Design

1. Maximum rates of water consumption shall be calculated and used as a basis of hydraulic design. Average daily water consumption 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 and maximum hourly 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 2.0.

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

Q_P is the maximum hourly water consumption rate.

Q_A is the average annual daily water consumption rate.

C is a constant varying from 2.0 to 6.0.

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

- a. Demand design shall be based on the estimated water demand 10 to 30 years in the future.
- b. Historical data or typical usage figures of service areas with similar characteristics, and appropriate peaking factors, shall be used to support the design.
- c. The design shall account for diurnal demand patterns.
- d. The Uniform Statewide Building Code (USBC) may be referenced to support the design water usage of non-residential buildings, as appropriate.

E. Fire Protection

1. Rates of flow for fire protection shall be estimated based on the latest revision of the Virginia Statewide Fire Prevention Code.
2. The minimum fire flow from any individual fire hydrant shall be 500 gpm. The minimum design fire flow during any fire event shall be 1,500 gpm. The minimum residual pressure during a fire flow event shall be 20 psi.
3. 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.
4. The sizing of fire service lines shall be determined using the procedures contained in these Standards and the latest edition of the Virginia Statewide Fire Prevention Code.
5. The minimum size water line used for fire protection shall be 8 inches in diameter.
6. Wherever possible, minimum sized fire service lines shall be looped to provide a feed from at least two directions.
7. Not more than one fire hydrant shall be installed on an 8-inch dead end

line. Dead end lines shall not contain more than 600 feet of the minimum sized line.

8. Fire hydrants shall be placed in legal rights-of-way or easements and shall generally be located at street intersections.
9. Where distances between intersections require the use of intermediate fire hydrants, they shall be placed in line with a property boundary between adjacent lots or parcels of land, wherever possible. Where fire hydrants cannot be placed in a legal right-of-way, an easement shall be provided.
10. Fire hydrants shall be located no more than 10 feet from the edge of roadway shoulder or back of curb.
11. Fire hydrants spacing for properties zoned or planned for agricultural or single-family residential use shall not exceed 1,000 feet or require a hose lay of over 500 feet from the hydrant to any part of any structure to be protected.
12. Fire hydrant spacing for properties zoned or planned for multi-family, residential, commercial, or industrial uses 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.
13. No fire hydrant shall be placed within the collapse zone of any building, The collapse zone is defined as 1.5 times the height of the building, or as otherwise determined by the Fire Marshal.
14. For commercial, industrial, and multi-family construction, fire hydrants shall be rated in accordance with the Insurance Service Office (ISO) standards and the Virginia Statewide Fire Prevention Code.
15. The above criteria for spacing fire hydrants may be modified by the Department or the Fire Marshal to improve fire hydrant accessibility for firefighting purposes.
16. Structures fully protected by an automatic sprinkler system and directly connected to the County's water system require installation of a reduced pressure detector assembly (RPDA) either inside the building or within an appropriate enclosure.

17. Structures protected by automatic sprinkler systems with a Fire Department Connection (FDC) require installation of an RPDA either inside the building or within an appropriate enclosure, and a dedicated fire hydrant. The dedicated hydrant is not credited towards external protection requirements. The FDC must be located within 50 feet of the dedicated hydrant, and typically will be located at the RPDA enclosure.

F. Structural Design

1. Structural requirements must be considered in the design of all water mains and appurtenances.
2. 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.
3. 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.
4. Proper support shall be provided for aerial or suspended lines, where specifically permitted by the Department.
5. Potable water line crossings above surface water must be specifically permitted by the Department prior to start of design, and must be:
 - a. Adequately supported.
 - b. Protected from freeze damage.
 - c. Accessible for repair or replacement.
 - d. Above the 100-year flood plain elevation.
 - e. Designed for expansion and contraction, where applicable.
6. Potable water lines crossing under surface water must meet the following requirements:
 - a. The pipe shall be of special construction having flexible watertight restrained joints.

- b. A valve shall be provided at each end of the water crossing so that the section can be isolated for test or repair. Valves will typically be within 50 feet of each end of the crossing, but in any event shall be easily accessible and not subject to flooding.
 - c. For testing of water lines under surface water, permanent sample taps shall be installed a reasonable distance from each end of the crossing in an area not subject to flooding.
 - d. Adequate cover shall be provided over the waterline.
 - e. For open-cut stream crossings, rip rap shall be placed in the stream bed to prevent erosion above the water line.
7. Steel casing pipe shall be sized in accordance with the permitting agency or these Standards, whichever is more stringent.

G. Miscellaneous Considerations

- 1. The minimum size water line pipe to be used on a public water system shall be 4 inches. Consideration should be given to the use of 4-inch diameter mains at the ends of cul-de-sacs where no fire hydrants are to be located and where extension of the water line is not anticipated.
- 2. Where deemed necessary by DPU, air, air/vacuum or pressure reducing valves, blow off tees and related fittings shall be provided. These shall be as specified by the Design Engineer, subject to approval by the Department.
- 3. The minimum design depth of cover for water mains 12" or smaller shall be 3-1/2 feet (42 inches). Additional depth shall be provided where required for thrust restraint or to clear underground obstructions.
- 4. The minimum design depth of cover for water mains larger than 12" shall be 5 feet (60 inches), or as otherwise required by the Department.
- 5. Any deviation from required design depths of cover must be approved by the Director. A profile of each water service which crosses a ditch line shall be shown on the plans. A minimum of 36 inches of cover shall be provided at the ditch invert. A typical profile is acceptable on plans with multiple minimum-sized service lines.

6. 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:

- a. Use constant pressure factor of 1.
- b. Include all outside hose bibs in combined fixture value total.
- c. For non-residential facilities or facilities with flush-valve fixtures, meters shall be sized as follows:

<u>METER SIZE (INCHES)</u>	<u>COMBINED FIXTURE VALUE TOTAL</u>
1	41 - 100
1-½	101 - 400
2	401 - 1200

- d. For residential facilities and office buildings with tank-type water closets, meters shall be sized as follows:

<u>METER SIZE (INCHES)</u>	<u>COMBINED FIXTURE VALUE TOTAL</u>
5/8	1 - 40
1	41 - 400
1-½	401 - 5500

- e. Plumbing Fixtures Values shall be as shown in AWWA Manual M-22 for 35 psi.
- f. Meter installations requiring a flow of greater than 160 gpm or with greater than the combined fixture value totals indicated above shall be reviewed, and meter size set, on a case-by-case basis in accordance with AWWA Manual M-22.
- g. A 5/8-inch meter may be used for non-residential facilities with tank type water closets and a combined fixture value total of 40 or less.
- h. A 1-inch meter is the minimum allowable size for any facility with flush valve fixtures.

7. Cathodic Protection: The Design Engineer shall consider soil conditions in the case of metallic pipes and conduits; and shall provide suitable cathodic protection where necessary.
8. Irrigation systems shall use Reduced Pressure Zone (RPZ) backflow prevention devices and shall be approved by the County's Building Inspection Department.
9. Where exposed to traffic, meter boxes, and vaults shall be designed for the appropriate traffic loading.
10. Meter Boxes for residential units shall be rated for a minimum 15,000-pound load and be installed in accordance with the Standard Drawings.
11. Meter Boxes for 1-½ and 2-inch meters shall be rated for a minimum of Tier 22 load.
12. Wherever practical, dead-end lines shall be avoided by looping mains. Where looping is required, the minimum size pipe shall be 8 inches.
13. 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.
14. No flushing devices shall be connected directly to any sewer.
15. The minimum size service line from the County main to the meter shall be 1 inch.
16. Vaults 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.
17. Vaults or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water. Where this cannot be achieved, a sump pump shall be installed in the vault.
18. The open end of an air relief valve should extend one-foot above ground and be provided with a screened downward facing elbow.

1.6.03 Drawings

- A. In addition to the requirements of Section 1.2 of these Standards, the drawing shall incorporate the following features:
1. Drawings for water lines shall show stationing, pipe size and material, 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.
 2. All valves, tees, bends, service lines, meters, fire hydrants, flushing valves and other fittings shall be shown on the plans. Northing and Easting coordinates shall be provided for all valves, hydrants, and meter boxes.
 3. Profiles shall be provided for all water lines. Existing and proposed grades shall be calculated and shown on the profiles. Profiles shall show and provide stationing for all valves, tees, bends, fire hydrants, flushing valves, water service connections, and other fittings.
 4. Blocking and/or restraint details and calculations shall be provided on the plans.
 5. General Notes, Current Goochland County Water and Sewer Notes (Form F-09), Stormwater Management and Erosion Control Notes (Form F-14), and a table of Estimated Materials Quantities shall be shown on the plans.
 6. 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 edge-to-edge clearance between utilities.
 7. Meter sizing form(s), backflow prevention details, and ISO calculations shall be included on the plans.

END OF SECTION 1.6

2.0 – STANDARD FORMS AND NOTES – TABLE OF CONTENTS

2.1 Standard Forms and Notes

F-01	Engineering Report
F-02	Not Used
F-03	Not Used
F-04	Sanitary Sewer Design Table *
F-05	Not Used
F-06	Review Checklist for Water and Sewer Plans
F-07a	Commercial Meter Sizing Form (Fixture Count Worksheet) *
F-07b	Residential Meter Sizing Form (Fixture Count Worksheet) *
F-08	Fire Flow Estimate Form
F-09	Water and Sewer Notes
F-10	Backflow Preventer Installation – RPZ – Outdoor with Enclosure
F-11	Backflow Preventer Installation – RPZ – Inside Building
F-12	Backflow Preventer Installation – RPZ – Irrigation System
F-13	Backflow Preventer Installation – Detector Check for Fire Service Line
F-14	Erosion Control & SWM Notes for Linear Utility Projects
F-15	Notification of Intent to Discharge to Sanitary Sewer

*These Forms are available as Excel Spreadsheets. Contact DPU for more information.

2.1

Standard Forms and Notes

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
SUBMISSION/REVIEW CHECKLIST FOR WATER AND SEWER PLANS**



Project Name (including Phase/Section if Applicable)

1. Virginia Professional Engineer's stamp, signature, and date. (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.
Line size required to adequately serve this project in accord with County Standards = _____ Inches
 - a. Average Domestic Design Flow _____ gpd
 - b. Peak Hour Domestic Flow _____ gpm
 - c. Design Fire Flow _____ gpm
 - d. Total Design Peak Flow _____ gpm
 - e. Residual Pressure at Total Design Peak Flow (last hydrant) _____ psi
4. Sanitary Sewer Service area map is submitted with plans. Sanitary Sewer Analysis is shown on sewer shed map.
5. Line size required to adequately serve this project in accord with County Standards = _____ Inches
 - a. Average Design Flow _____ gpd
 - b. Equivalent Residential Units _____ ERU
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. For phased projects, 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 are profiled. Crossings with other utilities are shown and conflicts are resolved.
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 review/approval.

Engineer's Signature

Certificate/License Number

Engineer's Name Printed or Typed

Date



Worksheet for Commercial Water Meter Sizing

	Project :
	Customer / Builder Name :
	Property Location/Address :

Fixture Type	Unit Fixture Value	Number of Fixtures	Fixture Value
Bathtub	8		
Shower Head (Shower Only)	4		
Toilet (Flush Valve Type)	35		
Toilet (Tank Type)	3		
Urinal (Pedestal Flush Valve)	35		
Urinal (Wall Flush Valve)	12		
Bidet	2		
Lavatory - 3/8" Connection	2		
Lavatory - 1/2" Connection	4		
Laundry Tray - 1/2" Connection	3		
Laundry Tray - 3/4" Connection	7		
Kitchen Sink - 1/2" Connection	3		
Kitchen Sink - 3/4" Connection	7		
Service Sink - 1/2" Connection	3		
Service Sink - 3/4" Connection	7		
Dishwasher - 1/2" Connection	4		
Dishwasher - 3/4" Connection	10		
Washing Machine - 1/2" Connection	5		
Washing Machine - 3/4" Connection	12		
Washing Machine - 1" Connection	25		
Drinking Fountain - Cooler	1		
Drinking Fountain - Public	2		
Hose Connection (1/2")	6		
Hose Connection (3/4")	10		
Dental Unit	1		
Dental Lavatory	2		
Bedpan Washers	10		
Other (Assign Apropriate Unit Fixture Value)			
TOTAL FIXTURE VALUE			
Peak-Flow Demand (gpm)			
REQUIRED WATER METER SIZE			



Goochland County
Department of Public Utilities
 PO Box 119 - 1800 Sandy Hook Road
 Goochland, VA 23063
 Telephone: (804) 556-5835

Worksheet for Residential Water Meter Sizing

	Project : _____		
	Customer / Builder Name : _____		
	Property Location/Address : _____		
Fixture Type	Unit Fixture Value	Number of Fixtures	Fixture Value
Bathtub	8		
Toilet (Tank Type)	3		
Shower (Single Head)	4		
Lavatory - 3/8" Connection	2		
Lavatory - 1/2" Connection	4		
Kitchen Sink - 1/2" Connection	3		
Kitchen Sink - 3/4" Connection	7		
Service Sink - 1/2" Connection	3		
Service Sink - 3/4" Connection	7		
Dishwasher - 1/2" Connection	4		
Dishwasher - 3/4" Connection	10		
Washing Machine	5		
Hose Connection	6		
Other (Assign a Unit Fixture Value)			
Other (Assign a Unit Fixture Value)			
TOTAL FIXTURE VALUE			
Peak-Flow Demand (gpm)			
REQUIRED WATER METER SIZE			

**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.

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

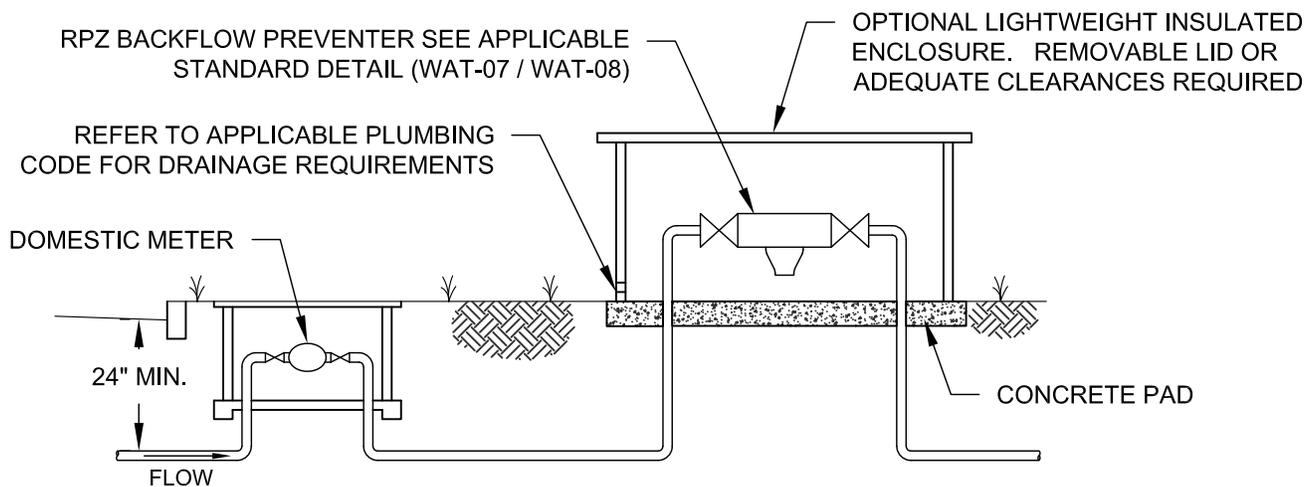
1. All construction, materials and installations shall conform to the latest edition of the Design and Construction Standards of the Goochland County Department of Public Utilities (DPU Standards).
2. Contractor shall provide all required Construction Submittals and Shop Drawings (Submittals) to DPU in accordance with DPU Standards. Construction shall not commence until DPU concurrence has been received for all Submittals.
3. Contractor is responsible for contacting DPU to schedule a pre-construction meeting at least 48 hours (two working days) prior to starting any work on this project. All work shall be subject to inspection. Contractor shall obtain all necessary permits prior to requesting a pre-construction meeting.
4. Contractor is responsible for locating and uncovering all sewer manholes and valve boxes after surface treatment of roads, and for adjusting them to the final road grades as needed.
5. Contractor shall verify location and elevation of all underground utilities. The locations and elevations of existing utilities across or along the line of the proposed work may not be shown on the plans and where shown may be only approximately correct.
6. Contractor is responsible for locating all underground lines and structures as necessary to complete the work. No claims for damages or extra compensation shall accrue to the contractor due to the presence of existing utilities or from any delay due to removal or rearrangement of the same. The contractor is responsible for any damage caused to underground structures.
7. Contractor must call "Miss Utility" toll free at 811 prior to start of construction.
8. Datum for all elevations shown is National Geodetic Survey.
9. Service saddles must be used on all water service connections.
10. Fire hydrants shall be installed in accordance with DPU Standards and Standard Details FIR-01a and FIR 01b.
11. All Fire Hydrants shall be National Standard Threads and shall be painted reflective silver.
12. Minimum depth of cover over water lines is 3.5 feet. Exceptions due to unusual circumstances in the field must be approved by DPU prior to installation.
13. Minimum depth of cover over gravity sewer lines is 5.5 feet in road rights-of-way and 4.5 feet within easements. Exceptions due to unusual circumstances in the field must be approved by DPU prior to installation Ductile Iron Pipe or C-900, DR-14 PVC pipe must be used where depth of cover is less than 5 feet within public roads, and where cover is less than 4 feet in other areas.

14. Minimum depth of cover over sanitary sewer force mains is 3.5 feet. Exceptions due to unusual circumstances in the field must be approved by DPU prior to installation.
15. For residential sewer connections, a cleanout shall be installed on the sewer service lateral at the edge of the ROW or Utility Easement in accordance with DPU Standards.
16. Commercial sewer connections must use a sample port in place of the cleanout at the edge of the ROW or Utility Easement in accordance with DPU Standards.
17. Watertight manhole covers shall be used on all manholes in easements and in flood plains. Manhole covers shall be in accordance with Standard Detail MAN-12.
18. Detectable Marking Tape is required on all buried lines in accordance with DPU Standards.
19. Copper tracer wire and tracer wire access boxes shall be installed on all water mains and all sewage force mains in accordance with DPU Standards.
20. On water systems, tracer wire access boxes with mow collars shall be installed adjacent to all fire hydrants.
21. On sewage force mains tracer wire access boxes shall be installed at the following locations:
 - a. Adjacent to the bypass connection riser on the pump station site.
 - b. Adjacent to the discharge manhole for the force main.
 - c. Other intermediate locations as determined by DPU and shown on the plans.
22. Gravity sewers which receive pumped flow shall be protected against sulfide attack for a distance of 1,200 feet downstream from the point of entry of the pumped flow. This shall be accomplished by the use of acid-resistant pipe and manholes in accordance with DPU Standards.
23. Design Engineer shall certify that unpaved streets are to subgrade prior to Contractor installing water system.
24. No permanent structures or trees shall be located within any utility easement.
25. Prior to requesting any Acceptance Inspection, Contractor shall flush and clean out gravity sewer mains as needed, perform CCTV recordings of all gravity sewer mains and manholes, and submit CCTV recordings to DPU for review.
26. Final Acceptance by County will not occur until all work shown on the approved Utility Plans is completed including curb & gutter, paving, grading and all required adjustments.
27. A Wetlands Permit may be required from the U.S. Army Corps of Engineers for this project. For information concerning such requirement, contact the appropriate local U.S. Army Corps of Engineers field office.

28. DPU will inspect all public 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. Other lines to be installed on site such as roof drains, foundation drains, private water supply lines, private sanitary sewer lines, etc., must be approved by the Department of Building Inspections prior to installation and are to be inspected by them before backfilling/covering.
29. Concurrent inspections by the Department of Building Inspections and DPU will be performed for the following: Mainline backflow preventers; monitoring manholes; grease traps; exclusion meters; irrigation meters. DPU will inspect to ensure that the proper appurtenance, as shown on the approved Utility Plans, has been installed and tested in accordance with DPU Standards.

GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES

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



PROCEDURE FOR OBTAINING WATER SERVICE WHERE BACKFLOW PREVENTION IS REQUIRED

1. OWNER MUST SUBMIT PLANS TO DEPARTMENT OF PUBLIC UTILITIES (DPU) FOR APPROVAL. PLANS MUST BE SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN VIRGINIA.
2. APPLY FOR PLUMBING PERMIT FROM GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS.
3. INSTALL DOMESTIC METER BOX AND SETTER IN ACCORDANCE WITH GOOCHLAND COUNTY DPU STANDARDS AND SPECIFICATIONS. DOMESTIC METER WILL BE INSTALLED BY DPU AFTER ALL REQUIREMENTS HAVE BEEN MET.
4. INSTALL PIPING AND BACKFLOW PREVENTER, INCLUDING BRASS MALE TEST COCK ADAPTORS - FOUR (4) STRAIGHT HOSE ADAPTOR FITTINGS, 1/4" SAE 45 FLARE TUBE x 1/4" NPT, FOR CONNECTION TO TEST DEVICE. BACKFLOW PREVENTION DEVICE WILL BE INSTALLED ON THE WATER SERVICE LINE, IMMEDIATELY AFTER THE DOMESTIC METER. REFER TO APPROVED PLANS FOR INSTALLATION DETAILS. NO TAP-INS OR CONNECTIONS MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
5. FREEZE PROTECTION IS REQUIRED. INSTALLATION OF A LIGHTWEIGHT INSULATED ENCLOSURE AND/OR HEAT TAPE ARE ACCEPTABLE METHODS OF FREEZE PROTECTION.
6. SHUTOFF VALVES FOR THE BACKFLOW PREVENTION DEVICE SHALL BE AS APPROVED BY THE MANUFACTURER OF THE DEVICE.
7. INSPECTION OF THE BACKFLOW PREVENTION DEVICE BY GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS IS REQUIRED PRIOR TO INSTALLATION OF DOMESTIC METER.
8. THE DEPARTMENT OF BUILDING INSPECTIONS HAS INSPECTION PURVIEW OVER ALL PIPING AND PLUMBING WORK ON THE CUSTOMER SIDE OF THE DOMESTIC METER.
9. OWNER MUST PAY ALL APPLICABLE CONNECTION FEE(S) AND METER FEE PRIOR TO INSTALLATION OF DOMESTIC METER.

REVISION DATE:

MARCH 2024

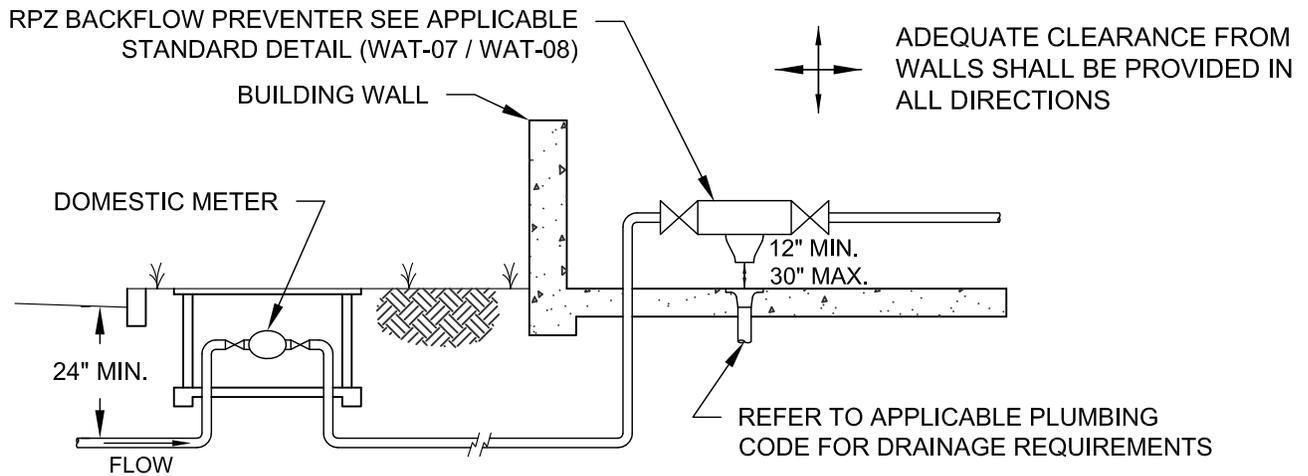
REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTION DEVICE OUTSIDE INSTALLATION

FORM NO.

F-10

GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES

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



PROCEDURE FOR OBTAINING WATER SERVICE WHERE BACKFLOW PREVENTION IS REQUIRED

1. OWNER MUST SUBMIT PLANS TO DEPARTMENT OF PUBLIC UTILITIES (DPU) FOR APPROVAL. PLANS MUST BE SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN VIRGINIA.
2. APPLY FOR PLUMBING PERMIT FROM GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS.
3. INSTALL DOMESTIC METER BOX AND SETTER IN ACCORDANCE WITH GOOCHLAND COUNTY DPU STANDARDS AND SPECIFICATIONS. DOMESTIC METER WILL BE INSTALLED BY DPU AFTER ALL REQUIREMENTS HAVE BEEN MET.
4. INSTALL PIPING AND BACKFLOW PREVENTER, INCLUDING BRASS MALE TEST COCK ADAPTORS - FOUR (4) STRAIGHT HOSE ADAPTOR FITTINGS, 1/4 " SAE 45 FLARE TUBE x 1/4" NPT, FOR CONNECTION TO TEST DEVICE. BACKFLOW PREVENTION DEVICE WILL BE INSTALLED ON THE WATER SERVICE LINE, AFTER THE DOMESTIC METER. REFER TO APPROVED PLANS FOR INSTALLATION DETAILS. NO TAP-INS OR CONNECTIONS MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
5. BACKFLOW PREVENTER SHALL HAVE MINIMUM 24" CLEARANCE FROM WALL TO TEST COCK ADAPTORS. ALL OTHER CLEARANCES FROM WALLS SHALL BE MINIMUM 12"
6. SHUTOFF VALVES FOR THE BACKFLOW PREVENTION DEVICE SHALL BE AS APPROVED BY THE MANUFACTURER OF THE DEVICE.
7. INSPECTION OF THE BACKFLOW PREVENTION DEVICE BY GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS IS REQUIRED PRIOR TO INSTALLATION OF DOMESTIC METER.
8. THE DEPARTMENT OF BUILDING INSPECTIONS HAS INSPECTION PURVIEW OVER ALL PIPING AND PLUMBING WORK ON THE CUSTOMER SIDE OF THE DOMESTIC METER.
9. OWNER MUST PAY ALL APPLICABLE CONNECTION FEE(S) AND METER FEE PRIOR TO INSTALLATION OF DOMESTIC METER.

REVISION DATE:

MARCH 2024

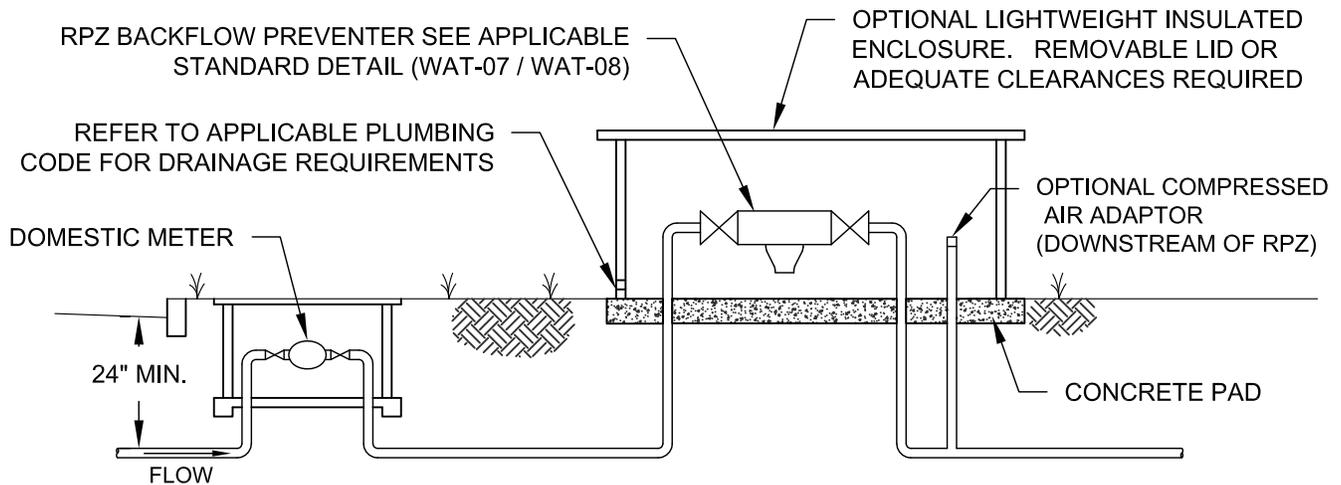
REDUCED PRESSURE ZONE (RPZ) BACKFLOW PREVENTION DEVICE INSIDE INSTALLATION

FORM NO.

F-11

GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES

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



PROCEDURE FOR OBTAINING WATER SERVICE WHERE BACKFLOW PREVENTION IS REQUIRED

1. OWNER MUST SUBMIT PLANS TO DEPARTMENT OF PUBLIC UTILITIES (DPU) FOR APPROVAL. PLANS MUST BE SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN VIRGINIA.
2. APPLY FOR PLUMBING PERMIT FROM GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS.
3. INSTALL DOMESTIC METER BOX AND SETTER IN ACCORDANCE WITH GOOCHLAND COUNTY DPU STANDARDS AND SPECIFICATIONS. DOMESTIC METER WILL BE INSTALLED BY DPU AFTER ALL REQUIREMENTS HAVE BEEN MET.
4. INSTALL PIPING AND BACKFLOW PREVENTER, INCLUDING BRASS MALE TEST COCK ADAPTORS - FOUR (4) STRAIGHT HOSE ADAPTOR FITTINGS, 1/4" SAE 45 FLARE TUBE x 1/4" NPT, FOR CONNECTION TO TEST DEVICE. BACKFLOW PREVENTION DEVICE WILL BE INSTALLED ON THE WATER SERVICE LINE, IMMEDIATELY AFTER THE DOMESTIC METER. REFER TO APPROVED PLANS FOR INSTALLATION DETAILS. NO TAP-INS OR CONNECTIONS MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
5. FREEZE PROTECTION IS REQUIRED. INSTALLATION OF A LIGHTWEIGHT INSULATED ENCLOSURE AND/OR HEAT TAPE ARE ACCEPTABLE METHODS OF FREEZE PROTECTION.
6. SHUTOFF VALVES FOR THE BACKFLOW PREVENTION DEVICE SHALL BE AS APPROVED BY THE MANUFACTURER OF THE DEVICE.
7. INSPECTION OF THE BACKFLOW PREVENTION DEVICE BY GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS IS REQUIRED PRIOR TO INSTALLATION OF DOMESTIC METER.
8. THE DEPARTMENT OF BUILDING INSPECTIONS HAS INSPECTION PURVIEW OVER ALL PIPING AND PLUMBING WORK ON THE CUSTOMER SIDE OF THE DOMESTIC METER.
9. OWNER MUST PAY ALL APPLICABLE CONNECTION FEE(S) AND METER FEE PRIOR TO INSTALLATION OF DOMESTIC METER.

REVISION DATE:

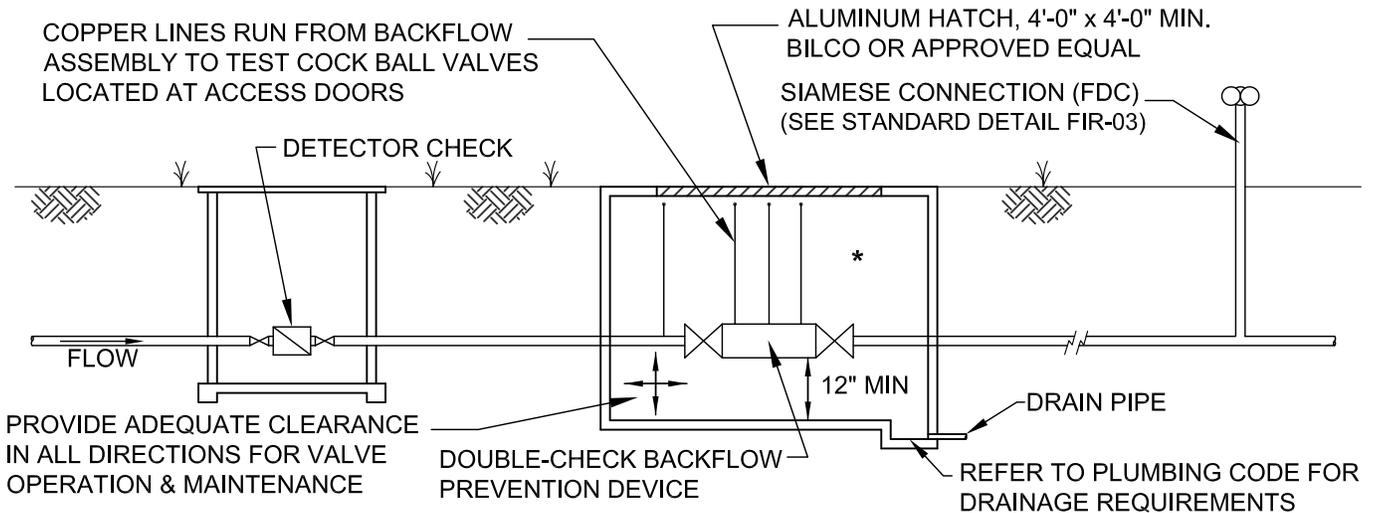
MARCH 2024

**REDUCED PRESSURE ZONE (RPZ)
BACKFLOW PREVENTION DEVICE
IRRIGATION SYSTEM WITH METER**

FORM NO.

F-12

GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES



* VAULT SHALL BE APPROPRIATELY SIZED, AND SHALL CONFORM TO ALL APPLICABLE BUILDING CODES.

PROCEDURE FOR OBTAINING WATER SERVICE WHERE BACKFLOW PREVENTION IS REQUIRED

1. OWNER MUST SUBMIT PLANS TO DEPARTMENT OF PUBLIC UTILITIES (DPU) FOR APPROVAL. PLANS MUST BE SEALED AND SIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN VIRGINIA.
2. APPLY FOR PLUMBING PERMIT FROM GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS.
3. INSTALL PIPING AND BACKFLOW PREVENTER, INCLUDING BRASS MALE TEST COCK ADAPTORS - FOUR (4) STRAIGHT HOSE ADAPTOR FITTINGS, 1/4 " SAE 45 FLARE TUBE x 1/4" NPT, FOR CONNECTION TO TEST DEVICE. BACKFLOW PREVENTION DEVICE WILL BE INSTALLED ON THE WATER SERVICE LINE, IMMEDIATELY AFTER THE DOMESTIC METER. REFER TO APPROVED PLANS FOR INSTALLATION DETAILS. NO TAP-INS OR CONNECTIONS MAY BE MADE BETWEEN THE METER AND THE BACKFLOW PREVENTER.
4. THE DEPARTMENT OF BUILDING INSPECTIONS HAS INSPECTION PURVIEW OVER ALL PIPING AND PLUMBING WORK ON THE CUSTOMER SIDE OF THE DOMESTIC METER.
5. ALL FIRE SYSTEM BACKFLOW PREVENTION REQUIREMENTS SHALL BE MET BEFORE DOMESTIC METER WILL BE INSTALLED. REFER TO APPROVED PLANS FOR INSTALLATION DETAILS. NO TAP-INS OR CONNECTIONS MAY BE MADE BETWEEN THE DETECTOR CHECK AND THE BACKFLOW PREVENTION ASSEMBLY.
6. INSPECTION OF THE BACKFLOW PREVENTION DEVICE BY GOOCHLAND COUNTY DEPARTMENT OF BUILDING INSPECTIONS IS REQUIRED PRIOR TO INSTALLATION OF DOMESTIC METER.
7. SHUTOFF VALVES FOR THE BACKFLOW PREVENTION DEVICE SHALL BE AS APPROVED BY THE MANUFACTURER OF THE DEVICE.
8. OWNER MUST PAY ALL APPLICABLE CONNECTION FEE(S) AND METER FEE PRIOR TO INSTALLATION OF DOMESTIC METER
9. SIAMESE CONNECTION (FDC) MAY BE LOCATED IN THE SAME VAULT AS BACKFLOW PREVENTION DEVICE WITH RISER EXTENDED THROUGH THE TOP OF THE VAULT.

REVISION DATE:

MARCH 2024

**DOUBLE-CHECK BACKFLOW PREVENTION ASSEMBLY
LOW HAZARD FIRE SYSTEM WITH DETECTOR-CHECK**

FORM NO.

F-13



Linear Utility Project - Erosion & Sediment Control Notes

Underground utility lines shall be installed in accordance with the following standards in addition to all other applicable criteria:

1. No more than 500 linear feet of trench may be opened at one time.
2. Excavated material shall be placed on the uphill side of trenches.
3. Effluent from dewatering operations shall be filtered or passed through an approved sediment trapping device, or both, and discharged in a manner that does not adversely affect flowing streams or off-site property.
4. Material used for backfilling trenches shall be properly compacted in order to minimize erosion and promote stabilization.
5. Soil stabilization shall be accomplished in accordance with the requirements in the *Standards & Specifications of the Department of Public Utilities*, and the *Virginia Erosion and Sediment Control Handbook*.
6. Contractor shall comply with applicable safety regulations at all times.
7. It shall be the Developer's responsibility to inspect all erosion control devices periodically and after every rainfall. Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devices shall be made immediately.
8. No disturbed area will be denuded for more than 14 calendar days.
9. All erosion and siltation measures are to be put in place prior to or as the first step in clearing and grading.
10. All storm and sanitary sewer lines not in streets are to be mulched and seeded immediately after backfilling. No more than five hundred linear feet are to be open at one time.
11. 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.
12. During construction, all storm sewer inlets will be protected by silt traps, maintained and modified as required by construction progress.
13. Temporary seeding will be applied within seven days to denuded areas that may not be at final grade, but which may remain dormant (undisturbed) for longer than thirty days. For temporary seeding use 50% of recommended amounts used for permanent seeding of fertilizer and lime and 100% of required amounts of seed and mulch.
14. All erosion control devices must be installed and maintained in accordance with the latest edition of the *Virginia Erosion and Sediment Control Handbook*.
15. If during construction, additional erosion control devices are found necessary, they shall be installed as directed by the County Engineer.



Linear Utility Project – Stormwater Management Notes

In accordance with **VDEQ Guidance Memo No. 15-2003** (dated 23 April 2015) any linear utility project being constructed without General VPDES Permit Coverage for Stormwater Management, shall be conducted in the following manner:

1. The project will not significantly alter the predevelopment runoff characteristics of the land surface after the completion of construction and final stabilization.
2. The project will be managed so that less than one (1) acre of land disturbance occurs on a daily basis.
3. The disturbed land where work has been completed will be adequately stabilized on a daily basis.
4. The environment will be protected from erosion and sedimentation damage associated with the land-disturbing activity.
5. The engineer and contractor will design, install, implement and maintain pollution prevention measures to:
 - A. Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters.
 - B. Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on-site to precipitation and to stormwater.
 - C. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.
 - D. Prohibit the discharge of wastewater from the washout of concrete.
 - E. Prohibit the discharge of wastewater from the washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials.
 - F. Prohibit the discharge of fuels, oils or other pollutants used in vehicle and equipment operation and maintenance.



Department of Public Utilities

PO Box 119 - 1800 Sandy Hook Road

Goochland, VA 23063

Telephone: (804) 556-5835

Notification of Intent to Discharge to Sanitary Sewer - Part 1

The following information is required with the submission of Utility Plans for a Plan of Development, Land Disturbance Plan 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?:	YES _____ NO _____
Discharge to Begin (Provide Approximate Date): _____	
SIC Code(s) and/or NAICS Code(s), where applicable: _____	
Acct. No.	_____

Describe the Specific Nature of the Business / Reason for Altering Existing Discharge:

Will the Discharge be Domestic Sewage Only? YES _____ NO _____

IF DISCHARGE IS 100% DOMESTIC SEWAGE, STOP HERE AND SIGN THIS FORM. COMPLETE PART 2 IF ANY PORTION OF DISCHARGE WILL BE NON-DOMESTIC.

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 _____

Return this Form to: Goochland County Department of Public Utilities, P.O. Box 119, Goochland, VA 23063



Notification of Intent to Discharge to Sanitary Sewer - Part 2

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

List All Chemicals/Pollutants that will or may be in Proposed Discharge:

Describe any/all Wastewater Pretreatment Methods/Facilities/Devices to be used:

Examples: Grease Traps or Interceptors, Oil/Water Separators, Neutralization Tanks, Chemical Precipitation, etc.

Estimated Wastewater Flows	Existing Discharge (GPD)	Proposed Discharge (GPD)
Restrooms (Domestic):		
Non-Domestic:		
Cooling Tower(s):		

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 _____

Return this Form to: Goochland County Department of Public Utilities, P.O. Box 119, Goochland, VA 23063

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BLK-02	Thrust Blocking Detail for Tees and Plugs
BLK-03	Thrust Blocking Detail for Lower Vertical Bends
BLK-04	Thrust Blocking Detail for Upper Vertical Bends
CAS-01	Specifications & Requirements for Casing Pipes
CAS-02	Casing Detail for Gravity Sewer Lines
CAS-03	Casing Detail for Water Lines & Sewer Force Mains
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DES-01	Standard Symbols for Utility Drawings
G-01	W&S in Subdivision Street 36' FC to FC
G-01	W&S in Subdivision Street 26' FC to FC
TR-01	Trenching and Bedding for Pressure Pipe
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FIR-01a	Typical Fire Hydrant
FIR-01b	Required Clear Area Around Fire Hydrant
FIR-02	Fire Suppression Backflow Assembly in Vault
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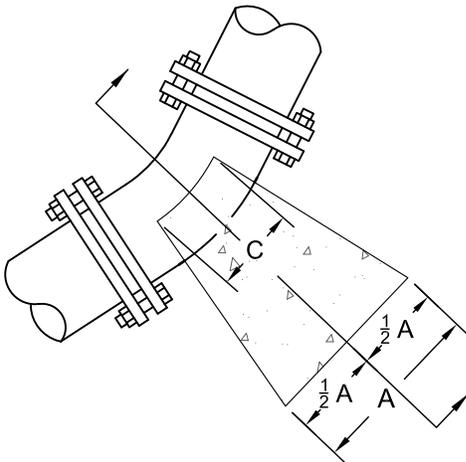
3.5 Sewage Pump Station Details

PS-01	Standard Pump Station – Detail Available Upon Request
PS-02	Emergency Bypass Pump Connection
PS-03	Support for Ultrasonic Level Sensor
PS-04	Pipe Support Type 1
PS-05	Pipe Support Type 2
PS-06	Pipe Support Type 3
PS-07	Link Seal
PS-08	Steel Bollard
PS-09	Cable Holder
PS-10	Force Main Connection to Existing Manhole

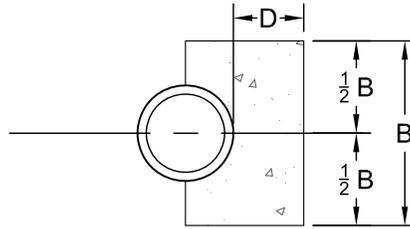
3.1

General Details

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



PLAN



SECTION

MINIMUM DIMENSIONS FOR THRUST BLOCKING AT HORIZONTAL BENDS

PIPE SIZE	11-1/4° BEND				22-1/2° BEND				45° BEND				90° BEND			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
4"	6"	12"	4"	6"	8"	12"	6"	7"	13"	12"	6"	8"	22"	12"	6"	12"
6"	8"	14"	6"	7"	10"	14"	6"	8"	16"	14"	6"	8"	27"	14"	6"	18"
8"	8"	16"	8"	7"	16"	16"	8"	8"	24"	16"	8"	9"	39"	16"	8"	18"
12"	16"	20"	12"	9"	24"	20"	12"	12"	39"	20"	12"	12"	60"	24"	10"	18"
16"	21"	24"	12"	9"	30"	24"	12"	15"	51"	30"	12"	15"	72"	30"	16"	21"
18"	21"	30"	12"	10"	39"	30"	12"	18"	72"	30"	12"	16"	96"	40"	20"	21"
20"	21"	30"	12"	10"	39"	30"	12"	18"	72"	30"	12"	16"	96"	40"	20"	21"
24"	24"	36"	12"	12"	45"	36"	12"	18"	84"	36"	12"	21"	115"	48"	24"	24"
30"	30"	42"	14"	14"	48"	42"	16"	21"	90"	48"	16"	27"	115"	60"	30"	30"

1. CONCRETE STRENGTH SHALL BE 3,000 PSI AT 28 DAYS.
2. DIMENSIONS GIVEN ARE MINIMUMS FOR DESIGN WATER PRESSURE UP TO 150 PSI. WHERE DESIGN PRESSURE EXCEEDS 150 PSI, DIMENSIONS SHALL BE INCREASED PROPORTIONAL TO INCREASE IN DESIGN PRESSURE.
3. ALL BEARING SURFACES SHALL EXTEND TO UNDISTURBED EARTH OR FIRM SUBGRADE.
4. ALL FITTINGS SHALL BE WRAPPED IN 4 MIL POLYETHYLENE TO PROTECT NUTS AND BOLTS.
5. WHERE RESTRAINED JOINT PIPE IS BEING USED AND PIPE DIAMETER IS 12" OR LESS, THRUST BLOCKING IS NOT REQUIRED FOR 11-1/4° OR 22-1/2° HORIZONTAL BENDS.

DATE:
MARCH 2024

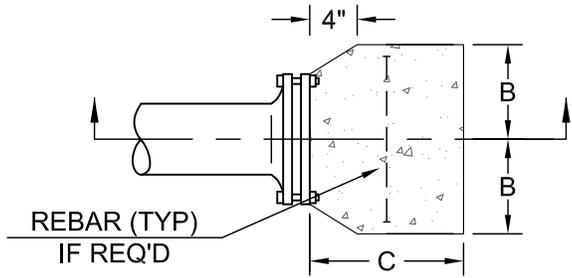
REVISION:

**THRUST BLOCKING DETAIL
FOR HORIZONTAL BENDS**

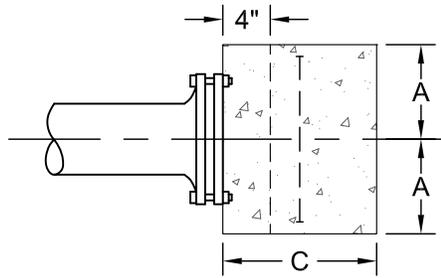
DETAIL

BLK-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



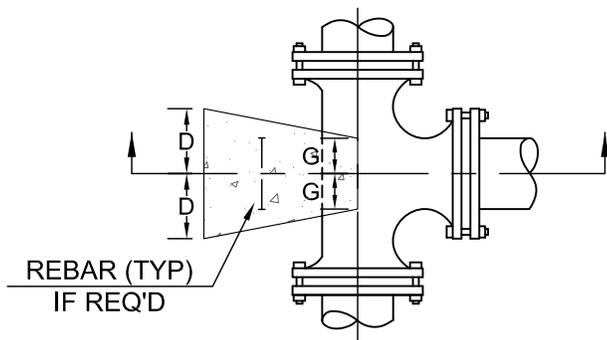
PLAN



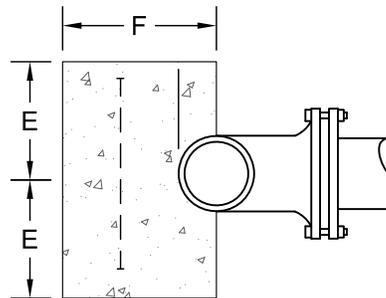
SECTION

MINIMUM DIMENSIONS FOR THRUST BLOCKING AT PLUGS									
DIMENSION	PIPE DIAMETER								
	4"	6"	8"	12"	16"	18"	20"	24"	30"
A	12"	12"	15"	21"	28"	32"	36"	40"	48"
B	6"	6"	9"	15"	20"	22"	24"	30"	40"
C	8"	8"	10"	14"	16"	18"	30"	22"	24"

NOTE: CONCRETE SHALL BE REINFORCED WHEN DIMENSION 'C' IS 16" OR GREATER.



PLAN



SECTION

MINIMUM DIMENSIONS FOR THRUST BLOCKING AT TEES									
DIMENSION	BRANCH DIAMETER								
	4"	6"	8"	12"	16"	18"	20"	24"	30"
D	6"	8"	9"	15"	20"	22"	24"	30"	40"
E	8"	10"	15"	20"	28"	32"	36"	40"	48"
F	6"	8"	9"	12"	14"	16"	18"	20"	24"
G	6"	6"	8"	8"	10"	10"	12"	12"	18"

NOTE: CONCRETE SHALL BE REINFORCED WHEN DIMENSION 'F' IS 16" OR GREATER.

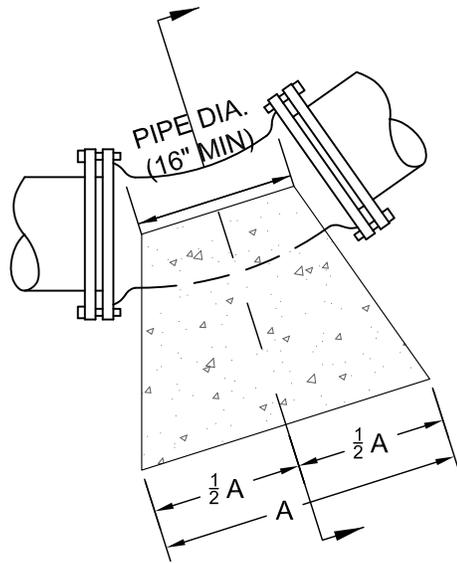
1. CONCRETE STRENGTH SHALL BE 3,000 PSI AT 28 DAYS.
2. DIMENSIONS GIVEN ARE MINIMUMS FOR DESIGN WATER PRESSURE UP TO 150 PSI. WHERE DESIGN PRESSURE EXCEEDS 150 PSI, DIMENSIONS SHALL BE INCREASED PROPORTIONAL TO INCREASE IN DESIGN PRESSURE.
3. ALL BEARING SURFACES SHALL EXTEND TO UNDISTURBED EARTH OR FIRM SUBGRADE.
4. ALL FITTINGS SHALL BE WRAPPED IN 4 MIL POLYETHYLENE TO PROTECT NUTS AND BOLTS.
5. THRUST BLOCKING FOR TAPPING SLEEVE ASSEMBLIES SHALL BE AS FOR COMPARABLY SIZED TEES.

DATE:
MARCH 2024
REVISION:

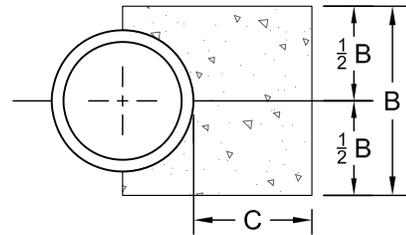
**THRUST BLOCKING DETAIL
FOR TEES AND PLUGS**

DETAIL
BLK-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



ELEVATION



SECTION

MINIMUM DIMENSIONS FOR THRUST BLOCKING AT LOWER VERTICAL BENDS										
BEND		PIPE SIZE								
		4"	6"	8"	12"	16"	18"	20"	24"	30"
11-1/4°	A	6"	6"	8"	8"	13"	17"	18"	22"	32"
	B	12"	14"	16"	24"	28"	32"	32"	36"	40"
	C	8"	8"	8"	8"	9"	10"	12"	12"	14"
22-1/2°	A	6"	10"	11"	16"	25"	33"	38"	43"	39"
	B	12"	14"	16"	24"	28"	32"	33"	36"	38"
	C	8"	8"	8"	9"	12"	14"	15"	16"	18"
45°	A	12"	14"	21"	32"	48"	66"	70"	72"	98"
	B	12"	14"	16"	24"	30"	32"	36"	42"	48"
	C	8"	8"	8"	14"	18"	24"	24"	30"	36"

1. CONCRETE STRENGTH SHALL BE 3,000 PSI AT 28 DAYS.
2. DIMENSIONS OF BLOCKING ARE MINIMUMS FOR DESIGN WATER PRESSURE UP TO 150 PSI.
3. WHERE DESIGN PRESSURE EXCEEDS 150 PSI, BLOCK DIMENSIONS SHALL BE INCREASED PROPORTIONALLY WITH INCREASE IN DESIGN PRESSURE.
4. ALL BEARING SURFACES SHALL EXTEND TO UNDISTURBED EARTH OR FIRM SUBGRADE.
5. ALL FITTINGS SHALL BE WRAPPED IN 4 MIL POLYETHYLENE TO PROTECT NUTS AND BOLTS.
6. 90° VERTICAL BENDS ARE NOT PERMITTED.

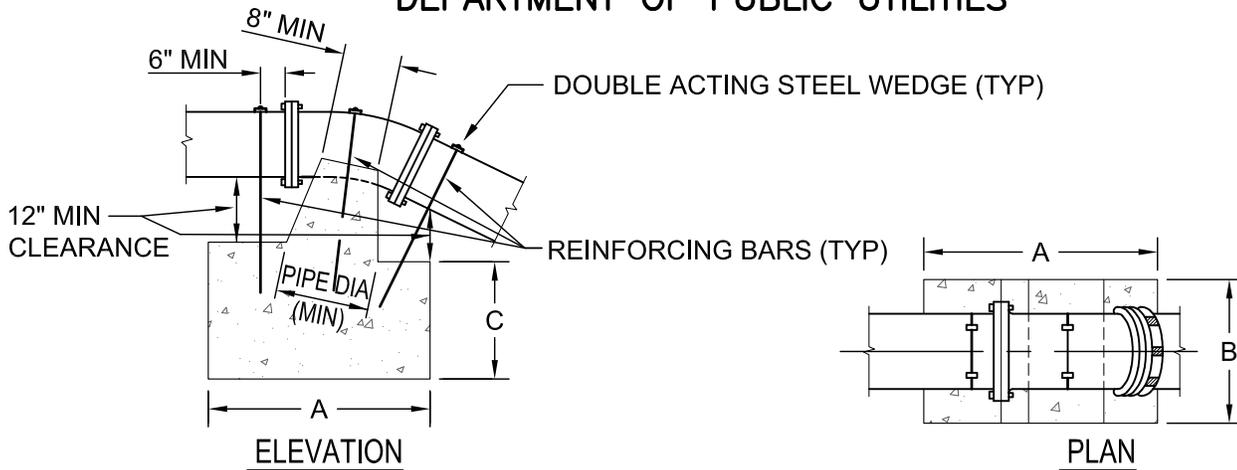
DATE:
MARCH 2024

REVISION:

**THRUST BLOCKING DETAIL
FOR LOWER VERTICAL BENDS**

DETAIL
BLK-03

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



DIMENSIONS & REINFORCEMENT FOR THRUST BLOCKING AT UPPER VERTICAL BENDS										
BEND		PIPE SIZE								
		4"	6"	8"	12"	16"	18"	20"	24"	30"
11-1/4°	A	18"	24"	24"	30"	39"	42"	48"	54"	60"
	B	18"	24"	24"	30"	39"	42"	48"	54"	60"
	C	18"	18"	24"	27"	30"	30"	30"	36"	36"
	REINF BAR NO., SIZE	3, #5	3, #5	3, #6	3, #6	3, #6	3, #8	3, #8	3, #10	3, #10
22-1/2°	A	24"	30"	33"	48"	54"	60"	66"	72"	84"
	B	24"	30"	33"	48"	54"	60"	66"	72"	84"
	C	18"	24"	27"	30"	36"	42"	42"	48"	54"
	REINF BAR NO., SIZE	3, #5	3, #5	3, #6	4, #6	4, #6	3, #8	3, #8	4, #10	4, #10
45°	A	30"	36"	42"	54"	72"	84"	90"	102"	120"
	B	30"	36"	42"	54"	72"	84"	90"	102"	120"
	C	24"	24"	30"	36"	42"	42"	48"	54"	60"
	REINF BAR NO., SIZE	3, #5	3, #5	3, #5	4, #6	4, #8	4, #8	4, #8	4, #10	4, #10

1. CONCRETE STRENGTH SHALL BE 3,000 PSI AT 28 DAYS.
2. DIMENSIONS GIVEN ARE MINIMUMS FOR DESIGN WATER PRESSURE UP TO 150 PSI. WHERE DESIGN PRESSURE EXCEEDS 150 PSI, DIMENSIONS SHALL BE INCREASED PROPORTIONAL TO INCREASE IN DESIGN PRESSURE.
3. ALL BEARING SURFACES SHALL EXTEND TO UNDISTURBED EARTH OR FIRM SUBGRADE.
4. ALL FITTINGS SHALL BE WRAPPED IN 4 MIL POLYETHYLENE TO PROTECT NUTS AND BOLTS.
5. CONCRETE SHALL BE REINFORCED WHEN DIMENSION 'L' IS 16" OR GREATER
6. REINFORCING BARS SHALL BE HOOKED AT EACH END AND EMBEDDED MIN. 8" INTO CONCRETE. EXPOSED REBAR SHALL BE PAINTED WITH TWO COATS OF BITUMINOUS PAINT.
7. WHERE 3 BARS ARE USED, THEY SHALL BE ARRANGED AS SHOWN ON ABOVE DETAIL.
8. WHERE 4 BARS ARE REQUIRED, OUTER PAIR SHALL BE ARRANGED AS SHOWN IN ABOVE WHILE INNER PAIR SHALL BE LOCATED ON THE FITTING, EQUIDISTANT FROM ITS MIDDLE.
9. 90° VERTICAL BENDS ARE NOT PERMITTED.

DATE:
MARCH 2024

REVISION:

**THRUST BLOCKING DETAIL
FOR UPPER VERTICAL BENDS**

DETAIL
BLK-04

**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"	0.500"	0.500"
8"	20"	0.500"	0.500"
10"	20"	0.500"	0.500"
12"	24"	0.500"	0.500"
15"	24"	0.500"	0.500"
16"	30"	0.500"	0.500"
18"	30"	0.500"	0.500"
20"	30"	0.500"	0.500"
21"	30"	0.500"	0.500"
24"	36"	0.563"	0.500"
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 A139, GRADE B.

NOTES:

1. FOR GRAVITY SEWERS, SLOPES THROUGH CASINGS SHALL NOT BE BASED ON MINIMUM GRADE WITHOUT APPROVAL FROM DPU.
2. WHEN USING STEEL CASING, A MINIMUM OF 0.500" THICKNESS IS REQUIRED WHERE GROUND COVER OVER PIPE EXCEEDS 15'.
3. CONTRACTOR SHALL MAKE AN EFFORT TO BORE IN THE APPROPRIATE DIRECTION BASED ON EXISTING SOIL CONDITIONS.
4. ENGINEER MUST SHOW LOCATION AND SIZE OF BORE AND RECOVERY PITS, AND LOCATION AND SIZE OF PERMANENT AND CONSTRUCTION EASEMENT, ON THE PLANS.
5. WHERE RESTRAINING DEVICES ARE REQUIRED FOR THE CARRIER PIPE, THE CASING PIPE SHALL BE INCREASED PROPORTIONALLY TO INCREASE IN OUTSIDE DIAMETER..
6. MINIMUM CASING DIAMETER SHALL PROVIDE A MINIMUM CLEARANCE OF 4" ALL AROUND JOINT RESTRAINTS HARDWARE.
7. WORK WITHIN RAILROAD RIGHT OF WAY MUST BE PERMITTED THROUGH THE RIGHT OF WAY OWNER

DATE:
MARCH 2024

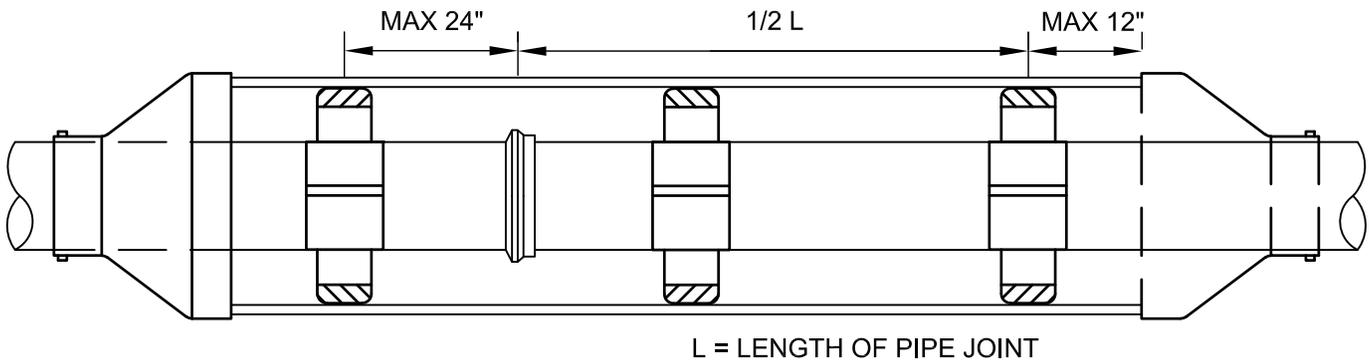
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**SPECIFICATIONS & REQUIREMENTS
FOR CASING PIPES**

DETAIL

CAS-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. GRAVITY SEWER CASING PIPE SHALL NOT BE INSTALLED AT MINIMUM SLOPE.
2. 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.
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 THE PIPE CASING.
5. CARRIER PIPE SHALL BE POSITIONED AND RESTRAINED WITHIN CASING TO COMPLY WITH GRADE REQUIREMENTS BY AN APPROVED STAINLESS STEEL CASING SPACER.
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. PROVIDE COATING WHERE REQUIRED.
7. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
8. STEEL CASING PIPE SHALL BE ASTM-A139, GRADE B. WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI.
9. CARRIER PIPE WITHIN CASING FOR SANITARY SEWER INSTALLATION SHALL BE FULLY RESTRAINED DUCTILE IRON (CLASS 52) AND IS TO BE USED FROM MANHOLE TO MANHOLE.
10. CASING SHALL BE SEALED BY USE OF WRAPAROUND END SEALS.
11. MANHOLES SHALL BE LOCATED AT LEAST 30' FROM EACH END OF THE CASING, OR AS APPROVED BY THE COUNTY.

DATE:
MARCH 2024

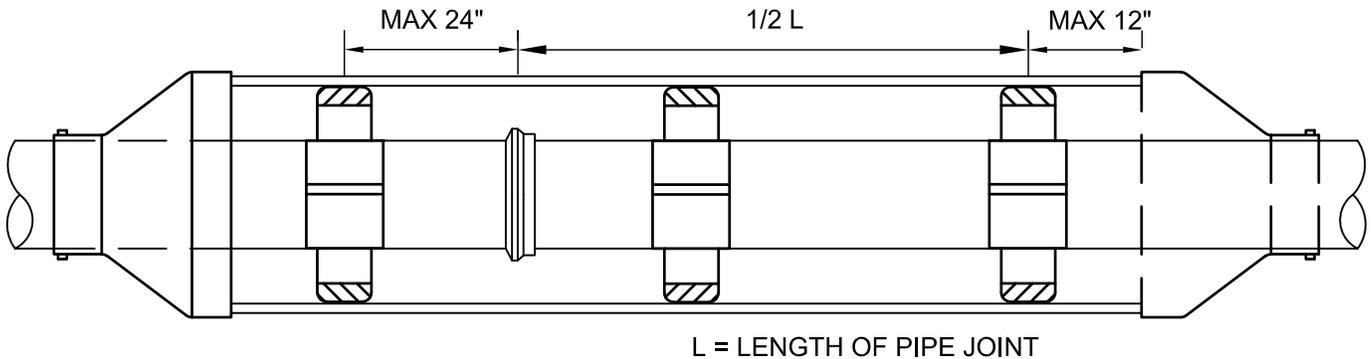
REVISION:

**CASING DETAIL FOR
GRAVITY SEWER LINES**

DETAIL

CAS-02

**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. PROVIDE COATING WHERE REQUIRED.
7. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
8. STEEL CASING PIPE SHALL BE ASTM A139, 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.

DATE:
MARCH 2024

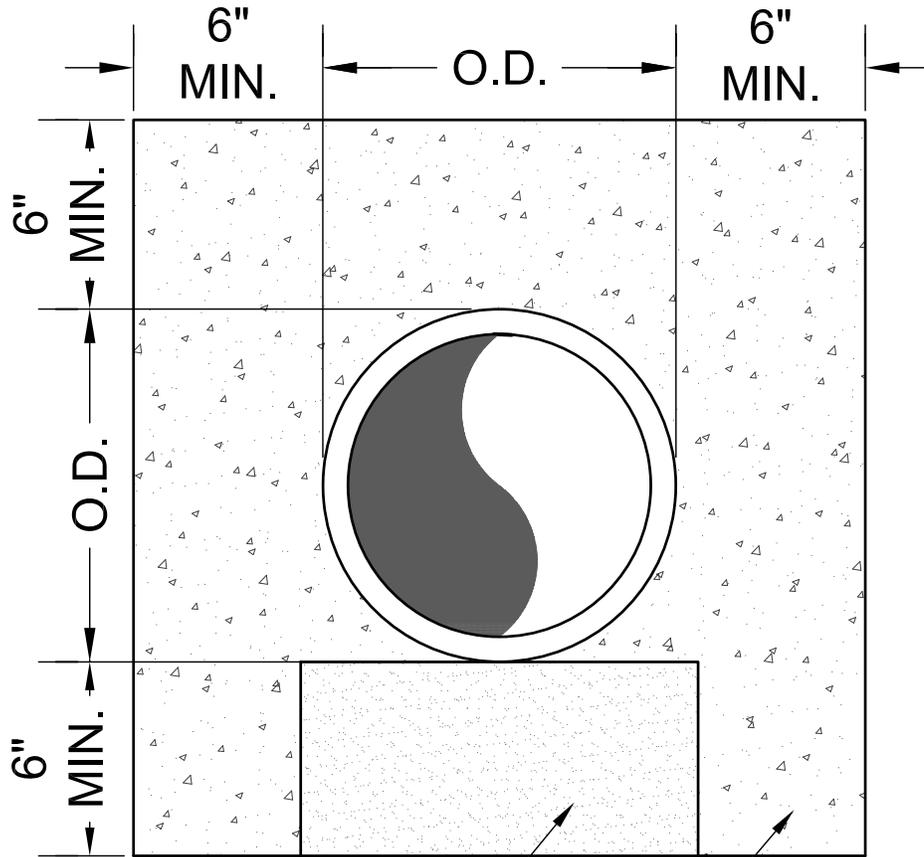
REVISION:

**CASING DETAIL FOR
WATER LINES & SEWER FORCE MAINS**

DETAIL

CAS-03

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



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

CONCRETE

NOTES:

1. CONCRETE ENCASEMENTS SHALL BE FORMED, AND THE WORK INSPECTED BY DPU, PRIOR TO PLACING CONCRETE AND PRIOR BACKFILLING.
2. AT STREAM CROSSINGS, ENCASEMENT SHALL EXTEND A MINIMUM OF TEN FEET (10') ON EITHER SIDE OF THE CROSSING.
3. CONCRETE SHALL BE 3,000 PDI STRENGTH AT 28 DAYS.

DATE:
MARCH 2024

REVISION:

PIPE ENCASEMENT DETAIL

DETAIL

CAS-04

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC 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		
FIRE HYDRANT		
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		

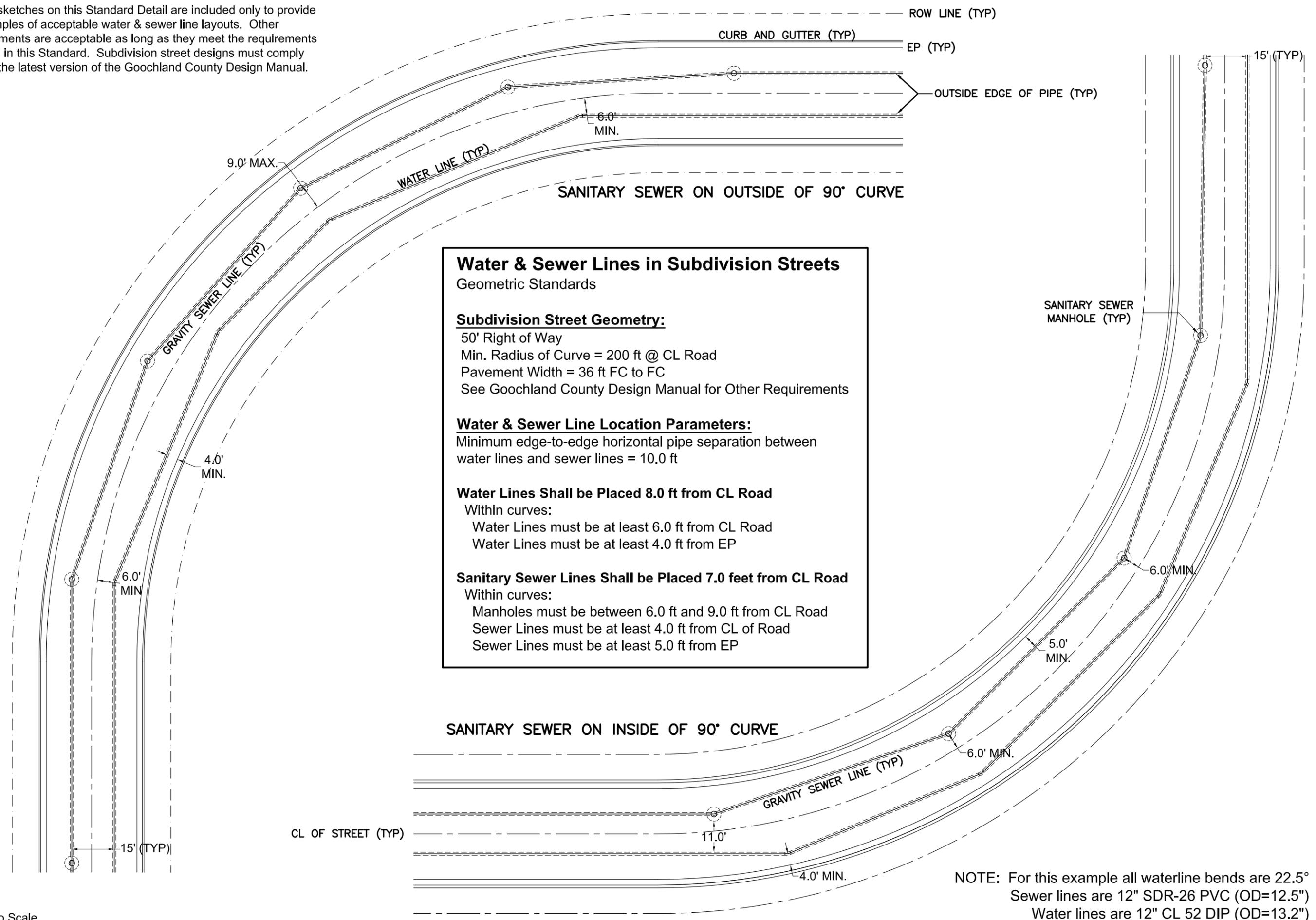
DATE:
MARCH 2024

REVISION:

STANDARD SYMBOLS FOR UTILITY DRAWINGS

DETAIL
DES-01

The sketches on this Standard Detail are included only to provide examples of acceptable water & sewer line layouts. Other alignments are acceptable as long as they meet the requirements listed in this Standard. Subdivision street designs must comply with the latest version of the Goochland County Design Manual.



Water & Sewer Lines in Subdivision Streets
Geometric Standards

Subdivision Street Geometry:
 50' Right of Way
 Min. Radius of Curve = 200 ft @ CL Road
 Pavement Width = 36 ft FC to FC
 See Goochland County Design Manual for Other Requirements

Water & Sewer Line Location Parameters:
 Minimum edge-to-edge horizontal pipe separation between water lines and sewer lines = 10.0 ft

Water Lines Shall be Placed 8.0 ft from CL Road
 Within curves:
 Water Lines must be at least 6.0 ft from CL Road
 Water Lines must be at least 4.0 ft from EP

Sanitary Sewer Lines Shall be Placed 7.0 feet from CL Road
 Within curves:
 Manholes must be between 6.0 ft and 9.0 ft from CL Road
 Sewer Lines must be at least 4.0 ft from CL of Road
 Sewer Lines must be at least 5.0 ft from EP

NOTE: For this example all waterline bends are 22.5°
 Sewer lines are 12" SDR-26 PVC (OD=12.5")
 Water lines are 12" CL 52 DIP (OD=13.2")

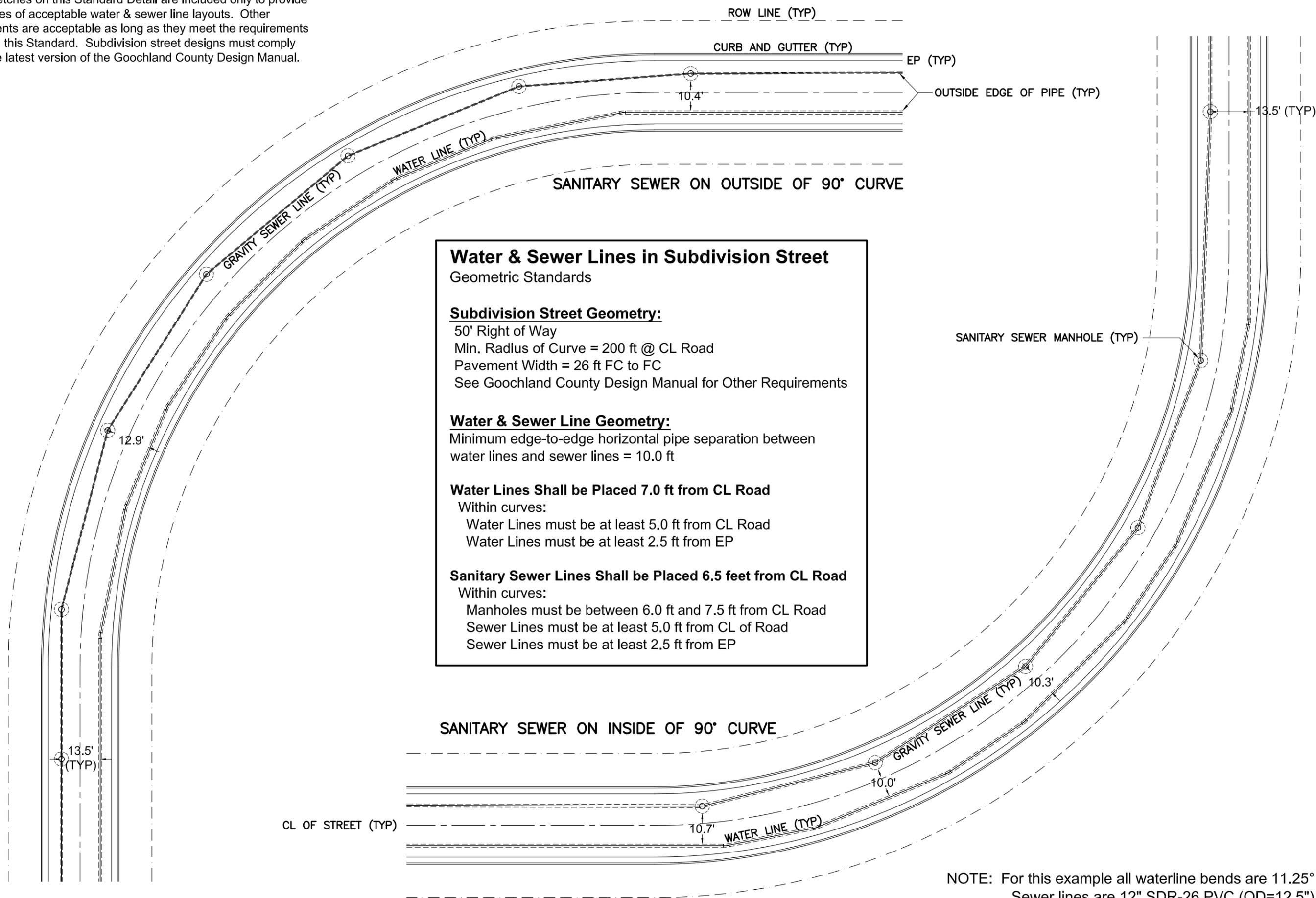
Not to Scale

DETAIL NO.
G-01

GEOMETRY FOR WATER AND SEWER LINES IN SUBDIVISION STREET
 ROW WIDTH = 56 FT - ROAD WIDTH = 36' FC to FC

DATE: MARCH 2024
 REVISION:

The sketches on this Standard Detail are included only to provide examples of acceptable water & sewer line layouts. Other alignments are acceptable as long as they meet the requirements listed in this Standard. Subdivision street designs must comply with the latest version of the Gochland County Design Manual.



Water & Sewer Lines in Subdivision Street
Geometric Standards

Subdivision Street Geometry:
50' Right of Way
Min. Radius of Curve = 200 ft @ CL Road
Pavement Width = 26 ft FC to FC
See Gochland County Design Manual for Other Requirements

Water & Sewer Line Geometry:
Minimum edge-to-edge horizontal pipe separation between water lines and sewer lines = 10.0 ft

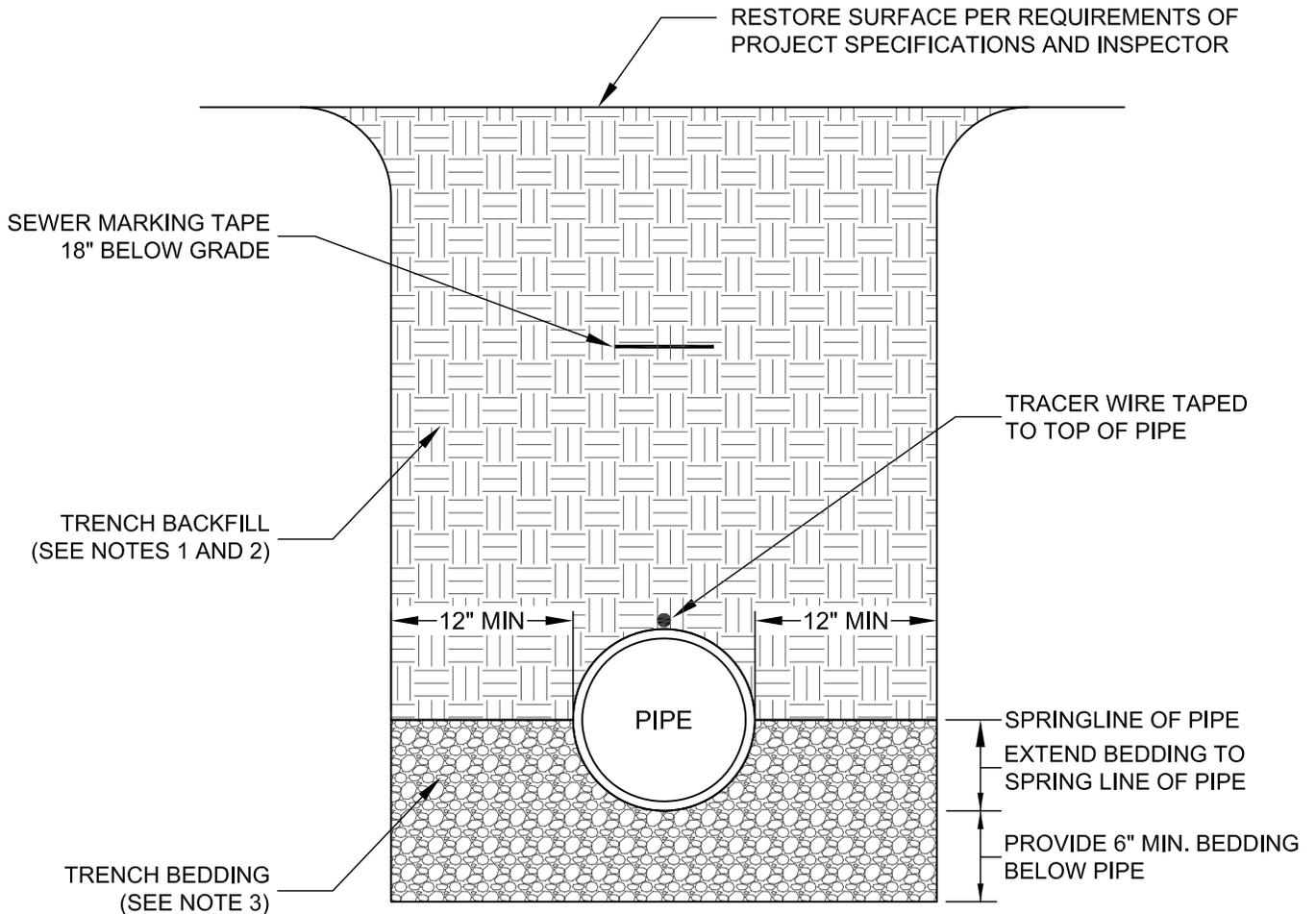
Water Lines Shall be Placed 7.0 ft from CL Road
Within curves:
Water Lines must be at least 5.0 ft from CL Road
Water Lines must be at least 2.5 ft from EP

Sanitary Sewer Lines Shall be Placed 6.5 feet from CL Road
Within curves:
Manholes must be between 6.0 ft and 7.5 ft from CL Road
Sewer Lines must be at least 5.0 ft from CL of Road
Sewer Lines must be at least 2.5 ft from EP

NOTE: For this example all waterline bends are 11.25°
Sewer lines are 12" SDR-26 PVC (OD=12.5")
Water lines are 12" CL 52 DIP (OD=13.2")

Not to Scale

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. IN UNPAVED AREAS, BACKFILL TRENCH WITH CLEAN EARTH FILL COMPACTED TO 90% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 12" LIFTS.
2. IN PAVED AREAS AND ROAD SHOULDERS, BACKFILL TRENCH WITH SELECT FILL COMPACTED TO 95% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 6" LIFTS.
3. TRENCH BEDDING SHALL BE COURSE AGGREGATE OR SELECT FILL COMPACTED TO 95% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 6" LIFTS.
4. DETAILS AND SPECIFICATIONS FOR CONCRETE ENCASEMENT, WHERE PERMITTED BY THE DEPARTMENT, SHALL BE PROVIDED ON THE DESIGN DRAWINGS.

DATE:
MARCH 2024

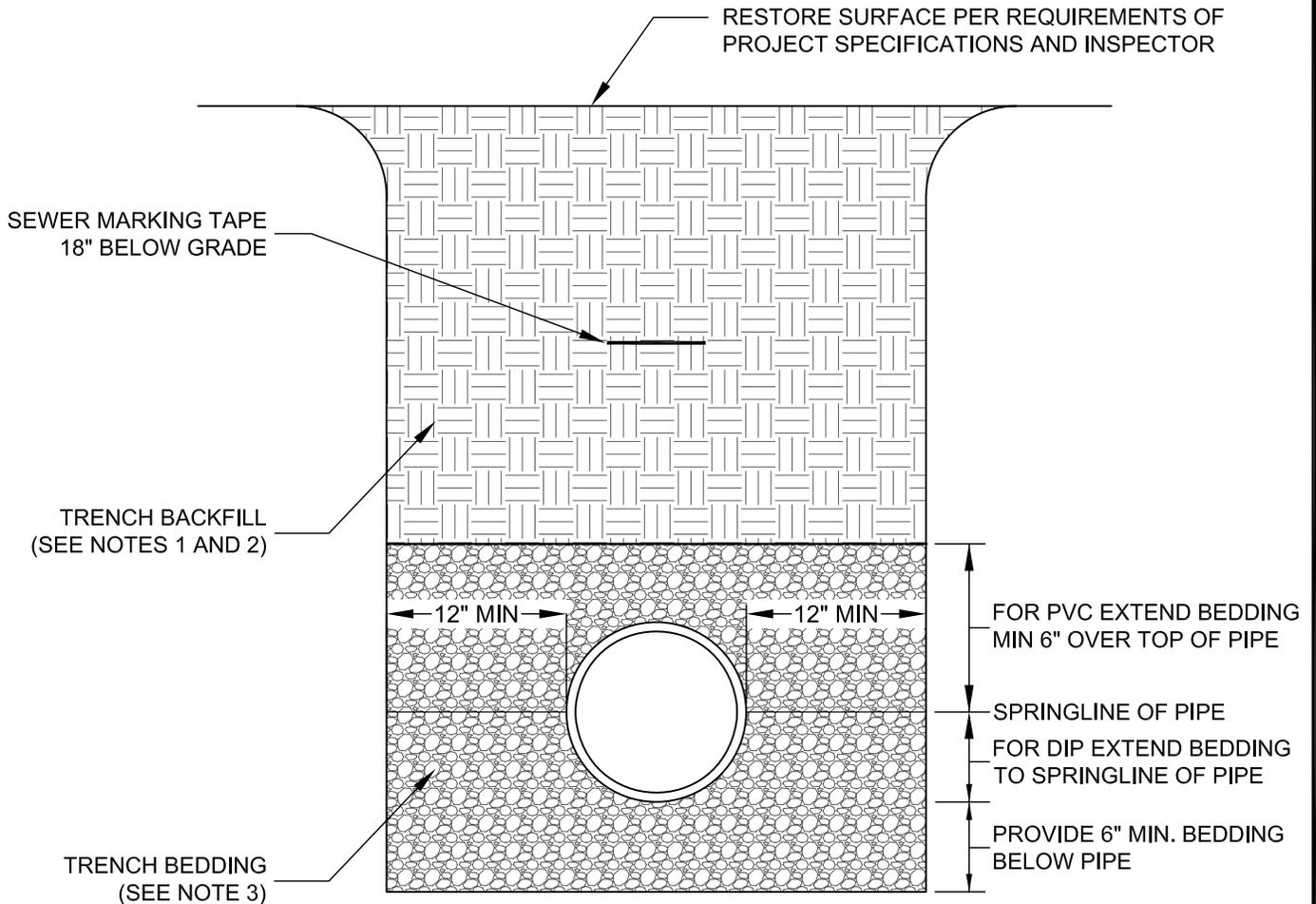
REVISION:

**TRENCHING AND BEDDING
FOR PRESSURE PIPE**

DETAIL

TR-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

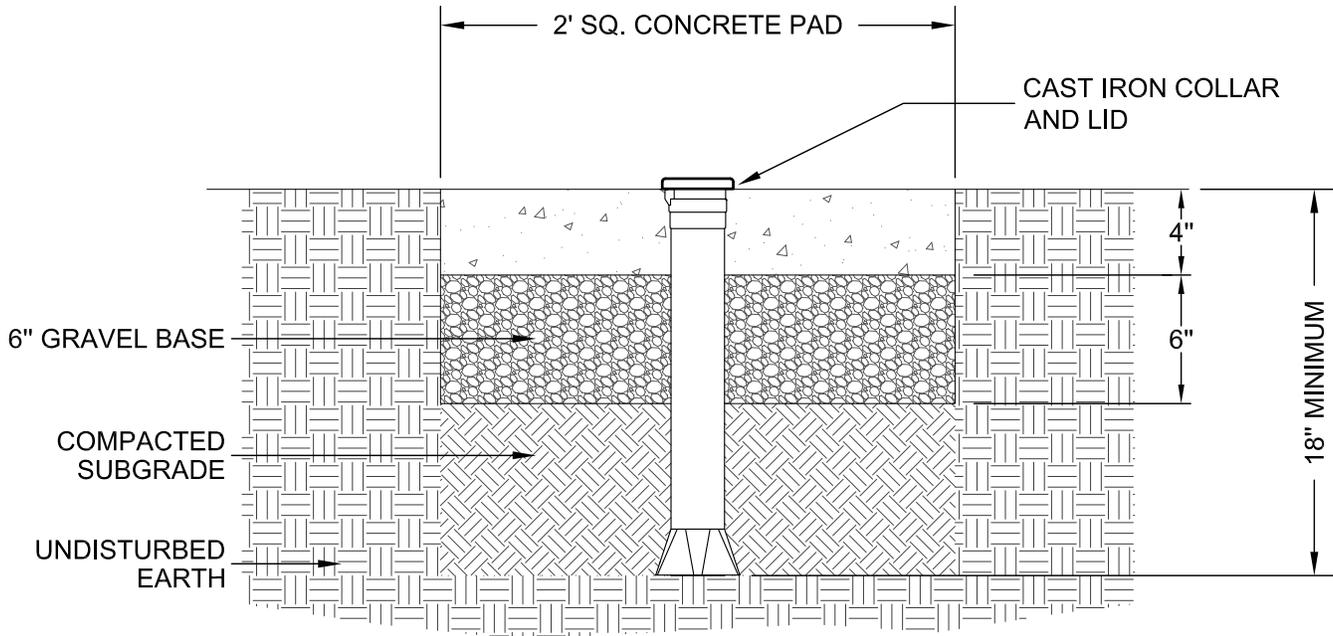
1. IN UNPAVED AREAS, BACKFILL TRENCH WITH CLEAN EARTH FILL COMPACTED TO 90% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 12" LIFTS.
2. IN PAVED AREAS AND ROAD SHOULDERS, BACKFILL TRENCH WITH SELECT FILL COMPACTED TO 95% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 6" LIFTS.
3. TRENCH BEDDING SHALL BE COURSE AGGREGATE COMPACTED TO 95% MAXIMUM DENSITY PER ASTM D698, MAXIMUM 6" LIFTS.
4. DETAILS AND SPECIFICATIONS FOR CONCRETE ENCASEMENT, WHERE PERMITTED BY THE DEPARTMENT, SHALL BE PROVIDED ON THE DESIGN DRAWINGS.

DATE: MARCH 2024
REVISION:

**TRENCHING AND BEDDING FOR
GRAVITY SEWER PIPE**

DETAIL
TR-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



**TYPICAL TEST STATION ACCESS BOX INSTALLATION
FOR WATER LINES AND FORCE MAINS**

1. TRACER WIRE ACCESS BOXES SHALL BE 2-1/2" SIZE WITH CAST IRON RIM AND LID, FLARED BOTTOM, MINIMUM 18" LENGTH, AT LEAST TWO TERMINALS, AND SHALL BE BINGHAM & TAYLOR P-200 TEST, COPPERHEAD INDUSTRIES SNAKEPIT LD, OR APPROVED EQUAL.
2. FOR WATER LINES, ONE TRACER WIRE ACCESS BOX SHALL BE INSTALLED ADJACENT TO EACH FIRE HYDRANT AT TIME OF CONSTRUCTION.
3. FOR FORCE MAINS, A TRACER WIRE ACCESS BOX SHALL BE PLACED AT EACH BEND AND AT MINIMUM SPACING OF 1,000 FEET ALONG THE PIPE.
4. LID TO BE OPENED USING AWWA PENTAGON KEY.
5. LID SHALL BE BLUE IN COLOR AND SHALL BE MARKED "WATER".OR "TEST".
6. CONCRETE FOR PAD SHALL BE 3,000 PSI AT 28 DAYS.
7. TRACER WIRE ACCESS BOXES ADJACENT TO FIRE HYDRANTS DO NOT REQUIRE A CONCRETE PAD.

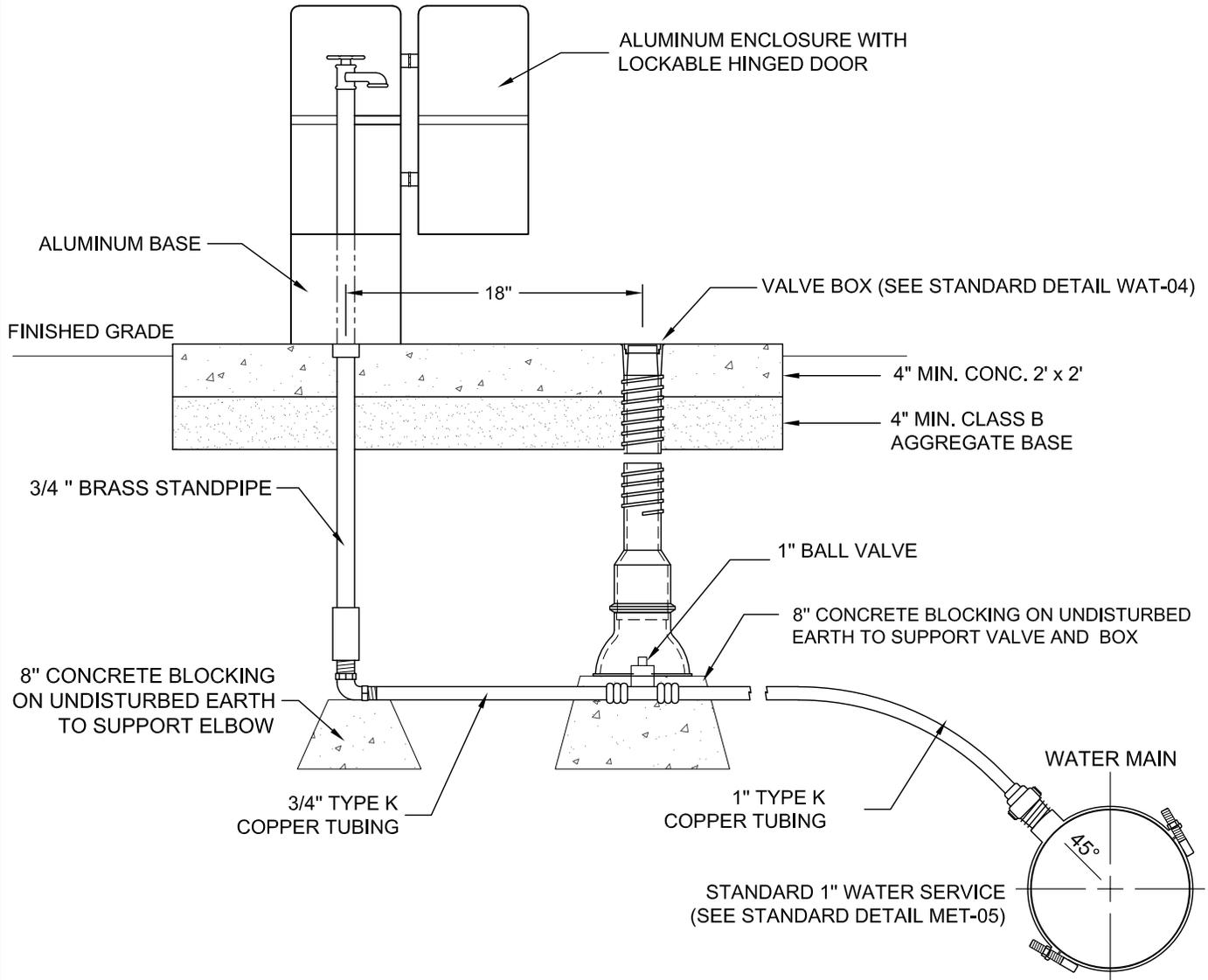
DATE:
MARCH 2024

REVISION:

**TRACER WIRE ACCESS BOX FOR
WATER LINES AND FORCE MAINS**

DETAIL
TST-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. DESIGN COVER FOR PIPING TO SAMPLING STATION SHALL BE 42". BACKFILL PIPING AS SPECIFIED ON STANDARD DETAIL MET-05.
2. PROVIDE 4" THICK WIRE MESH-REINFORCED CONCRETE PAD EXTENDING MINIMUM 6" FROM ALL SIDES OF SAMPLING STATION AND VALVE BOX.
3. ALL STATIONS SHALL BE ENCLOSED IN A LOCKABLE, NON-REMOVABLE, ALUMINUM HOUSING.
4. STATION SHALL PROVIDE ALL BRASS WATERWAY AND NOZZLE SHALL BE UNTHREADED.
5. ALL WORKING PARTS SHALL BE BRASS AND SHALL BE REMOVABLE FROM ABOVE GROUND WITH NO DIGGING.
6. SAMPLING STATION SHALL BE ECLIPSE #88, MUELLER HYDRO-GUARD, OR APPROVED EQUAL.

DATE:
MARCH 2024

REVISION:

BACT-T SAMPLING STATION

DETAIL
TST-02

3.2

Sewer Details

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

FOR USE WITH STANDARD PRE-CAST MANHOLES (SEE DETAIL MAN-02)

		PIPE SIZE (IN)									
		4	6	8	10	12	15	18	21	24	
MANHOLE DIAMETER (IN)	48	PIPE SIZE (IN) 4	36	40	41	44	46	51			
		6		43	45	47	50	54			
		8			46	49	51	56			
		10				51	53	58			
		12					56	60			
	15						65				
	60	PIPE SIZE (IN) 4	29	32	33	35	37	41	45	47	50
		6	32	35	36	38	40	44	47	49	53
		8	33	36	37	39	41	45	49	51	54
		12					45	48	52	54	58
15							52	56	58	62	
18								60	62	66	
21									64	68	
24									72		

FOR USE WITH TYPE 1, TYPE 2 AND TYPE 3 MANHOLES (SEE DETAILS MAN-05, MAN-06, AND MAN-07)

		PIPE SIZE (IN)													
		8	10	12	15	18	21	24	27	30	33	36	42	48	
MANHOLE DIAMETER (IN)	72	PIPE SIZE (IN) 12	34	36	37	40	44	45	49	50	53	55	58		
		15	37	39	40	44	47	48	52	53	56	58	61		
		18					50	52	55	56	60	61	64		
		21						53	57	58	61	63	66		
		24							60	61	64	66	69		
		27								63	66	68	71		
		30									69	71	74		
		33										72	76		
	36											79			
	84	PIPE SIZE (IN) 12	29	31	32	35	38	39	42	43	46	47	50	54	58
		15	32	33	35	37	40	42	44	46	48	50	53	57	61
		18	35	36	38	40	43	44	47	48	51	53	55	59	63
		21						46	49	50	53	54	57	61	65
		24							51	53	55	57	59	64	68
		27								54	57	58	61	65	69
		30									59	61	64	68	72
33											62	65	69	73	
36											68	72	76		
42												76	80		
48													84		
96	54	53	54	55	58	60	61	64	65	67	69	71	75	78	

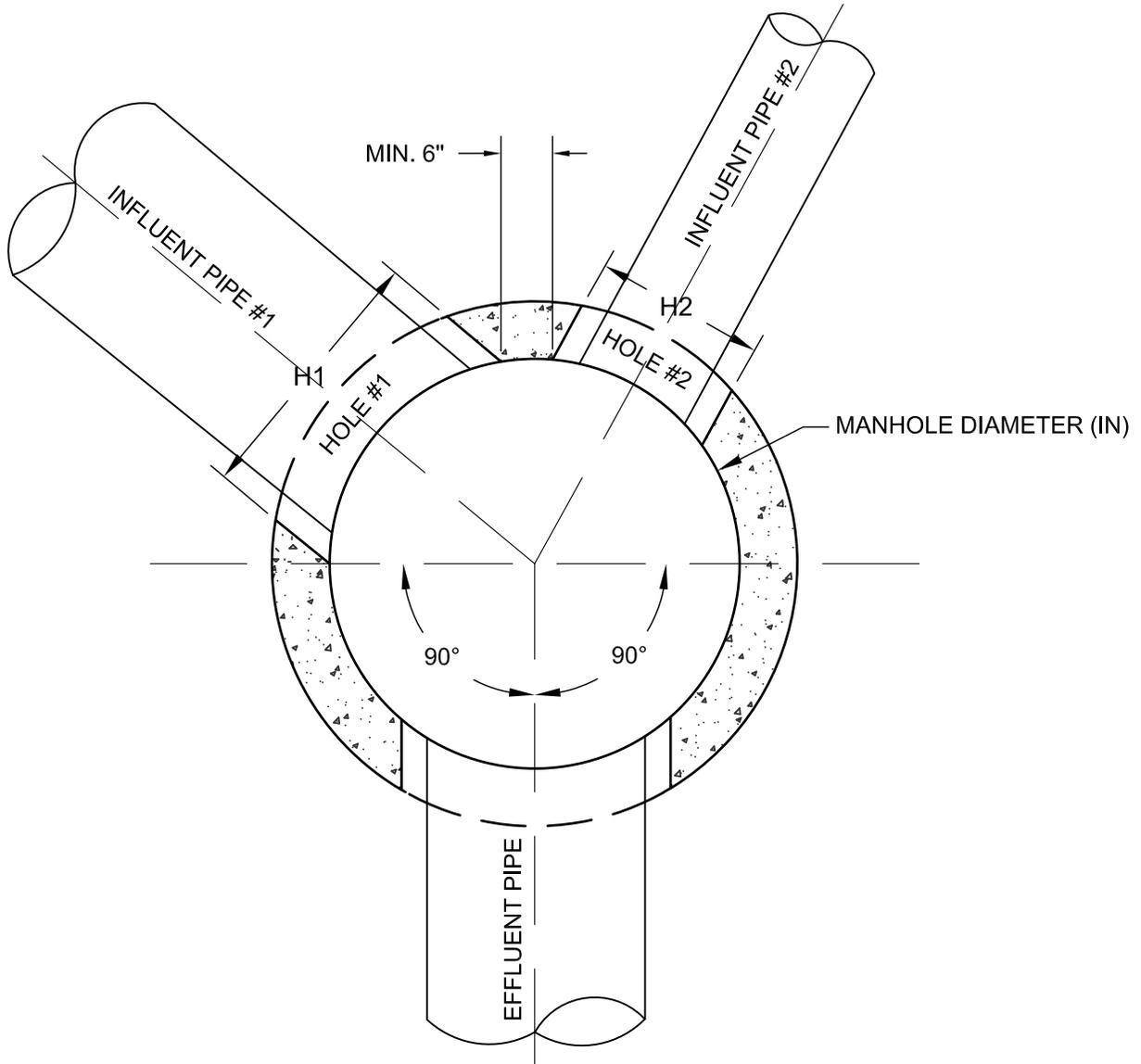
1. MINIMUM ANGLES ARE BASED ON HOLE SIZES FOR KOR-N-SEAL STAINLESS STEEL WEDGE CONNECTORS
2. FOR CONDITIONS OTHER THAN ABOVE, MINIMUM ANGLES SHALL BE CALCULATED USING ACTUAL HOLE SIZES AND THE FORMULA INCLUDED ON STANDARD DETAIL MAN-01b
3. 4" AND 6" PIPES ARE FOR SERVICE LATERALS ONLY. SERVICE LATERALS SHALL NOT BE CONNECTED TO MANHOLES LARGER THAN 60" WITHOUT SPECIFIC APPROVAL FROM DPU
4. THE MINIMUM ALLOWABLE ANGLE BETWEEN AN EFFLUENT PIPE AND ANY INFLUENT PIPE IS 90°

DATE:
MARCH 2024
REVISION:

**SANITARY SEWER MANHOLE SIZING AND
MINIMUM ANGLES BETWEEN INFLUENT PIPES**

DETAIL
MAN-01a

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



$\text{MINIMUM ANGLE (DEG)} = \frac{(H1/2 + H2/2 + 7) * 360}{\pi * \text{MH DIAM (INCHES)}}$	Where: H1 = Diameter of Hole #1 (IN) H2 = Diameter of Hole #2 (IN)
--	--

1. THE ANGLE TABLES ON STANDARD DETAIL MAN-01a ARE FOR USE ONLY WITH KOR-N-SEAL STAINLESS STEEL WEDGE CONNECTORS
2. FOR OTHER CONNECTORS USE THE ABOVE FORMULA TO CALCULATE MINIMUM ANGLES BASED ON ACTUAL HOLE SIZES
3. MINIMUM ALLOWABLE ANGLE BETWEEN EFFLUENT PIPE AND ANY INFLUENT PIPE IS 90°

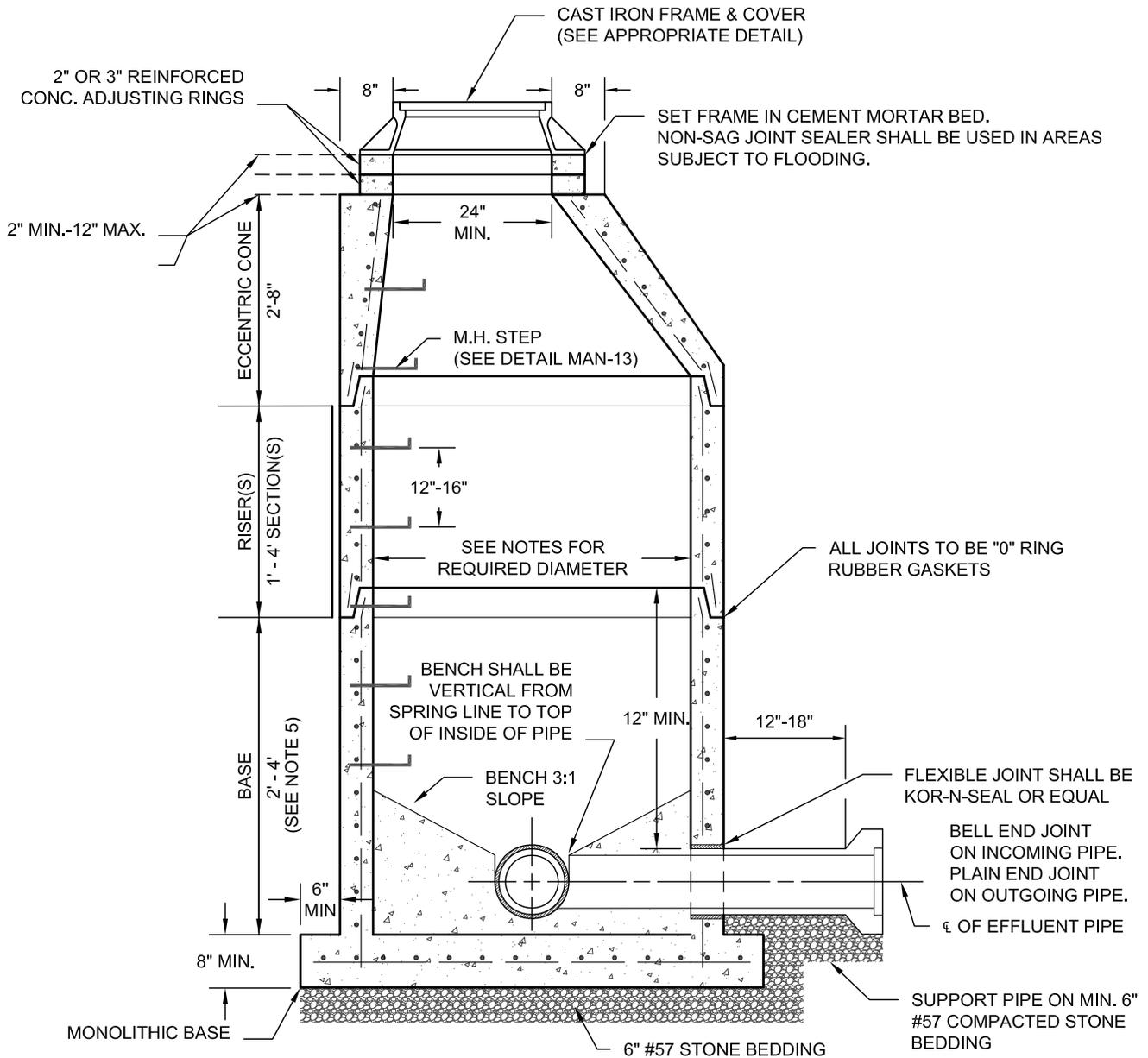
DATE:
MARCH 2024

REVISION:

**SANITARY SEWER MANHOLE
MINIMUM ANGLE CALCULATIONS**

DETAIL
MAN-01b

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

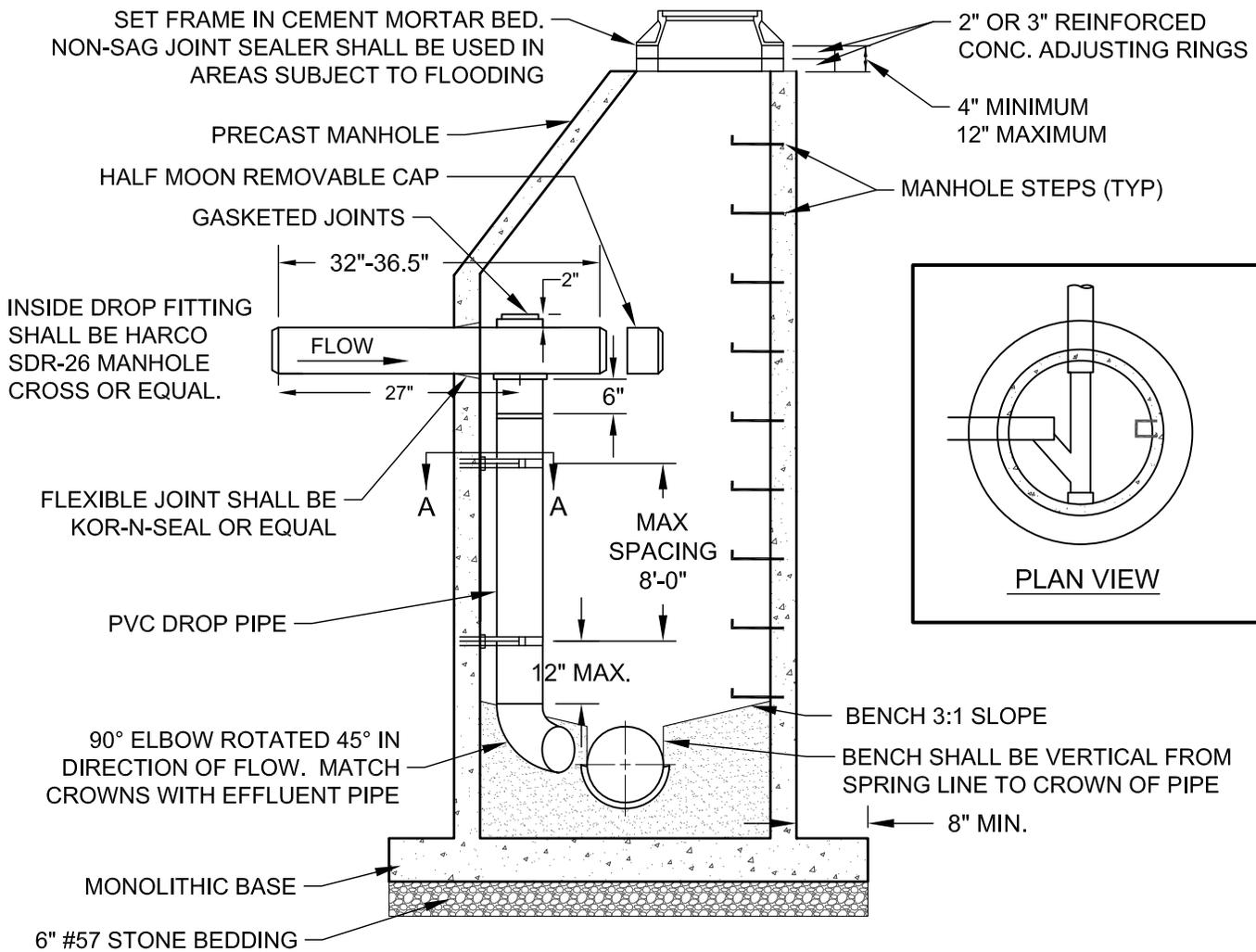
1. MANHOLES SHALL BE PRE-CAST CONCRETE.
2. BENCH SHALL BE CONCRETE.
3. MANHOLE STEPS SHALL BE AT LEAST 90° FROM OUTLET PIPE.
4. MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPECIFICATION C-478.
5. DROP BETWEEN INLET PIPE INVERT(S) AND OUTLET PIPE INVERT SHALL BE AS SHOW ON PLANS, BUT NOT LESS THAN 0.10 FT
6. THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 48" DIAMETER MANHOLE IS 15".
7. THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 60" DIAMETER MANHOLE IS 24".
8. FOR PIPE SIZES LARGER THAN 24" USE TYPE 1, 2, OR 3 MANHOLE.

DATE:
MARCH 2024
REVISION:

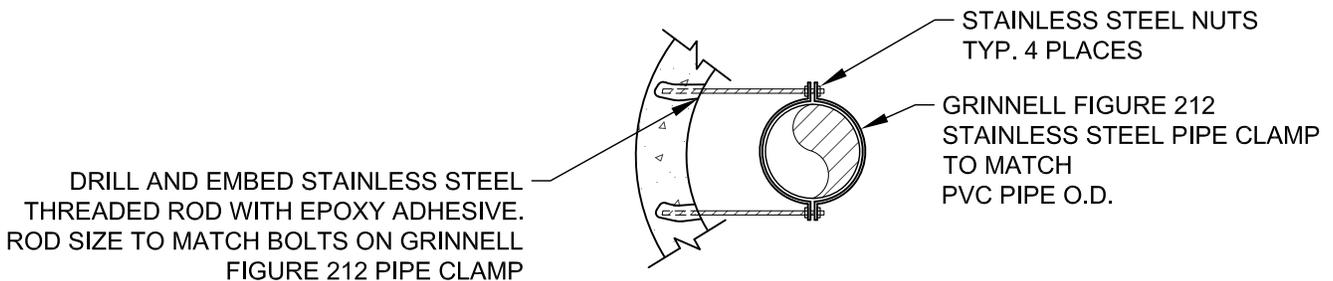
**PRECAST CONCRETE MANHOLE
FOR SEWER LINES UP TO 15"**

DETAIL
MAN-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



INSIDE DROP MANHOLE SHALL BE MINIMUM 60" DIAMETER



SECTION A-A

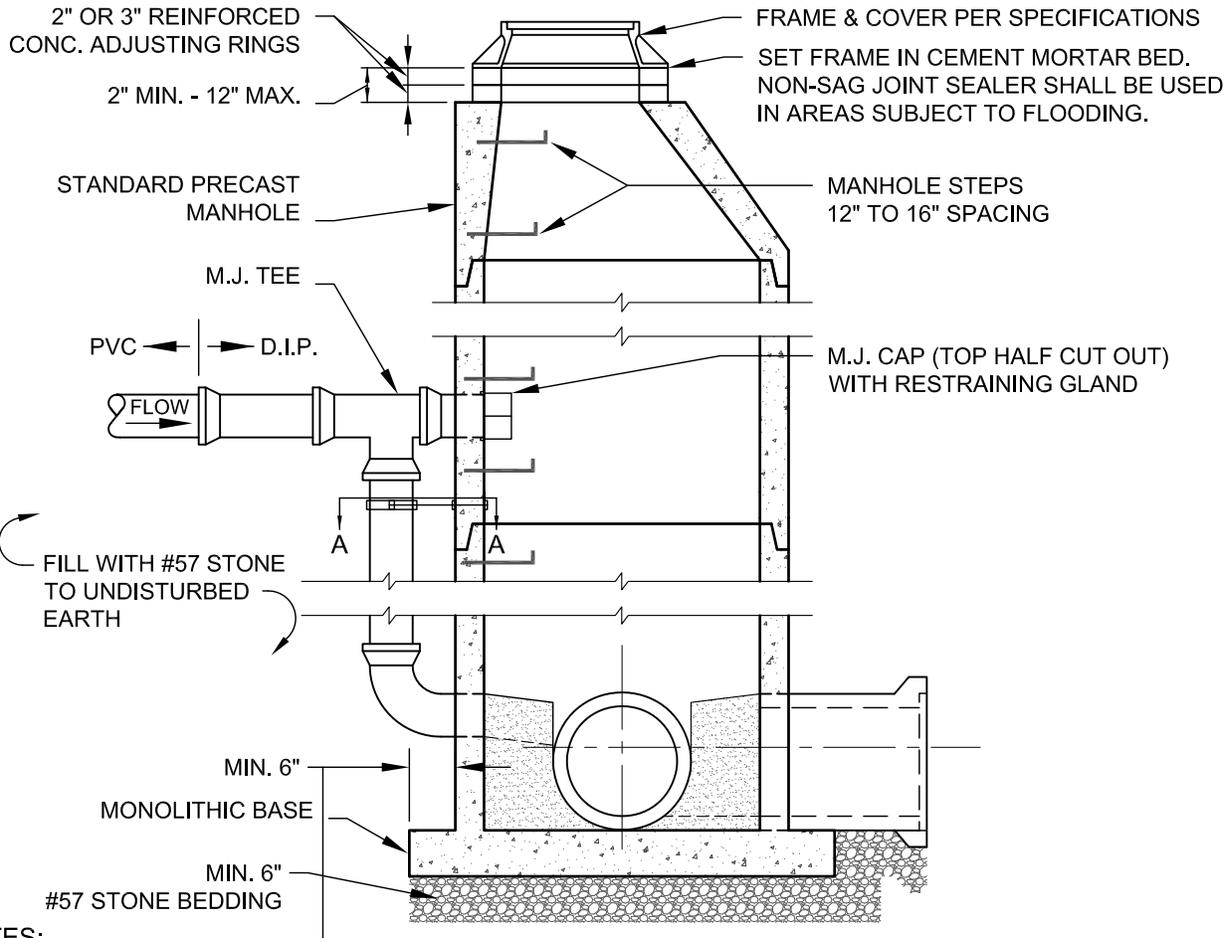
DATE:
MARCH 2024

REVISION:

STANDARD INSIDE DROP MANHOLE

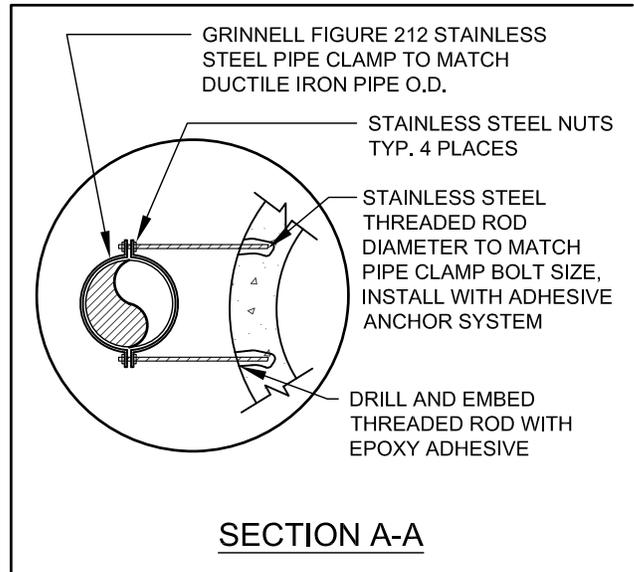
DETAIL
MAN-03

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1) INSIDE DROP CONNECTION IS STANDARD FOR GOOCHLAND COUNTY. USE OF OUTSIDE DROP CONNECTION REQUIRES SPECIFIC PERMISSION FROM DPU.
- 2) WHERE A DROP OF LESS THAN 2' IS PROPOSED, PIPE SLOPE AND/OR MANHOLE ELEVATION(S) SHALL BE ADJUSTED TO ALLOW THE USE OF A STANDARD MANHOLE CONNECTION.
- 3) ALL DROP PIPES SHALL BE DUCTILE IRON.
- 4) DROP INLET PIPE SHALL BE 0.10 MINIMUM ABOVE OUTLET PIPE UNLESS INDICATED GREATER ON DRAWING.
- 5) MATCH PIPE CROWNS WHERE OUTLET PIPE IS LARGER THAN DROP INLET PIPE.
- 6) INSIDE DROP CONNECTION MANHOLES SHALL BE ONE SIZE LARGER THAN OTHERWISE REQUIRED FOR A STANDARD MANHOLE CONNECTION



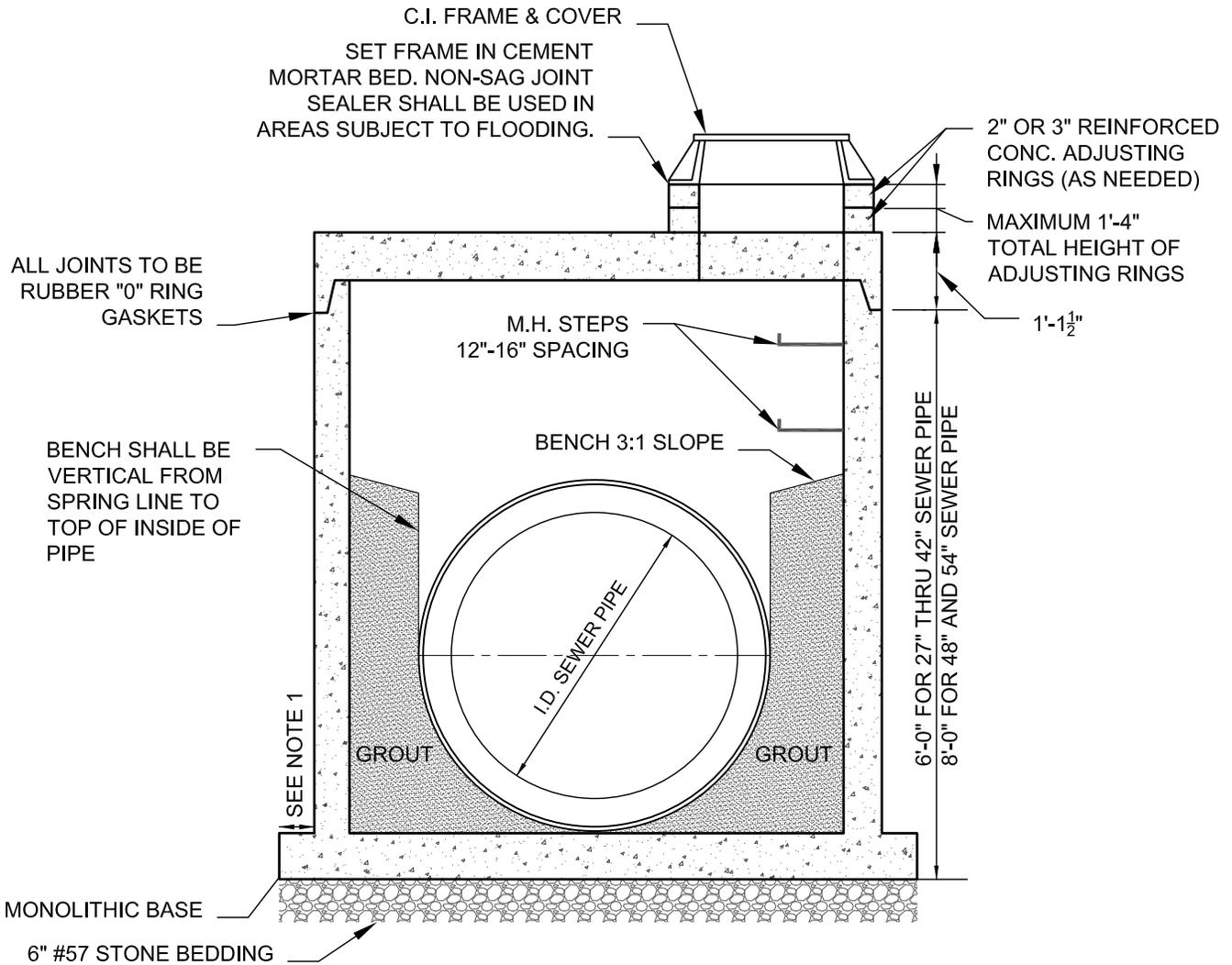
SECTION A-A

DATE:
MARCH 2024
REVISION:

**OUTSIDE DROP CONNECTION
MANHOLE DETAIL**

DETAIL
MAN-04

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1) MINIMUM BENCH WIDTH = 6" FOR 72" MANHOLE; 8" FOR 84" AND 96" MANHOLE.
- 2) MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C478.
- 3) SEE STANDARD DETAILS MAN-01a & MAN-01b TO DETERMINE MINIMUM ANGLES BETWEEN PIPES.
- 4) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 72" DIAMETER MANHOLE IS 36".
- 5) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 84" DIAMETER MANHOLE IS 48".
- 6) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 96" DIAMETER MANHOLE IS 54"
- 7) STRUCTURES FOR PIPES LARGER THAN 54" MUST BE CUSTOM DESIGNED.

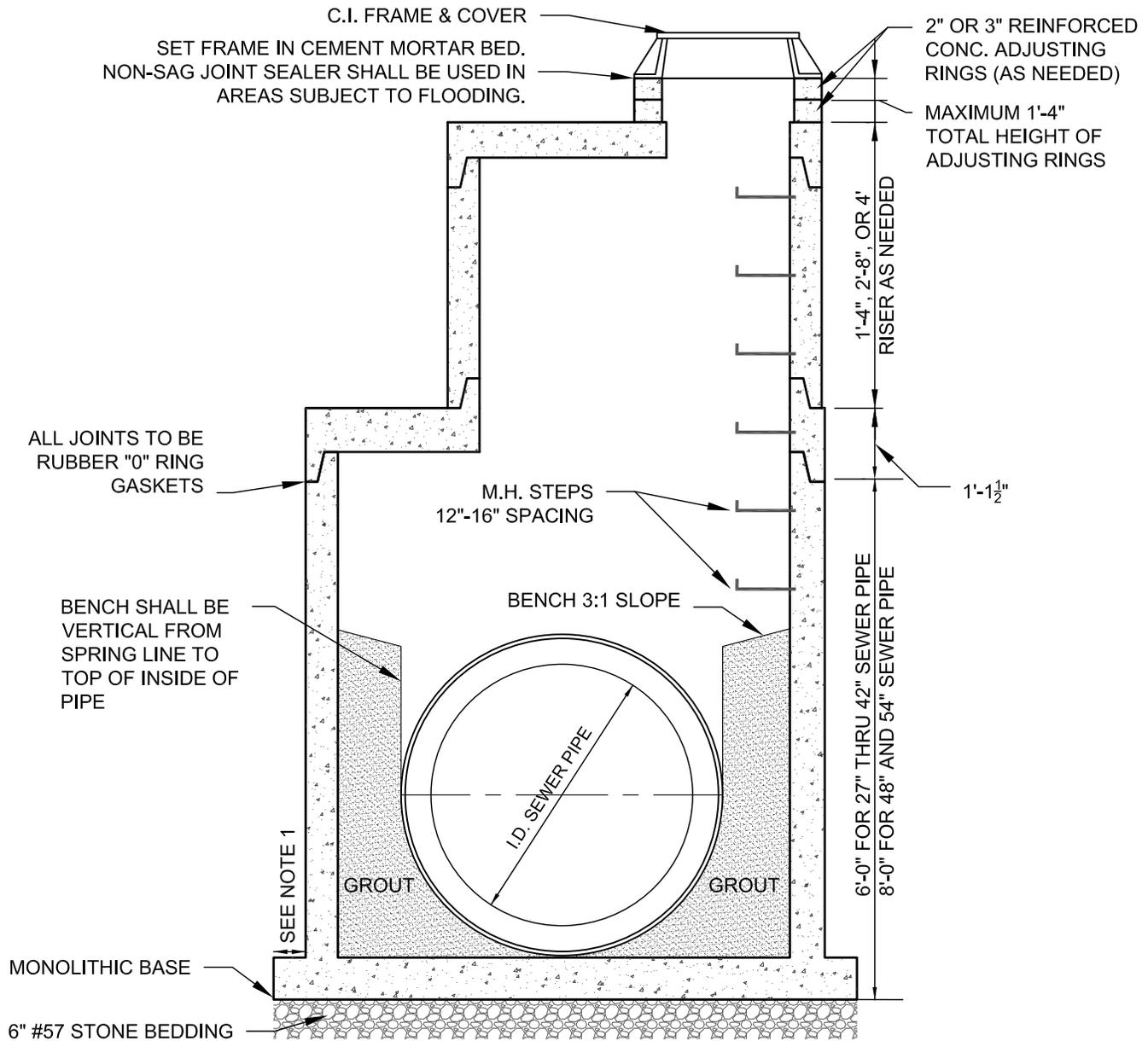
DATE:
MARCH 2024

REVISION:

**72", 84" AND 96" I.D.
MANHOLE DETAIL – TYPE 1**

DETAIL
MAN-05

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

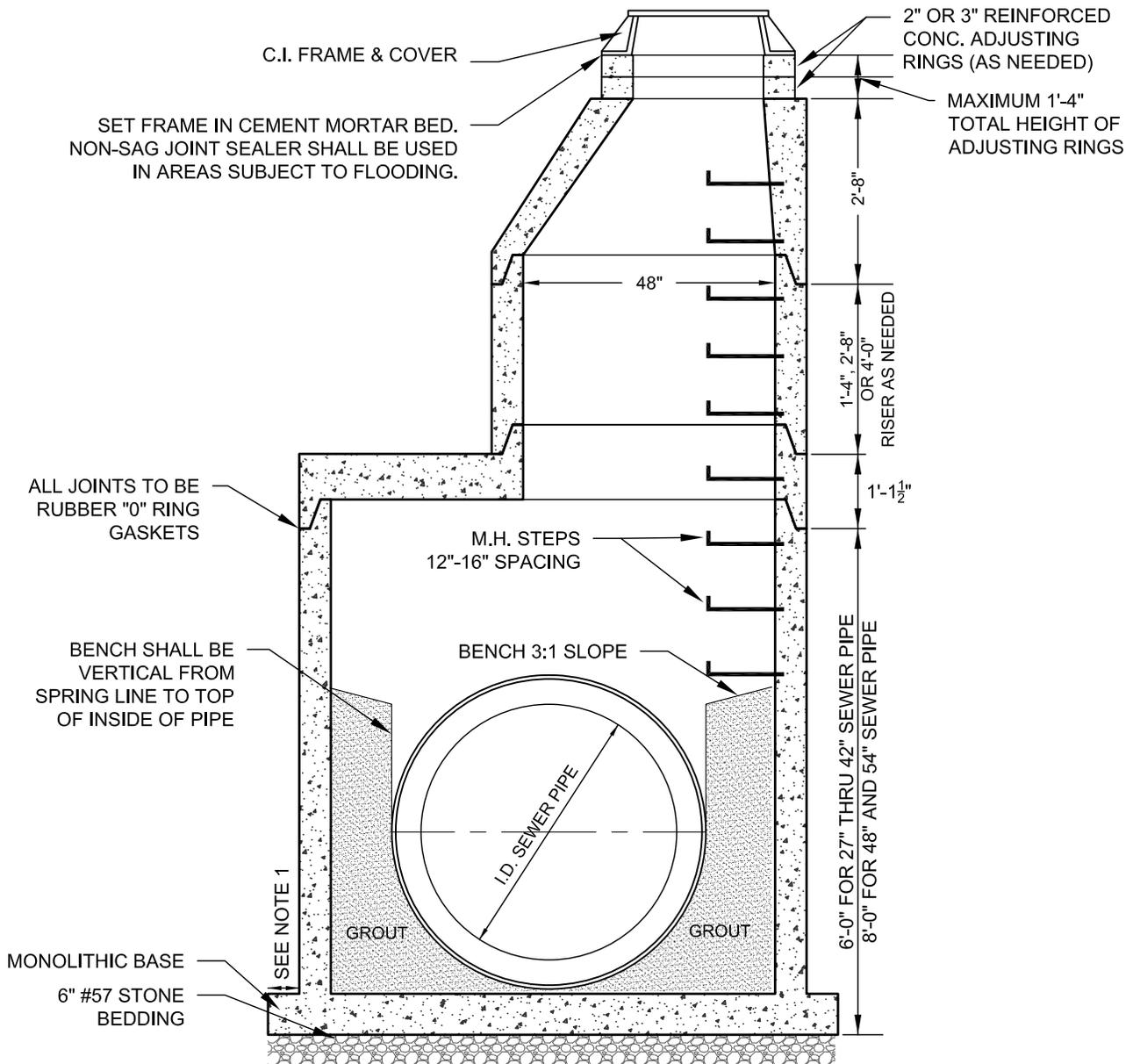
- 1) MINIMUM BENCH WIDTH = 6" FOR 72" MANHOLE; 8" FOR 84" AND 96" MANHOLE.
- 2) MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
- 3) SEE STANDARD DETAILS MAN-01a & MAN-01b TO DETERMINE MINIMUM ANGLES BETWEEN PIPES.
- 4) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 72" DIAMETER MANHOLE IS 36".
- 5) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 84" DIAMETER MANHOLE IS 48".
- 6) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 96" DIAMETER MANHOLE IS 54"
- 7) STRUCTURES FOR PIPES LARGER THAN 54" MUST BE CUSTOM DESIGNED.

DATE:
MARCH 2024
REVISION:

**72", 84" AND 96" I.D.
MANHOLE DETAIL – TYPE 2**

DETAIL
MAN-06

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1) MINIMUM BENCH WIDTH = 6" FOR 72" MANHOLE; 8" FOR 84" AND 96" MANHOLE.
- 2) MANHOLE CONSTRUCTION SHALL CONFORM TO ASTM SPEC. C-478.
- 3) SEE STANDARD DETAILS MAN-01a & MAN-01b TO DETERMINE MINIMUM ANGLES BETWEEN PIPES.
- 4) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 72" DIAMETER MANHOLE IS 36".
- 5) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 84" DIAMETER MANHOLE IS 48".
- 6) THE MAXIMUM ALLOWABLE PIPE DIAMETER IN A 96" DIAMETER MANHOLE IS 54"
- 7) STRUCTURES FOR PIPES LARGER THAN 54" MUST BE CUSTOM DESIGNED.

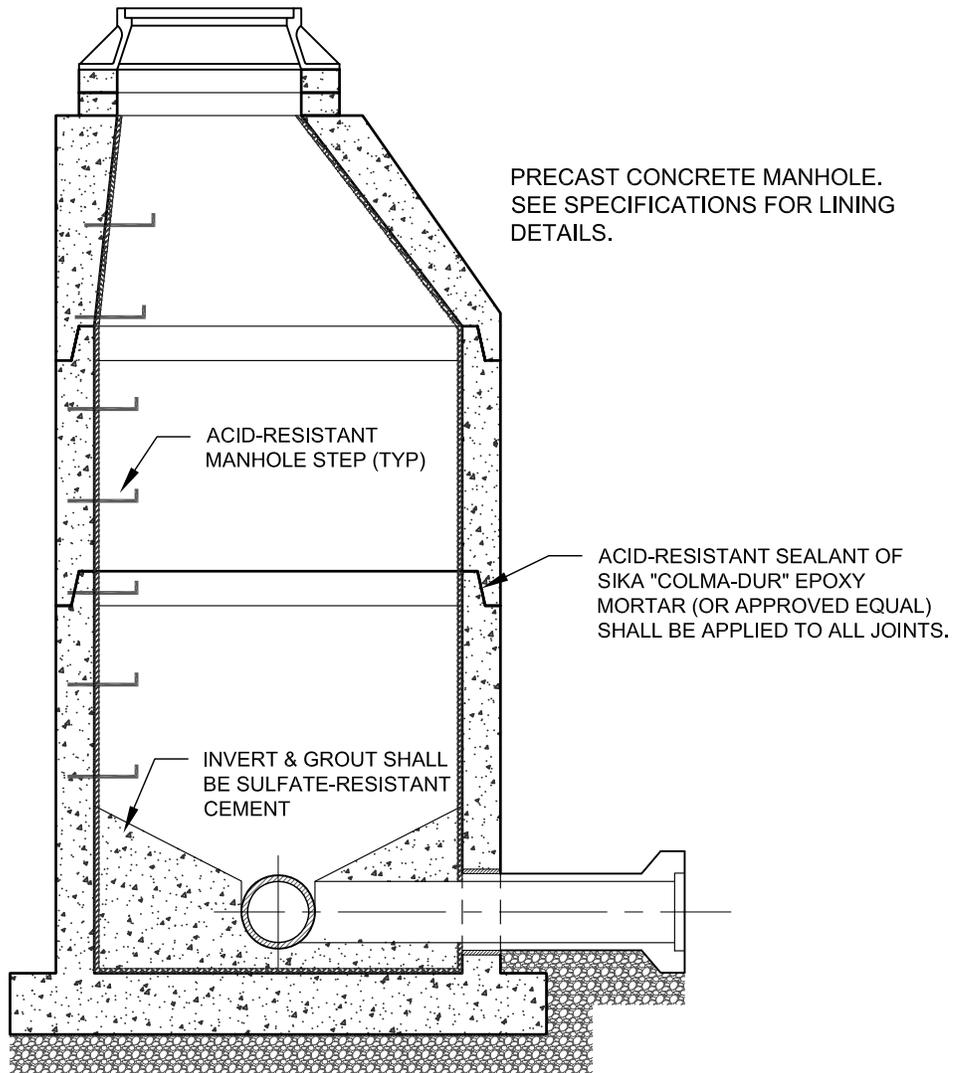
DATE:
MARCH 2024

REVISION:

**72", 84" AND 96" I.D.
MANHOLE DETAIL – TYPE 3**

DETAIL
MAN-07

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

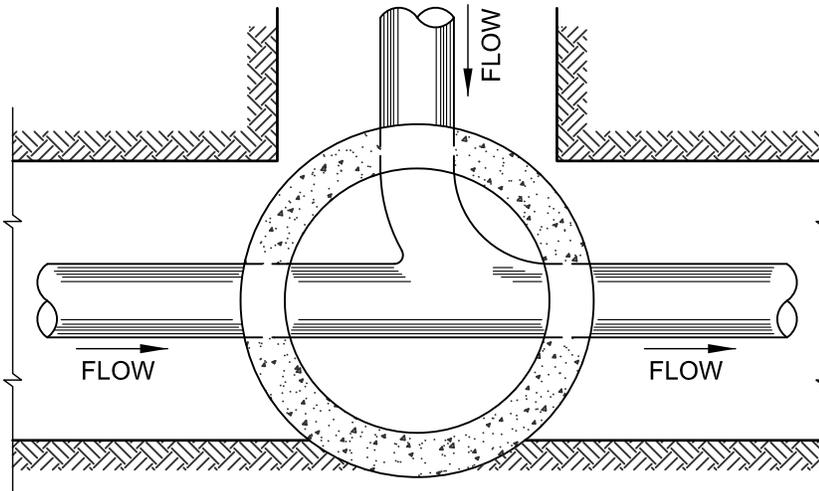
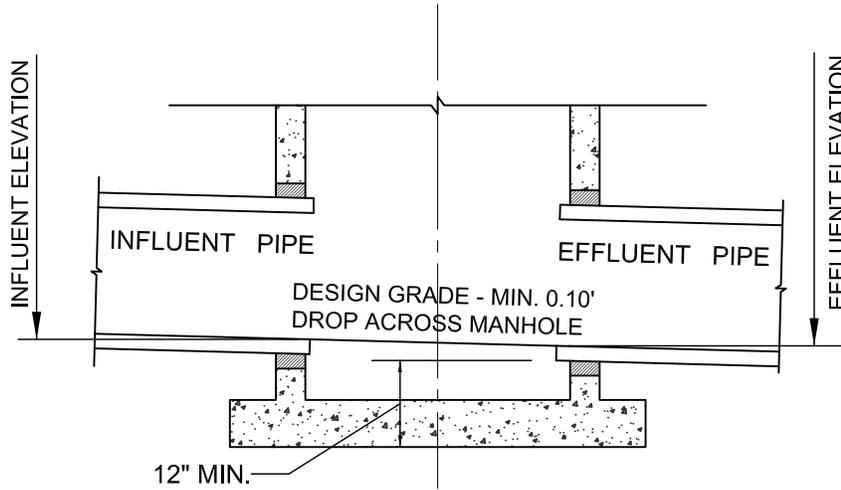
1. THIS STANDARD DETAIL PROVIDES ADDITIONAL REQUIREMENTS FOR ACID-RESISTANT MANHOLE LINING. SEE SPECIFICATIONS AND APPROPRIATE STANDARD DETAIL(S) FOR MANHOLE CONSTRUCTION REQUIREMENTS.
2. ACID-RESISTANT LINING SHALL BE USED IN ALL MANHOLES WHICH RECEIVE A FORCE MAIN DISCHARGE AND ALL MANHOLES WITHIN 1,200 FT DOWNSTREAM OF A FORCE MAIN DISCHARGE POINT.
3. ACID-RESISTANT LINING SHALL BE IN ACCORDANCE WITH STANDARDS AND SPECIFICATIONS.
4. JOINTS SHALL BE PACKED AND BRUSHED WITH SIKA "COLMA-DUR" EPOXY MORTAR OR APPROVED EQUAL

DATE:
MARCH 2024
REVISION:

ACID-RESISTANT MANHOLE LINING
FOR NEW MANHOLES

DETAIL
MAN-08

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1) THE EFFLUENT ELEVATION AT A MANHOLE IS ESTABLISHED FROM THE INFLUENT ELEVATION OF THE MANHOLE IMMEDIATELY DOWNSTREAM AND THE SLOPE OF THE PIPE.
- 2) ELEVATIONS SHOWN APPLY AT THE CENTERLINE OF MANHOLES AND ARE BASED ON THE HORIZONTAL DISTANCE C.L. TO C.L. BETWEEN MANHOLES AND THE SLOPE OF THE PIPE.
- 3) PIPE OPENINGS SHALL BE CONCENTRIC WITH THE PIPE AT THE SPECIFIED INVERT.
- 4) PIPE OPENING DIAMETER SHALL BE AS RECOMMENDED BY BOOT MANUFACTURER FOR OUTSIDE DIAMETER OF THE PIPE.
- 5) MINIMUM INVERT DROP SHALL BE AS SHOWN ON PLANS, BUT NOT LESS THAN 0.10'.

DATE:
MARCH 2024

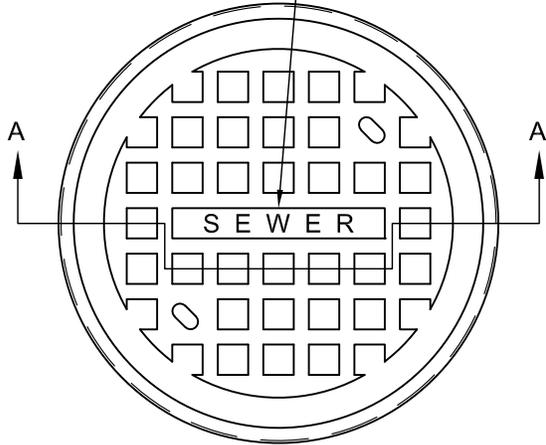
REVISION:

STANDARD MANHOLE INVERT DETAILS

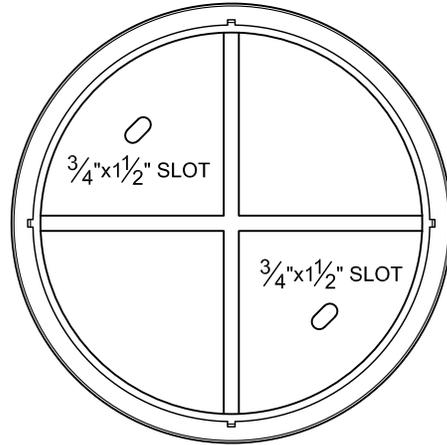
DETAIL
MAN-09

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

"SEWER" SHALL BE CAST IN TOP OF COVER AS SHOWN.
LETTERS TO BE 1" HEIGHT
AND RAISED 3/8".

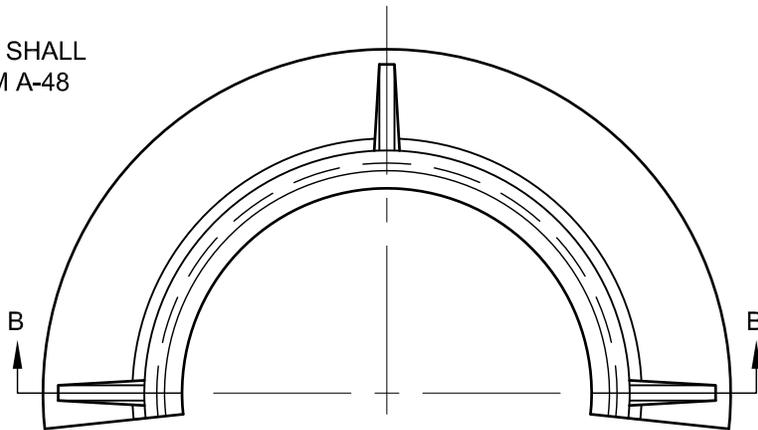


COVER - TOP



COVER - BOTTOM

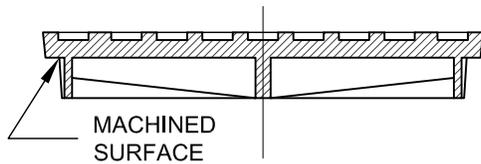
FRAME AND COVER SHALL
BE CAST IRON ASTM A-48
CLASS 30



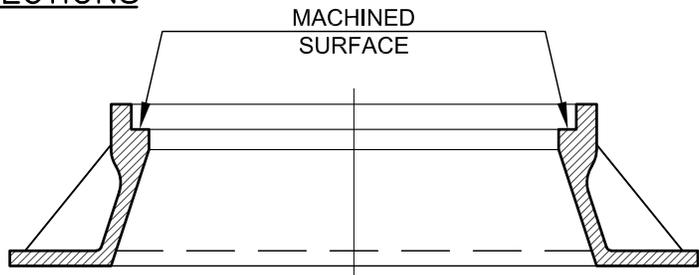
FRAME

SECTIONS

NOTE:
MANHOLE COVER SHALL HAVE
A CLEAR OPENING OF 2'-0".



A-A



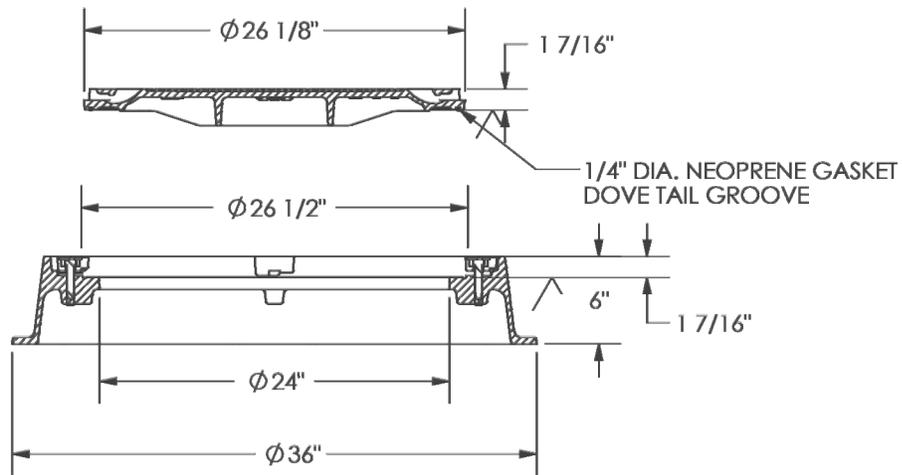
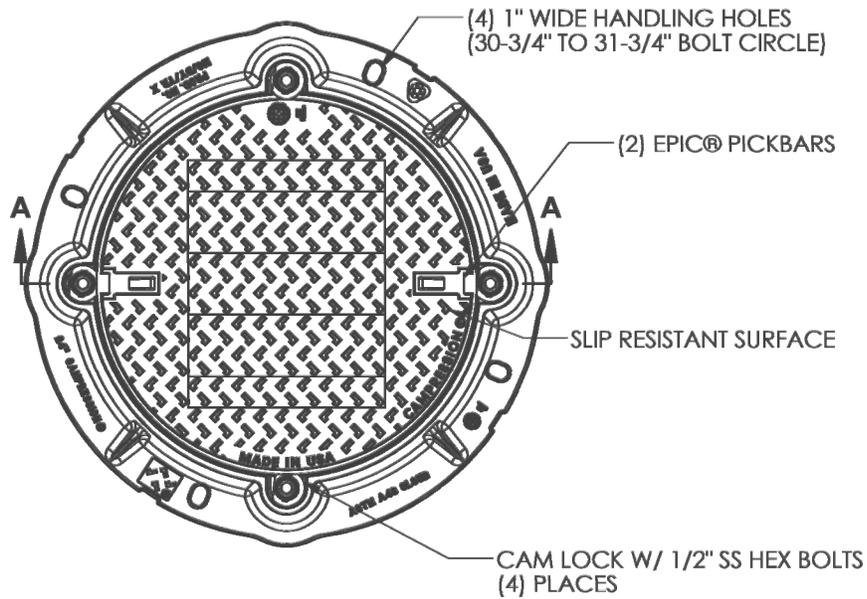
B-B

DATE:
MARCH 2024
REVISION:

STANDARD MANHOLE FRAME AND COVER

DETAIL
MAN-10

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



SECTION A-A

NOTES:

1. FRAME SHALL BE SET IN 1/4" BED OF NON-SAG COLMA JOINT SEALER & BOLTED TO THE MANHOLE CONE SECTION WITH 4-3/4" ANCHOR BOLTS.
2. ANCHOR BOLTS AND NUTS SHALL BE HOT DIPPED GALVANIZED.
3. SEATING SURFACES BETWEEN FRAME & COVER SHALL BE MACHINED.
4. WATERTIGHT MANHOLE FRAMES & COVERS SHALL BE USED IN EASEMENTS AND WHERE OTHERWISE SHOWN ON THE PLANS OR REQUIRED BY DPU.
5. FRAME & COVERS SHALL BE EAST JORDAN IRON WORKS PRODUCT 42339031W01 OR APPROVED EQUAL.
6. COVER SHALL HAVE LETTERING AS SHOWN ON STANDARD DETAIL MAN-10.

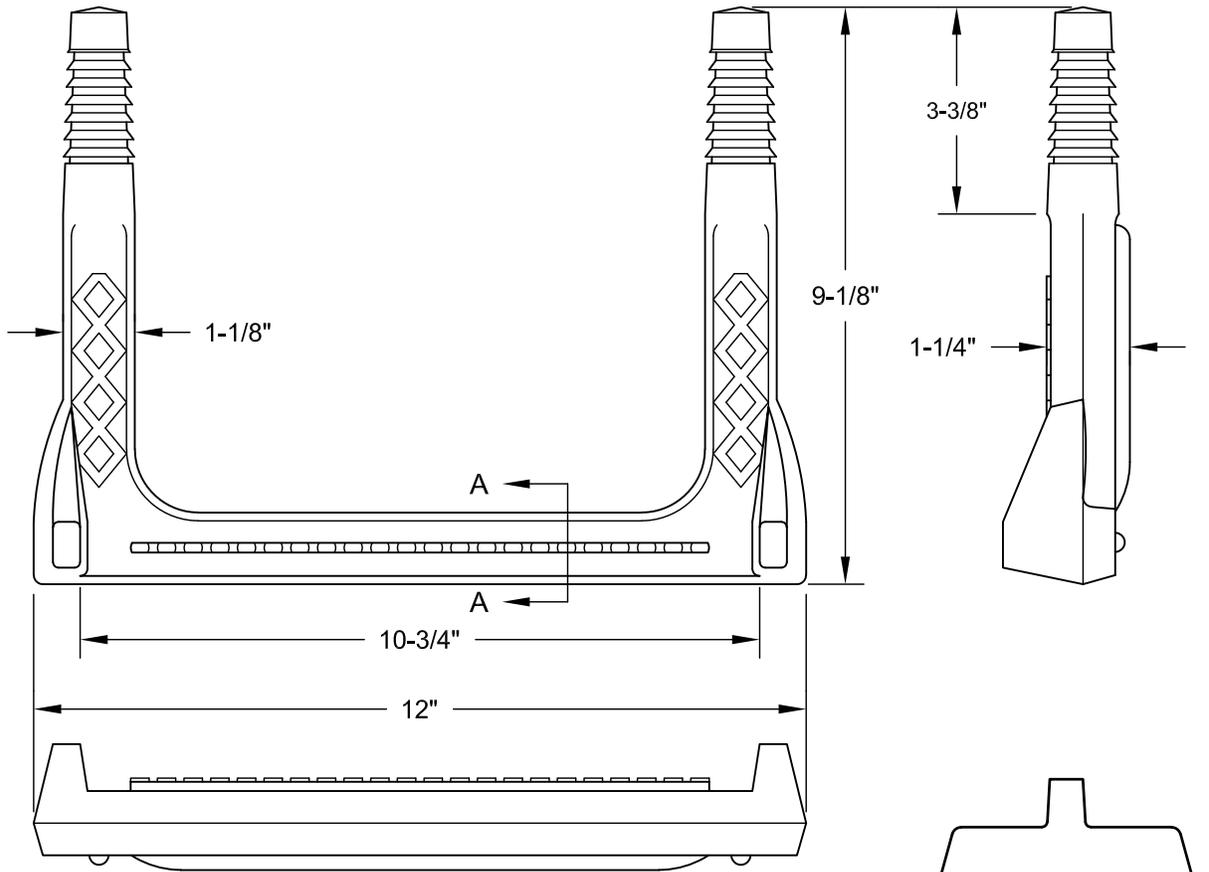
DATE:
MARCH 2024

REVISION:

WATERTIGHT MANHOLE FRAME AND COVER

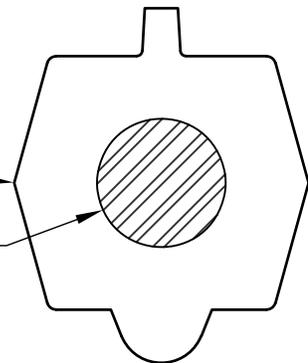
DETAIL
MAN-12

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

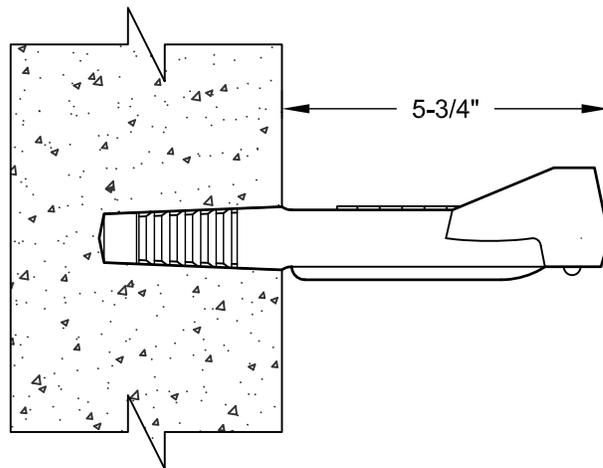


COPOLYMER POLYPROPYLENE PLASTIC

1/2" GRADE 60 STEEL REINFORCEMENT



SECTION-A

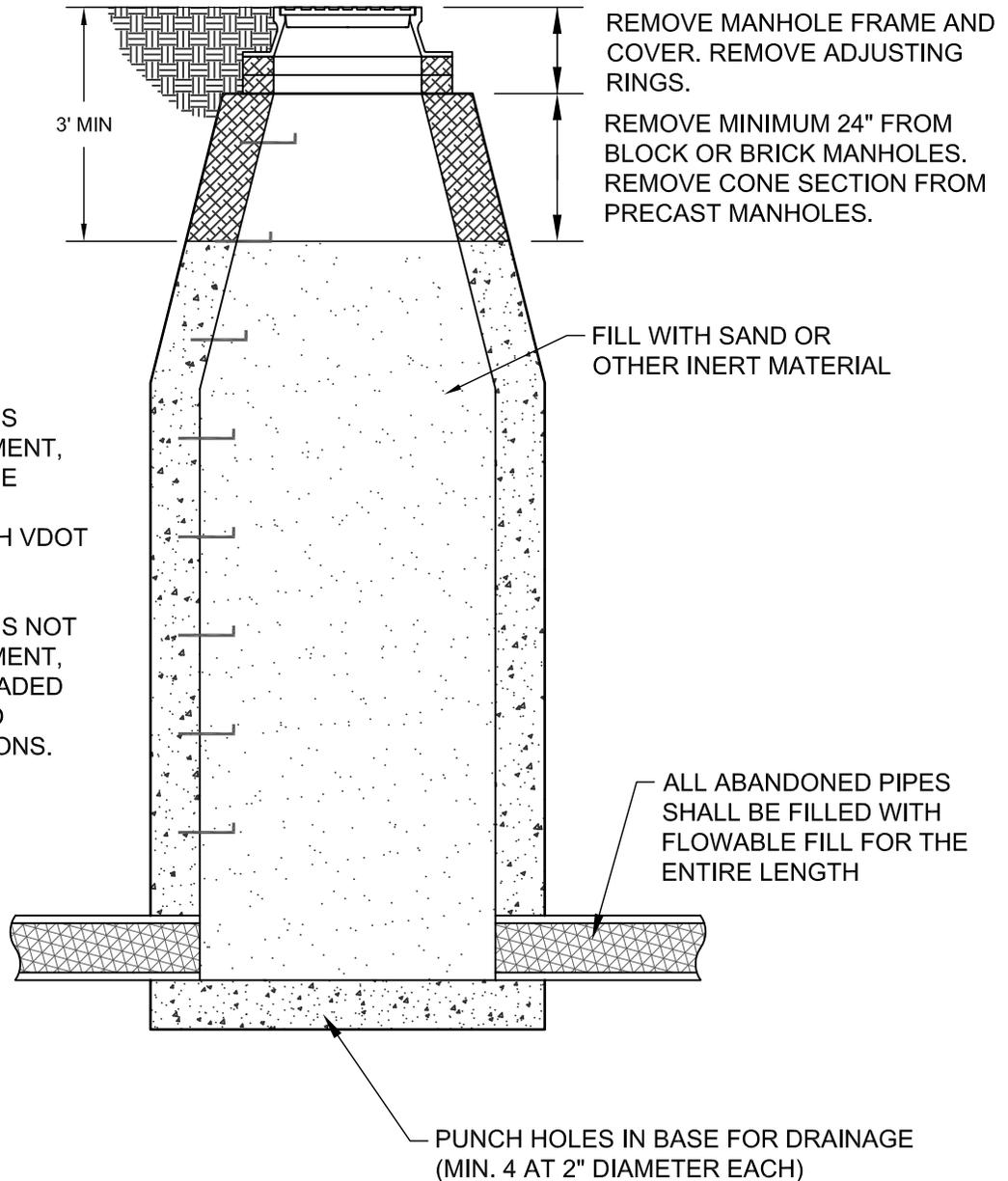


DATE:
MARCH 2024
REVISION:

STANDARD MANHOLE STEP

DETAIL
MAN-13

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



WHERE MANHOLE IS LOCATED IN PAVEMENT, PAVEMENT MUST BE RESTORED IN ACCORDANCE WITH VDOT STANDARDS.

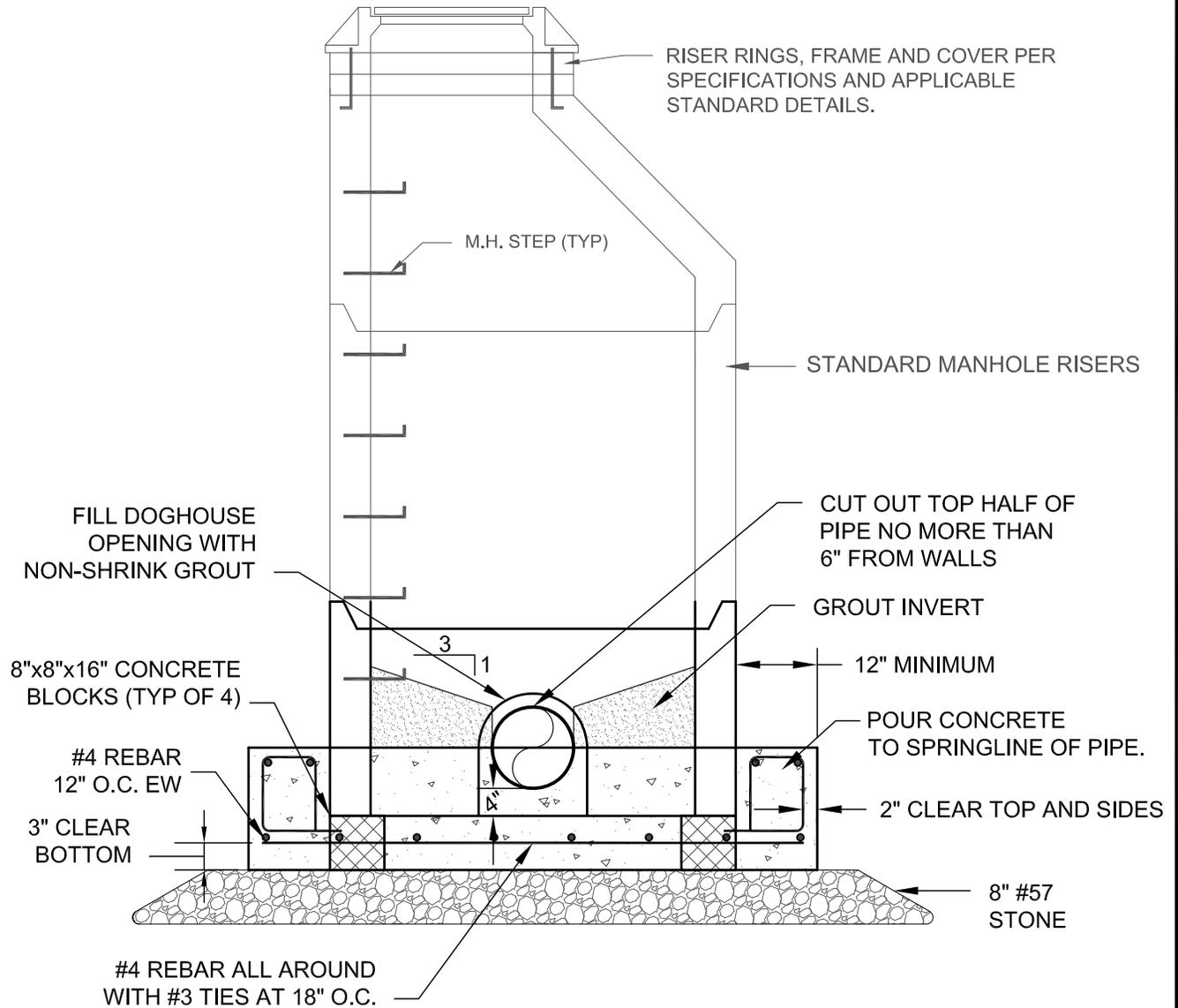
WHERE MANHOLE IS NOT LOCATED IN PAVEMENT, AREA MUST BE GRADED AND RESTORED TO ORIGINAL CONDITIONS.

DATE:
MARCH 2024
REVISION:

DETAIL FOR ABANDONMENT OF MANHOLE

DETAIL
MAN-14

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTE:

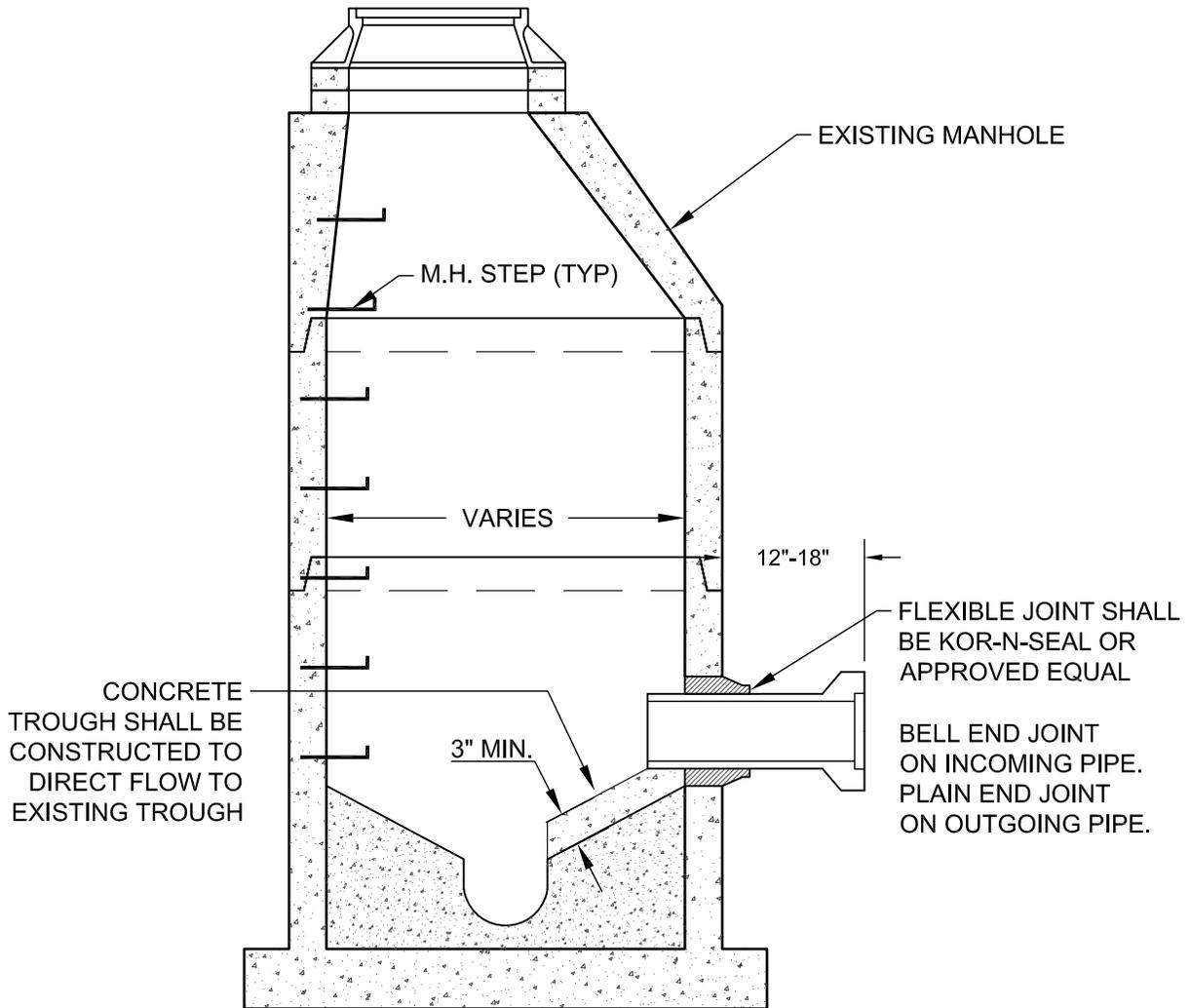
1. DOGHOUSE MANHOLE MAY ONLY BE USED WITH SPECIFIC PERMISSION OF THE DIRECTOR.
2. APART FROM THE DOGHOUSE BASE, THE MANHOLE SHALL MEET ALL REQUIREMENTS AND SPECIFICATIONS FOR A STANDARD PRECAST MANHOLE.
3. CONCRETE SHALL BE 3000 PSI MIN STRENGTH AT 28 DAYS.

DATE:
MARCH 2024
REVISION:

DOGHOUSE MANHOLE

DETAIL
MAN-15

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. CORED HOLE(S) SHALL BE RADIAL TO CENTER OF MANHOLE.
2. KOR-N-SEAL FLEXIBLE CONNECTOR, OR EQUAL, SHALL BE INSTALLED PER MANUFACTURER'S STANDARDS.
3. INVERT ELEVATION OF THE INFLUENT LINE SHALL BE NO MORE THAN 30 INCHES ABOVE THE MANHOLE INVERT OUT.
4. IF NEW PIPE IS SMALLER THAN EFFLUENT PIPE THEN SET INVERT OF NEW PIPE TO MATCH CROWNS WITH EFFLUENT PIPE.
5. EXISTING MANHOLE SHALL NOT BE CORED AT ANY EXISTING RISER JOINT.
6. MINIMUM PIPE ANGLE REQUIREMENTS MUST BE MET (SEE DETAILS MAN-01a AND MAN-01b).

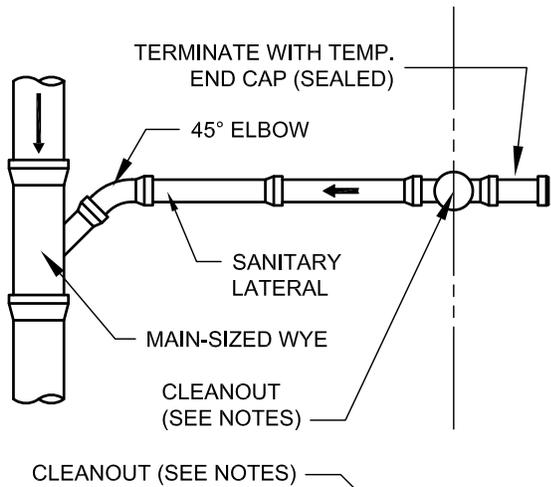
DATE:
MARCH 2024

REVISION:

**NEW SEWER LINE CONNECTION
TO EXISTING MANHOLE**

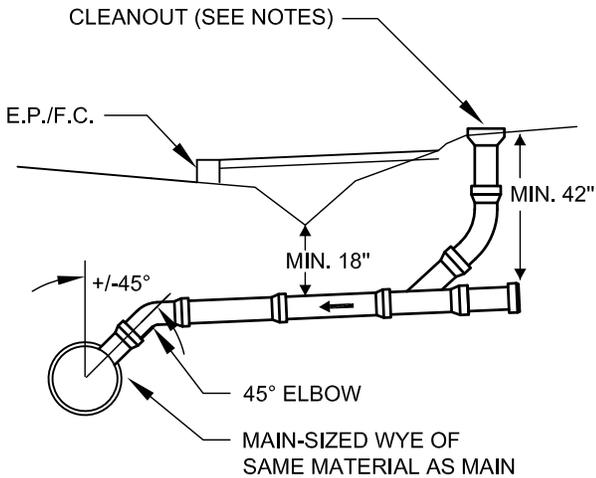
DETAIL
MAN-17

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



SANITARY SEWER CONNECTION NOTES:

1. FOR NEW CONSTRUCTION, USE MAIN-SIZE WYE OF SAME PIPE MATERIAL AS MAIN.
2. FOR CONNECTION TO EXISTING MAIN, USE COMPRESSION TYPE TEE CAST IRON SADDLE BY GENECO SEALTITE OR EQUAL (SEE BELOW).
3. LATERAL & CLEANOUT SHALL BE SDR-26 PVC OR D.I.P.
4. D.I.P. IS REQUIRED IF LESS THAN 42" COVER.
5. ENTIRE LATERAL SHALL BE BEDDED IN ACCORDANCE WITH THE APPROPRIATE SPECIFICATION FOR PIPE MATERIAL USED.
6. MIN. SLOPE FOR 4" LATERAL = 2.08%
7. MIN. SLOPE FOR 6" LATERAL = 1.00%
8. MAX. SLOPE FOR ANY LATERAL = 5.00%
9. SLOPES GREATER THAN 5% MAY BE APPROVED IF JUSTIFIED BY LATERAL LENGTH AND TERRAIN.
10. MIN. 18" COVER AT DITCH LINE (IF PRESENT).
11. REFER TO STANDARDS AND SPECIFICATIONS SECTION 4.6.06 FOR ADDITIONAL INFORMATION.

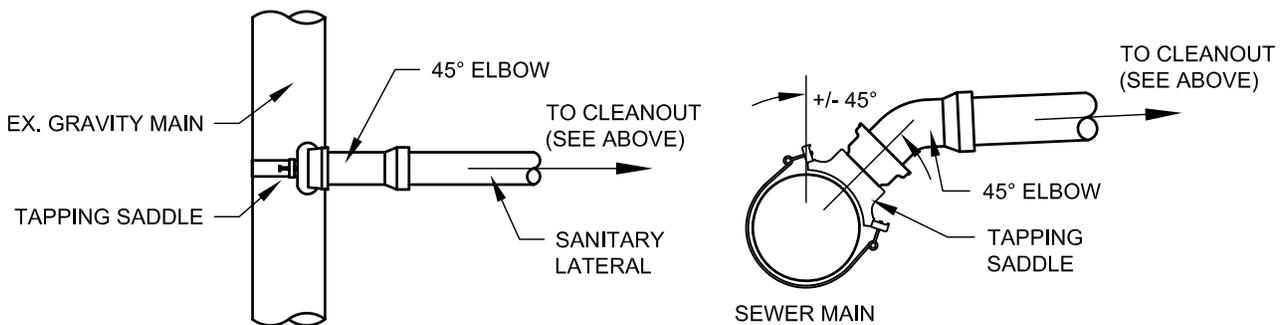


CLEANOUT NOTES:

- A. CLEANOUT SHALL BE BEHIND SIDEWALK (IF PRESENT).
- B. CLEANOUT SHALL BE INSTALLED ON PROPERTY LINE (OR EASEMENT LINE) FOR ALL HOUSE CONNECTIONS.
- C. MATERIAL SHALL BE SDR-26 PVC OR D.I.P.
- D. USE CAST IRON BODY ADAPTOR WITH GASKETED BELL AND SOUTHERN CODE (RECESSED) BRASS PLUG.
- E. FOR RESIDENTIAL SUBDIVISIONS, USE CLEANOUT STACK AS SHOWN ON DETAIL SEW-01b.

SERVICE CONNECTION FOR NEW CONSTRUCTION (TYP.)

N.T.S.



NOTES FOR CORING OF MAIN AND INSTALLATION OF TAPPING SADDLE:

1. DO NOT ALLOW PIPE COUPON TO FALL IN TO SEWER MAIN.
2. UNDER NO CIRCUMSTANCES SHALL ANY PART OF INSERTED PIPE PROTRUDE INTO SEWER MAIN.

SERVICE CONNECTION TO EXISTING SEWER MAIN (TYP.)

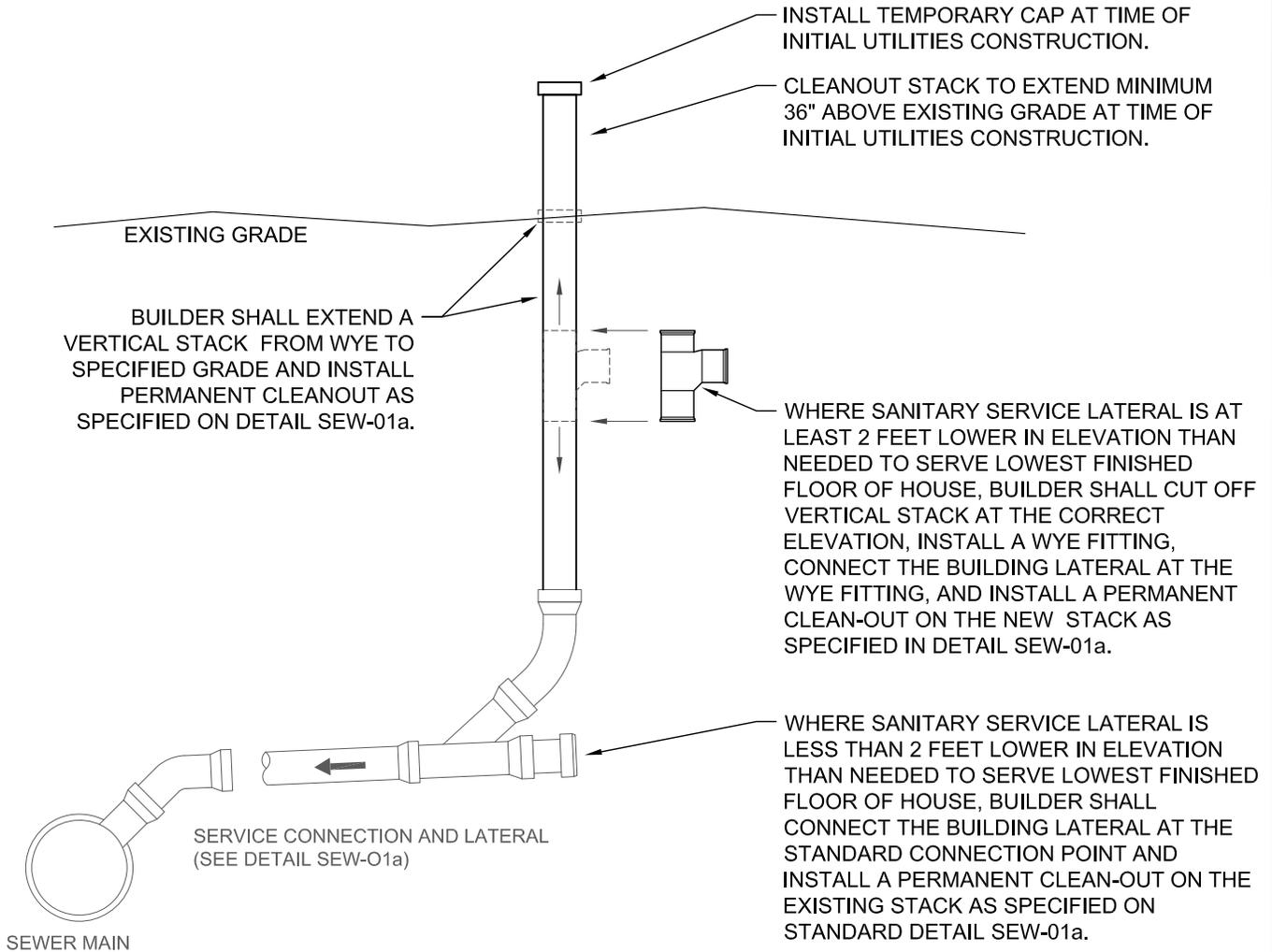
N.T.S.

DATE:
MARCH 2024
REVISION:

**STANDARD SANITARY SEWER
SERVICE CONNECTION AND CLEANOUT**

DETAIL
SEW-01a

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



SANITARY SEWER CLEANOUT STACK IN RESIDENTIAL SUBDIVISION

N.T.S.

NOTES:

1. THIS DETAIL IS FOR CLEANOUT STACK INSTALLATION ON LOTS IN RESIDENTIAL SUBDIVISIONS WHERE THE FINISHED FLOOR ELEVATION OF THE HOUSES AND/OR FINISHED GRADE AT THE SANITARY SEWER CLEANOUTS HAVE NOT BEEN ESTABLISHED AT THE TIME OF INITIAL UTILITIES CONSTRUCTION.
2. SEE DETAIL SEW-01a FOR SANITARY SEWER SERVICE CONNECTION AND CLEANOUT.
3. THIS DETAIL MAY ALSO BE USED FOR ANY PROJECT WHERE THE BUILDING FINISHED FLOOR ELEVATION(S) AND/OR FINISHED GRADE AT THE SANITARY SEWER CLEANOUT HAVE NOT BEEN ESTABLISHED AT THE TIME OF INITIAL UTILITIES CONSTRUCTION.

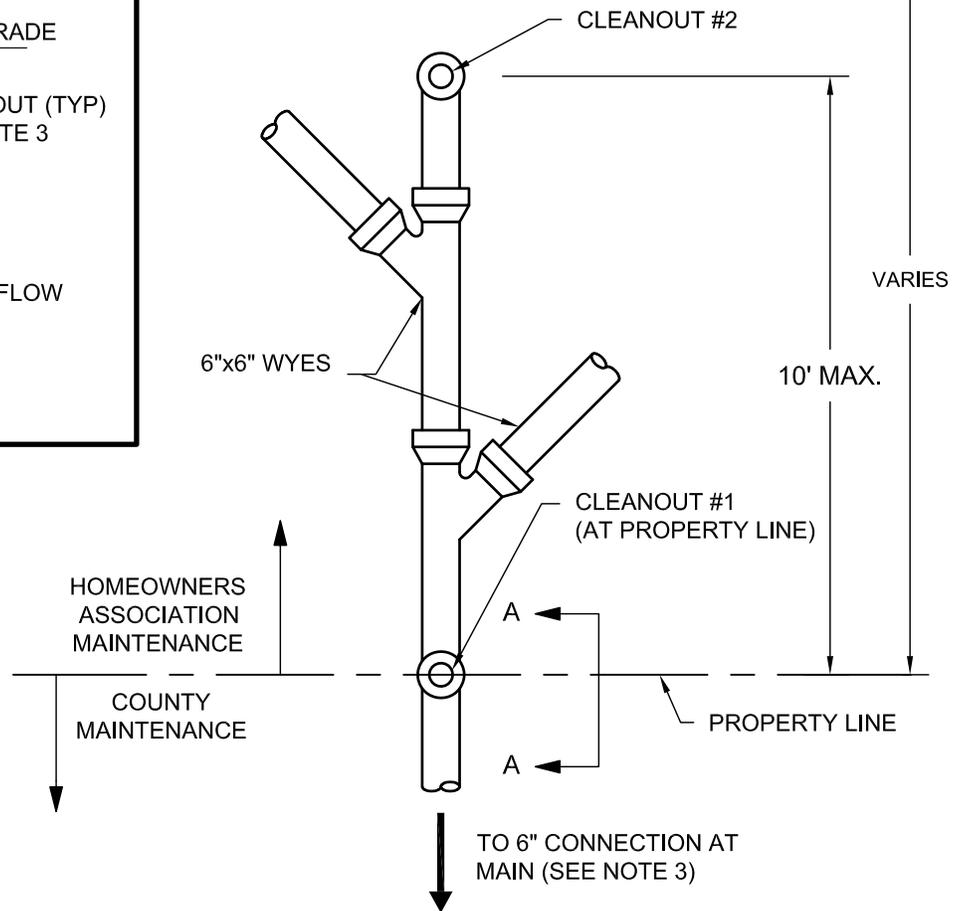
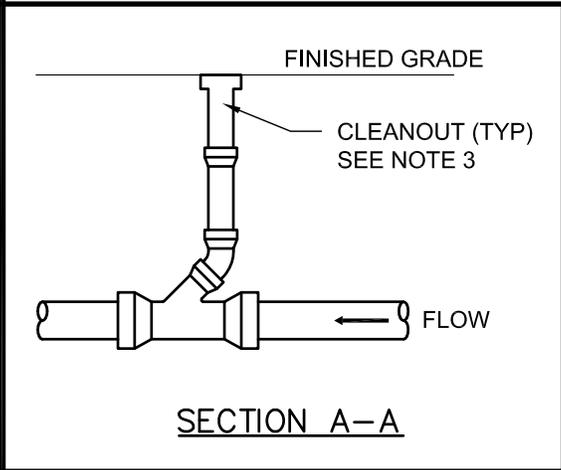
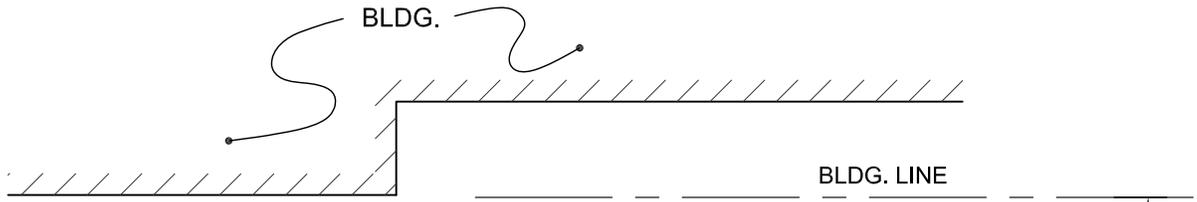
DATE:
MARCH 2024

REVISION:

SANITARY SEWER CLEANOUT STACK
FOR RESIDENTIAL SUBDIVISIONS

DETAIL
SEW-01b

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

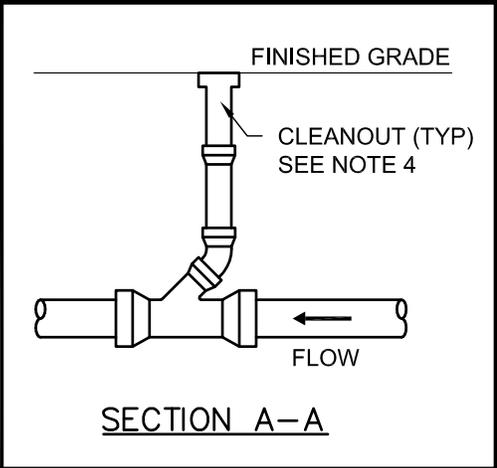
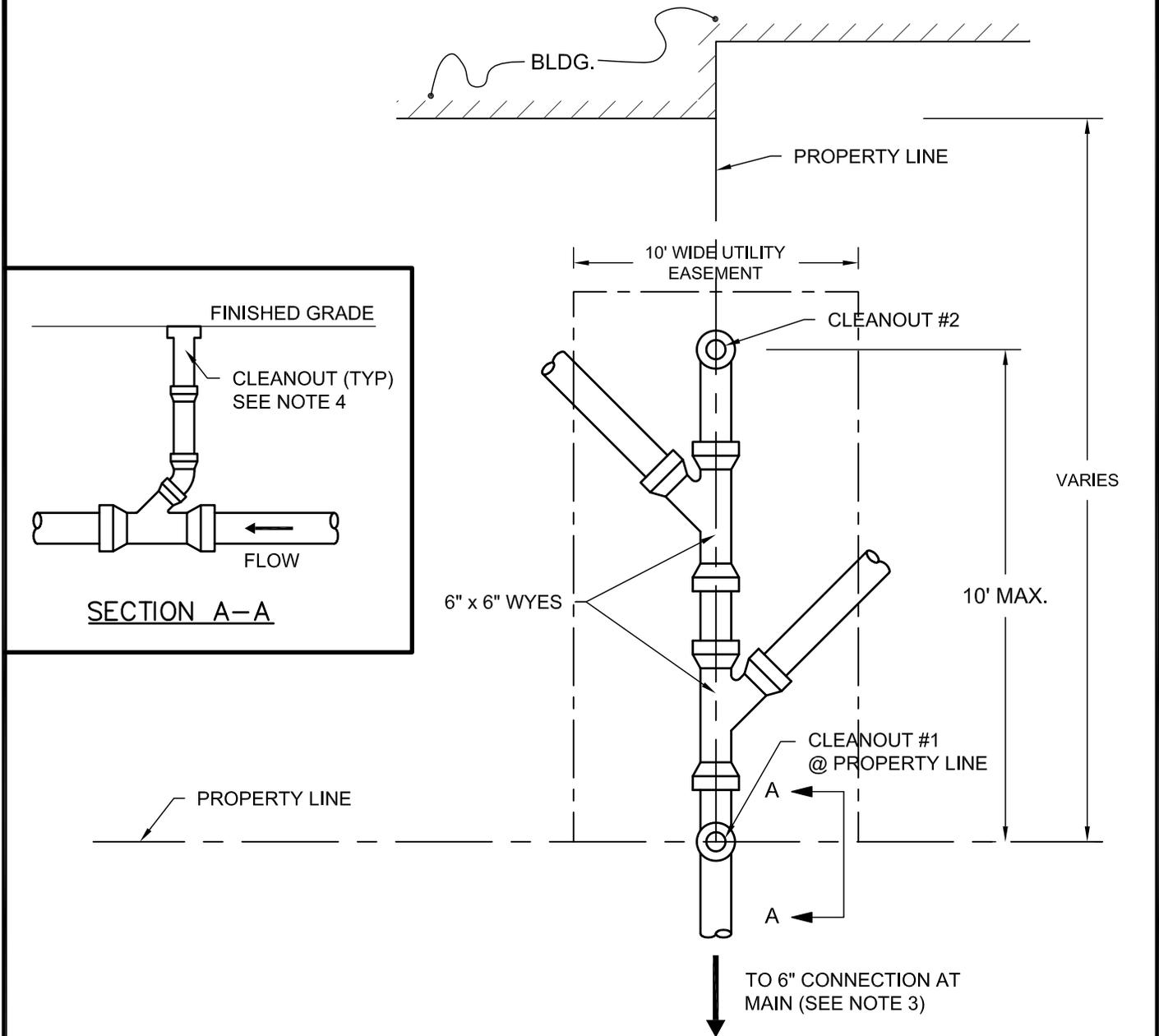
1. THIS DUAL SANITARY SEWER CONNECTION IS FOR USE ONLY IN SITUATIONS WHERE BOTH BUILDINGS TO BE SERVED ARE ON THE SAME PARCEL.
2. THE PROPERTY OWNER / HOMEOWNERS ASSOCIATION IS RESPONSIBLE FOR SEWER CONNECTION FROM BUILDING TO PROPERTY LINE IN ACCORDANCE WITH PLUMBING CODE.
3. SEE DETAIL SEW-01 FOR DETAILS AND NOTES REGARDING CONNECTION TO MAIN.
4. USE CAST IRON BODY ADAPTOR WITH A GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG AT CLEANOUTS.

DATE:
MARCH 2024
 REVISION:

DUAL SANITARY SEWER SERVICE CONNECTION
FOR MULTI-FAMILY CONDOMINIUMS

DETAIL
SEW-02a

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

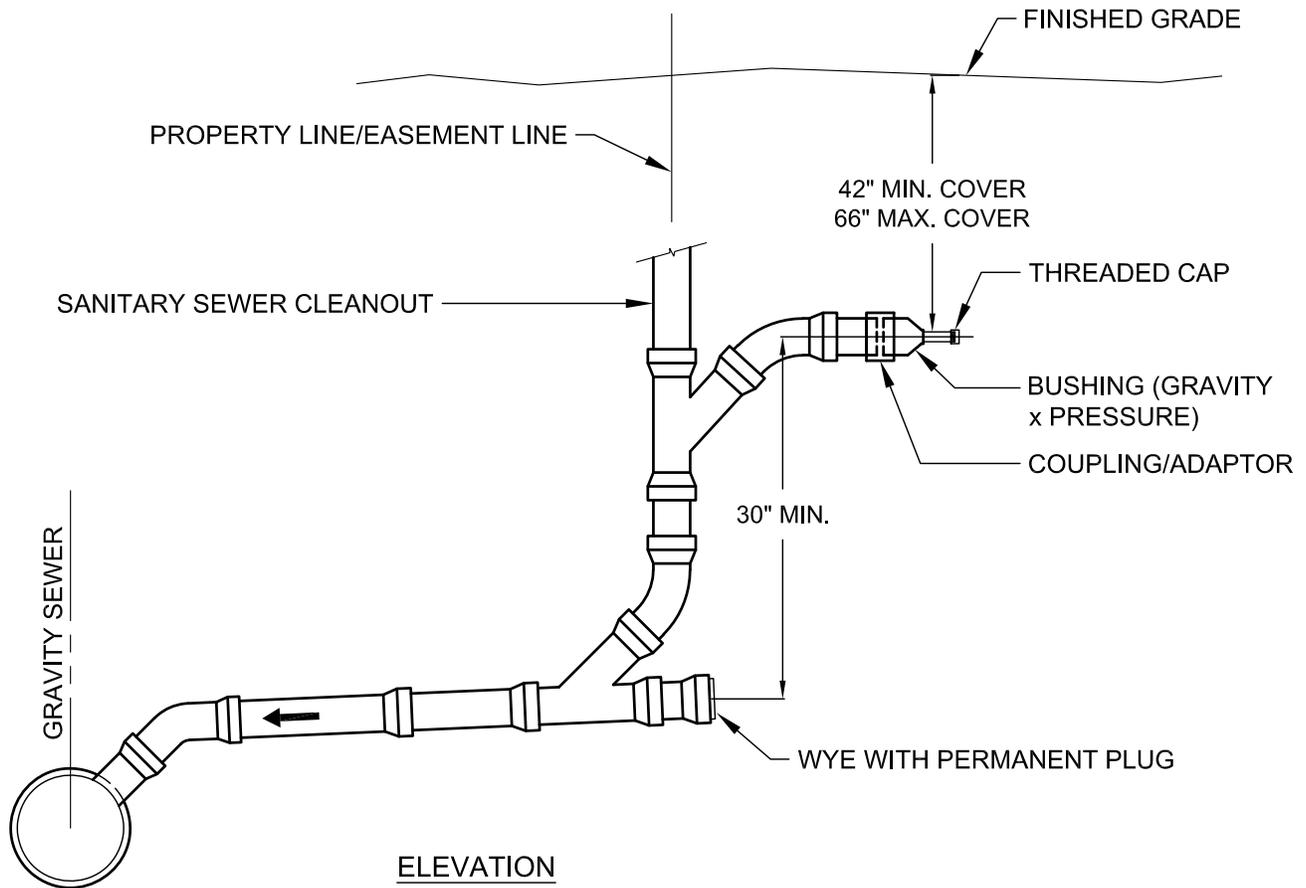
1. THIS DUAL SANITARY SEWER CONNECTION MAY ONLY BE USED WHERE THE COMMON LATERAL CAN BE RUN ALONG THE PROPERTY LINE BETWEEN THE TWO UNITS TO BE SERVED.
2. A MINIMUM 10' WIDE UTILITY EASEMENT IS REQUIRED, CENTERED ON THE LATERAL.
3. SEE DETAIL SEW-01 FOR DETAILS AND NOTES REGARDING CONNECTION TO MAIN.
4. USE CAST IRON BODY ADAPTOR WITH A GASKETED BELL AND SOUTHERN CODE (RECESSED) TYPE BRASS PLUG AT CLEANOUTS.

DATE:	MARCH 2024
REVISION:	

DUAL SANITARY SEWER SERVICE CONNECTION
FOR TOWNHOUSES ON INDIVIDUAL LOTS

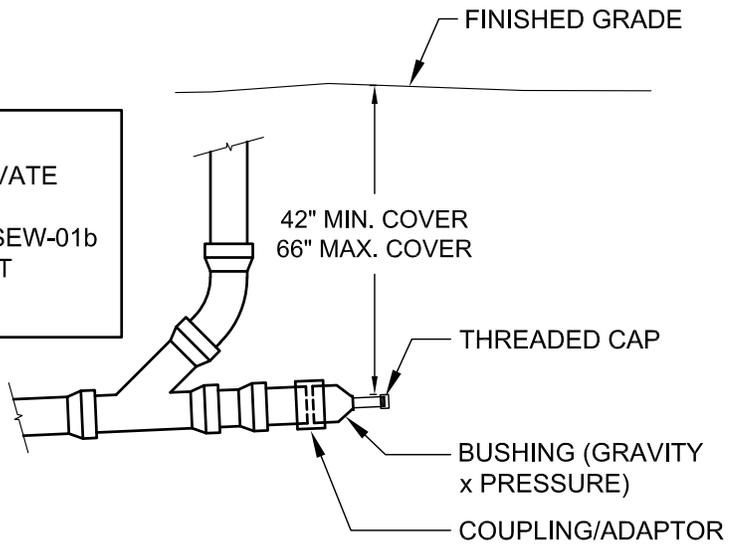
DETAIL
SEW-02b

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. FOR SERVICE CONNECTIONS FROM PRIVATE GRINDER PUMPS ONLY.
2. SEE STANDARD DETAILS SEW-01a AND SEW-01b FOR SERVICE CONNECTION & CLEANOUT REQUIREMENTS.



ALTERNATE FOR SHALLOW GRAVITY LATERAL

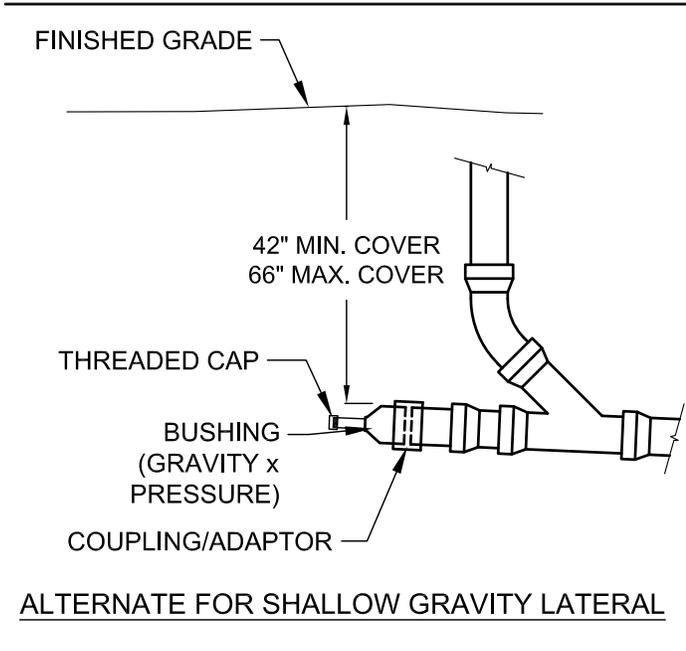
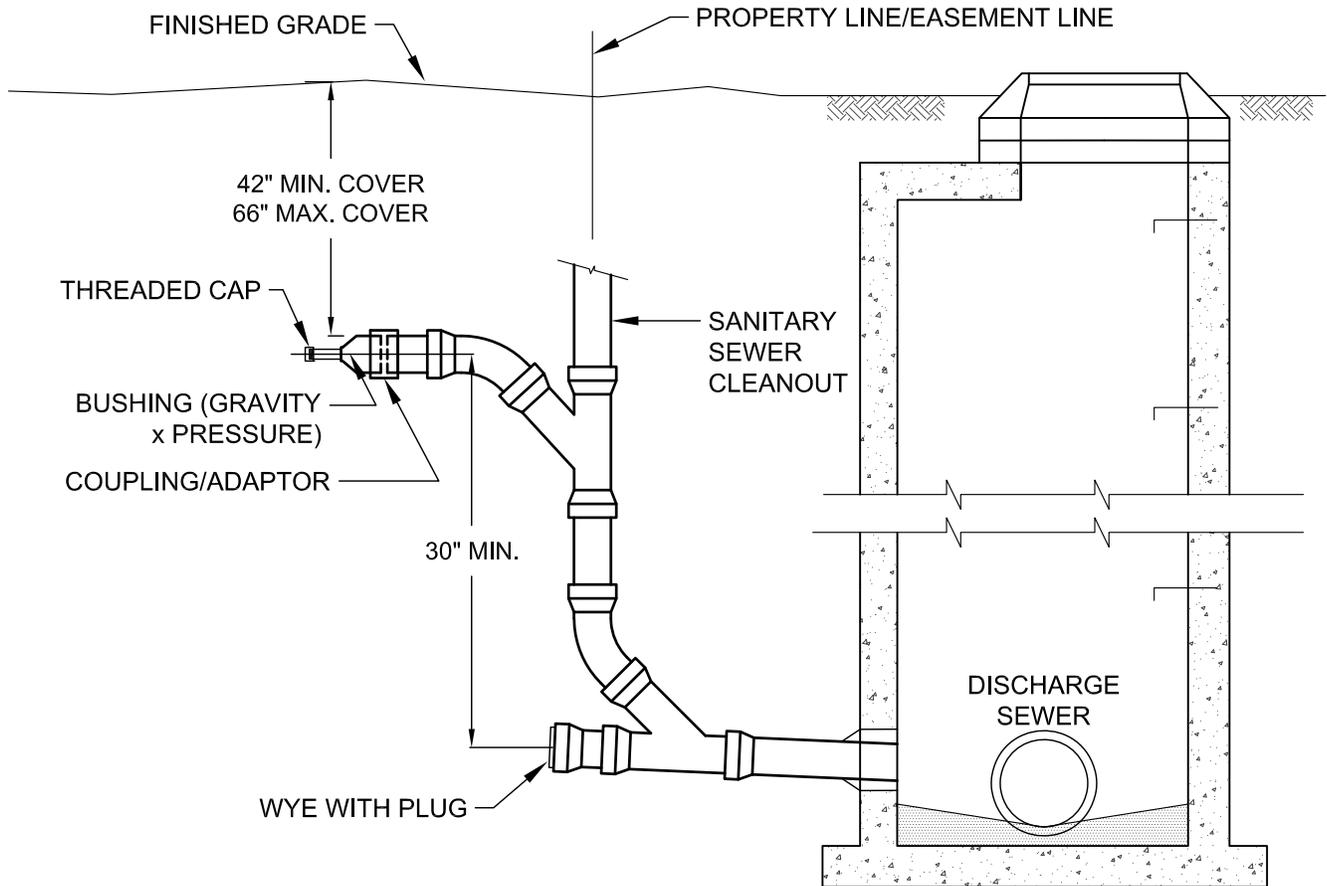
DATE:
MARCH 2024

REVISION:

**PRESSURE SEWER HOUSE CONNECTION
TO GRAVITY SEWER LINE**

DETAIL
SEW-05a

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



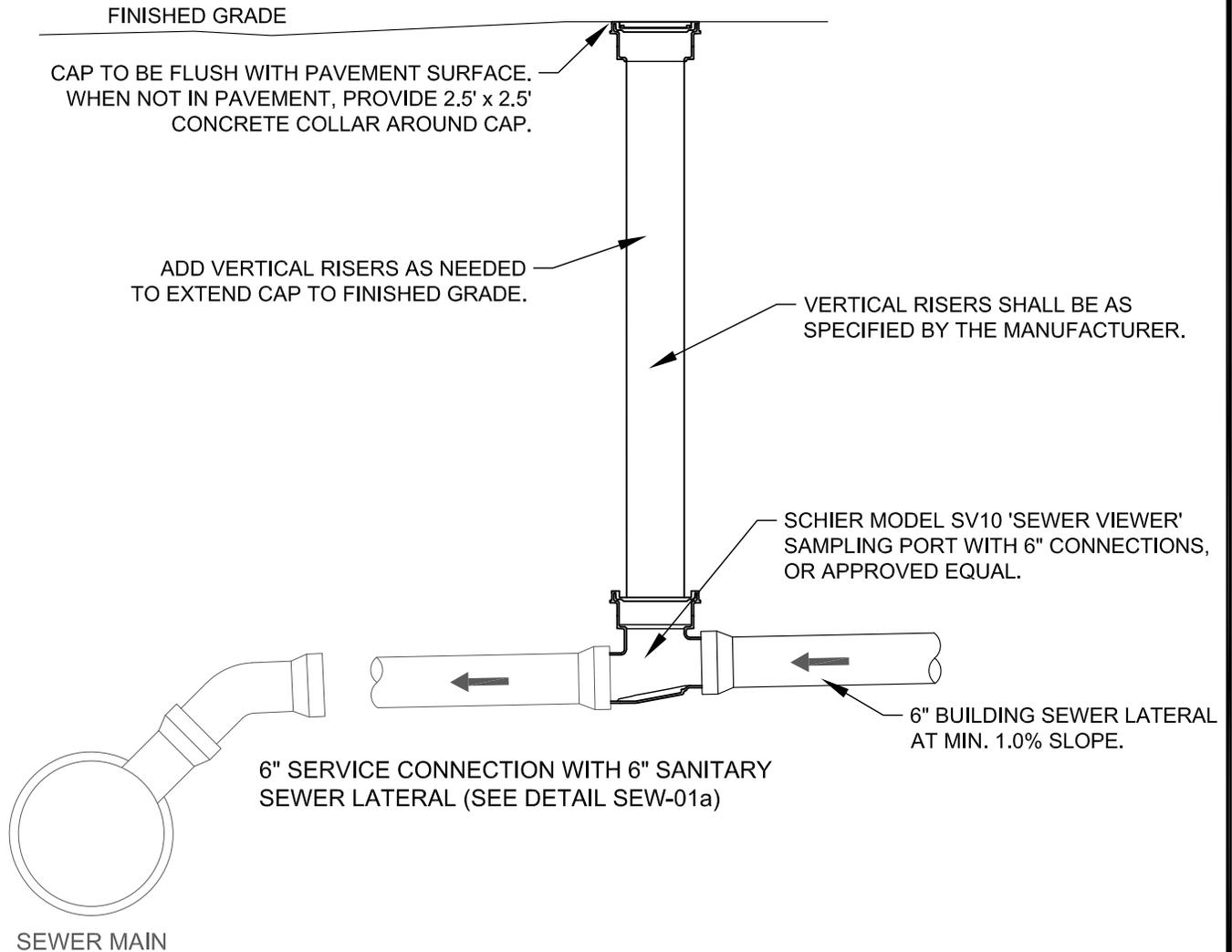
- NOTES:**
1. DETAIL TO BE USED WHEN CONNECTING FORCE MAIN FROM PRIVATE GRINDER PUMP TO GRAVITY SEWER MANHOLE.
 2. APPLY ACID RESISTANT LINING TO MANHOLE AS REQUIRED IN STANDARDS & SPECIFICATIONS.
 3. SEE STANDARD DETAILS SEW-01a AND SEW-01b FOR SERVICE LATERAL AND CLEANOUT REQUIREMENTS.
 4. CLEANOUT SHALL BE LOCATED AT LEAST 10' FROM MANHOLE.

DATE:
MARCH 2024
REVISION:

**PRESSURE SEWER HOUSE CONNECTION
TO GRAVITY SEWER MANHOLE**

DETAIL
SEW-05b

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



SAMPLE PORT & CLEANOUT FOR 6" COMMERCIAL GRAVITY SEWER CONNECTION N.T.S.

NOTES:

1. THIS DETAIL IS FOR STANDARD 6-INCH COMMERCIAL GRAVITY SEWER CONNECTIONS.
2. THE SAMPLE PORT SHALL BE A SINGLE UNIT AND SHALL BE A SHIER 'SEWER VIEWER' SAMPLING PORT MODEL SV10 OR APPROVED EQUAL, AND SHALL ALSO SERVE AS INITIAL CLEANOUT FOR GRAVITY SEWER CONNECTION.
3. SEE DETAIL SEW-01a FOR SANITARY SEWER SERVICE CONNECTION AND LATERAL.

DATE:
MARCH 2024

REVISION:

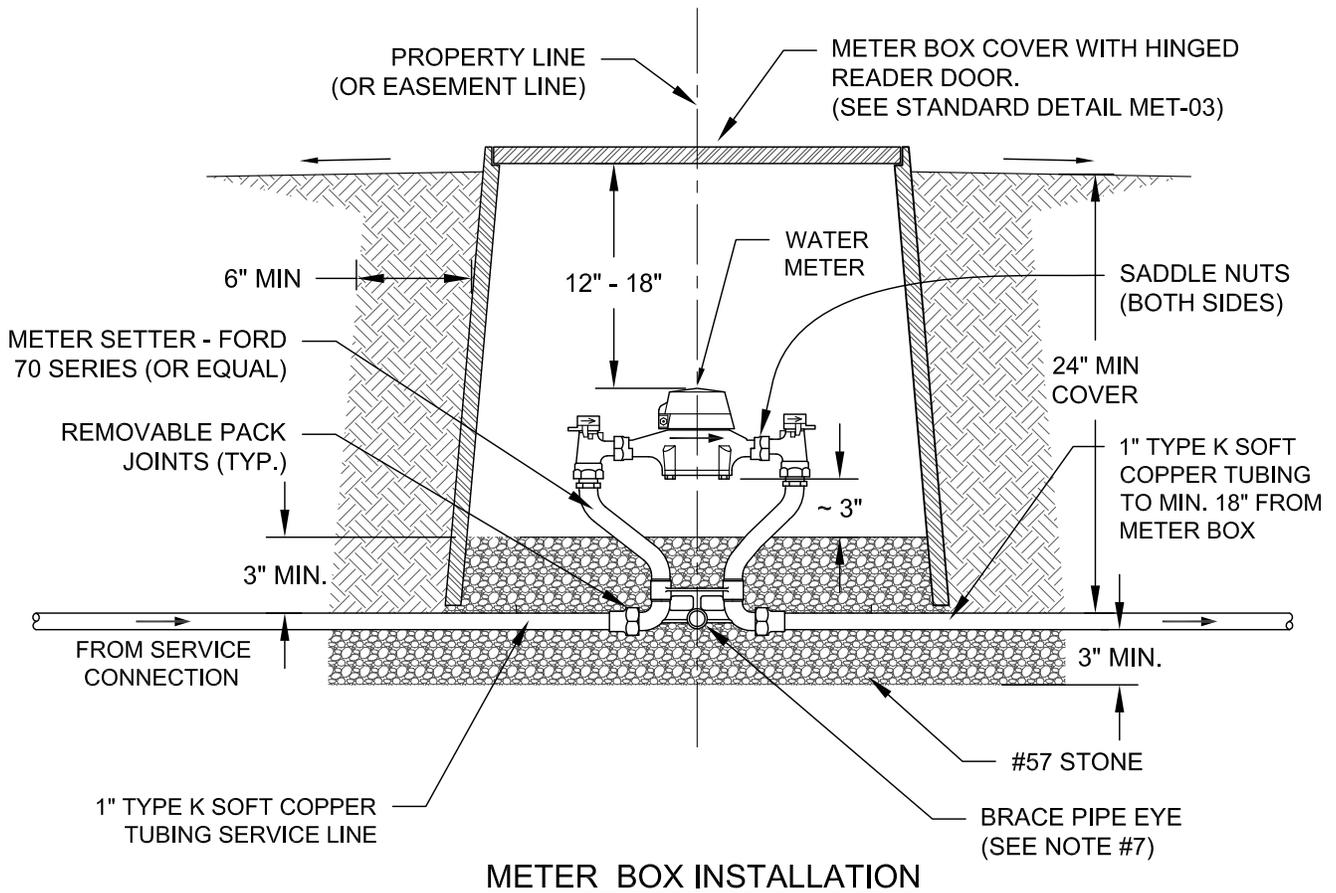
**SAMPLE PORT AND CLEANOUT FOR
6" COMMERCIAL SANITARY SEWER LATERAL**

DETAIL
SEW-06

3.3

Water Details

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



METER BOX INSTALLATION

NOTES:

- 1) THIS INSTALLATION SHALL BE USED FOR ALL 5/8" AND 1" METERS. EACH END OF METER SETTER SHALL HAVE REMOVABLE PACK JOINTS SUITABLE FOR COPPER TUBING.
- 2) SEE STANDARD DETAIL MET-03 FOR METER BOX REQUIREMENTS.
- 3) SEE STANDARD DETAIL MET-05 FOR SERVICE CONNECTION REQUIREMENTS.
- 4) ALL METERSETTERS SHALL HAVE SADDLE NUTS, PADLOCK WINGS AND SHALL BE EQUIVALENT TO FORD OR MUELLER.
- 5) PROVIDE 18" OF 1/2" SCH 80 PVC (OR EQUAL) PIPE CENTERED THROUGH BRACE PIPE EYE.
- 6) BACKFILL SERVICE LINE WITH 6" SAND OR STONE DUST ALL AROUND.
- 7) METER BOXES FOR RESIDENTIAL CONNECTIONS SHALL BE LOCATED OUTSIDE DRIVEWAYS AND OTHER PAVEMENT UNLESS SPECIFICALLY APPROVED OTHERWISE BY DPU.
- 8) PROVIDE POSITIVE DRAINAGE AWAY FROM METER BOX IN ALL DIRECTIONS.
- 9) METER BOX SHALL BE CENTERED OVER METER SETTER, WITH VALVES AT LEAST 2" FROM INSIDE WALL.
- 10) METER BOX SHALL BE FREE OF DEFECTS IN MANUFACTURING AND INSTALLATION, WITH NO ABNORMAL DISTORTION OR INWARD BULGING OF WALLS.
- 11) METER SETTER AND METER BOX SHALL BE LEVEL. VALVES SHALL BE ALIGNED WITH EACH OTHER BOTH VERTICALLY & HORIZONTALLY, AND SHALL BE BETWEEN 7-1/2" AND 8-1/2" APART.
- 12) METER SETTER SHALL BE FREE OF EXCESSIVE DIRT AND MUD.
- 13) WATER METER WILL BE FURNISHED & INSTALLED BY THE DEPARTMENT OF PUBLIC UTILITIES.

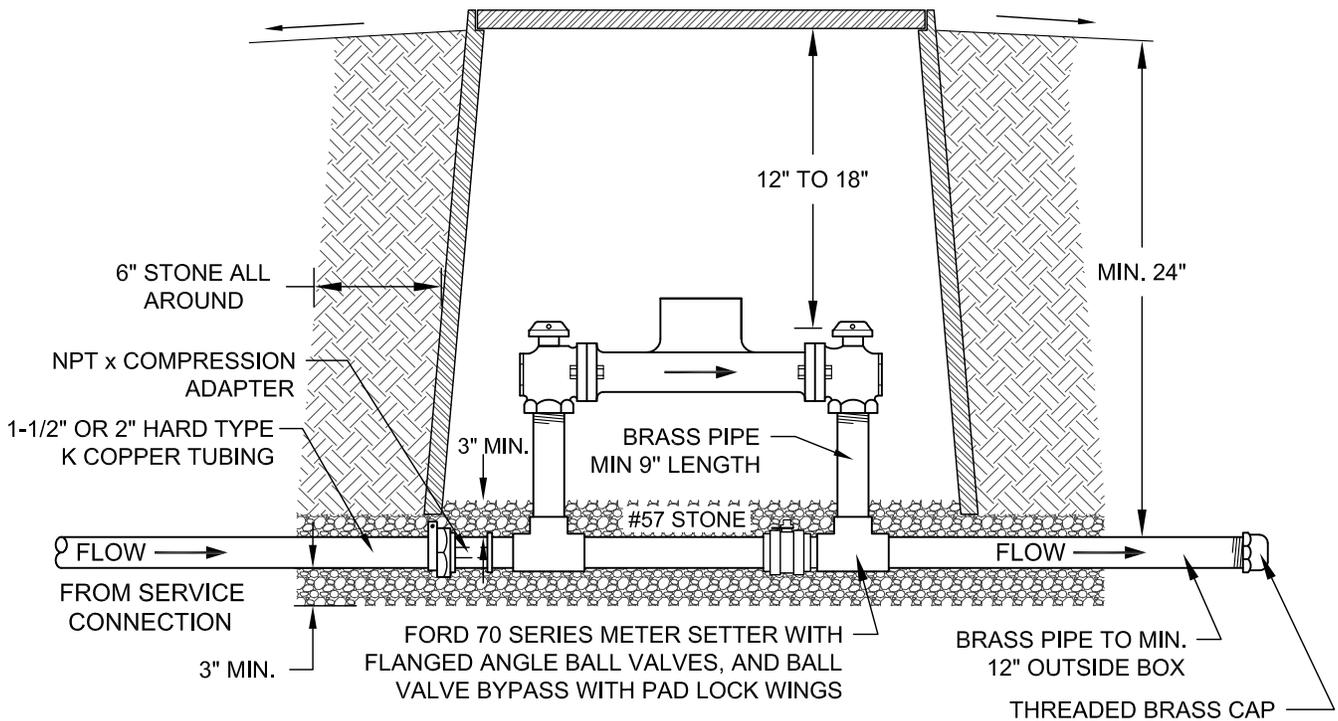
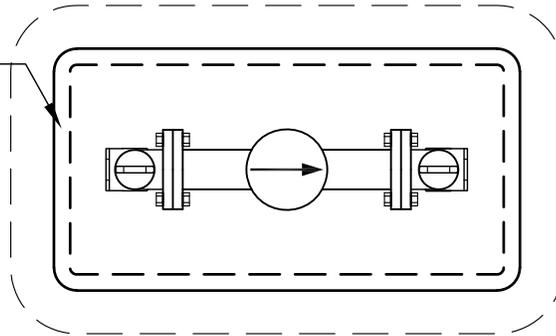
DATE:
MARCH 2024
REVISION:

**STANDARD METER BOX & METERSETTER
INSTALLATION FOR 5/8" AND 1" METERS**

DETAIL
MET-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

SEE STANDARD DETAIL MET-03
FOR METER BOX SPECIFICATIONS



NOTES:

- 1) THIS INSTALLATION SHALL BE USED FOR ALL 1-1/2" AND 2" METERS.
- 3) SEE STANDARD DETAIL MET-03 FOR METER BOX REQUIREMENTS.
- 4) SEE STANDARD DETAIL MET-06 FOR SERVICE CONNECTION REQUIREMENTS.
- 5) BACKFILL SERVICE LINE WITH 6" SAND OR STONE DUST ALL AROUND.
- 6) METER BOXES FOR RESIDENTIAL CONNECTIONS SHALL BE LOCATED OUTSIDE DRIVEWAYS AND OTHER PAVEMENT UNLESS SPECIFICALLY APPROVED OTHERWISE BY DPU.
- 7) PROVIDE POSITIVE DRAINAGE AWAY FROM METER BOX IN ALL DIRECTIONS.
- 8) METER BOX SHALL BE CENTERED OVER METER SETTER, WITH VALVES AT LEAST 2" FROM INSIDE WALL.
- 9) METER BOX SHALL BE FREE OF DEFECTS IN MANUFACTURING AND INSTALLATION, WITH NO ABNORMAL DISTORTION OR INWARD BULGING OF WALLS.
- 10) METER SETTER AND METER BOX SHALL BE LEVEL.
- 11) METER SETTER SHALL BE FREE OF EXCESSIVE DIRT AND MUD.
- 12) WATER METER WILL BE FURNISHED & INSTALLED BY THE DEPARTMENT OF PUBLIC UTILITIES.

DATE:
MARCH 2024

REVISION:

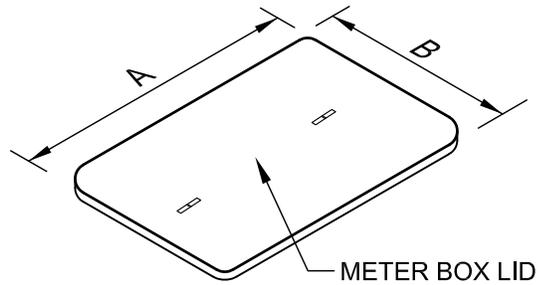
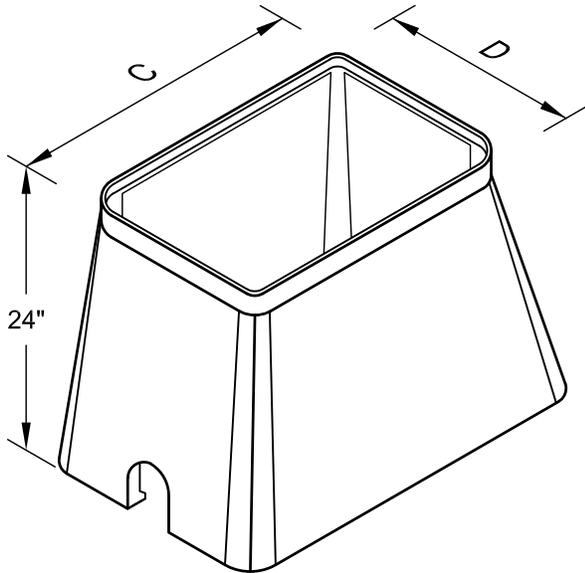
**WATER METER SETTING
FOR 1-1/2" AND 2" METER**

DETAIL
MET-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

STANDARD METER BOXES - MINIMUM DIMENSIONS			
Meter Size	5/8"x 3/4" & 1"	1-1/2"	2"
* Model No.	PM121824PCH00050	PM243624HDH00050	PM304824HD0050
DIM A	20-7/16"	38-1/2"	50-1/2"
DIM B	14-7/16"	26-1/2"	32-1/2"
DIM C	22-3/4"	40-7/8"	52-7/8"
DIM D	16-3/4"	28-7/8"	34-7/8"

* Meter Boxes and Lids Shall be Hubbell PenCell PM (PEM Series) or Approved Equal



NOTES:

- 1) METER BOXES SHALL BE PLACED IN UNPAVED, NON-TRAFFIC AREAS.
- 2) METER BOXES SHALL BE HUBBELL PENCELL PM (PEM SERIES) HDPE OR APPROVED EQUAL.
- 3) METER BOX COVERS SHALL BE FLUSH MOUNTED POLYMER CONCRETE OR HDPE BY HUBBELL OR APPROVED EQUAL.
- 4) METER BOXES SHALL HAVE A MINIMUM VERTICAL LOAD RATING OF 15,000 LBS AND HAVE AN ANTI-SETTLING FLANGE ON BOTTOM OF THE BOX.
- 5) WHERE A METER BOX MUST BE PLACED IN TRAFFIC AREAS, BOX SPECIFICATION SHALL BE DETERMINED ON A CASE-BY-CASE BASIS.
- 6) ALL METER BOXES MUST BE BEDDED COMPLETELY IN CLEAN STONE AND SHALL BE FREE OF DIRT AND DEBRIS.

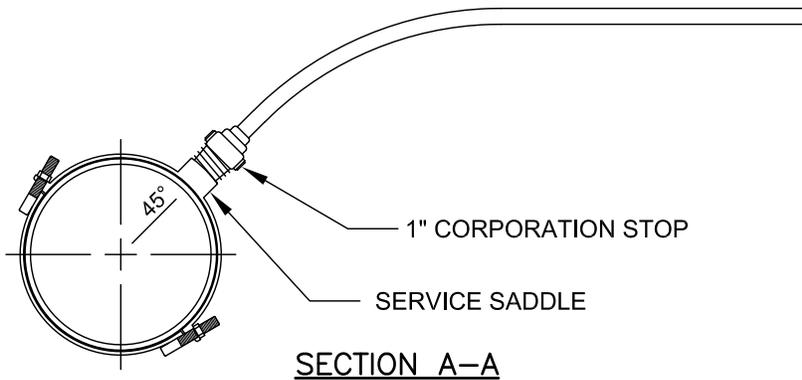
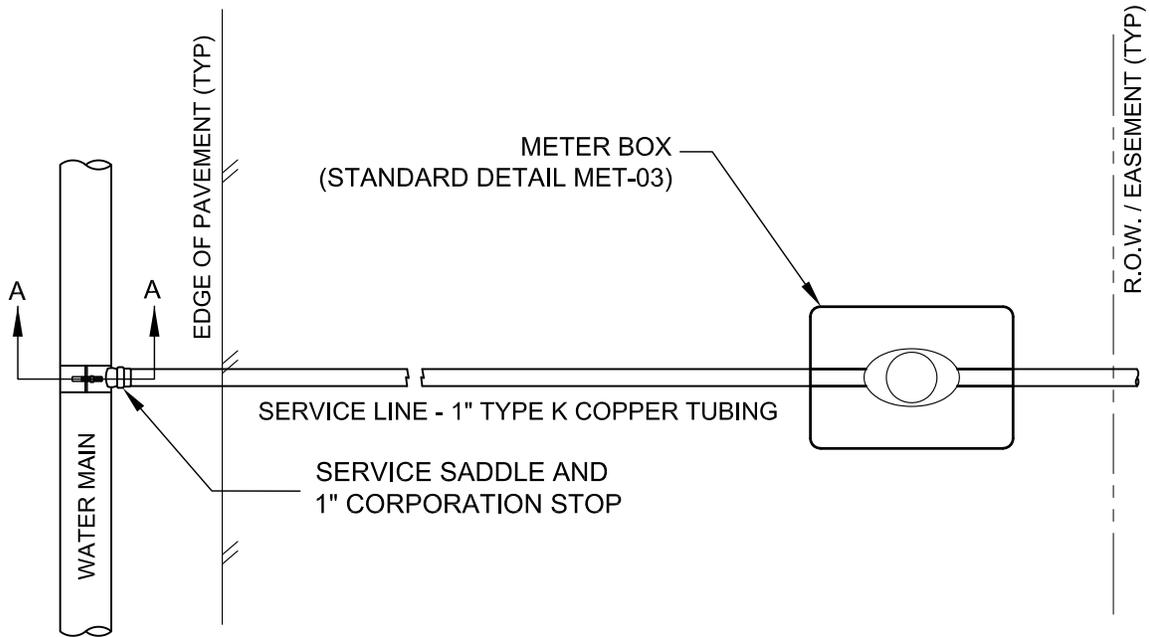
DATE:
MARCH 2024

REVISION:

**STANDARD WATER METER BOXES FOR
METERS 2" AND SMALLER**

DETAIL
MET-03

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

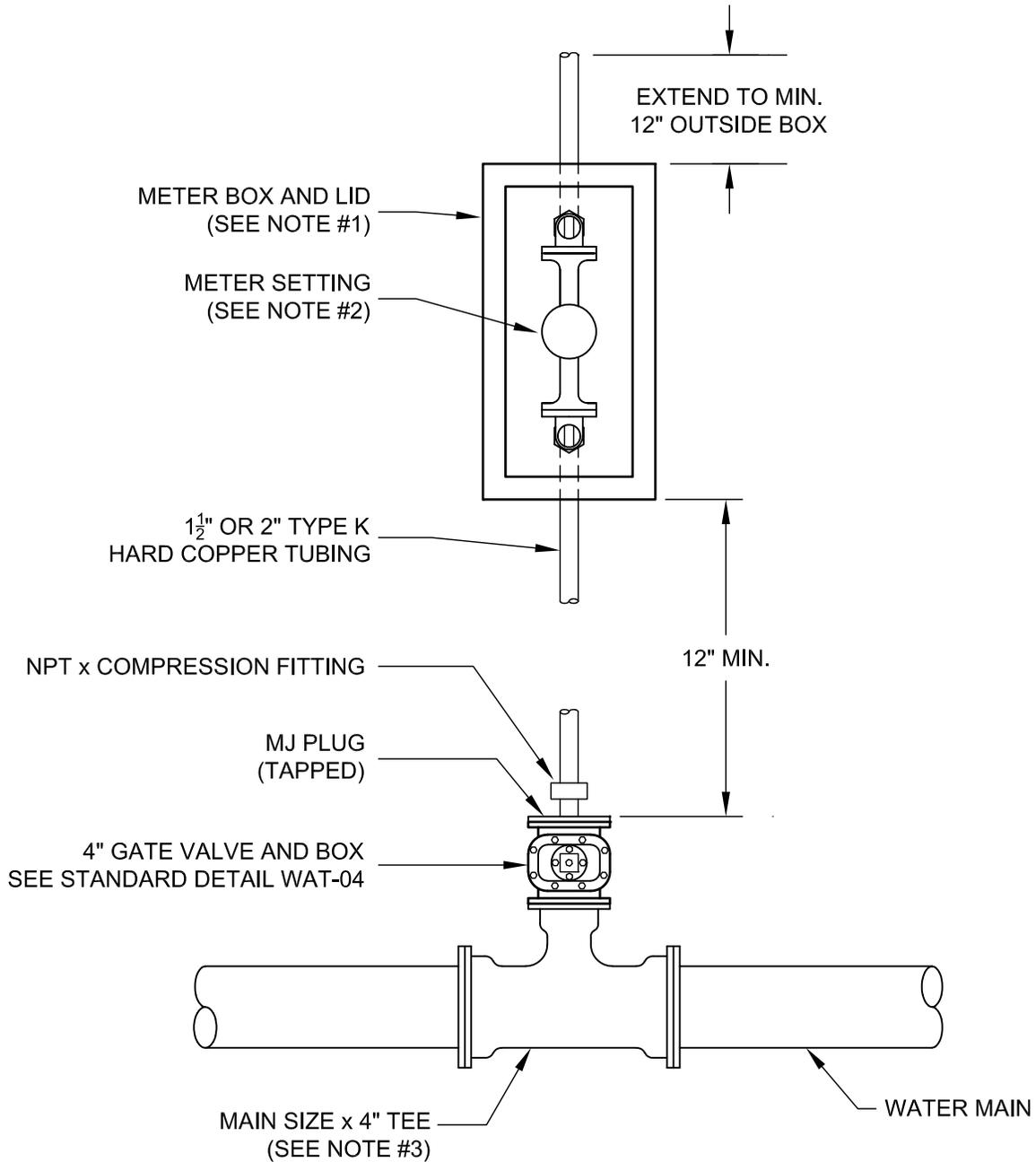
- 1) THIS IS THE STANDARD WATER SERVICE CONNECTION FOR USE WITH 5/8" AND 1" METERS. DESIGN EXCEPTIONS MUST BE APPROVED BY DPU.
- 2) ALL SERVICE LINES SHALL BE A SINGLE PIECE OF TYPE K COPPER FROM THE CORPORATION STOP TO THE METER.
- 3) SERVICE SADDLE SHALL BE FORD FC202 OR APPROVED EQUAL WITH 1" AWWA/CC THREADS BY FLARED OR COMPRESSION END FOR 1" COPPER TUBING.
- 4) CORPORATION STOP SHALL BE FORD BALLCORP FB1000 SERIES OR APPROVED EQUAL WITH 1" AWW/CC TAPER THREADS.
- 5) BACKFILL SERVICE LINE WITH 6" OF SAND ALL AROUND.
- 6) MAINTAIN MINIMUM 36" COVER OVER SERVICE LINE FROM MAIN TO METER BOX.
- 7) SEE STANDARD DETAILS MET-01 AND MET-03 AND THE APPROPRIATE SECTIONS OF THE STANDARDS FOR METER BOX AND METER SETTER REQUIREMENTS AND SPECIFICATIONS.

DATE:
MARCH 2024
REVISION:

**5/8" X 3/4" AND 1" WATER SERVICE
CONNECTION AND METER BOX**

DETAIL
MET-05

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTE:

1. SEE STANDARD DETAIL MET-03 FOR METER BOX REQUIREMENTS.
2. SEE STANDARD DETAIL MET-02 FOR METER SETTING REQUIREMENTS.
3. SEE STANDARD DETAIL BLK-02 FOR THRUST BLOCKING REQUIREMENTS.

DATE:
MARCH 2024

REVISION:

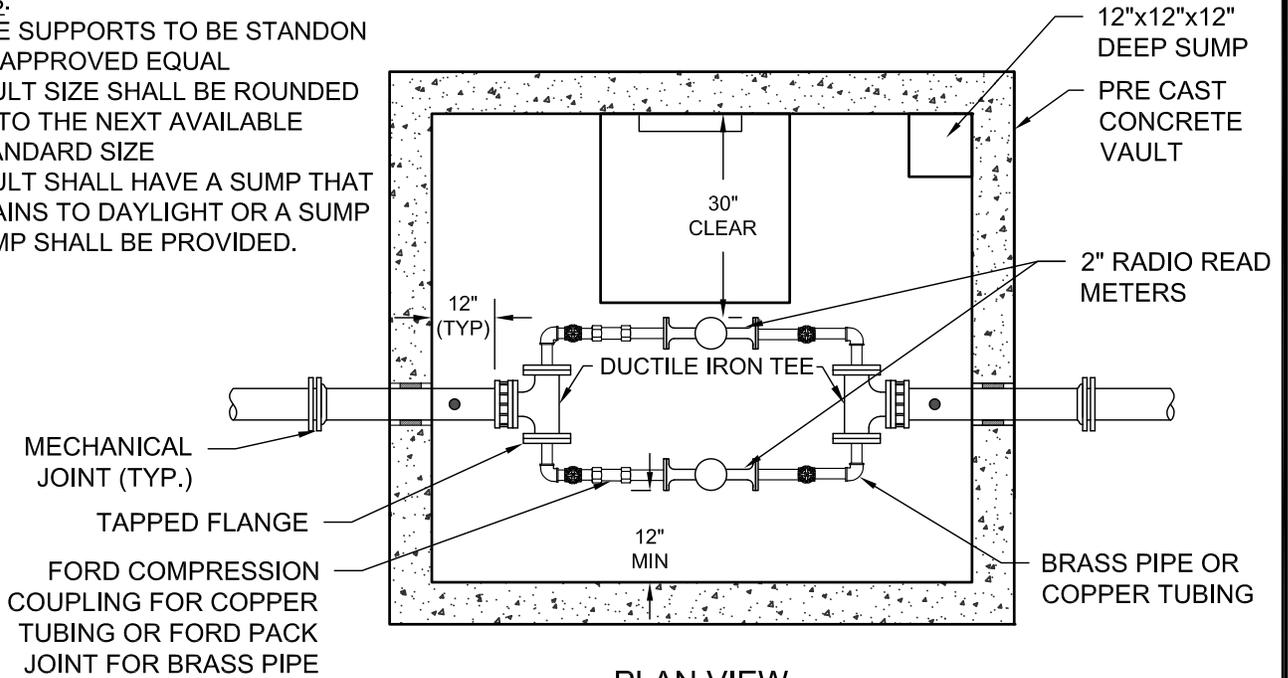
**STANDARD WATER SERVICE CONNECTION FOR
1-1/2" AND 2" SERVICE LINES**

DETAIL
MET-06

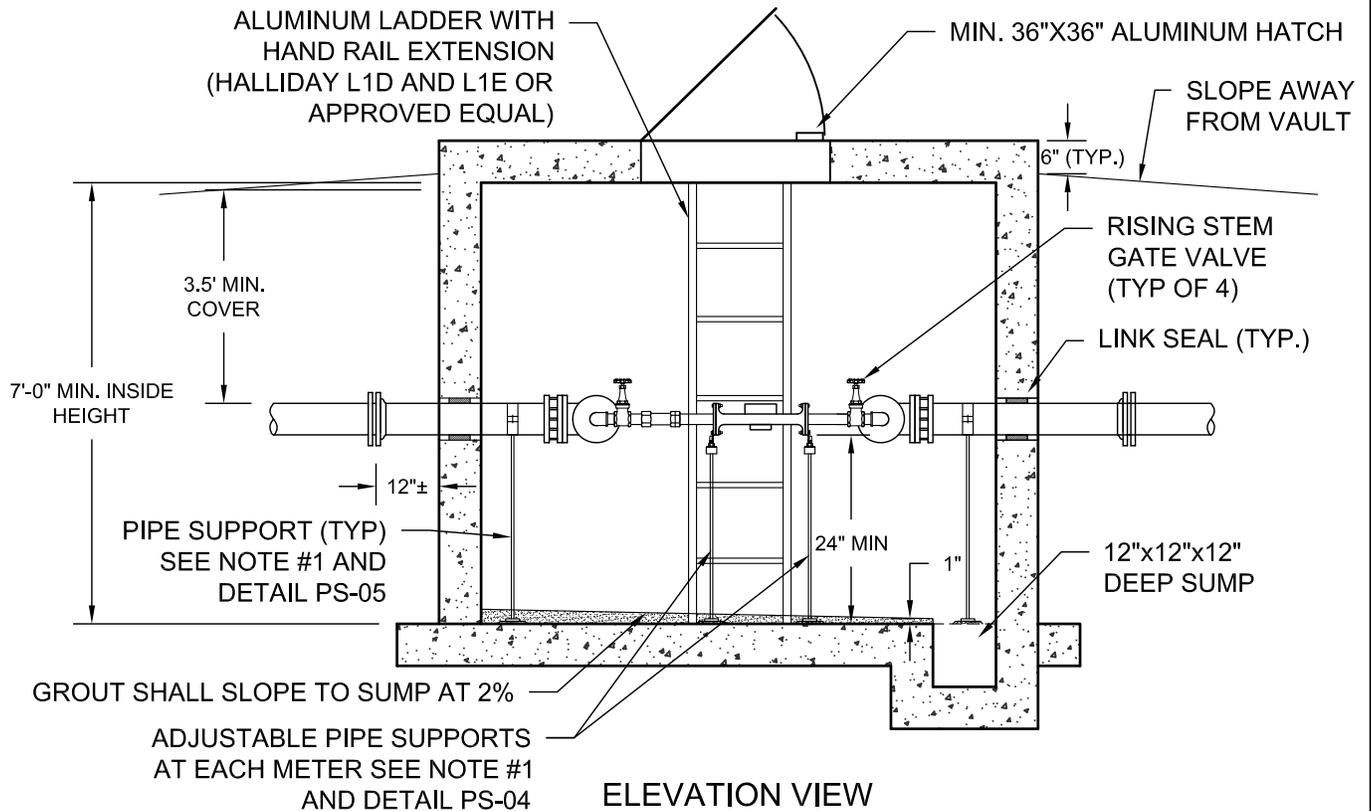
**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

NOTES:

1. PIPE SUPPORTS TO BE STANDON OR APPROVED EQUAL
2. VAULT SIZE SHALL BE ROUNDED UP TO THE NEXT AVAILABLE STANDARD SIZE
3. VAULT SHALL HAVE A SUMP THAT DRAINS TO DAYLIGHT OR A SUMP PUMP SHALL BE PROVIDED.



PLAN VIEW



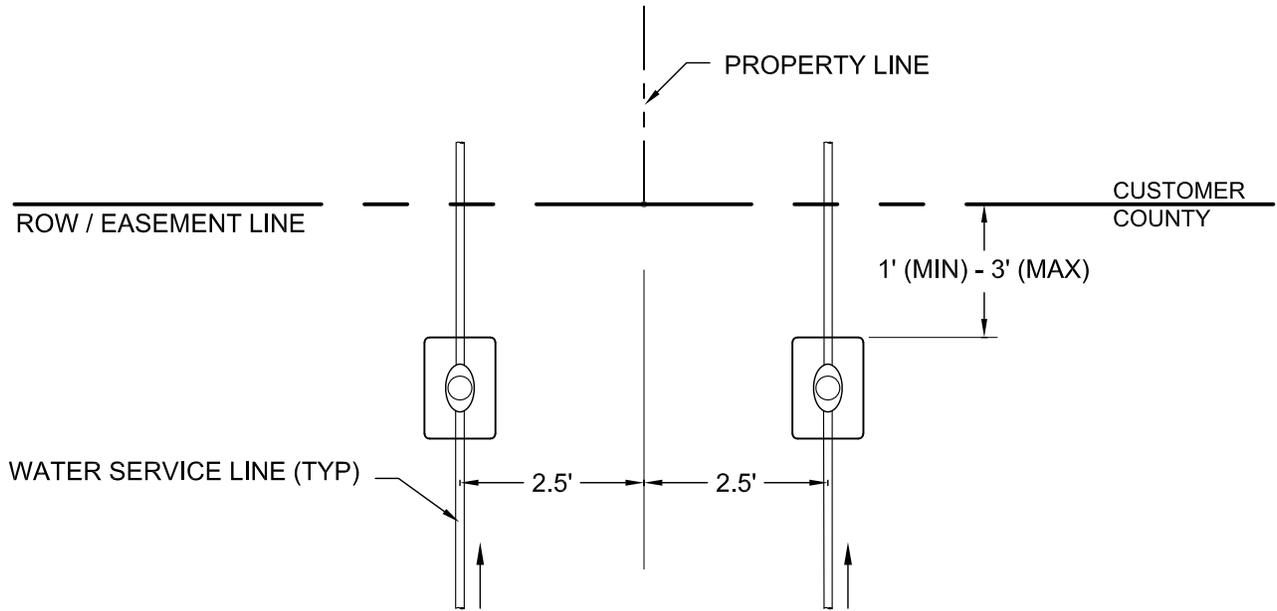
ELEVATION VIEW

DATE:
MARCH 2024
REVISION:

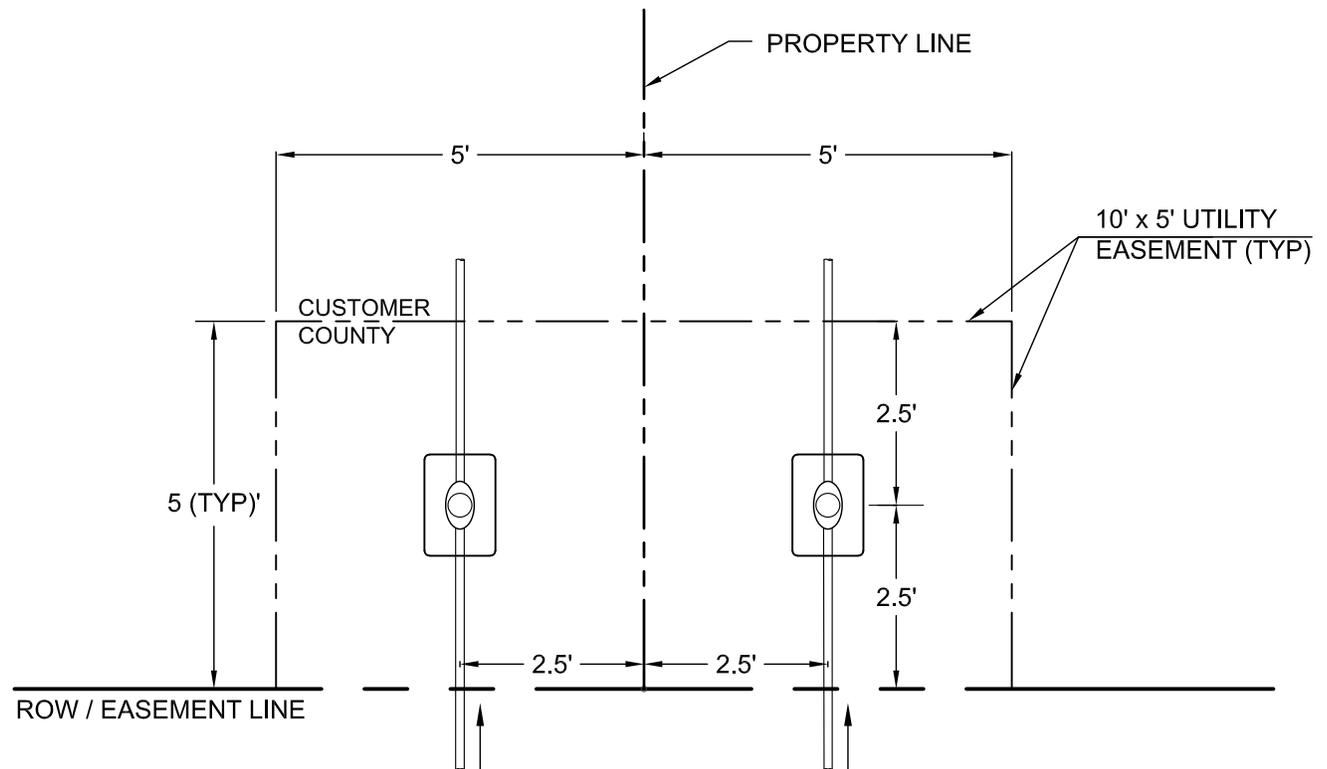
DUAL 2" METER SETTING

DETAIL
MET-07

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



METER BOXES IN RIGHT OF WAY



METER BOXES ON LOTS (OUTSIDE ROW)

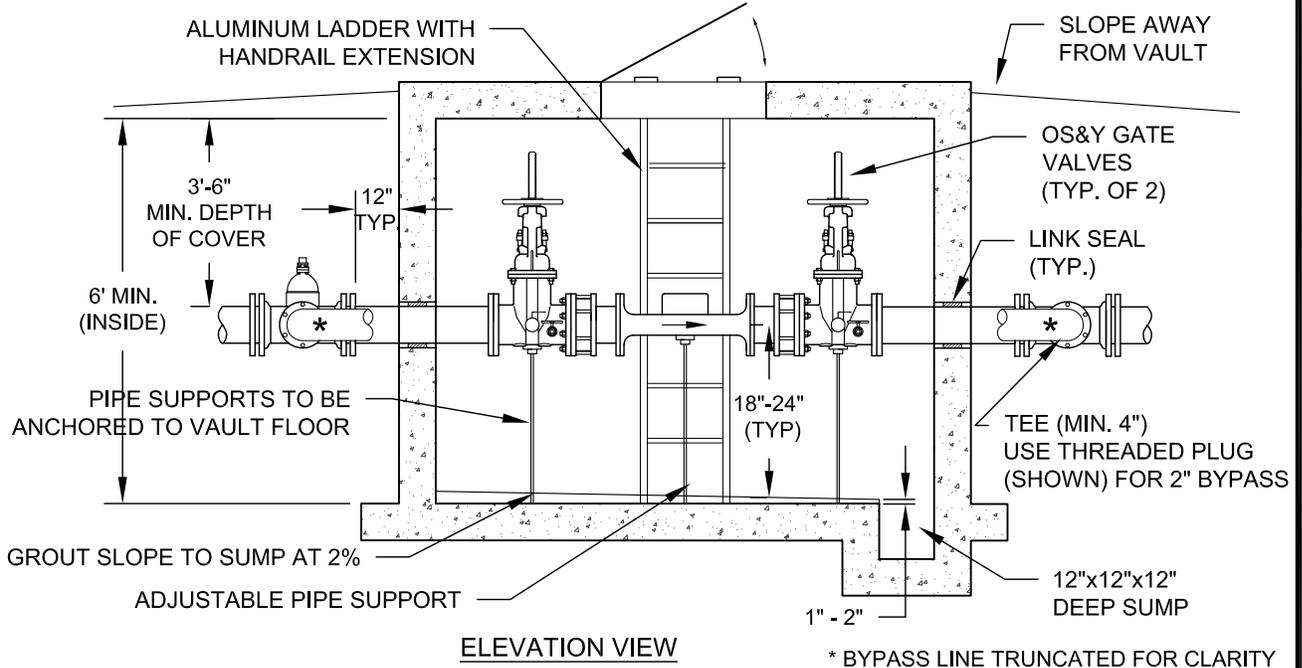
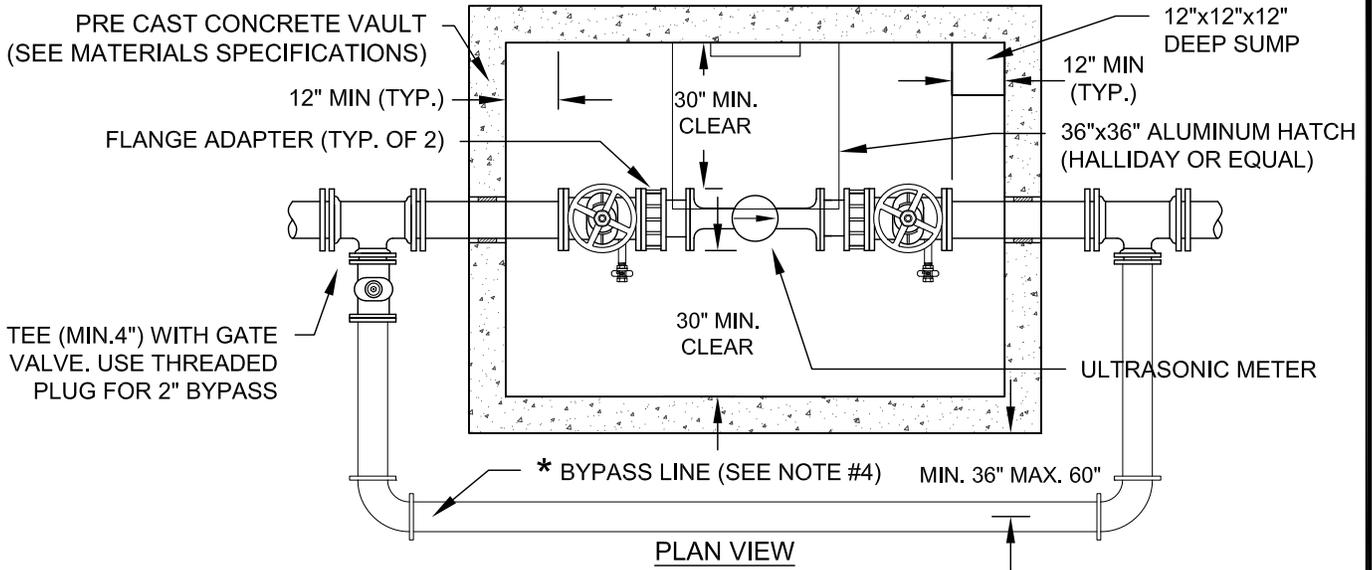
DATE:
MARCH 2024

REVISION:

**TYPICAL WATER METER LOCATIONS IN
RESIDENTIAL SUBDIVISIONS**

DETAIL NO.
MET-08

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1) PRE-CAST VAULT SHALL BE AS MANUFACTURED BY HANOVER PRECAST OR APPROVED EQUAL.
- 2) PIPE SUPPORTS TO BE ANCHORED TO VAULT FLOOR (NOT GROUT) USING STAINLESS STEEL ADHESIVE ANCHORS.
- 3) PIPE SUPPORTS TO BE IN ACCORDANCE WITH STANDARD DETAILS.
- 4) VAULT SIZE SHALL BE ROUNDED UP TO NEXT AVAILABLE STANDARD SIZE.
- 5) BYPASS LINE SHALL BE 2" SMALLER IN DIAMETER THAN SERVICE LINE (MINIMUM 2"). USE TYPE "K" HARD COPPER TUBING IF 2" OR SMALLER, DIP FOR LARGER THAN 2".
- 6) FOR 3" METER USE 4" PIPE, VALVES & FITTINGS WITH REDUCER AT EACH END OF METER.
- 7) METHOD FOR DRAINING VAULT MUST BE SHOWN ON PLANS (GRAVITY OR SUMP PUMP).

DATE:
MARCH 2024

REVISION:

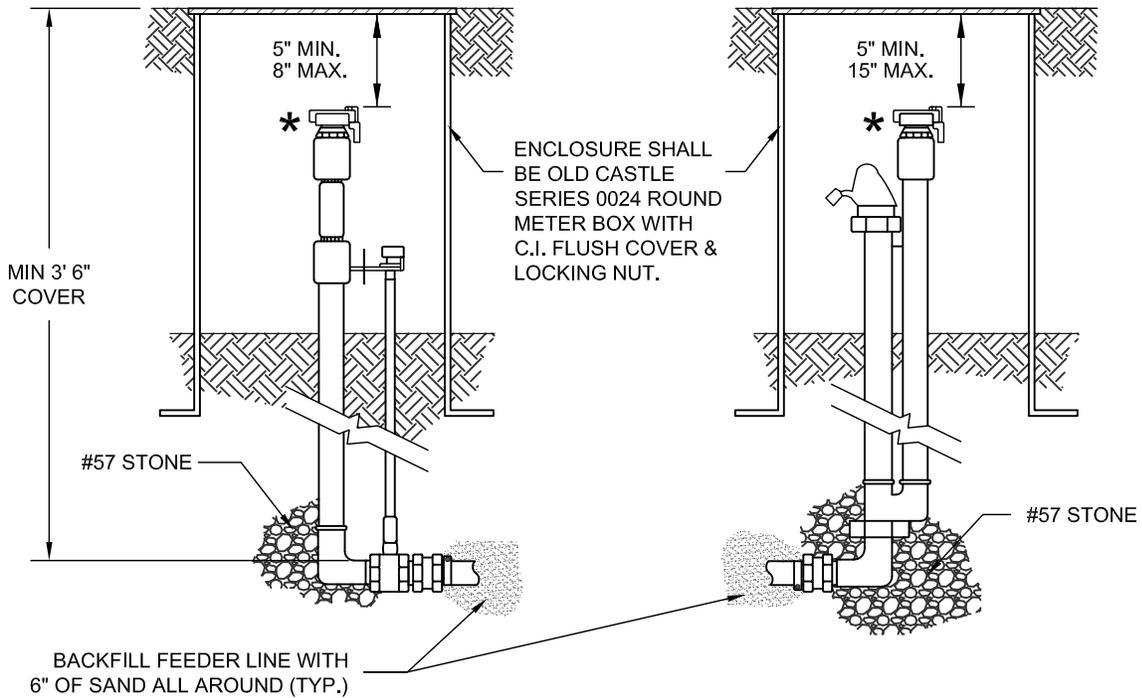
**METER SETTING AND VAULT FOR
3" TO 10" ULTRASONIC METER**

DETAIL
MET-10

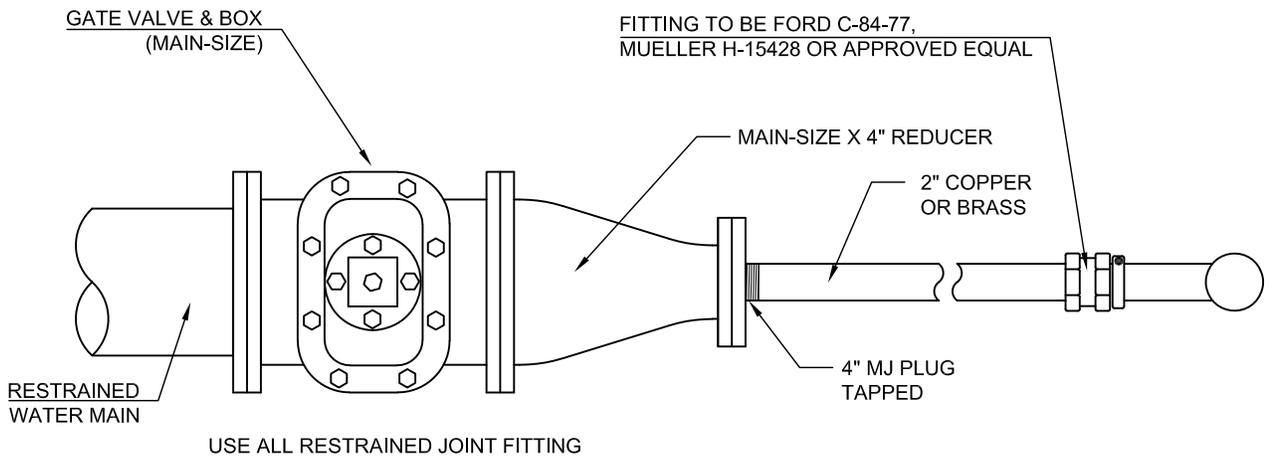
GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES

2" AQUARIUS "ONE-O-ONE" HH

MAINGUARD MODEL # 78



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



FLUSHING HYDRANT LOCATION REQUIREMENTS:

- 1) FOR DEAD-END RUNS AND CUL-DE-SACS SEE STANDARD DETAIL WAT-02
- 2) FOR THROUGH STREETS SEE STANDARD DETAIL WAT-03

DATE:
MARCH 2024

REVISION:

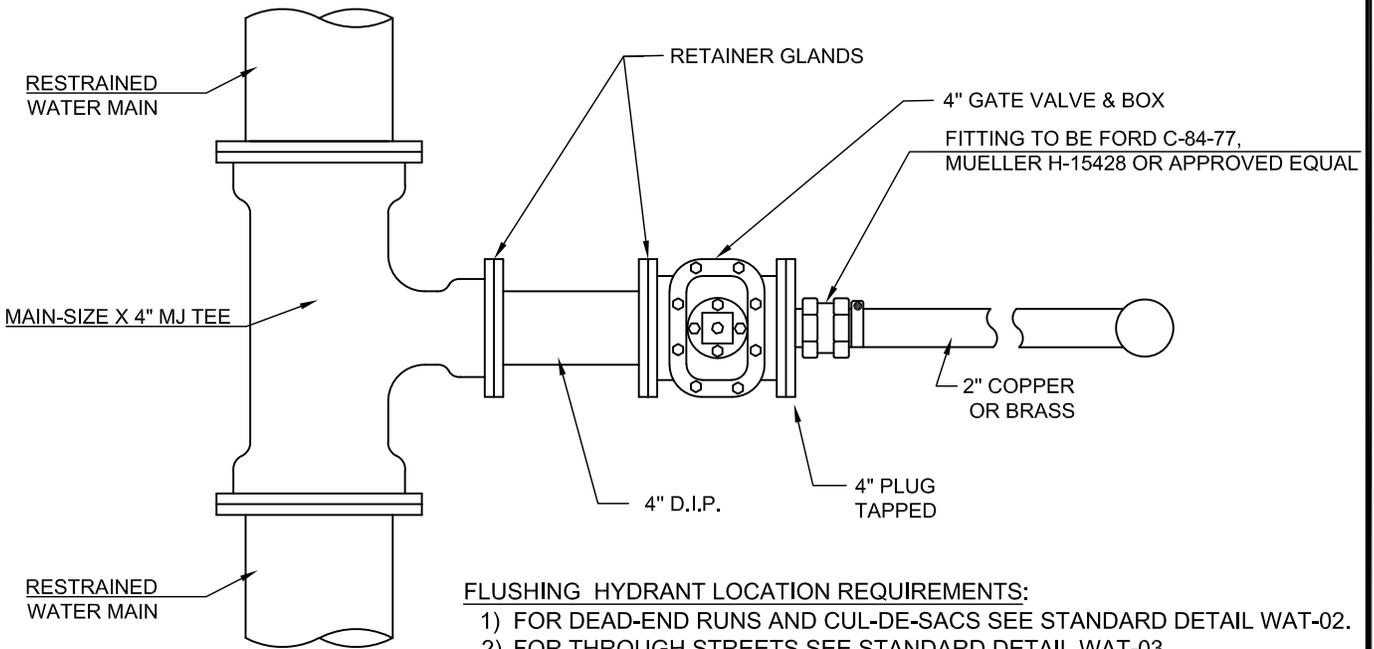
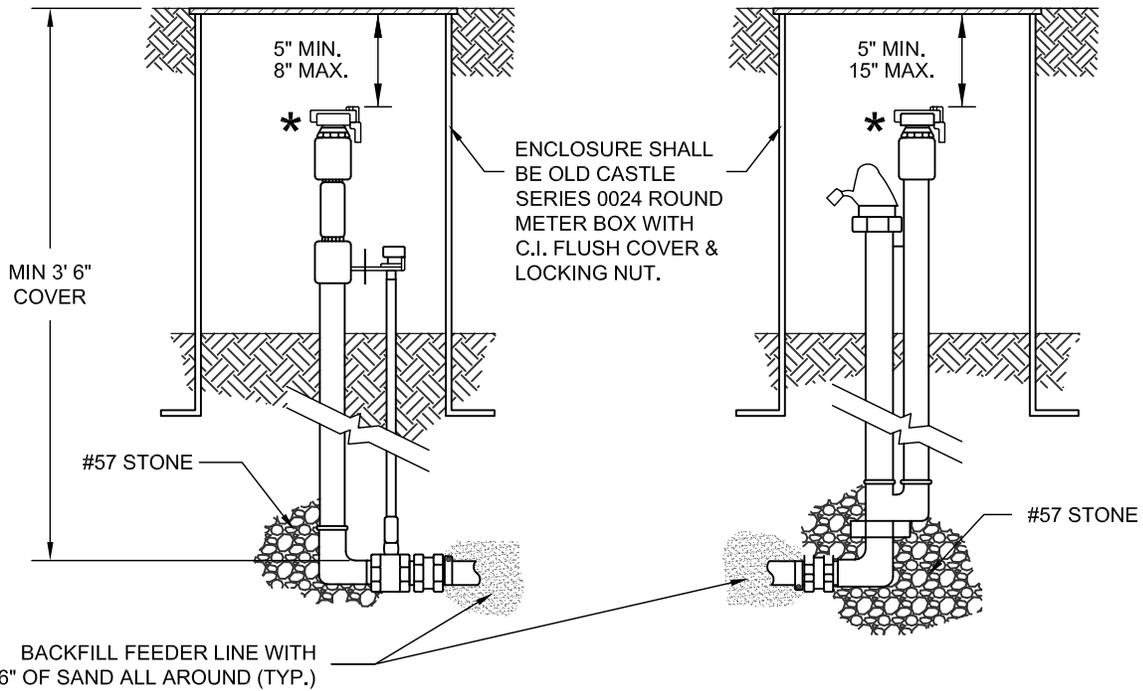
FLUSHING HYDRANT AT DEAD-END

DETAIL
WAT-01a

GOOCHLAND COUNTY DEPARTMENT OF PUBLIC UTILITIES

2" AQUARIUS "ONE-O-ONE" HH

MAINGUARD MODEL # 78



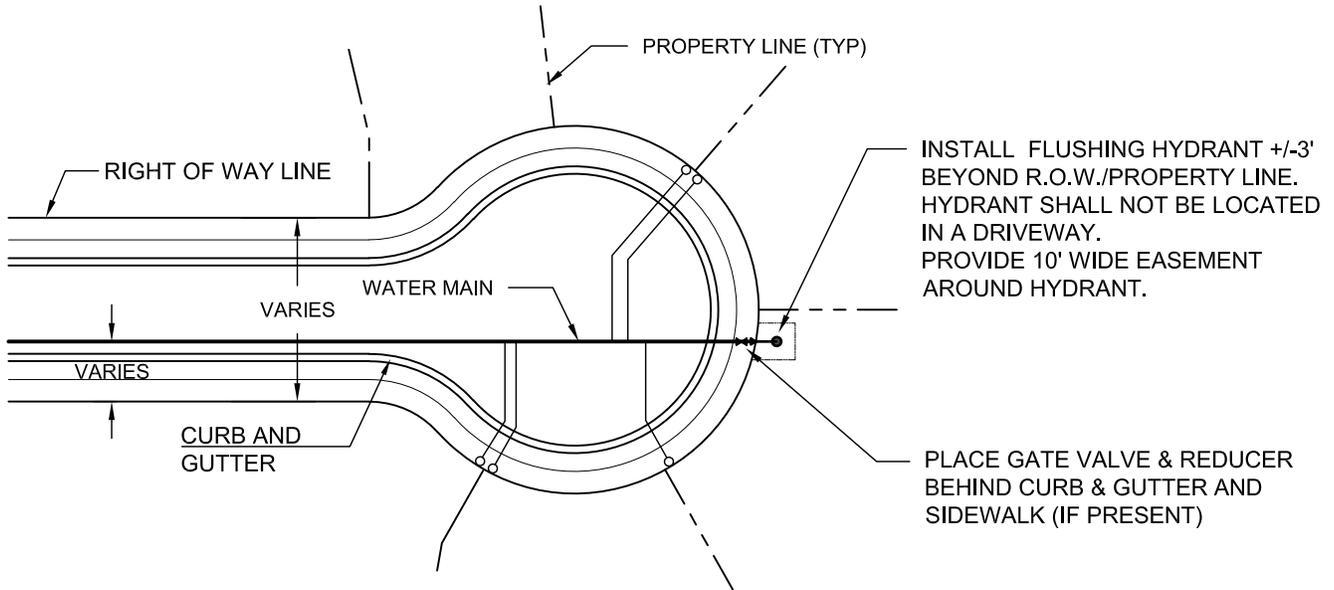
DATE:
MARCH 2024
REVISION:

FLUSHING HYDRANTS ALONG WATER MAIN

DETAIL
WAT-01b

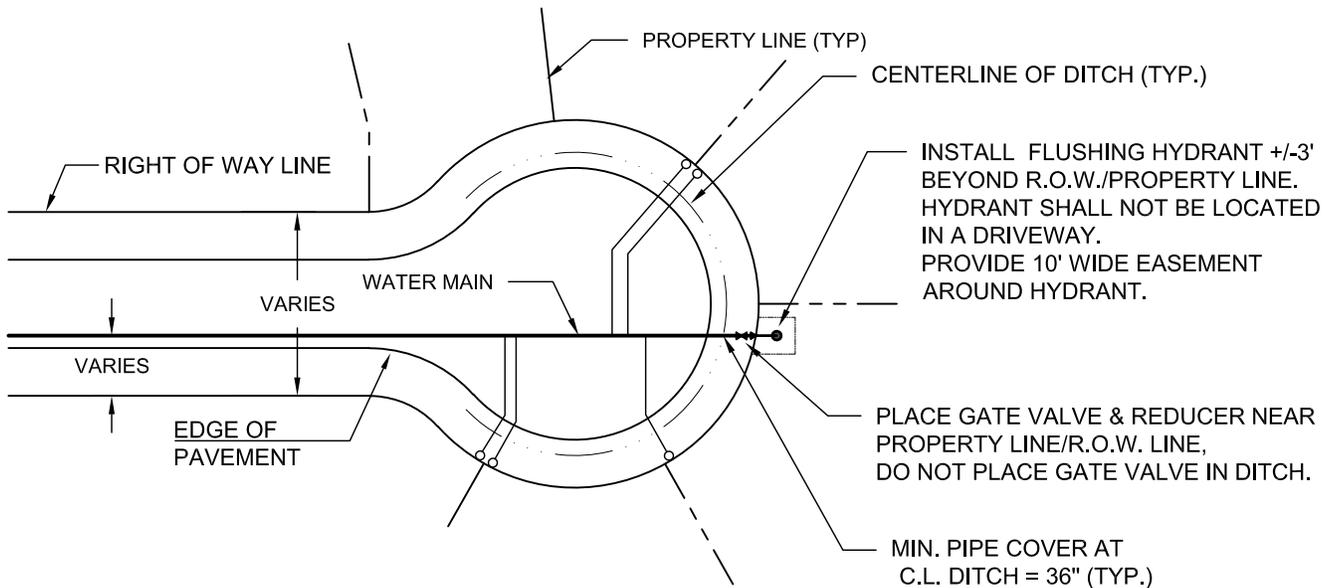
**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

CUL-DE-SAC WITH CURB AND GUTTER



NOTE: SEE STANDARD DETAIL WAT-1a FOR FLUSHING HYDRANT INSTALLATION DETAILS

CUL-DE-SAC WITHOUT CURB AND GUTTER



NOTE: SEE STANDARD DETAIL WAT-1a FOR FLUSHING HYDRANT INSTALLATION DETAILS

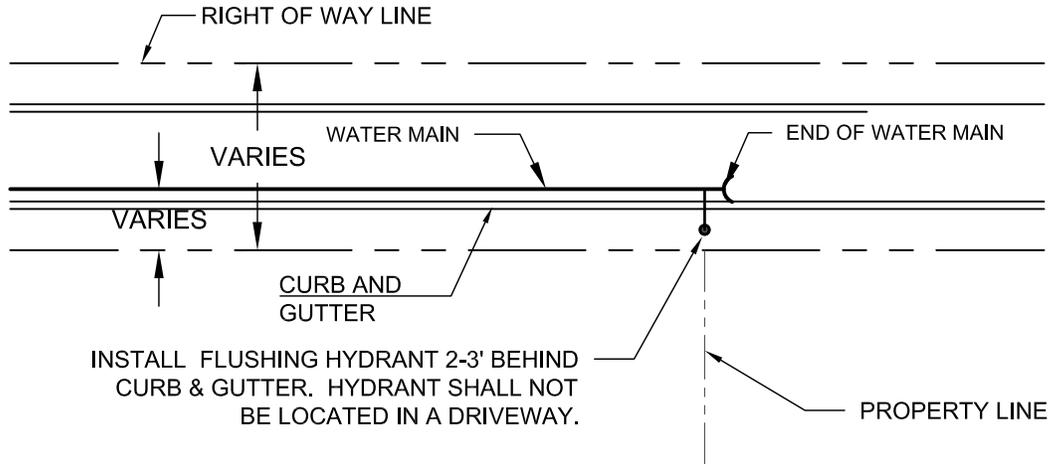
DATE:
MARCH 2024
REVISION:

**TYPICAL FLUSHING HYDRANT LOCATION
ON CUL-DE-SAC**

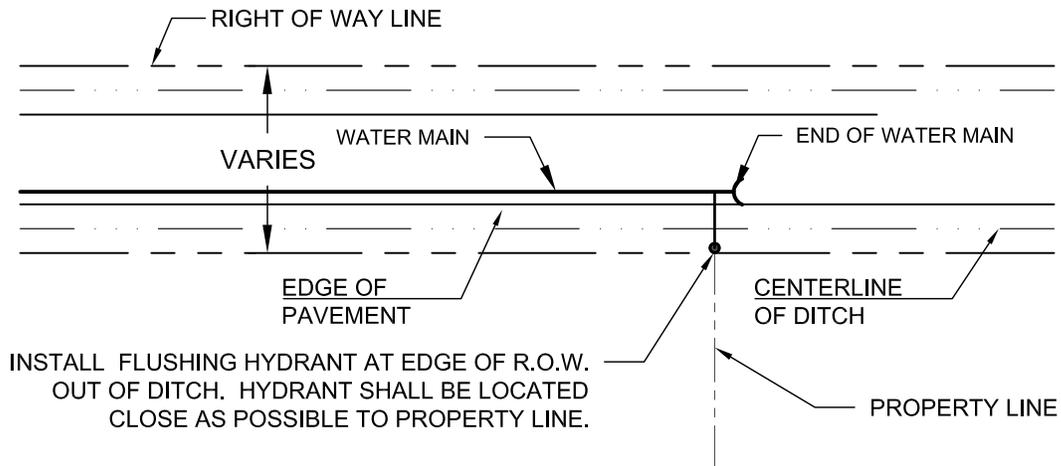
DETAIL
WAT-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**

STREET WITH CURB AND GUTTER



STREET WITHOUT CURB AND GUTTER



NOTES:

- 1) WHERE DITCH IS PRESENT, FLUSHING HYDRANT SHALL BE PLACED BETWEEN DITCH-LINE AND ROW. LINE AS SHOWN ABOVE
- 2) SEE STANDARD DETAIL WAT-01b FOR FLUSHING HYDRANT INSTALLATION DETAILS

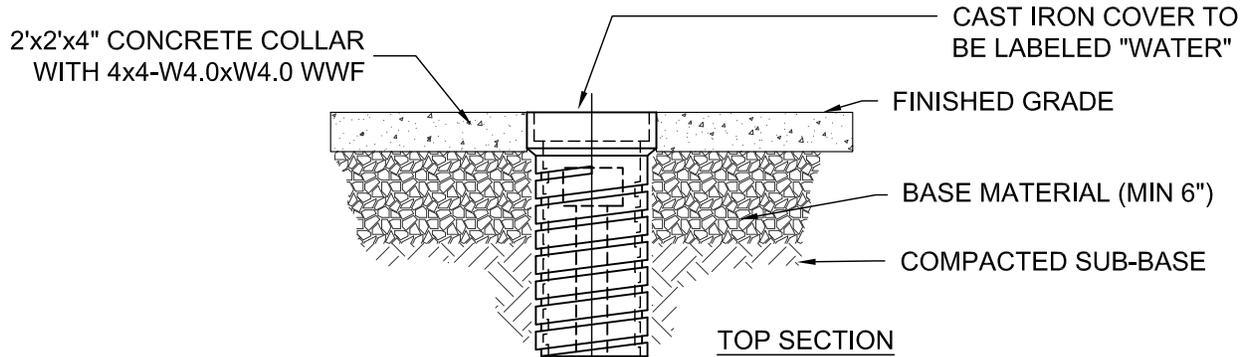
DATE:
MARCH 2024

REVISION:

**TYPICAL FLUSHING HYDRANT LOCATION
ALONG A STREET OR ROADWAY**

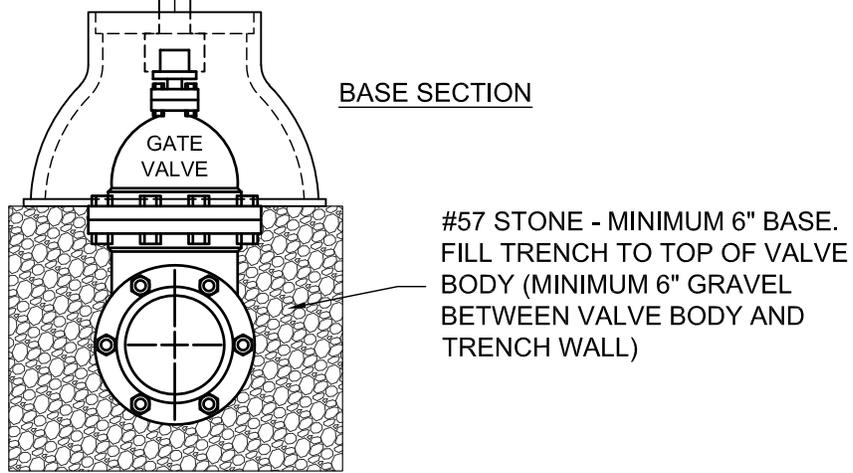
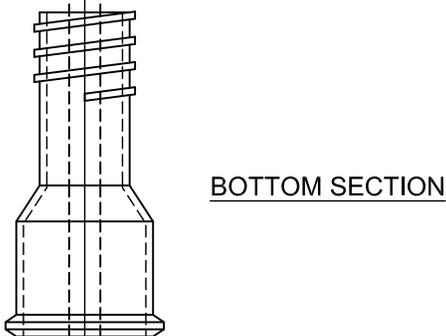
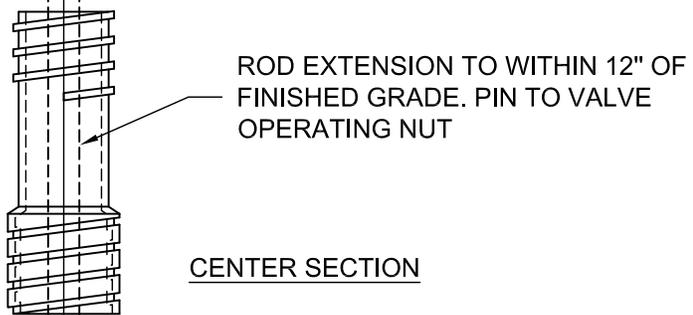
DETAIL
WAT-03

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

- 1) SCREW-TYPE ADJUSTABLE VALVE BOX SHALL BE CAST IRON FULLY THREADED ON TO BOTTOM SECTION.
- 2) VERTICAL ADJUSTMENT SHALL BE MADE BY THREADING TOP SECTION UP/DOWN ON CENTER SECTION OR BY REPLACING CENTER SECTION.



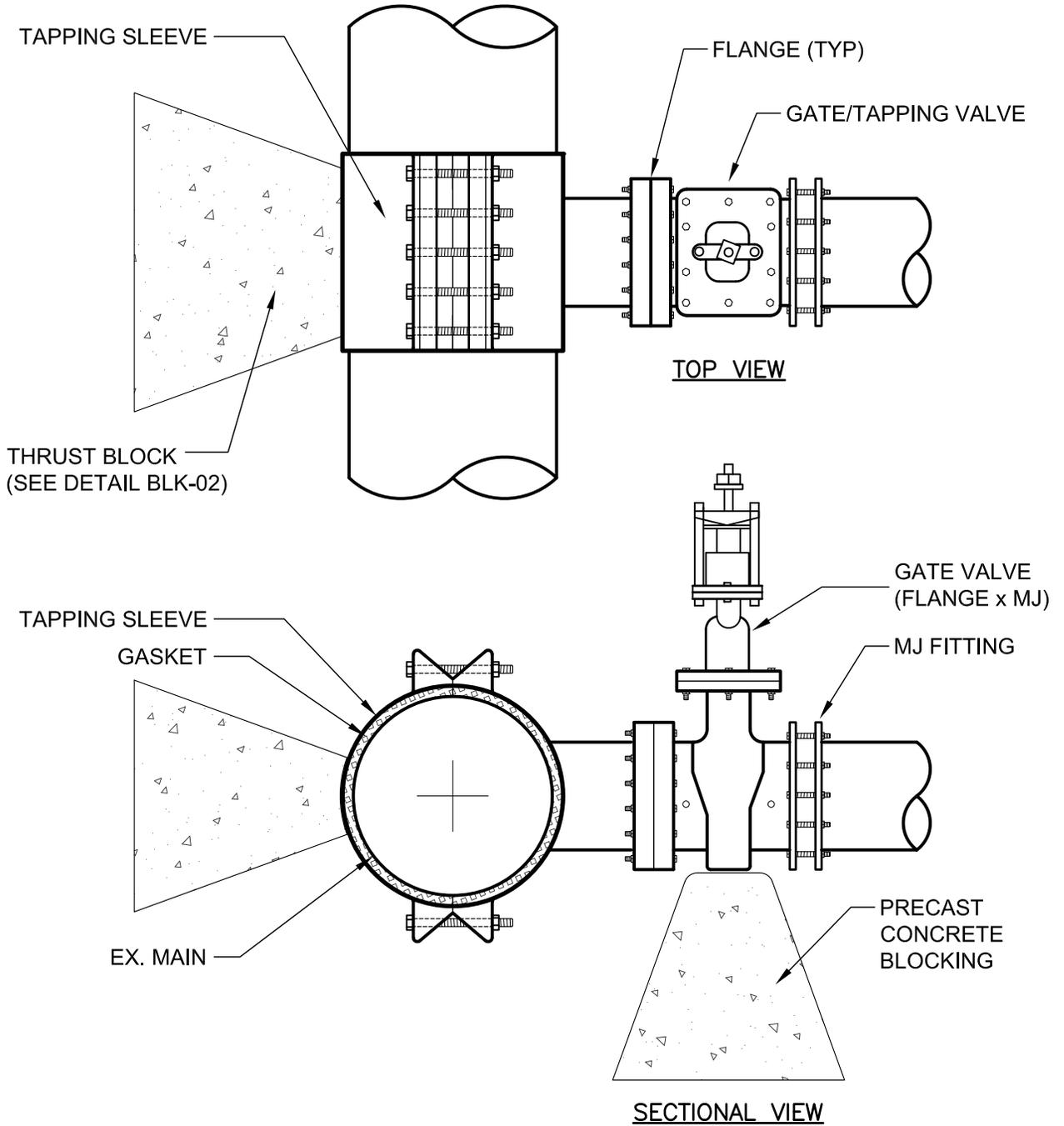
DATE:
MARCH 2024

REVISION:

TYPICAL UNDERGROUND GATE VALVE

DETAIL
WAT-04

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



1. TAPPING SLEEVE SHALL BE STAINLESS STEEL WITH FLANGED OUTLET, TEST PLUG AND FULL CIRCUMFERENTIAL GASKET.
2. BODY, FLANGE AND TEST PLUG SHALL BE 304-TYPE PASSIVATED STAINLESS STEEL.
3. SOLID PRECAST CONCRETE BLOCKING SHALL BE USED AS FOOTING FOR TAPPING VALVE. BLOCKING SHALL REST ON UNDISTURBED EARTH OR GRAVEL BASE.
4. CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF MECHANICAL JOINT FITTINGS.

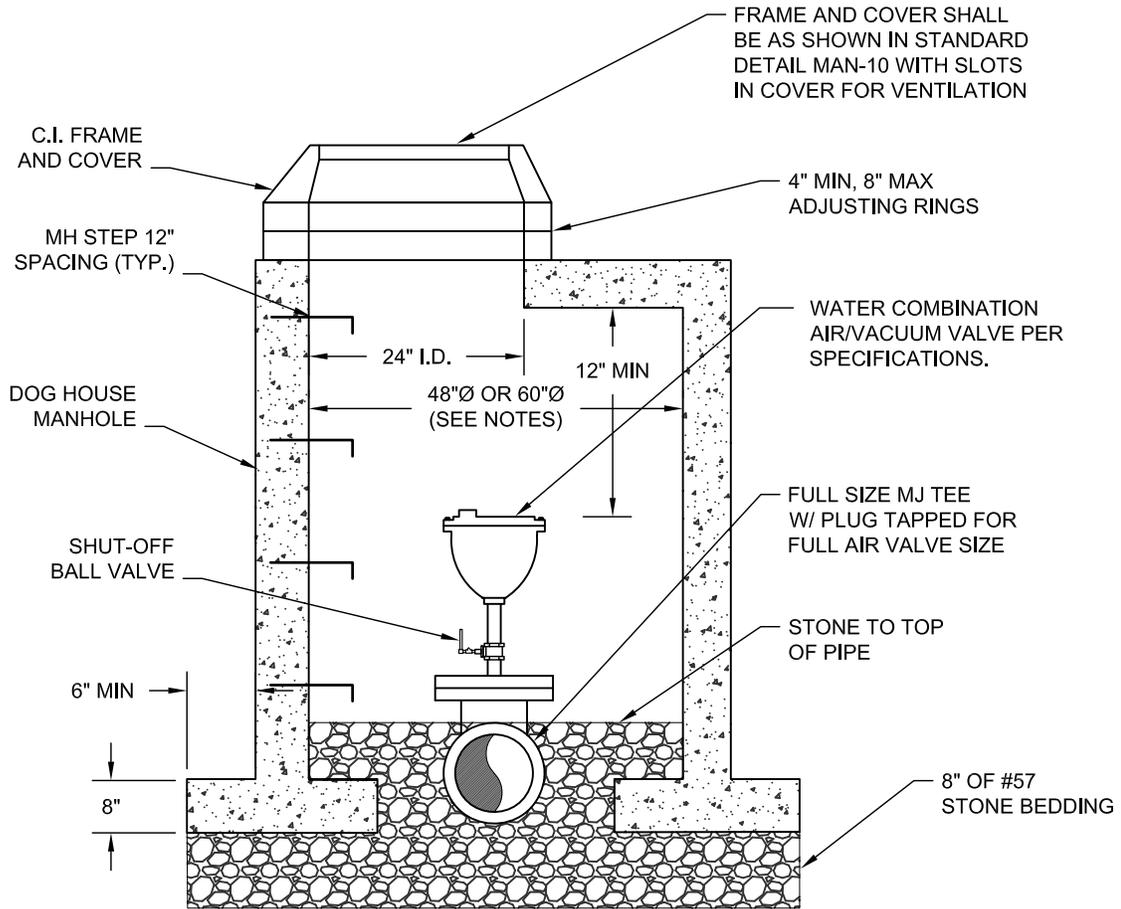
DATE:
MARCH 2024

REVISION:

**TAPPING SLEEVE AND
VALVE ASSEMBLY**

DETAIL
WAT-05

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. STONE BEDDING SHALL EXTEND TO UNDISTURBED EARTH IN ALL DIRECTIONS.
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.
5. 60" DIAMETER MANHOLES SHALL BE USED FOR ANY WATER MAIN LARGER THAN 12".
6. COMBO VALVES TO BE INSTALLED ON PIPE SIZES SMALLER THAN 8 INCHES AT DISCRETION OF THE DEPARTMENT OF PUBLIC UTILITIES.

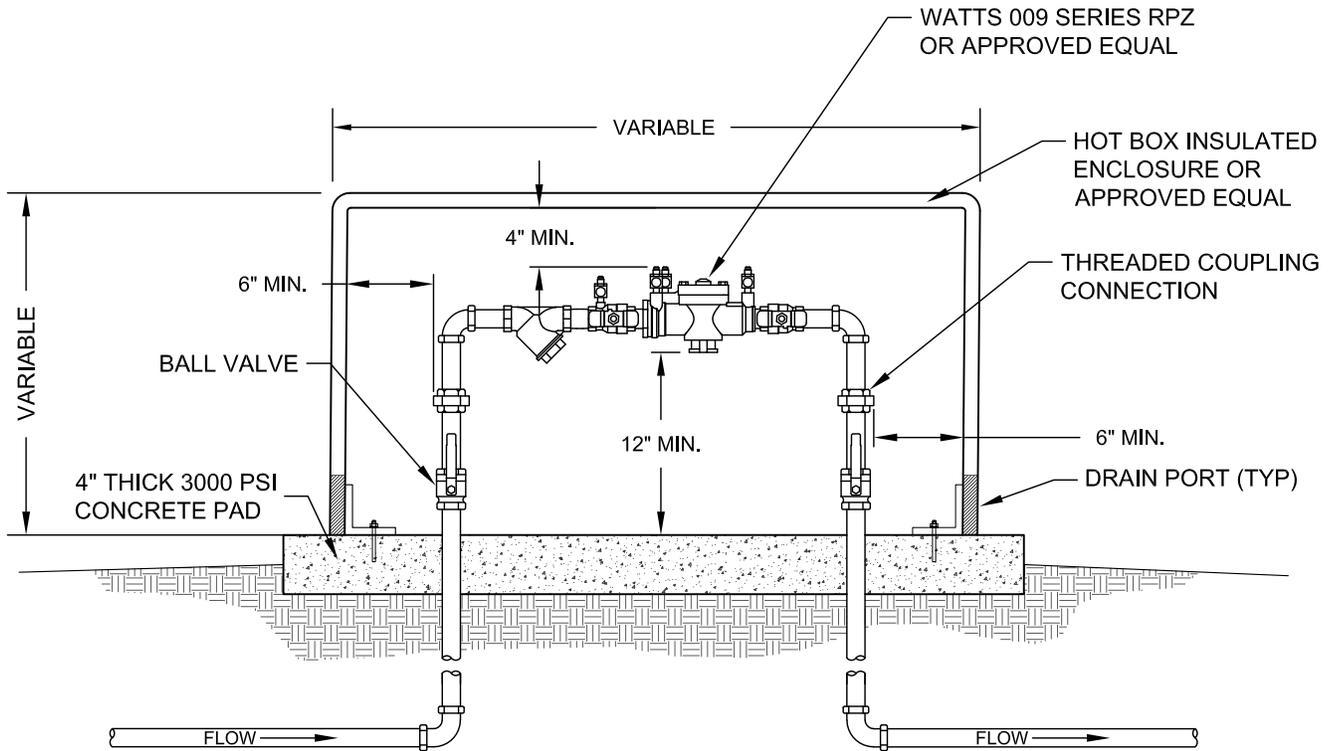
DATE:
MARCH 2024

REVISION:

**COMBINATION AIR/VACUUM VALVE
ASSEMBLY FOR 8"-24" WATER LINES**

DETAIL
WAT-06

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

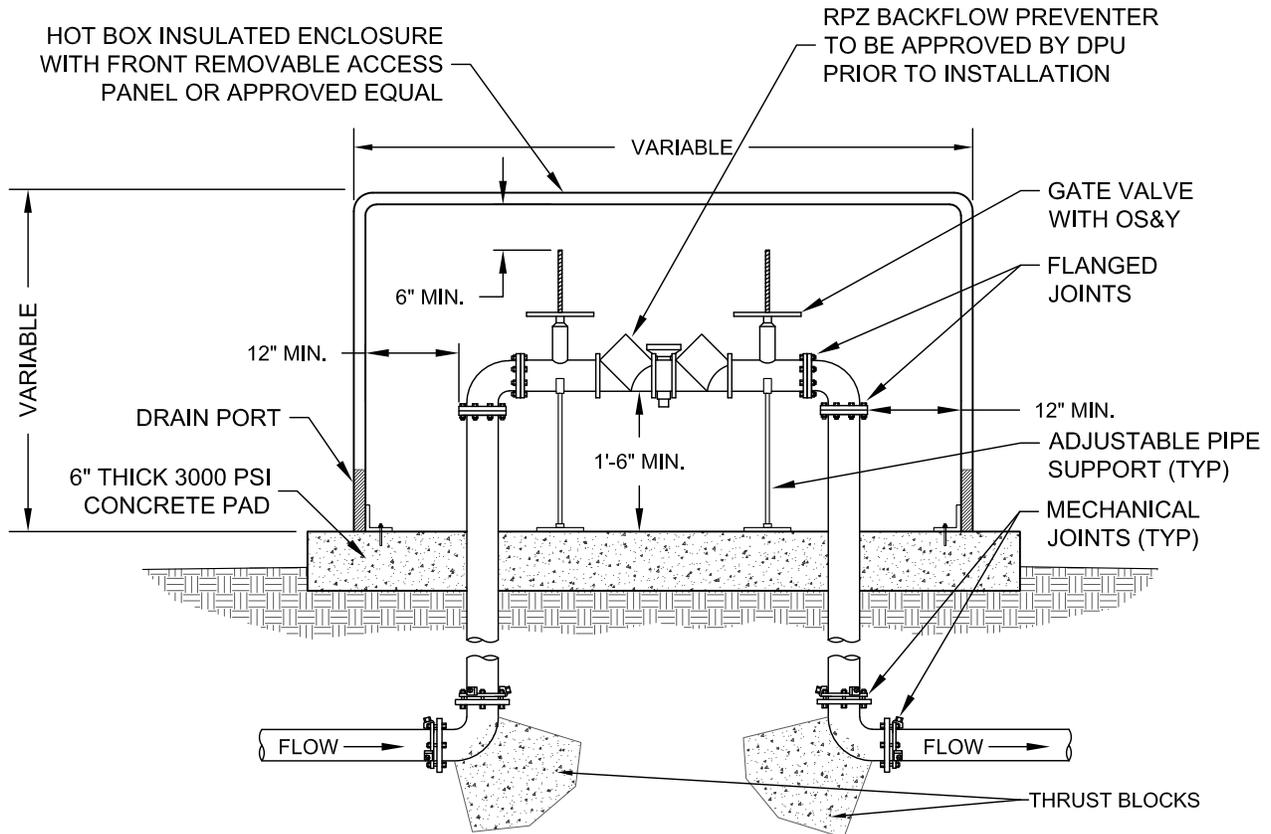
- 1) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS ALONG WITH THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES.
- 2) ADEQUATE POSITIVE DRAINAGE AWAY FROM THE ENCLOSURE SHALL BE PROVIDED.
- 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:
MARCH 2024
REVISION:

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

DETAIL
WAT-07

**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.

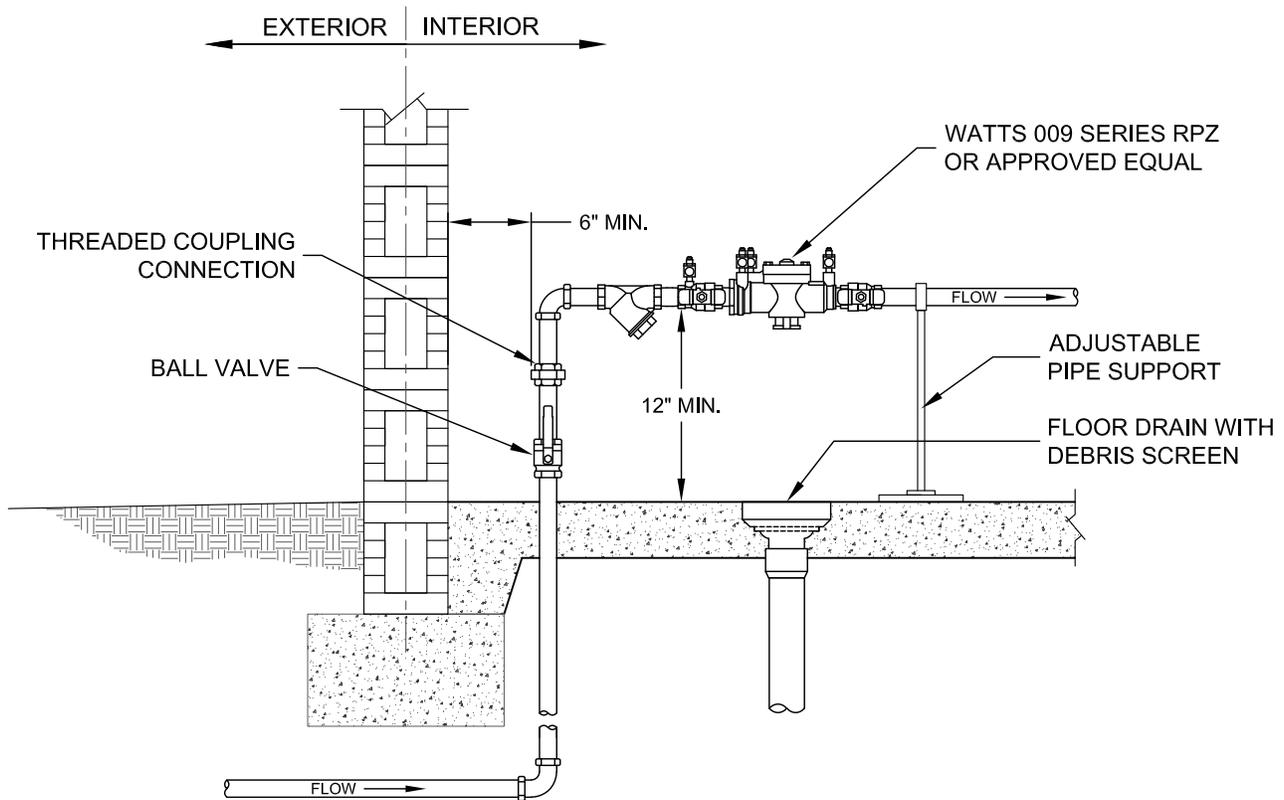
DATE:
MARCH 2024

REVISION:

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

DETAIL
WAT-08

**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.
- 3) FLOOR DRAINS SHALL NOT DISCHARGE TO SANITARY SEWER UNDER ANY CIRCUMSTANCES.

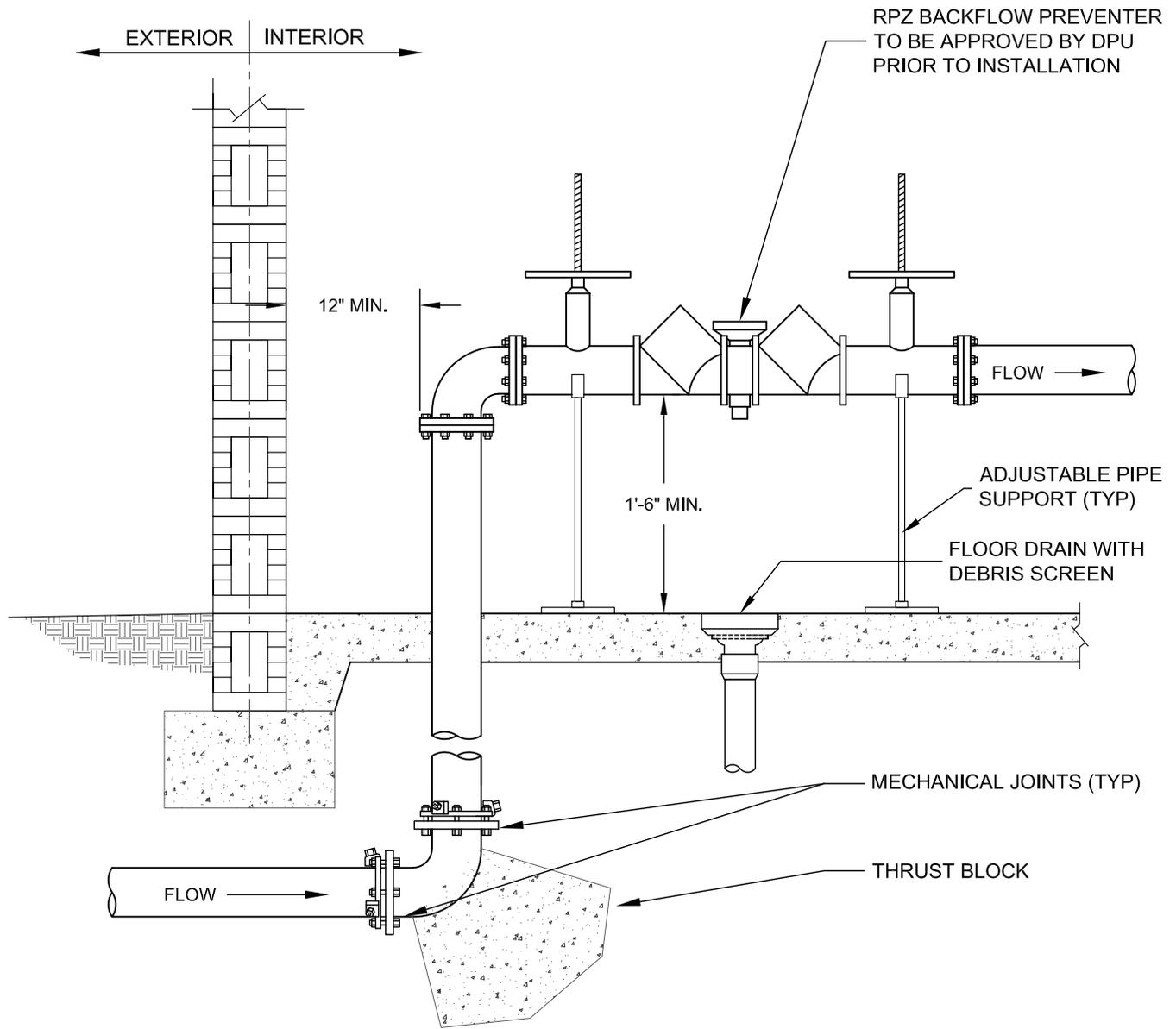
DATE:
MARCH 2024

REVISION:

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

DETAIL
WAT-09

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

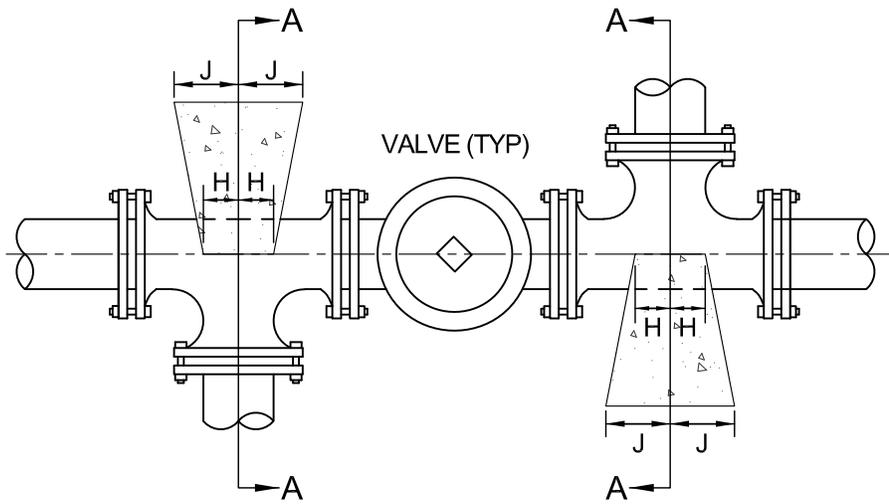
- 1) ALL ASPECTS OF THE BACKFLOW PREVENTER ASSEMBLY SHALL COMPLY WITH GOOCHLAND COUNTY STANDARDS AND SPECIFICATIONS, THE VIRGINIA DEPARTMENT OF HEALTH SPECIFICATIONS FOR CROSS CONNECTIONS AND BACKFLOW PREVENTION DEVICES, AND THE VIRGINIA STATE PLUMBING CODE.
- 2) PROPERTY OWNER SHALL BE RESPONSIBLE FOR MAINTENANCE AND OPERATION OF BACKFLOW ASSEMBLY AND COMPLIANCE WITH REPORTING AND TESTING REQUIREMENTS.
- 3) FLOOR DRAINS SHALL NOT DISCHARGE TO SANITARY SEWER UNDER ANY CIRCUMSTANCES.

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MARCH 2024
REVISION:

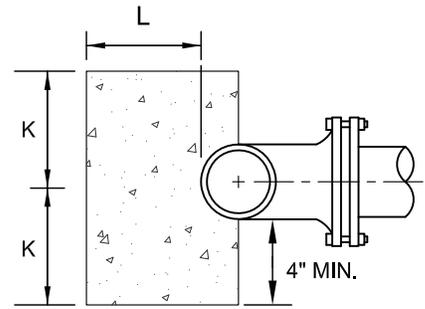
**2- $\frac{1}{2}$ " TO 10" COMMERCIAL INDOOR
RPZ BACKFLOW PREVENTER ASSEMBLY**

DETAIL
WAT-10

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



PLAN VIEW



EXTEND CONCRETE TO
UNDISTURBED EARTH
OR FIRM SUBGRADE

SECTION A-A

SIZING OF TEES (A < B)		
RUN DIAMETER	BRANCH DIAMETER	
	A	B
A	A x A	B x B
B	B x A	B x B

MINIMUM THRUST BLOCK DIMENSIONS BASED ON BRANCH PIPE DIAMETER									
BLOCK DIMENSIONS	BRANCH PIPE DIAMETER								
	4"	6"	8"	10"	12"	16"	20"	24"	30"
J	6"	8"	9"	1'-1"	1'-3"	1'-8"	2'-0"	2'-6"	3'-4"
K	8"	10"	1'-3"	1'-4"	1'-9"	2'-4"	3'-0"	3'-4"	4'-0"
L	6"	8"	9"	10"	12"	1'-2"	1'-6"	1'-8"	2'-0"
H	4"	6"	6"	6"	6"	8"	1'-0"	1'-0"	1'-0"

NOTES:

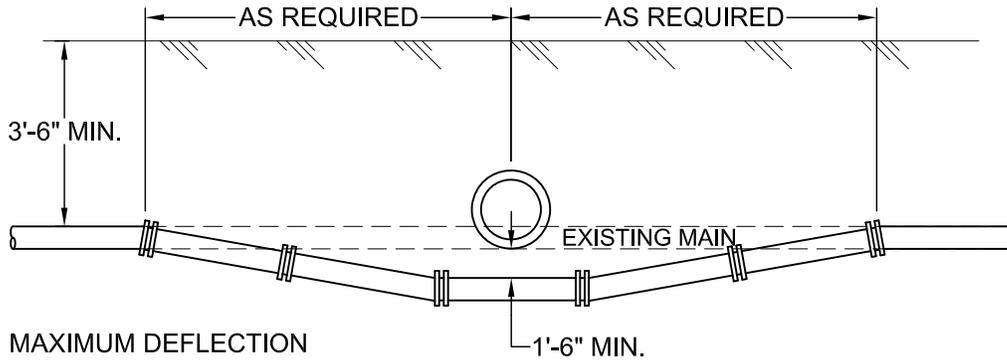
- 1) THIS CONFIGURATION SHALL BE USED IN LIEU OF A CROSS FITTING AT ALL 4-PIPE INTERSECTIONS OF WATER LINES.
- 2) IF BRANCH LINE IS LARGER DIAMETER THAN RUN LINE THEN VALVES AND TEES SHALL BE SIZED TO MATCH THE LARGER PIPE DIAMETER, WITH REDUCERS AT EACH END OF THE RUN.
- 3) ADDITIONAL VALVES SHALL BE PLACED AT EACH TEE AS REQUIRED BY DPU AND/OR THESE STANDARDS AND SPECIFICATIONS.
- 4) COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 3,000 PSI OR GREATER AT 28 DAYS.
- 5) THRUST BLOCK DIMENSION TABLE IS APPROPRIATE FOR DESIGN WATER PRESSURE UP TO 150 PSI.
- 6) WHERE DESIGN WATER PRESSURE IS GREATER THEN 150 PSI, THRUST BLOCK DIMENSIONS SHALL BE PROPORTIONALLY INCREASED BASED ON ACTUAL DESIGN PRESSURE.
- 7) MINIMUM SURFACE AREA OF THRUST BLOCK AT BEARING SURFACE = 2J x 2K.
- 8) THRUST BLOCK BEARING SURFACES SHALL BE EXTENDED TO UNDISTURBED EARTH OR FIRM SUBGRADE.

DATE:
MARCH 2024
REVISION:

**SIZING OF TEES & THRUST BLOCKING
AT FOUR-WAY WATERLINE INTERSECTION**

DETAIL
WAT-11

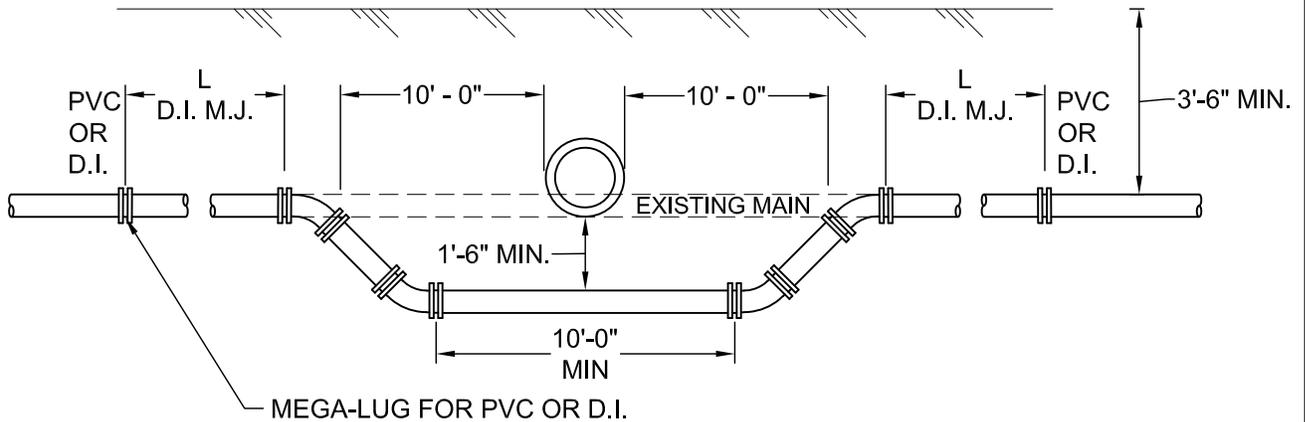
**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



MAXIMUM DEFLECTION
PER JOINT = $\frac{1}{2}$ MFRS.
RECOMMENDED AMOUNT

LOWERING/ NEW INSTALLATION BY DEFLECTION
METHOD. ALLOWED FOR DUCTILE IRON PIPE ONLY.

OR



NOTES:

1. LOWERED SECTION TO BE OF DUCTILE IRON MECHANICAL JOINT PIPE WITH RESTRAINED JOINTS. DESIGN ENGINEER SHALL CALCULATE LENGTH OF REQUIRED RESTRAINED SECTION. RESTRAIN AT LEAST ONE PIPE JOINT BEYOND UPPER VERTICAL BEND.
2. THRUST BLOCKS FOR VERTICAL BENDS MAY BE DELETED WITH RESTRAINED JOINTS.
3. LOWERING OF WATER LINES AT PIPE CROSSING SHALL NOT BE USED ON NEW WATER LINE CONSTRUCTION WITHOUT SPECIFIC APPROVAL FROM DPU.

DATE:
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REVISION:

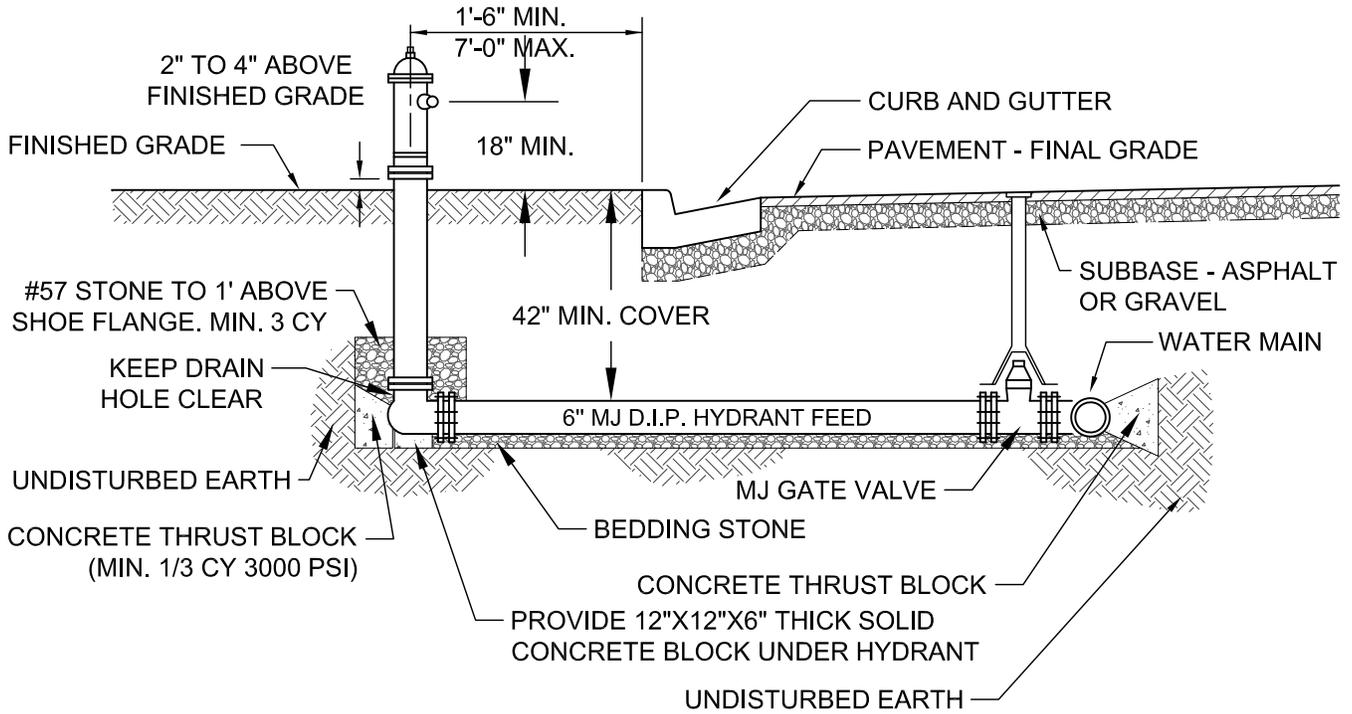
**LOWERING EXISTING WATER MAIN
FOR NEW UTILITY INSTALLATION**

DETAIL
WAT-13

3.4

Fire Details

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

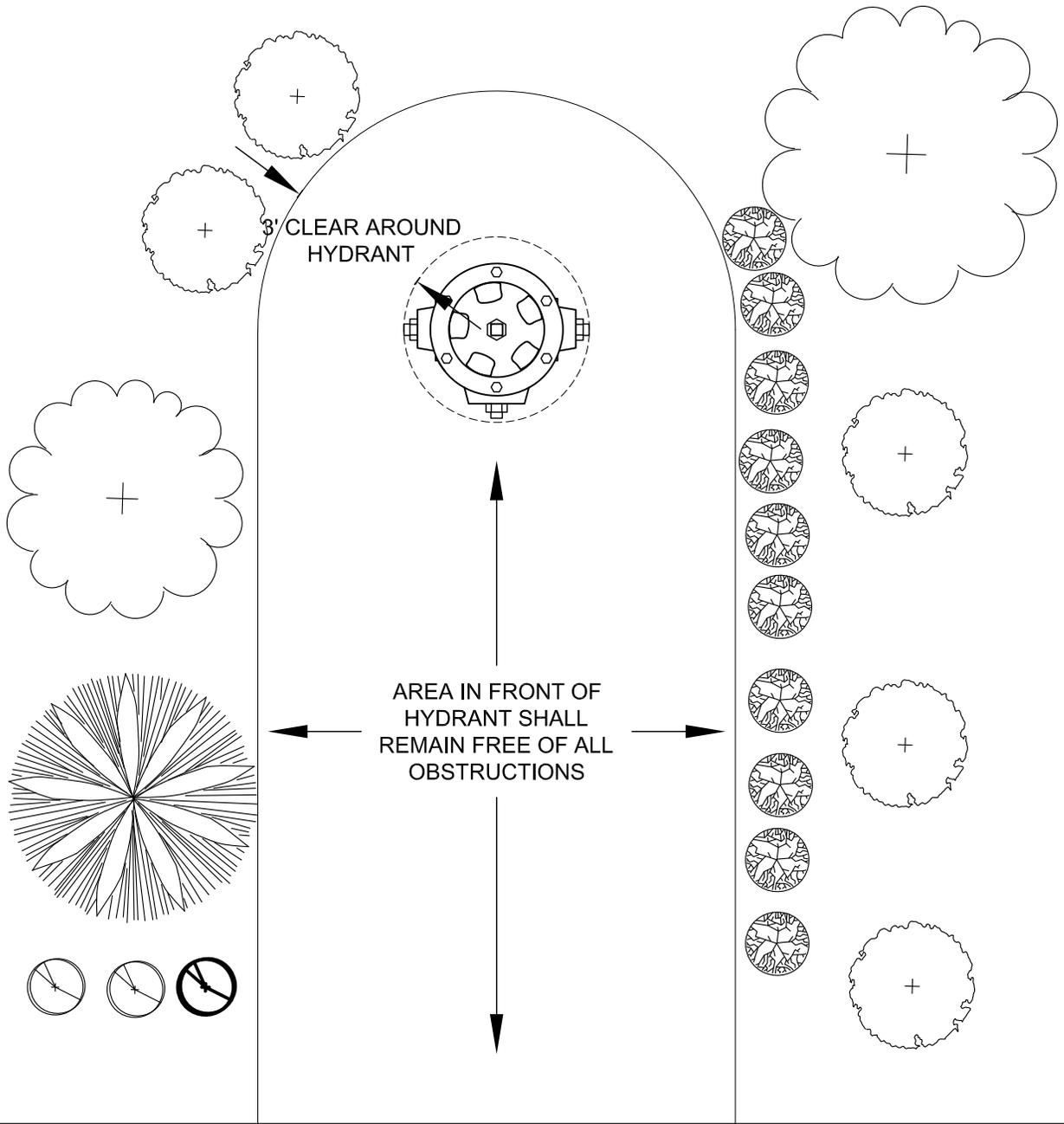
1. USE RESTRAINED JOINTS ON GATE VALVE, ALL FITTINGS, AND FIRE HYDRANT.
2. DUCTILE IRON PIPE IS REQUIRED FOR ALL PIPING FROM FIRE HYDRANT TO WATER MAIN.
3. HYDRANTS SHALL BE LOCATED A MINIMUM DISTANCE OF 50' FROM ANY STRUCTURE.
4. NO STRUCTURES ARE PERMITTED WITHIN 5 FEET OF ANY HYDRANT.
5. NO TREES, SHRUBS OR OTHER PLANTINGS EXCEPT GRASS ARE PERMITTED WITHIN 3 FEET OF ANY FIRE HYDRANT.
6. DRAIN HOLE SHALL BE KEPT CLEAN/CLEAR TO ALLOW PROPER DRAINAGE.
7. DRAIN HOLE SHALL NOT BE PRESENT ON HYDRANTS IN AREAS SUBJECT TO SURFACE FLOODING, PONDING, OR HIGH GROUNDWATER TABLE.
8. ON ROADS WITHOUT CURB AND GUTTER, CONTROL VALVE SHALL BE LOCATED IN SHOULDER OF ROAD BETWEEN PAVEMENT AND DITCH. MINIMUM COVER AT DITCH MUST BE 36".
9. VALVE BOXES OUTSIDE PAVEMENT SHALL HAVE CONCRETE COLLAR, MIN. 24" X 24".
10. HYDRANTS SHALL BE MINIMUM 5' FROM ANY DRIVEWAY/ENTRANCE.
11. HYDRANTS SHALL BE INSTALLED MINIMUM 2' FROM TOP SLOPE OF ANY DRAINAGE DITCH, AND SHALL NOT BE INSTALLED WITHIN DITCH.
12. OUTLET THREADS SHALL BE NATIONAL STANDARD THREAD (NST).

DATE:
MARCH 2024
REVISION:

TYPICAL FIRE HYDRANT

DETAIL
FIR-01a

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



HYDRANT ACCESS POINT - FACE OF CURB, EDGE OF PAVEMENT, ETC.

NOTES:

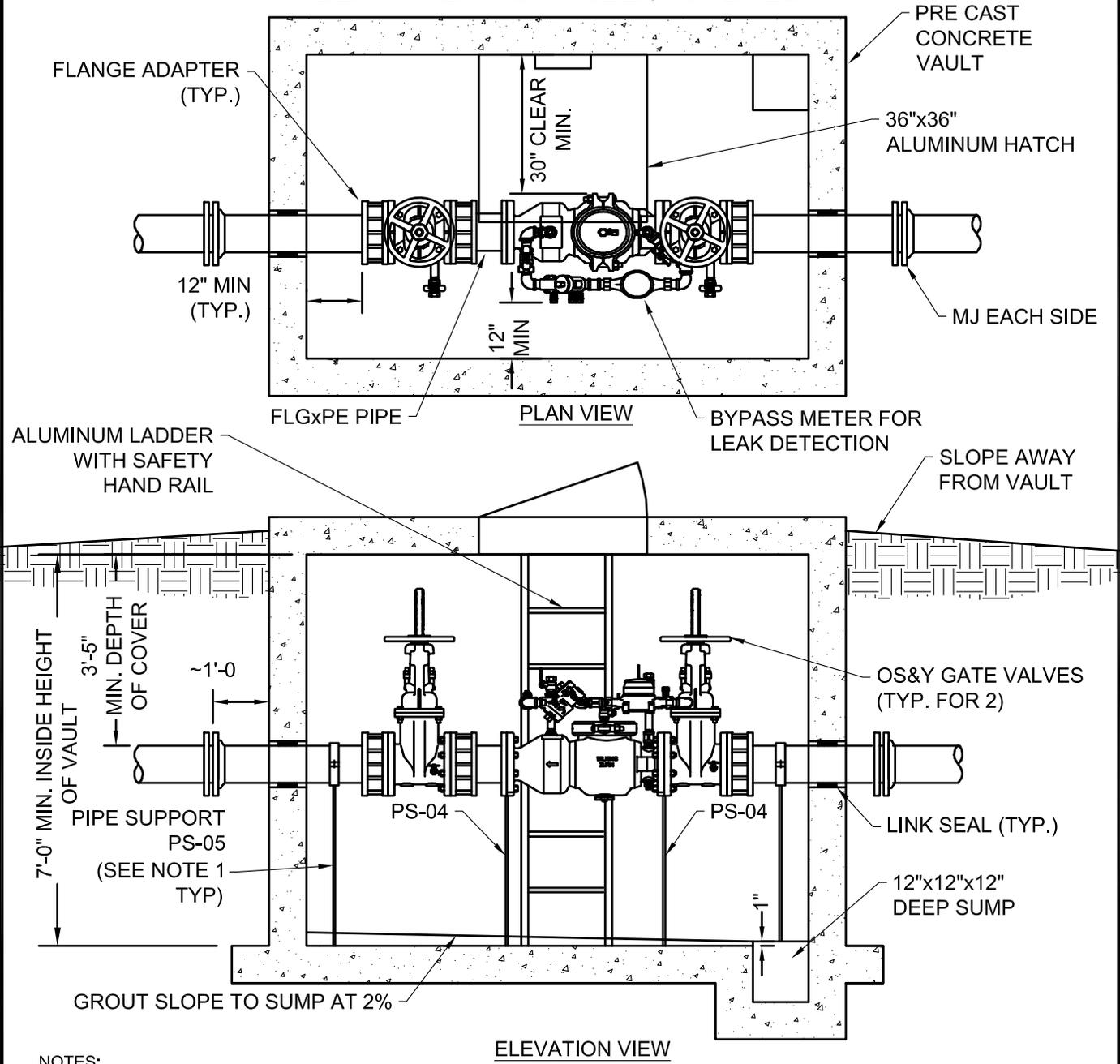
- 1) THERE SHALL BE NO TREES, SHRUBS OR OTHER PLANTINGS EXCEPT GRASS WITHIN 3 FEET OF ANY FIRE HYDRANT.
- 2) THE AREA BETWEEN THE HYDRANT ACCESS POINT AND THE FIRE HYDRANT SHALL BE KEPT CLEAR OF ALL PLANTINGS EXCEPT GRASS.
- 3) GROUND ELEVATION SHALL BE BETWEEN 2" AND 4" BELOW BASE FLANGE.
- 4) TREES AND SHRUBS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.

DATE:
MARCH 2024
REVISION:

REQUIRED CLEAR AREA
AROUND FIRE HYDRANT

DETAIL
FIR-01b

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



- 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
 3. ALL ASSEMBLIES SHALL BE INSTALLED IN COMPLIANCE WITH GOOCHLAND COUNTY DPU STANDARDS & SPECIFICATIONS AND VIRGINIA DEPARTMENT OF HEALTH (VDH) WATERWORKS REGULATIONS.
 4. BACKFLOW PREVENTION DEVICE SHALL BE DCDA, WATTS SERIES 709 OR APPROVED EQUAL.
 5. ALL PIPING SHALL BE PRESSURE CLASS 350 DUCTILE IRON PIPE.
 6. UNDERGROUND FITTINGS SHALL BE MECHANICAL JOINT; EXPOSED FITTINGS SHALL BE FLANGED.
 7. VAULT SHALL NOT BE LOCATED IN ANY AREA PRONE TO PONDING OR FLOODING.
 8. ADEQUATE POSITIVE DRAINAGE IN ALL DIRECTIONS AWAY FROM THE VAULT SHALL BE PROVIDED.
 9. TOP OF VAULT SHALL BE 3'-6" ABOVE FINAL GRADE.
 10. PROPERTY OWNER SHALL BE RESPONSIBLE FOR OPERATION, MAINTENANCE & TESTING OF ASSEMBLY.

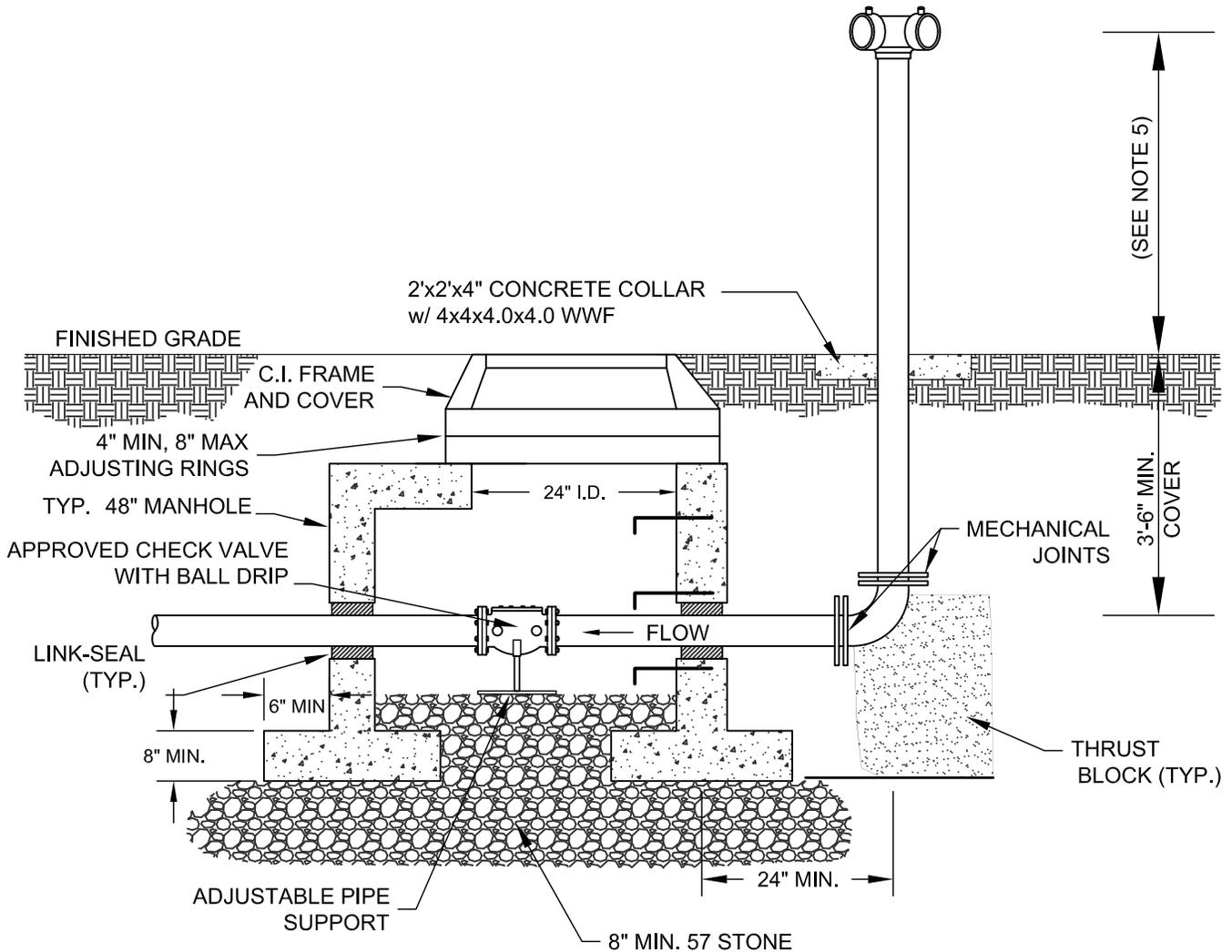
DATE:
MARCH 2024

REVISION:

**FIRE SUPPRESSION BACKFLOW ASSEMBLY
IN VAULT**

DRWG. NO.
FIR-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

- 1.) SHALL ONLY BE USED WITH SPECIFIC PERMISSION
- 2.) 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.
- 3.) STONE BEDDING SHALL EXTEND TO UNDISTURBED EARTH IN ALL DIRECTIONS AROUND MANHOLE.
- 4.) ALL M.J. FITTINGS SHALL BE RESTRAINED ON EACH END.
- 5.) THE HEIGHT OF STANDPIPE SHALL BE IN CONFORMANCE WITH THE MOST CURRENT NFPA STANDARDS.
- 6.) ALL THREADS SHALL BE NATIONAL STANDARD.

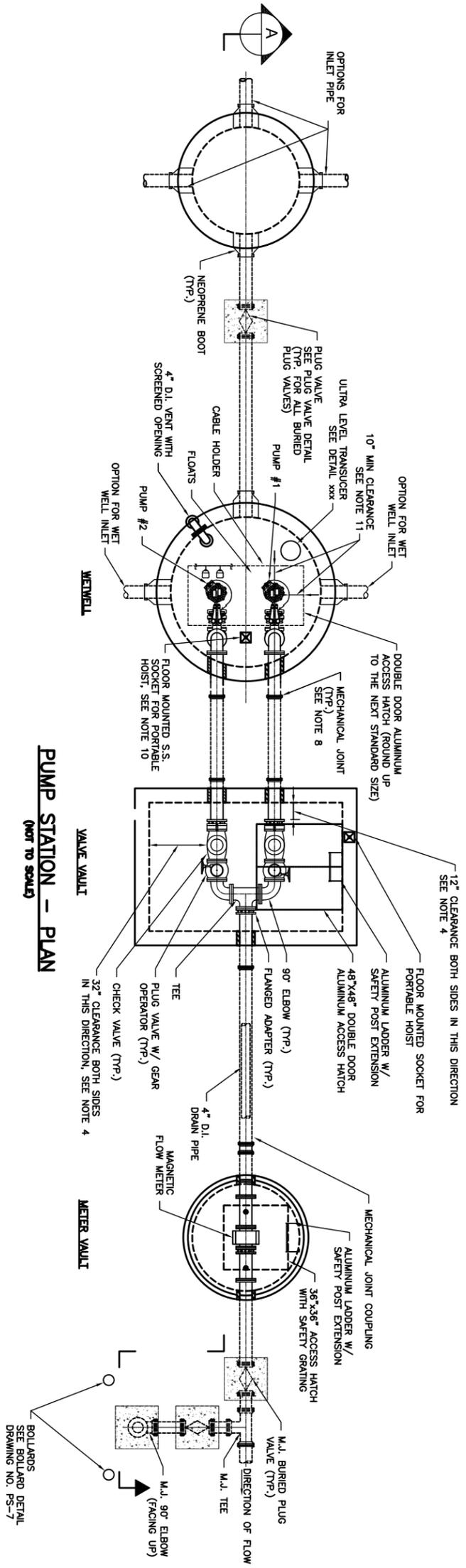
DATE:
MARCH 2024
REVISION:

**STANDARD YARD FIRE DEPARTMENT
CONNECTION (FDC)**

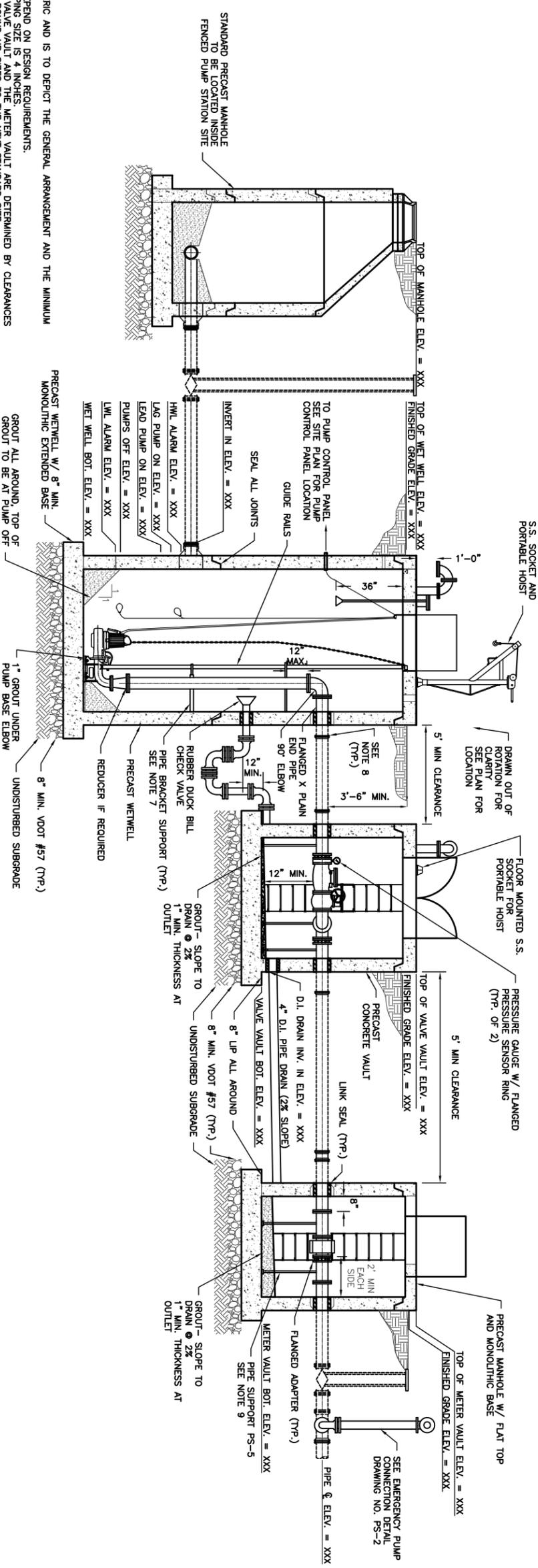
DETAIL
FIR-03

3.5

Sewage Pump Station Details



PUMP STATION - PLAN
(NOT TO SCALE)



PUMP STATION - SECTION
(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. VALVE AND PIPE ARE DETERMINED BY CLEARANCES AND MINIMUM DIMENSIONS FOR THE VALVE VAULT AND TO THE NEXT STANDARD SIZE.
 4. MINIMUM DIMENSIONS FOR THE VALVE VAULT SHALL BE 12\"/>

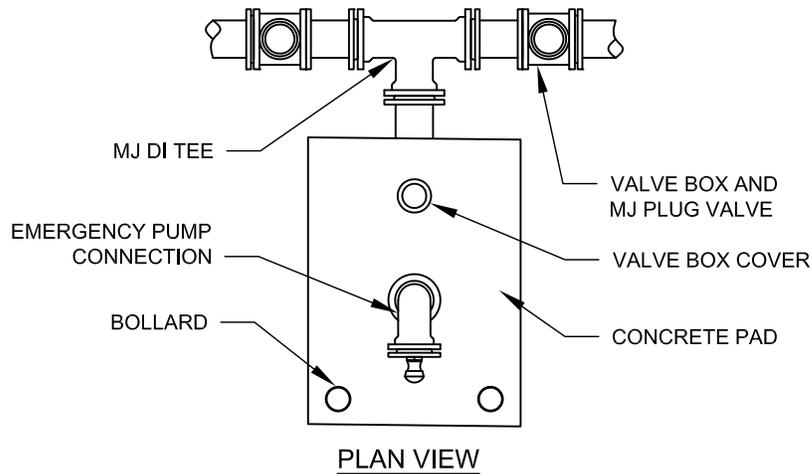
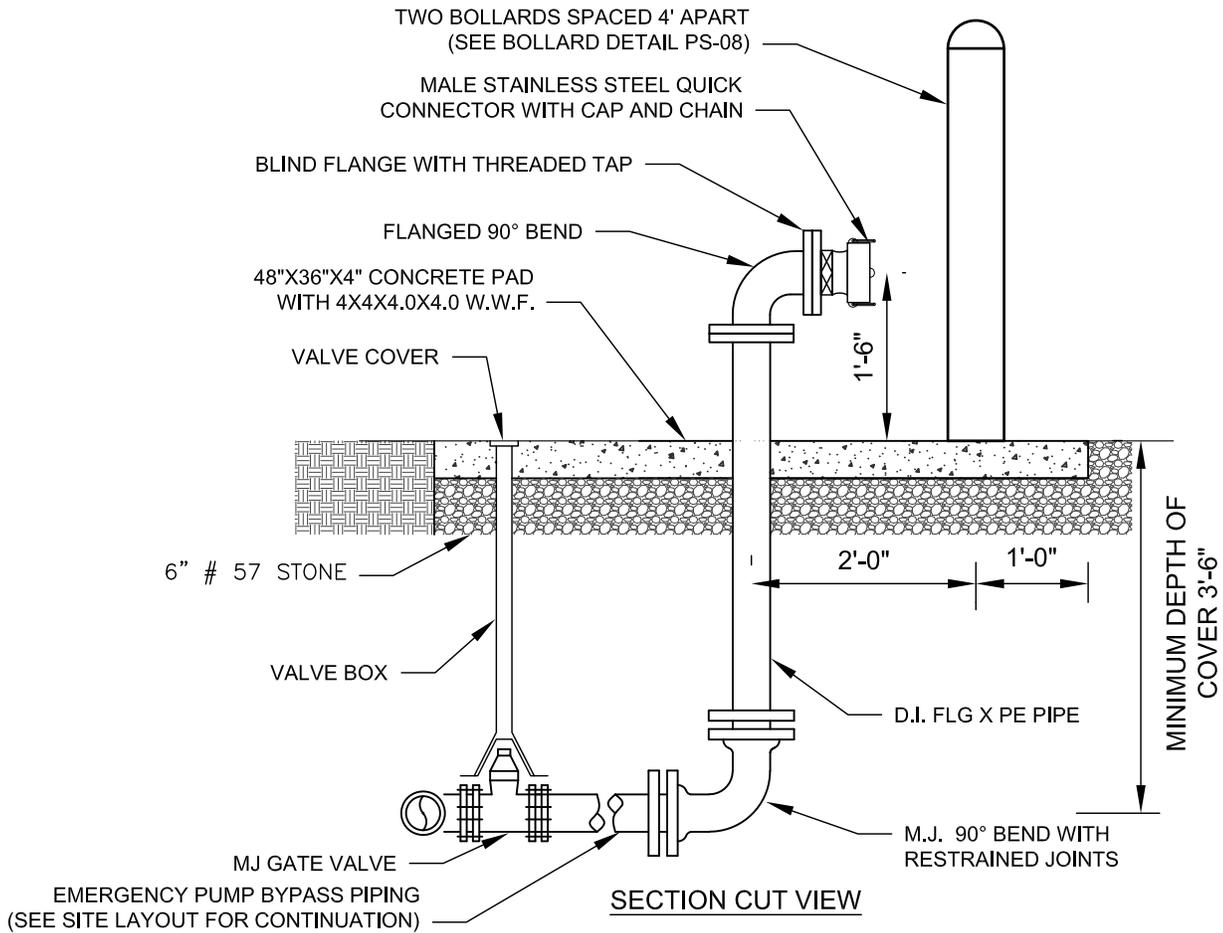
* THIS DRAWING IS FOR PUMP STATION DESIGN GUIDANCE ONLY. EACH PUMP STATION DESIGN SHALL TAKE INTO CONSIDERATION ALL INDIVIDUAL AND UNIQUE SITE REQUIREMENTS.

DATE:
MARCH 2024
REVISION:

STANDARD SUBMERSIBLE SEWAGE PUMP STATION

DETAIL
PS-01

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



NOTES:

1. PREPARE, PRIME AN PAINT ALL EXPOSED PIPING.
2. SEE SITE PLAN FOR PIPE SIZES.

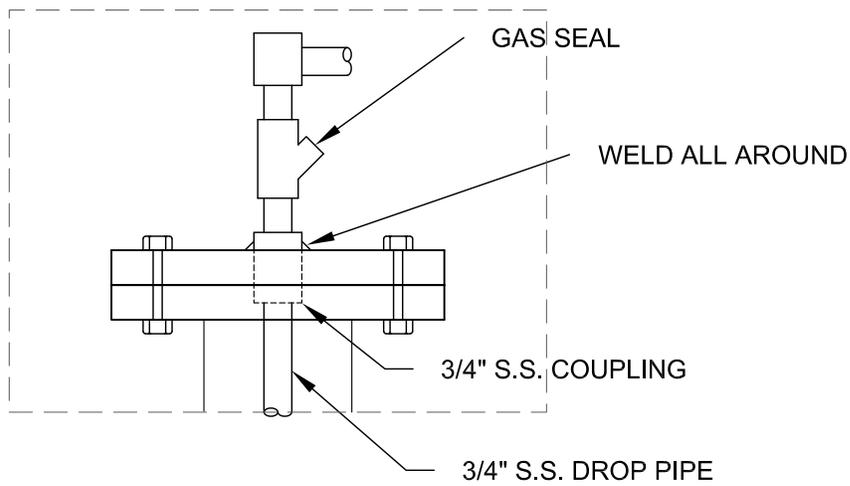
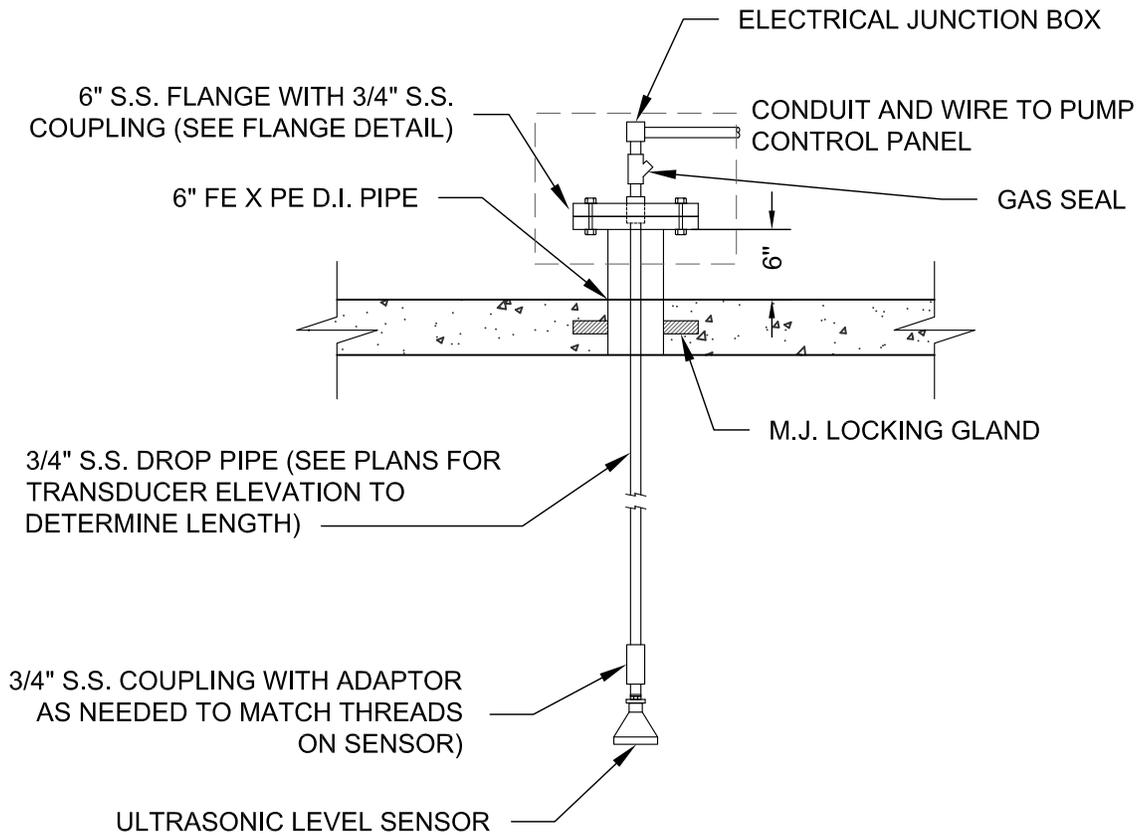
DATE:
MARCH 2024

REVISION:

**EMERGENCY BYPASS
PUMP CONNECTION**

DETAIL
PS-02

**GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES**



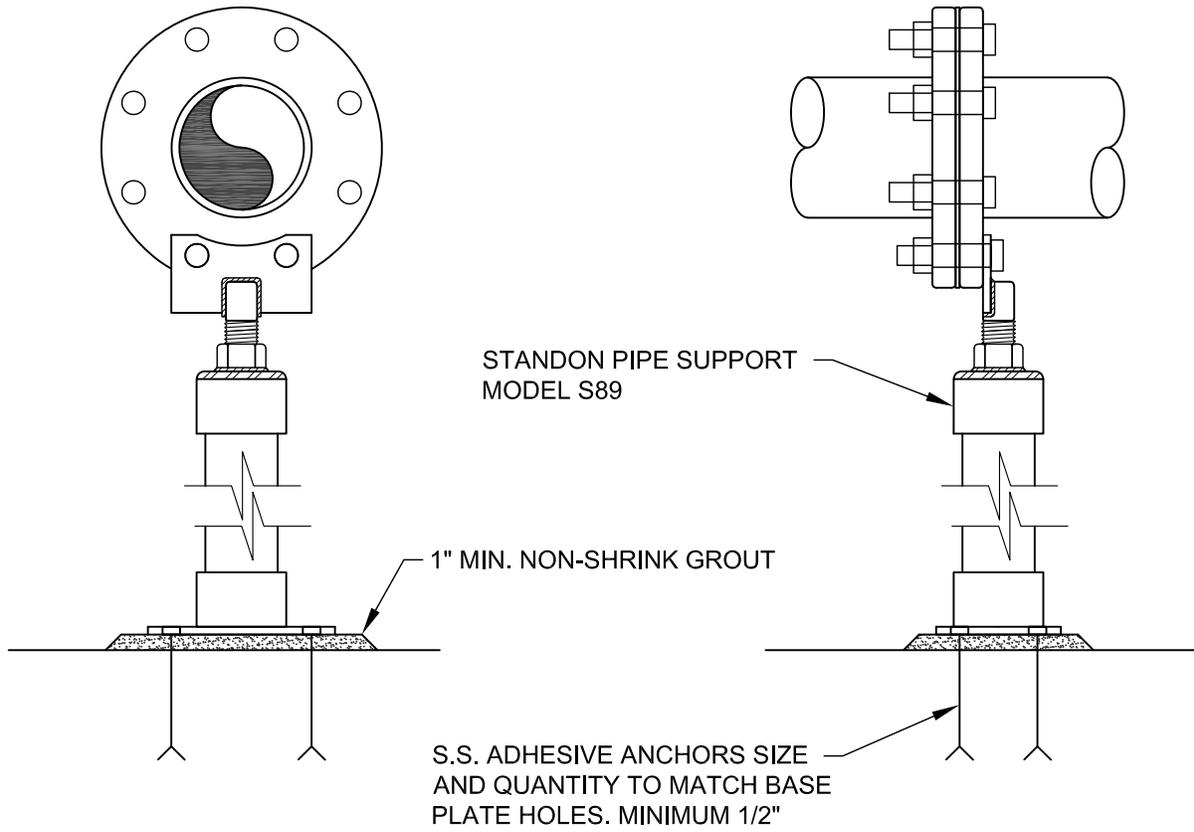
DATE:
MARCH 2034

REVISION:

**SUPPORT FOR ULTRASONIC
LEVEL SENSOR**

DETAIL
PS-03

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

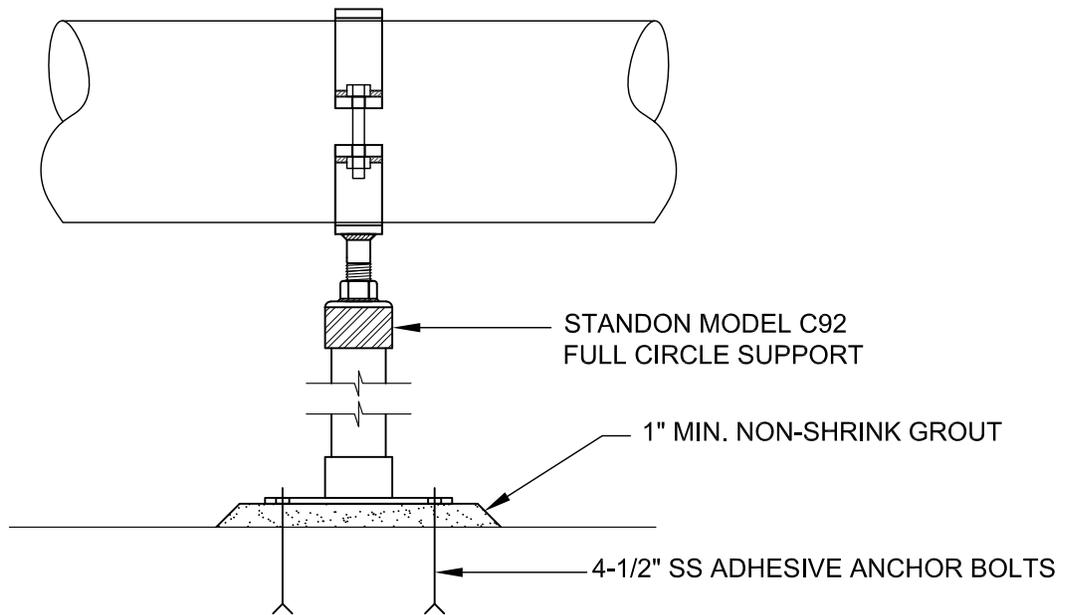
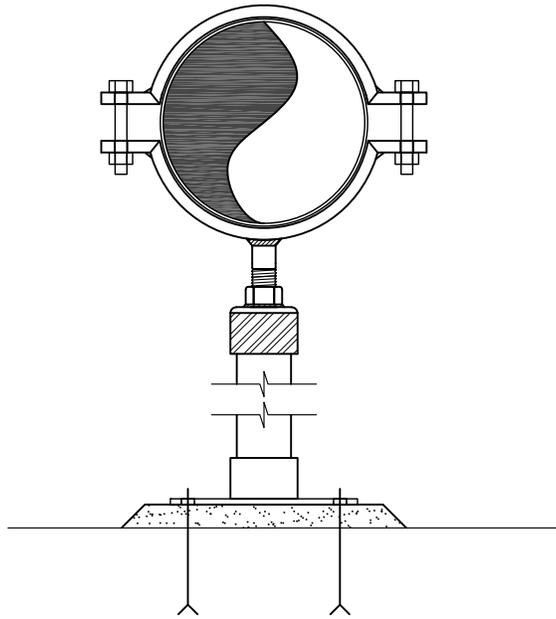


DATE:
MARCH 2024
REVISION:

PIPE SUPPORT
TYPE 1

DETAIL
PS-04

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

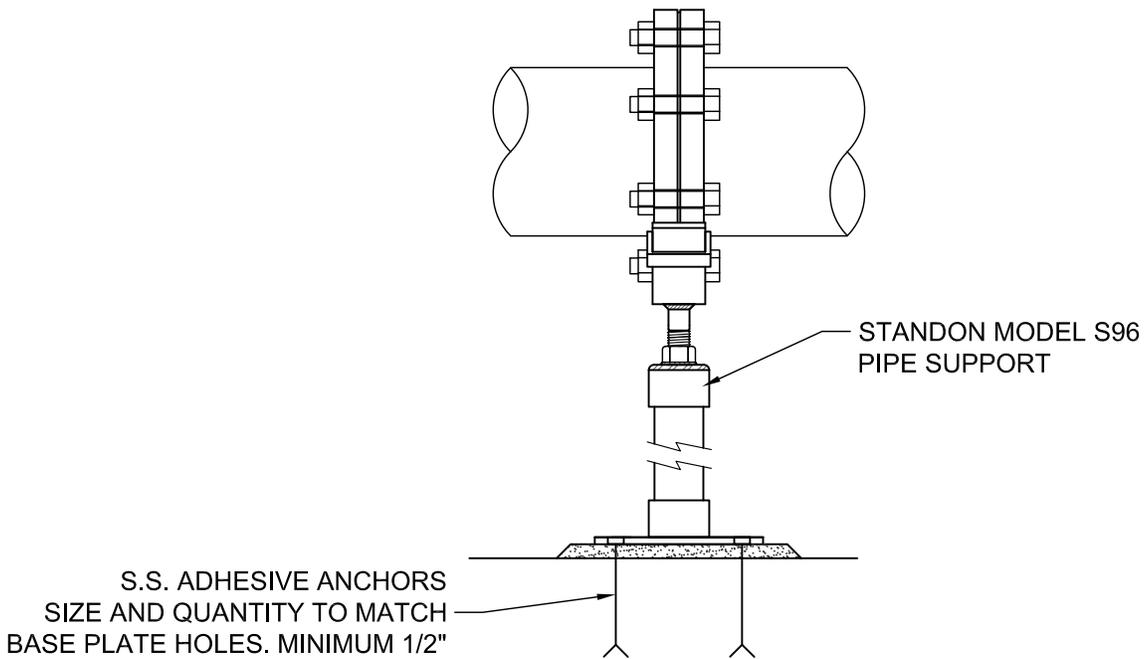
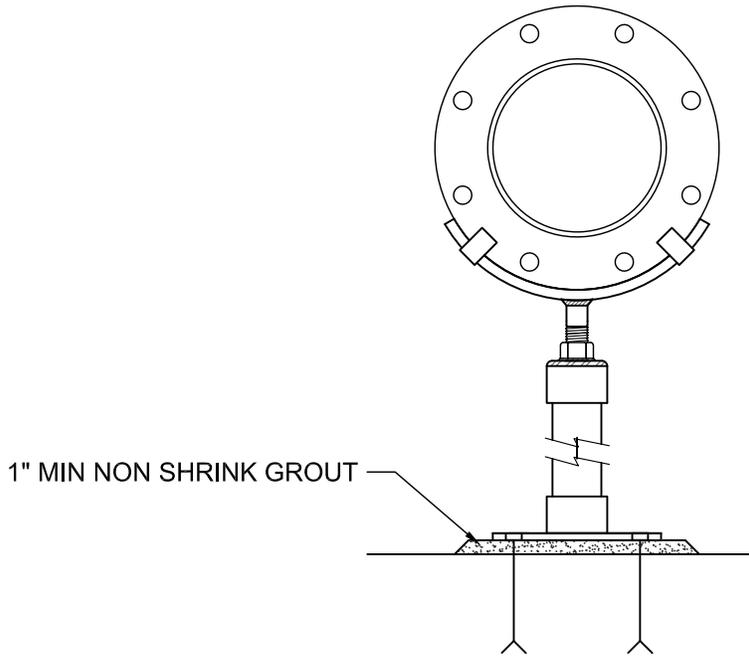


DATE:
MARCH 2024
REVISION:

PIPE SUPPORT
TYPE 2

DETAIL
PS-05

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

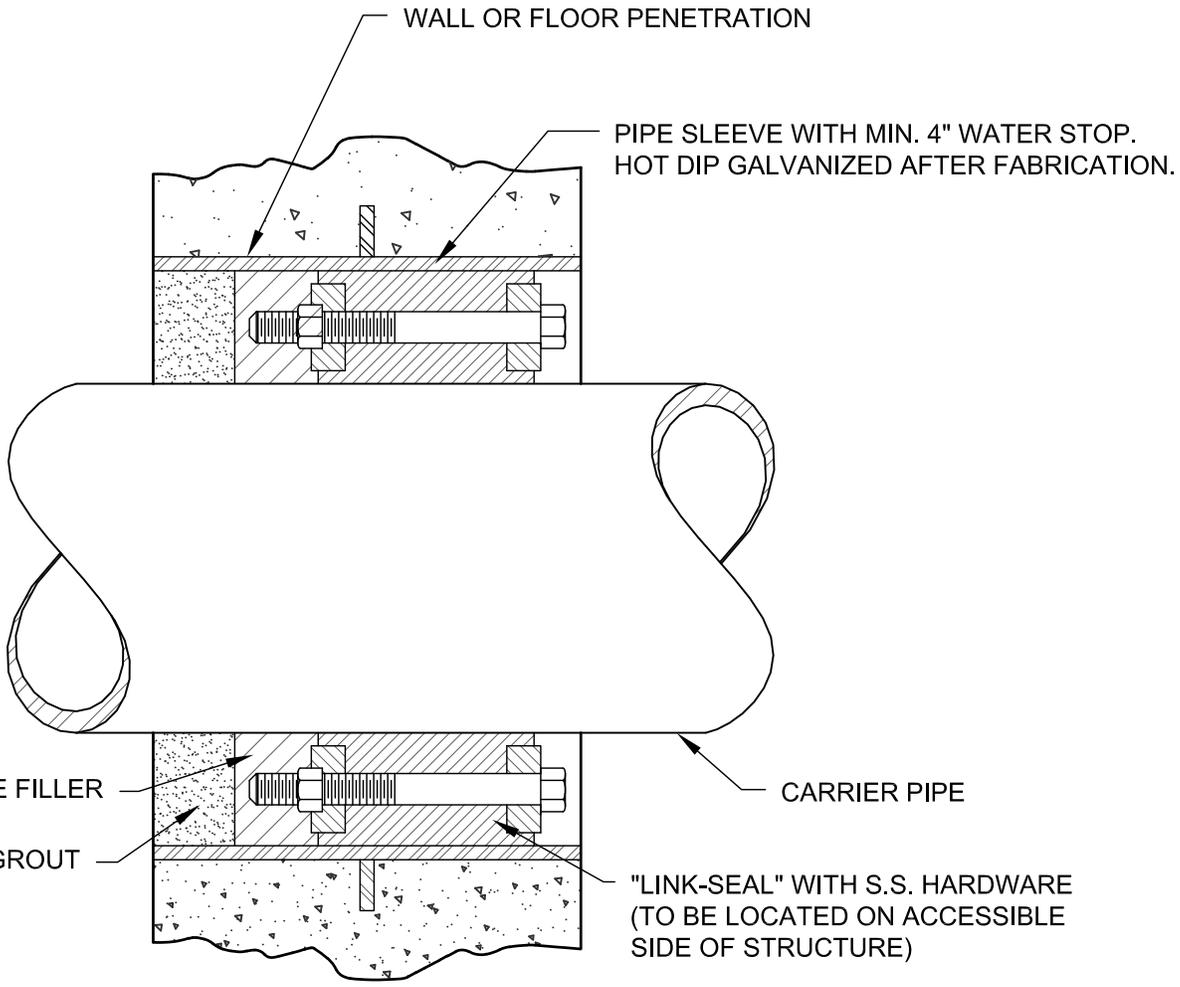


DATE:
MARCH 2024
REVISION:

PIPE SUPPORT
TYPE 3

DETAIL
PS-06

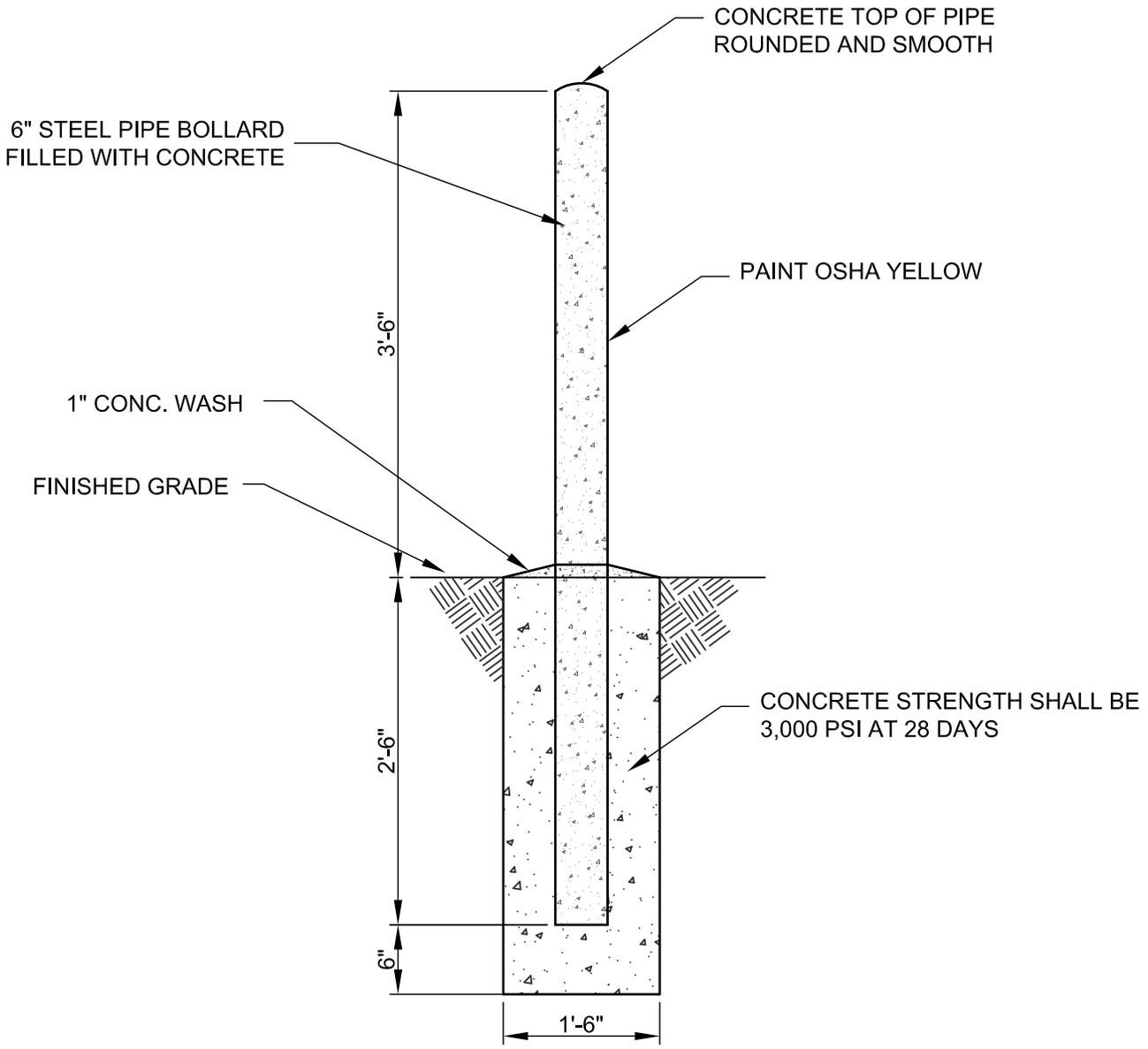
GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTE: HOLE SIZE AND LINK SEAL SIZE SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS

DATE: MARCH 2024	LINK SEAL	DETAIL PS-07
REVISION:		

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

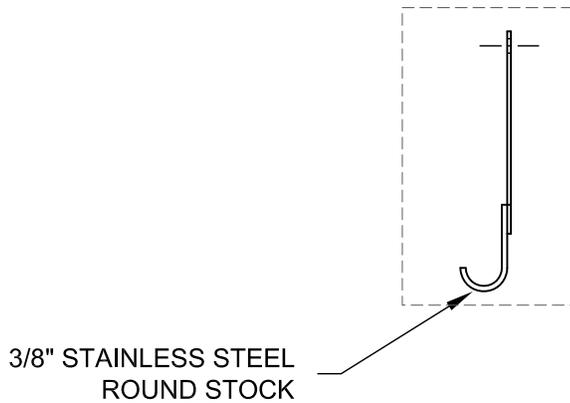
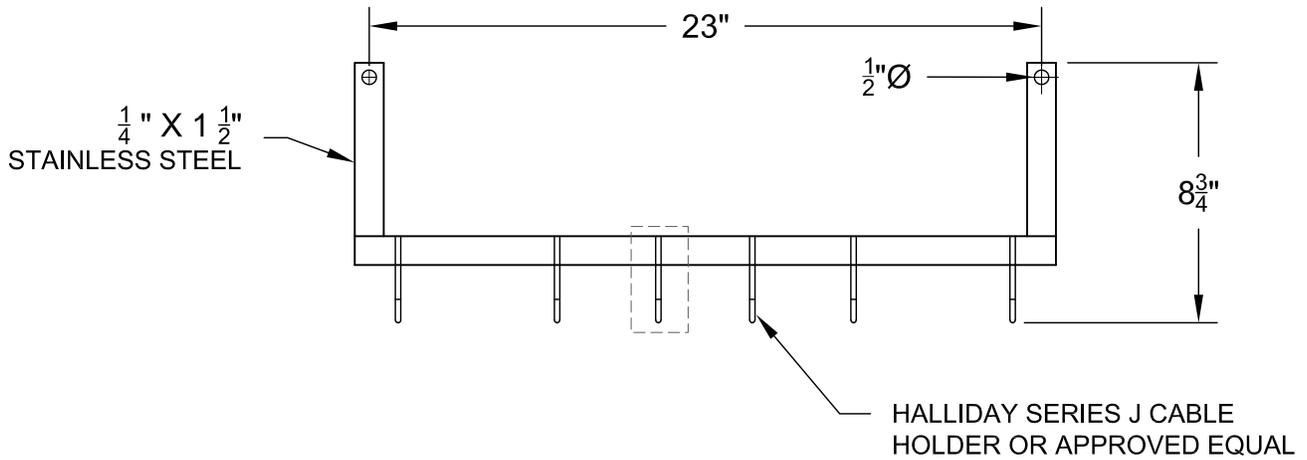


DATE:
MARCH 2024
REVISION:

STEEL BOLLARD

DETAIL
PS-08

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES



NOTES:

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

DATE:
MARCH 2024

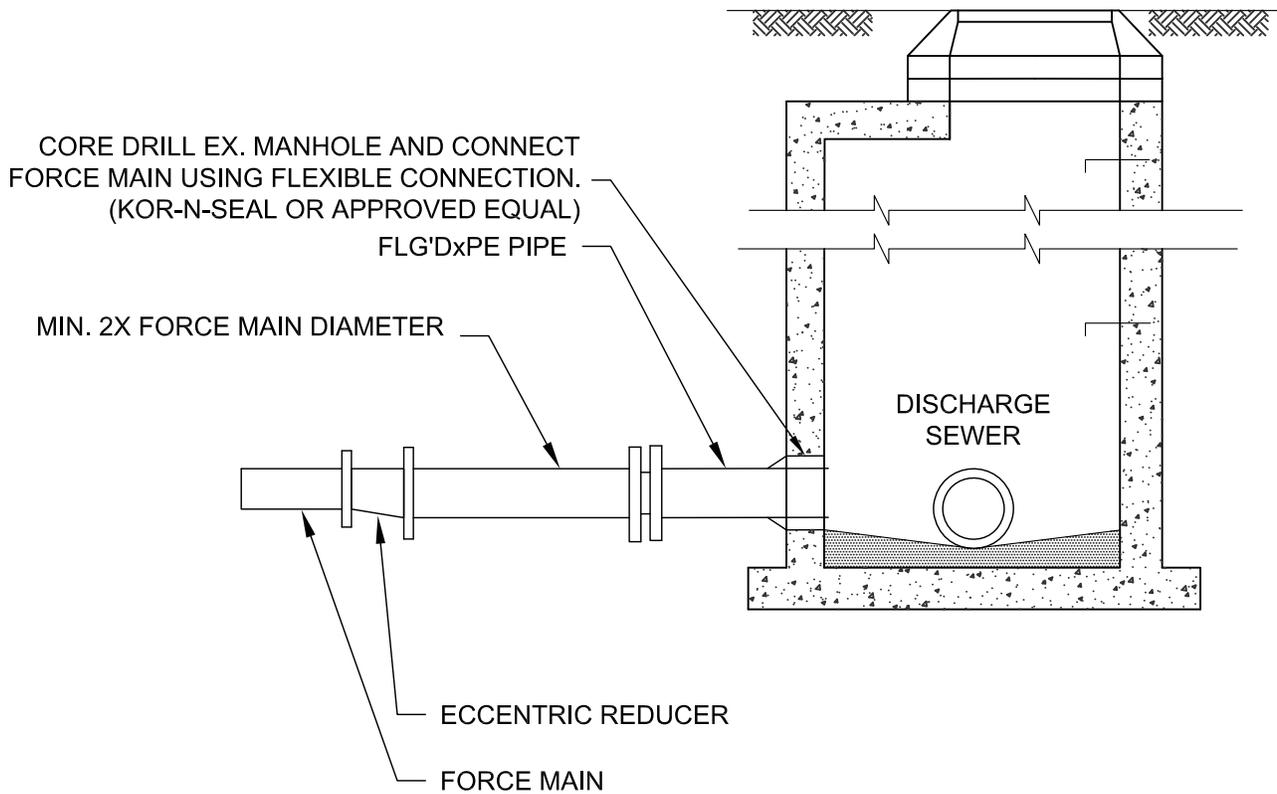
REVISION:

CABLE HOLDER

DETAIL
PS-09

GOOCHLAND COUNTY
DEPARTMENT OF PUBLIC UTILITIES

TRANSITION TO GRAVITY PIPE. PIPE DIAMETER
AND SLOPE SHALL BE AS REQUIRED TO
CONVEY PEAK PUMPING RATE.



NOTE:

1. SEE DETAIL MAN-08 FOR ACID RESISTANT MANHOLE LINING REQUIREMENTS.
2. RESTRAIN ALL JOINTS.

DATE:
MARCH 2024

REVISION:

FORCE MAIN CONNECTION
TO EXISTING MANHOLE

DETAIL
PS-10

4.1 GENERAL CONSTRUCTION STANDARDS

4.1.01 Work Within VDOT Roads

- A. A permit from VDOT is required for any work within any VDOT right-of-way. The contractor is responsible for obtaining the necessary VDOT permit(s) and shall always comply with all provisions of the permit(s).

4.1.02 Coordination

- A. Phases of the construction which involve the temporary interruption of essential services shall be scheduled in consultation with Utility Provider(s), Property Owners, affected Utility Users, and the Department, and shall not be of longer duration than absolutely necessary to accomplish the purpose for such interruptions. Liaison in this matter shall be required before beginning any work. The Contractor shall notify the Department not less than 48 hours in advance of commencing work.
- B. 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 Department may disapprove the proposed time and date of any and all connections. In such cases, the Inspector will coordinate with the Contractor to determine a suitable time and date for the work.
- C. The Contractor shall not operate any valves on the County system or make connections to existing sewer and/or water lines before proper notification is made to the County so that inspection of this work can be made.
- D. The Contractor shall be responsible for planning, designing, obtaining, and/or implementing all temporary services, utilities, connections, temporary piping, site access and other provisions needed to maintain continuous operation of the utility.

4.1.03 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 proper 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 has sole authority to allow 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.

4.1.04 Use of Water

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

4.1.05 Conflicts

- A. Should any requirements of these Specifications conflict with requirements of a governmental or private authority having jurisdiction, then to the extent of such conflict, and only to such extent, these Specifications shall be superseded.

4.1.06 Safety

- A. The Contractor shall accept sole responsibility for work area safety. The County shall not be responsible for the Contractor's safety precautions or for the 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.

4.1.07 Existing Structures

- A. The location of existing sewers, water, 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 site at all times.
- B. The Contractor shall dig any and all 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.
- C. 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.
- D. Prior to commencing work, the Contractor shall contact Virginia 811 (formerly "Miss Utility") for assistance in locating existing underground utilities.
- E. The Contractor shall observe all precautions with respect to fire and shall avoid indiscriminate or unnecessary mutilation or cutting of trees within and outside of project work areas and/or easements. Any damage to property not in the work area or easements will be the Contractor's responsibility.

4.1.08 Routine Inspections

- 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 issue can be referred to the Director for Final Determination.
- B. Department personnel and their authorized representatives shall have access at all times to all parts of the work for the purpose of observing and/or performing inspections of water and sewer construction.

4.1.09 Final Inspection

- A. Before Final Inspection of the work, the Contractor shall clean up the work site(s), including all rights of way and easements and shall restore these areas as closely as possible to their original condition. All unnecessary machinery, tools, surplus material, temporary buildings, and other structures shall be removed from the project site.

4.1.10 Notification to Property Owners

- A. The Contractor shall properly notify in writing all owners of property which may be affected by the work a minimum of two (2) weeks prior to the start of any construction (including staking and land clearing).

4.1.11 Connections to Existing Water and Sewer Systems

- A. All water line tie-ins to an existing distribution system, including vertical and horizontal relocations, shall be coordinated with the Inspector. Typically, tie-ins shall be scheduled to start Tuesday through Thursday between 9:00 a.m. and 12:00 p.m. Tie-ins may be scheduled outside these time periods upon written request by the Contractor, and approval by the Department.
- B. Tie-ins to water mains and sewer force mains will not be allowed two workdays before, and two workdays after, Thanksgiving and Christmas. Tie-ins may be restricted at other times at the discretion of the Director.
- C. The Inspector will determine the suitability of proposed tie-in dates/times and will coordinate a mutually acceptable schedule with the Contractor.
- D. In the interest of public safety and/or customer service the County may require the Contractor to perform tie-ins to existing systems at times other than those listed.
- E. No portion of any water or sewer system may be shut down for the purposes of making a tie-in of new construction without express written permission from the

Director. When a shutdown is permitted, the Contractor shall prepare a specific plan for the tie-in which minimizes shutdown time(s), and which includes a detailed scope of work and a list of all tasks to be performed to accomplish the tie-in. The plan must be submitted to the Department for review and must be approved by the Director prior to scheduling the tie-in. Sufficient personnel, equipment, and materials, including backups for key pieces of equipment and materials, shall be on-site prior to the shutdown. Where applicable, excavation and preassembling of fittings shall be performed. If, in the opinion of the Inspector, sufficient resources are not available, or the Contractor is otherwise not properly prepared to perform the work, the shutdown and tie-in will be postponed and rescheduled.

- F. The Contractor shall adhere to the VOSH Asbestos Construction Standard, Part 1926.1101 for work on pipe containing asbestos material. Tie-ins to asbestos cement pipe shall be made to rough barrel pipe. Tie-ins to the machined section of asbestos cement pipe will not be permitted. Where asbestos cement pipe couplings have been removed, the machined end of the pipe shall be removed. Abandonment, removal, and/or disposal of asbestos cement pipe shall be per State and Federal requirements.
- G. Tie-ins involving fittings shall include provisions for temporary blocking until concrete thrust-blocking has cured.
- H. All pipe and fittings used for a tie-in to the water system shall be swabbed with a 1% chlorine solution prior to connection.
- I. Before a tie-in may commence, all valves needed for the operation, including fire hydrant valves, shall be readily accessible. The Contractor and the Inspector shall verify that all “Normally Open” valves are fully open, and all “Normally Closed” valves are fully closed, prior to commencing. Immediately following a tie-in involving a shutdown, the Contractor and Inspector shall verify that all valves have been returned to their normal positions. Fire hydrants in or near the work area shall be checked to ensure water is available and each hydrant is in working order.

4.1.12 Field Engineering

- A. Grades, Lines and Levels
 - 1. The Design Engineer shall establish baseline and control points. From these points, the Contractor shall furnish all necessary personnel and equipment to establish line and grade as required for the work.
 - 2. The Contractor shall be responsible for the preservation of all stakes and marks established by the Design Engineer.

3. In addition to certifying the as-built information for utilities the 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.
4. With written approval from the Director, Field Engineering may be performed by a Professional Engineer other than the Design Engineer.

4.1.13 Project Meetings

- A. A preconstruction meeting with the Inspector and the Contractor shall be scheduled before beginning any work.
- B. The Inspector shall be invited to all progress meetings held during construction of the project.

4.1.14 Construction Schedule

- A. Construction Schedules
 1. Contractor shall submit a detailed construction schedule prior to the preconstruction conference. The Construction schedule shall be reviewed at the monthly progress meeting and updated as required.

4.1.15 Shop Drawings and Submittals

- A. Prior to the preconstruction meeting, required Shop Drawings, Working Drawings, and other pertinent information (the Submittals) shall be provided to DPU by the Contractor for all materials and equipment to be furnished and installed as part of the project.
- B. Construction shall not commence until the Submittals have been reviewed and accepted by the Department. Acceptance by the Department will be indicated by noting "No Exceptions Taken" on the submittal review form.
- C. Working Drawings consist of such detailed drawings as may reasonably be required for successful completion of the project and which are not included on Plans. These may include anchor bolts, centering and form work, masonry, layout diagrams, flanged pipe spool drawings, etc.
- D. If deviations, discrepancies, or conflicts are discovered between the Submittals and the Plans or these Specifications, either prior to or after concurrence has been received, the Plans and these Standards shall control and shall be followed.
- E. No materials shall be used in the work which do not comply with the accepted Submittals.

- F. After a Shop Drawing has been accepted by DPU no change in brand or manufacturer will be permitted unless satisfactory written justification is presented to and approved by the Department.
- G. The Submittals shall include manufacturers' installation instructions and long and short-term storage requirements.
- H. The Submittals must comply with the following requirements:
 - 1. They must be clearly marked and submitted sufficiently in advance of the work they cover to afford ample time for checking, correcting, and rechecking if necessary.
 - 2. Before submitting, 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..
 - 3. At the time of submission, Shop Drawings 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. 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 Plans and the Standards and Specifications of the Goochland County Department of Public Utilities.

Checked By: _____ Date: _____
 - 5. The person signing the stamp must be designated in writing by the Contractor as having that authority. The signature shall be handwritten in ink. Stamped signatures are not acceptable.
 - 6. Acceptance of the Submittals by DPU does not constitute approval, and in no way relieves the Contractor of responsibility for errors or omissions in dimensions or quantities or for failure to meet all applicable Standards.
- I. Department Action:
 - 1. Review of Shop Drawings and other submittals is only for conformance with the design concept of the project. Markings or comments do not

relieve the Contractor from compliance with the Plans and these Specifications nor do they allow departure therefrom. 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 Plans and Specifications.

2. Following review of Shop Drawings, each drawing shall receive one of the following designations:
 - a. No Exceptions Taken – Acceptance by DPU: Work may proceed, provided it complies with Contract Documents, when submittal is returned with this marking.
 - b. Revise and Resubmit - 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.
 - c. Rejected - 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.

4.1.16 Deviation from Plans

- A. There shall be no deviation from the plans, profiles, cross-sections, and specifications in any particular except on written consent of the Director. If any unapproved deviation occurs on the part of the Contractor or any Subcontractor, the error shall be corrected in a manner satisfactory to the Department.
- B. If unforeseen conditions arise during Construction, the Contractor shall notify the Inspector and Engineer. Any proposed deviations from the Plans shall be submitted to the County for review and approval prior to execution.

4.1.17 Temporary Facilities and Controls

- A. Temporary Electricity: The Contractor shall provide electric power for construction purposes. The Contractor shall acquire all required permits for such installation.
- B. Temporary Sanitary Facilities: The 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.

4.1.18 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 Director.
 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 existing facilities 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.
 - c. Even if approved for reuse, no broken or unserviceable item shall be

reused. In such instances, the item shall be replaced with a new, functionally equivalent, item.

7. For all materials and equipment designated to be turned over to the County, the Contractor shall remove all items carefully, clean them, and transport them to an area on site or a storage facility designated by the Department. All sewer service materials or equipment shall be disinfected before turning over to the County.
8. Manufacturer's Instructions
 - a. All installation of work shall comply with manufacturer's written instructions. Prior to installation, the Contractor shall obtain and distribute copies of such instructions to all parties involved in the installation, including two copies to the Inspector.
 - b. Handle, install, connect, clean, condition, and adjust products in strict accordance with such instructions and in conformity with manufacturer's requirements.
 - c. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the manufacturer.

B. Transportation and Handling:

1. Arrange deliveries of products in accordance with construction schedules, and 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 upon delivery, inspect shipments to assure compliance with requirements and approved submittals, and 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. Store 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. P prevent soiling and staining.
 - b. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - c. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
 - d. 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.

4.1.19 Warranties and Guarantees

- A. The 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. Warranties and Guarantees shall be for a period of one year from the date of Final Acceptance of the project.
- B. Guarantee: The Contractor warrants the equipment and/or materials delivered and installed as part of the project are free from defects in design, material or workmanship, and damage caused prior to final inspection.
- C. Prompt Repair: The Contractor shall promptly repair or replace all defective or damaged items installed as part of the project.
- D. County's Option: In the event of equipment and/or materials failure, during such time or in such a location that immediate repairs are mandatory, the Contractor shall respond promptly, regardless of time. If the Contractor is not available,

County personnel or other contractors secured by the County, will conduct repairs. The Contractor shall then reimburse the County for parts and labor and/or other contractors' costs necessary to correct deficiencies during the warranty period.

END OF SECTION 4.1

4.2 SITE CLEARING

4.2.01 General

- A. This section provides requirements for general site clearing operations, including removal of trees and vegetation, protection of existing trees to be left standing, and clearing and grubbing. The Contractor is responsible for performing all work necessary to meet these requirements.
- B. Site clearing operations shall comply with all applicable Federal, State and Local requirements and restrictions.
- C. Provide barricades, coverings, safety fence, or other types of protection necessary to prevent damage to existing facilities and appurtenances not indicated to be removed as well as improvements on adjoining properties.
- D. Restore all improvements damaged by this work to their original condition, subject to acceptance by the Owner and/or authorities having jurisdiction.
- E. Site clearing and grubbing shall be limited to those areas designated on the drawings as being within the limits of construction, easements, and right-of-way designated for the work. The contractor shall not clear or grub outside of the limits of construction without written permission of the property owner.
- F. Depressions caused by clearing and grubbing shall be filled and compacted with suitable material, as approved by the inspector, unless further earthwork is required.

4.2.02 Clearing

- A. Remove from the site and permanent easements: trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and other incidental structures as needed to allow for new construction. Where fences are removed to perform work, provide relocated temporary fencing as needed.
- B. Undisturbed stumps and roots which will be a minimum of 5 feet below finished grade and which will not be located under, directly over, or within 10 feet of any structure or pipeline, may be left in place. The tops of stumps left in place shall not be more than 3 inches above original grade.

4.2.03 Existing Trees and Shrubs

- A. Trees and shrubs located within the Limits of Disturbance and which that are to remain in place will be indicated on Drawings and shall be conspicuously marked on site.

- B. Protect existing trees and other vegetation indicated to remain in place against cutting, breaking and 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. Temporary fences, barricades or guards shall be provided as required to protect trees and vegetation to be left standing.
- C. Felled trees may remain property of the landowner upon request and shall be removed or cut in lengths as mutually agreed to by the Contractor, the Inspector and the landowner. If the landowner does not want the trees, they shall become the property of the Contractor and shall be removed from the site and properly disposed of by the Contractor.

4.2.04 Grubbing

- A. Grub areas within and to a point 10 feet outside of all structures and pipelines, except as otherwise indicated on the plans.
- B. Within the work area, remove from the ground to a depth of 18 inches below existing grade, all stumps, roots, root mats, organic material and debris and properly dispose of all materials.
- C. Only hand grubbing methods are permitted inside the drip lines of trees which are to remain.

4.2.05 Disposal of Waste Materials

- A. Remove all waste material from site and dispose of it in a legal manner such as an approved landfill.
- B. Continually clean up debris resulting from site clearing operations as the work progresses.
- C. 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 in accordance with the requirements of the Erosion and Sediment Control Plan and the Virginia Department of Transportation, as applicable.
- D. Burning of materials on site is prohibited.

END OF SECTION 4.2

4.3 TRENCHING AND BACKFILLING

4.3.01 General

- A. Work included in this section includes trenching and backfilling for underground pipelines and related structures only.
- B. Work shall conform to County requirements. Where construction is within the road right-of-way, the requirements of the Virginia Department of Transportation (VDOT) shall govern.
- C. Reference Specifications include, but may not be limited to:
 - 1. American Society for Testing and Materials (ASTM)
 - 2. American Association of State Highways and Transportation Officials (AASHTO)
 - 3. Virginia Department of Transportation (VDOT)

4.3.02 Definitions

- A. Excavation: Removal of material encountered to required subgrade and/or subsoil elevations indicated, and the subsequent disposal of materials removed.
- B. Fill: Material placed and compacted above the level of the subsoil, which existed before construction of the project.
- C. Rock: Hard bed rock, boulders, or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material that cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.
- D. Subgrade: The undisturbed earth, or the compacted soil layer, immediately below granular subbase, drainage fill, or topsoil materials.
- E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.
- F. Unauthorized Excavation: Removal of materials below indicated subgrade elevations or beyond horizontal excavation dimensions without specific direction of the Inspector.
- G. Undercut Excavation: Additional excavation made necessary by the presence of unsuitable bearing materials at the specified subgrade or subsoil elevation. Undercut excavation must be approved by the Inspector. Where unsuitable

materials are encountered, the Contractor shall perform undercut excavation as needed or as directed by the Inspector.

- H. Unsuitable Material: Material such as clay mass, frozen materials, cinders, ashes, refuse, vegetable and organic material, or any other material deemed unsuitable by the Inspector. Unsuitable material shall be removed and replaced with suitable material as specified herein for the intended use.
- I. Bedding: Bedding is the material placed under the pipe as indicated on the appropriate Standard Detail.
- J. Backfill: Material placed on top of bedding. Backfill is used to cover the pipe and fill the trench. The contractor shall use the correct type(s) of backfill as indicated on the appropriate Standard Detail for the pipe being installed.

4.3.03 Testing and Inspection

- A. Compaction testing shall be performed by a licensed, independent testing agency. The testing shall be performed by agency personnel in the presence of the Inspector. The testing company shall submit the results to the County.
- B. In trenching operations, compaction testing shall be performed at increments of approximately 1,000 L.F. of trench, and at all commercial driveway entrance crossings.
- C. Inspector must approve subgrade prior to bedding and pipe installation, and each fill layer prior to installation of the next layer.
- D. The degree of compaction obtained shall be verified by means of field density tests made by an independent testing agency. Where tests indicate a deficiency in degree of compaction, the Contractor shall correct such conditions and the independent testing agency shall conduct additional tests to verify that the corrected work is satisfactory.

4.3.04 Explosives

- A. Work with explosives shall be executed by persons who are licensed or otherwise authorized by governing authorities for the work required.
- B. The Contractor shall be responsible for obtaining the necessary blasting permit(s) from the County Fire Marshal and/or other authorities having jurisdiction.
- C. Explosives shall be stored and used in accordance with all applicable Federal, State, and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from his use of explosives.

4.3.05 Existing Utilities

- A. 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 which are not shown on Drawings, or when location differs from that shown on Drawings, notify the Inspector for instructions before proceeding.
- B. The Contractor shall coordinate with the local utility companies prior to constructing portions of work adjacent to utility poles and other structures. The Contractor shall stabilize utility poles and/or other structures as required by the utility owner.

4.3.06 Products

- A. Select fill shall be Type I or Type II in accordance with Section 207 of the VDOT Road and Bridge Specifications.
- B. Clean earth fill shall be approved by the Inspector and shall be free of debris, roots, frozen materials, organic matter, rock, or gravel larger than 1-½ inches in any dimension or other harmful, deleterious matter and shall be classified as ML or better material in accordance with the Unified Soils System, ASTM D2487.
- C. Fine aggregate shall be #9 or #10 stone as per VDOT Road and Bridge Specifications Section 203 or Grade A or Grade B fine aggregate as per VDOT Road and Bridge Standard Section 202.
- D. Coarse aggregate shall be #57 stone as per VDOT Road and Bridge Specifications Section 203.
- E. Where concrete is to be used, the Contractor shall submit a job mix with Laboratory Testing Reports for approval by the Department. Concrete for bedding, backfill or encasement shall be 3000 psi minimum.
- F. Riprap, where shown on the Drawings, shall conform to VDOT Specification Sec. 414.03 Dry Riprap.
- G. Topsoil is defined as the top 6 inches of original soil from the trench. Topsoil provided by the Contractor shall be fertile, friable loam, containing not less than 2 percent by weight of finely divided, decomposed vegetation. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than ½- inch diameter, stones larger than ½-inch diameter and other material toxic or harmful to growth.

4.3.07 Excavation

- A. Contractor shall strip existing topsoil, leaf mold and organic materials and deposit it in storage piles separate from other excavated material.

- B. Where the trench excavation exceeds the specified width, the Contractor shall consult with the Design Engineer to determine whether measures need to be taken to account for increased loads on pipe.
- C. Where unauthorized excavations occur, the Contractor shall restore affected areas to the elevations and dimensions shown on the Drawings using granular fill material.
- D. The Contractor shall be responsible for the removal of any/all unsatisfactory material from the site.

4.3.08 Trenching and Bedding

- A. Trenches may be opened only as far in advance of pipe laying as permitted by the Inspector.
- B. Excavate to the lines and grades indicated for pipelines and structures making proper allowance for pipe bedding materials, pipe bells and concrete form work.
- C. Excavate pipeline trenches with vertical walls. Specified trench width shall be maintained from bottom of trench to a point 18 inches above top of pipe.
- D. Where unsuitable soil is encountered, the Contractor shall excavate to a depth acceptable to the Inspector and shall replace unsuitable material with thoroughly and uniformly compacted pipe bedding material as indicated on the applicable Standard Detail.
- E. The width of the trench at and below the top of the pipe shall not exceed the width of the trench as shown on the applicable Standard Detail.
- F. Pipe bedding and backfill shall be performed as follows:
 - 1. Pressure Pipe:
 - a. Ductile iron pressure lines and PVC pressure lines 4 inches and larger shall be installed with bedding and backfill in accordance with Standard Detail TR-01 – Pressure Pipe Trench.
 - b. Pressure pipe 3 inches and smaller of PVC, polyethylene pipe and copper tubing shall be backfilled with a minimum of 6 inches of sand or fine aggregate all around.
 - c. Excavate for bell holes at each joint so that entire barrel of pipe shall be fully supported the entire length.
 - d. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use bedding and backfill

as specified on Standard Detail TR-01 – Pressure Pipe Trench, regardless of pipe material.

2. Gravity Sewer:
 - a. Ductile iron and PVC gravity sewer lines shall be installed with bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer Trench.
 - b. Where rock is encountered, excavate and remove rock to a minimum 6 inches below the bottom of the pipe and use appropriate bedding and backfill as specified on Standard Detail TR-02 – Gravity Sewer Trench.
- G. All pipes shall be installed in a dry trench. The excavation shall be dewatered as necessary to provide proper protection of the trench. The method and equipment used for dewatering shall be subject to the approval of the Inspector.
- H. All soil is unclassified unless indicated otherwise.
- I. All foundation soils and subgrades shall be tested by a licensed, independent, testing agency to determine subgrade soil bearing capacity.
- J. Adequate positive drainage away from trenches and excavations shall be maintained throughout construction. Keep excavation free of water while work is being performed and until backfilled. Where underground streams or springs are found, provide temporary drainage or pumping and notify the Inspector.
- 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, Contractor shall excavate the entire structure to an even depth at least 8 inches below the bottom elevation of the structure and shall back-fill with coarse aggregate fill and thoroughly compact. Provide a minimum of 8 inches between rock excavation and sides of structures.

4.3.09 Sheeting and Shoring

- A. Contractor shall maintain trench walls in a safe condition at all times. The use of sheeting and/or shoring may be required at the discretion of the Inspector.
- B. Unless otherwise directed by the Inspector, all sheeting and bracing shall be removed in such a manner that the construction or other structures are not endangered. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately with approved material and compacted by ramming with tools especially adapted for that purpose, or by other means approved by the Inspector.

- C. Sheeting and shoring left in place shall be cut off to a depth of not less than 24 inches below grade. The cutoff sections shall be removed from the site.

4.3.10 Compaction

- A. Power-driven hand tampers shall be used for compacting materials adjacent to structures and in areas inaccessible to rollers. Use equipment capable of adding moisture to the soil material as determined by moisture-density tests. Where required, uniformly apply water to the surface of the subgrade or layer of soil material in such a manner as to prevent free water appearing on the surface, either during or subsequent to compacting operations.
- B. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified percentage of maximum density.
- C. Do not place or compact material that is muddy, frozen, or contains frost or ice.
- D. 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).

4.3.11 Backfill

- A. Unless otherwise required by DPU Standards or as directed by the Inspector, the Contractor shall backfill all trenches immediately after the pipes and appurtenances are laid therein.
- B. Backfill shall be properly placed uniformly on each side of the pipe and compacted as required. The Contractor shall not backfill on muddy or frozen soil, nor shall muddy or frozen soil be used as backfill.
- C. 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 which satisfy the compaction requirements.
- D. Depressions caused by removal of stumps or other clearing operations shall be excavated to firm subgrade and filled with clean earth fill compacted as specified.
- E. 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.

- F. The Contractor shall compact soil materials using equipment suitable for materials to be compacted and work area locations.
- G. Coarse aggregate fill placed under manholes and other structures shall be compacted to the required density.

4.3.12 Grading

- A. The Contractor shall:
 - 1. 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.
 - 2. Finish all surfaces free from irregular changes.
 - 3. Finish subgrade areas to receive topsoil to within 0.10 foot of required subgrade elevations.
 - 4. Shape subgrade under walks to line, grade, and cross-section to within 0.10 foot of required subgrade elevations.
 - 5. Shape subgrade under pavement to line, grade, and cross-section to within ½ inch of required subgrade elevations.
 - 6. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.
 - 7. Locate and adjust all manholes, valve boxes, etc. to final grade.
- B. Where compacted areas are disturbed by subsequent construction or adverse weather, the Contractor must scarify the surface, reshape and compact to the required density. Hand tampers shall be used for recompacting areas over underground utilities.
- C. Unless otherwise shown on the drawings, all disturbed areas shall be restored to original grade.

4.3.13 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 as otherwise indicated on the Plans.
- B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified.
- C. All abandoned underground pipes shall be removed or filled with flowable fill.

- D. The Contractor is responsible for the proper off-site disposal of all pipes and appurtenances removed as part of the Work.

4.3.14 Erosion Control

- A. The Contractor shall implement the approved erosion and sediment control plan, and continually comply with federal, state and local erosion control laws and the latest edition of the *Virginia Erosion and Sediment Control Handbook*.
- B. All required erosion and sediment control measures shall be in place prior to work starting.
- C. No more than 100 feet of trench shall be open at any one time without the approval of the Inspector. At the end of the day, all but the last length of pipe installed shall be backfilled at minimum.
- D. The ends of any pipes to be left open at the end of a workday shall be temporarily plugged or blocked.
- E. All disturbed areas shall be stabilized as soon as possible after backfilling.
- F. Graded areas shall be protected 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. Upon completion of work, after spoils and debris have been removed, final grading shall be performed, and permanent seeding applied to any areas disturbed by operations.
- H. Any additional and/or alternate ground cover shown or described on the Plans shall be installed at the time of final grading, or as otherwise specified on the Plans.

4.3.15 Clean Up

- A. The Contractor shall keep the entire work area clean at all times and shall promptly remove all materials and debris not intended for incorporation into the project. The surfaces of all paved areas shall be cleaned in accordance with VDOT requirements.
- B. Maintain the work area from the nuisance of dust, mud and/or settling during the entire length of the project and for one year from the date of Final Acceptance.

END OF SECTION 4.3

4.4 HORIZONTAL DIRECTIONAL DRILLING

4.4.01 Description

- A. This section includes requirements for using the horizontal directional drilling (HDD) method of installing underground pressure pipe. This method is also commonly referred to as directional drilling, directional boring, or guided horizontal boring.

4.4.02 Quality Assurance

- A. Qualifications
 - 1. The Directional Drilling Contractor or Subcontractor shall have a minimum of 5-years' experience constructing water, wastewater, or reclaimed water pipes using the HDD method. Experience shall include pipelines of the same or larger diameter and the same or greater lengths as those included in the project.
 - 2. The Contractor's operations shall be in conformance with the most recent edition of the Plastic Pipe Institute "Handbook of Polyethylene Pipe" and the pipe manufacturer's requirements.

4.4.03 Shop Drawings and Submittals

- A. The Contractor shall provide shop drawings and submittals to the County which are specific to the HDD method. These shall be provided to the DPU for review and acceptance prior to construction, and shall be comprised of the following:
 - 1. A detailed Work Plan
 - 2. Pipe
 - 3. Joining procedure
 - 4. Training and experience of directional boring machine operator(s)
 - 5. Specifications for directional drilling equipment, including maintenance and calibration records
 - 6. Any/all proposed deviations from design
- B. The Contractor must submit a Work Plan which details the procedures and schedule to be used to execute the HDD installation. At a minimum, the Work Plan shall include the following:
 - 1. A description of all tools and equipment to be used

2. A description of the proposed route(s) by which the work area(s) will be accessed
3. A list of the personnel who will be performing the work, including their qualifications and relevant experience
4. A list of any/all Subcontractors
5. An environmental protection plan specific to the HDD operation
6. Contingency plans for possible problems which may arise during the work

C. Equipment

1. The Contractor shall submit specifications on directional drilling equipment to be used and shall ensure that the equipment will be adequate to complete the work. Equipment submittals shall include but not be limited to the following:
 - a. Drilling rig
 - b. Mud system
 - c. Down-hole tools
 - d. Guidance system
 - e. Rig safety systems
 - f. Data logger

D. Records

1. Redline drawings shall be maintained by the Contractor throughout the work. Any deviation from the approved plans shall be noted on the redline drawings, including the nature and extent of the deviation.
2. Fusion results for all field joints shall be provided to DPU for review prior to acceptance of the work.

4.4.04 Equipment

A. The directional drilling equipment shall consist of the following:

1. A directional drilling rig of sufficient capacity to perform the bore and pullback operations.
2. A drilling fluid mixing and delivery system of sufficient capacity to complete the installation,

3. A guidance system to accurately guide boring operations.
 4. A vacuum truck of sufficient capacity to handle the drilling fluid volume.
- B. All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in proper working order for continuous drilling operations.

4.4.05 Drilling System

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push, and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground, if required, to withstand the pulling, pushing, and rotating pressure required to properly complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

4.4.06 Pipe

- A. Pipe shall be High Density Polyethylene (HDPE) in accordance with these Standards.
1. Installation Curvature
 - a. The radius of curvature of the installed pipeline shall not be less than two times the minimum radius as defined by the pipe manufacturer for the size and thickness of the pipe being installed.

4.4.07 Tracer Wire

- A. Tracer wire shall be installed with the pipe in accordance with requirements of the pipe manufacturer, the tracer wire manufacturer, and Sections 4.5, 4.6, and 5.3.24.B of these Standards.

4.4.08 Drilling Fluids

- A. Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material such as bentonite or a polymer surfactant mixture producing a slurry of custard-like consistency.

4.4.09 Personnel Requirements

- A. Responsible representatives of the Contractor and Subcontractor(s) shall be present at all times during directional drilling operations. A responsible representative as specified herein is defined as a person experienced in the type of work being performed and who has the authority to represent the Contractor and the drilling Subcontractor in a routine decision-making capacity concerning the manner and method of carrying out the Work.
- B. The Contractor and Subcontractor(s) shall have a sufficient number of competent workers on site at all times to ensure placement of the utilities in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the directional drilling operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site throughout the HDD operation.
- C. A competent and experienced supervisor representing the Contractor or Subcontractor who is thoroughly familiar with the equipment and type of work to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the project site during the directional drilling operation.

4.4.10 Work Plan

- A. The Work Plan must be comprehensive, realistic, and based on actual working conditions for the particular Project. The Work Plan shall document the requirements to complete the Project.
 - 1. Calibration records for guidance equipment shall be included in the Plan.
 - 2. Specifications for any drilling fluid additives that the Contractor intends to use or might use shall be submitted with the Plan.

4.4.11 Installation

- A. Erosion and sediment control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. The Contractor is responsible for off-site disposal of drilling mud in accordance with local, state, and federal requirements.
- B. No added chemicals or polymer surfactants shall be used in the drilling fluid without written consent of the Director, after a determination is made that the chemicals to be added are not harmful or corrosive to the system and are environmentally safe.
- C. Pilot Hole: Pilot hole shall be drilled along the bore path with no deviations greater than ± 1 -foot in the horizontal plane and ± 1 -foot in the vertical plane. In the event that the pilot does deviate from bore path more than ± 1 -foot, the

Contractor shall notify the Design Engineer and the Inspector. The Design Engineer or DPU may require the Contractor to pullback and re-drill from the location along bore path before the deviation. The Contractor shall submit any proposed deviations from the design bore path with the submittals.

- D. Reaming: Upon successful completion of pilot hole, the Contractor will ream borehole to a minimum of 25% greater than the outside diameter of the pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
- E. Pullback: After successfully reaming borehole to the required diameter, Contractor shall put the pipe through the borehole. In front of the pipe shall be a swivel and barrel reamer to compact bore hole walls. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, the Contractor shall not apply more than the maximum safe pipe pull pressure at any time. A break away link rated below the maximum safe pull force shall be utilized. Pullback duration shall be limited to 12 hours maximum for each drill.
- F. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole in such a manner as to prevent deformation of, or damage to, the pipe.
- G. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the Department and the Design Engineer have been consulted and the issue addressed.
- H. The pipe shall be pulled back through the borehole using the wet insertion construction technique. The pipe shall be installed full of water.
- I. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement, or distortion of surface features.
- J. A boring log shall be kept with horizontal and vertical location of the installation. The horizontal location of the bore shall be marked in the field during the bore at a minimum of 50-foot increments and at directional changes. These marks shall include the bore depths. The contractor shall locate and record these marks in accordance with the requirements for Record Drawings contained in these Standards.

4.4.12 Inspection

- A. Fusion joining shall include a processor or electronic data recording device capable of reading and storing the input parameters and the fusion results for later download to a record file. The Contractor shall provide this information to the Department prior to acceptance of the work.

4.4.13 Field Testing

- A. Acceptance testing of the directionally drilled pipe shall be in accordance with DPU Standards for pressure pipe.

END OF SECTION 4.4

4.5 WATER DISTRIBUTION SYSTEM INSTALLATION

4.5.01 General Requirements

- A. The Contractor shall have a sufficient number of competent workers at the work site at all times to ensure the utility placement is made in a timely, satisfactory manner.
- B. Locate fire hydrants as shown on the Plans and install in accordance with these Standards and the appropriate Standard Detail(s).
- C. Provide combination air/vacuum valves at locations shown on drawings. Install a ball valve between water main and combination air/vacuum valves. Construct manholes for air and vacuum relief valve as shown in the Standard Details.
- D. 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 inches above top surface.
- E. Use cast iron or PVC 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.
- F. Provide mechanical pipe seals to wall penetrations 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.
- G. 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. Joint restraints shall be installed upstream and downstream of each bend, valve, and fitting for the minimum distance determined by the Engineer. Restraint calculations shall be provided on the drawings and length of restrained joints shall be indicated on the profiles.
- H. Concrete reaction anchors (thrust blocks) shall bear against undisturbed earth and shall be of the size and shape shown on the Standard Details.
- I. Use metal harness restraints as specified elsewhere in this section.
- J. 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.

- K. Encase water pipelines crossing under highways and railways in a casing pipe. The casing pipe shall be of the diameter and wall thickness required in the Standard Details or the controlling authority with jurisdiction over the crossing, whichever is more stringent. Joining of steel casing pipe shall meet requirements of AWWA C206. Install casing pipe by jacking, boring, or open cut if permitted.
1. Install casings at railroad crossings in accordance with the requirements of AREMA Standards for installation of pipelines carrying nonflammable substances under railway tracks.
 2. Install casings per the Standard Details or as otherwise required by the right-of-way owner.
 3. The Contractor is responsible for obtaining all required permits from the right-of-way owner prior to beginning work. Copies of the permits shall be submitted to the Department for approval.
 4. Casing ends shall be sealed to protect against foreign matter entering casing.
 5. Casing pipe shall meet the requirements of Section 5.1 of these Standards.

4.5.02 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 4.3 - 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, material and type of pipe being installed. 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 up grade.
- G. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health *Waterworks Regulations* and these Standards.

- H. NOTE: The use of pipe lubricants other than Blue Lube has been shown to cause significant taste and odor conditions when used in drinking water disinfected with chloramines. The Department will not accept completed water lines that exhibit taste and odor conditions as a result of the use of unapproved lubricants.

4.5.03 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. 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, and 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 use a calibrated torque wrench to tighten all nuts to torque listed below, or as otherwise specified by the manufacturer.:

<u>Bolt Size (inches)</u>	<u>Torque (foot-pounds)</u>
1. 5/8	40 – 60
2. 3/4	60 – 90
3. 1	70 – 100
4. 1-1/4	90 – 120

- C. Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed. If a bolt tightening pattern is specified by the manufacturer it shall be followed exactly.
- D. Join lock-type mechanical joint pipe according to manufacturer’s recommendations.
- E. Permissible deflection in mechanical joint pipe shall not be greater than 1/2 of that listed in AWWA C600 or as 1/2 that allowed by the pipe manufacturer.
- F. Permissible deflection in lock-type mechanical joint pipe shall be 1/2 that recommended by manufacturer.

4.5.04 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 Blue Lube pipe lubricant to the gasket and the spigot end of the joining pipe. 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 deflections of PVC pipe which cannot be accomplished with bend fitting(s) shall be by bending of the pipe in accordance with manufacturers' specifications and instructions.
- C. Maximum joint deflection at DIP push-on joints shall be 1/2 that allowed by the manufacturer.

4.5.05 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 each valve for satisfactory operation prior to installation.
- B. Provide all underground valves with valve boxes, except as specifically noted otherwise on the drawings. Set valve boxes in accordance with Standard Details.
- C. Set box in alignment with valve stem centered on valve nut, using a valve box adaptor. Set the valve box to prevent transmitting shock or stress to the valve. PVC extensions shall not be permitted.
- D. 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-inch operating nut.

4.5.06 Installation of Tapping Sleeves and Tapping Valves

- A. All tapping sleeves shall be set to avoid interference with existing pipe joints. Typically, tapping sleeves shall be installed perpendicular to the vertical axis of the pipe being tapped. Proposed alternate configurations will be considered by the Department on a case by case basis.
- B. All tapping sleeves and valves shall undergo a pressure test of 150 psi 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 Inspector. Installation of taps shall be scheduled with the Inspector a minimum of 48 hours in advance.

4.5.07 Warning Tape

- A. Detectable tracer tape shall be installed in utility trenches directly above all water mains approximately 18 inches 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 in Section 5.1.

4.5.08 Tracer Wire and Access Boxes

- A. In addition to detectable tracer tape, tracer wire shall be installed with all water mains and shall be attached to all fittings. Tracer wire shall be taped directly to the top of the pipe at a maximum spacing of 8 feet and within 12" on each side of all fittings, and shall be installed in a continuous traceable manner.
- B. Tracer wires must be interconnected at pipe intersections. When non-metallic water lines have metallic service lines attached, the conductive tracer wire shall be attached to both the main line tracer wire and the corporation stop.
- C. In valve boxes, tracer wire shall be brought to within 6 inches of the surface and left in a coil containing at least 24" of wire.
- D. Tracer wire shall be adequately and securely connected to tracer wire access boxes in accordance with the manufacturer's specifications.
- E. Tracer wire access boxes are to be utilized and spaced no more than 1,000 feet apart.
- F. Tracer wire access boxes shall be installed adjacent to all fire hydrants, and at other locations as shown on the plans or directed by the Inspector.
- G. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes.
- H. Tracer wire shall comply with the product specifications as detailed in Section 5.1.24 of these Standards.

4.5.09 Acceptance Tests

- A. The County will supply water at no cost, for testing potable water lines only. Where water must be trucked to the test site, the Contractor shall be responsible for the cost of transportation.
- 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 thrust blocking has been poured, the line, or any valved section of the line, shall be subjected to a hydrostatic pressure test. Testing shall be in accordance with AWWA C600, except as modified herein.

- D. The line to be tested shall be filled with potable water at a velocity of approximately 1 foot per second (fps). Take necessary measures to eliminate all air.
- E. After the system has been filled, pressure shall be raised by pump to 1.5 times the working pressure or 150 psi, whichever is greater. Test pressures shall:
 - 1. Not be less than 1.25 times 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 line being tested, compensating for gage elevation.
 - 5. Test pressure must be maintained for two hours. If pressure cannot be maintained, the Contractor shall determine the cause, perform necessary repairs, and repeat the test until successful.
- F. 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.
- G. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = SD * P^{0.5} / 148,000$$

Where: 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.

- H. All visible leaks shall be repaired regardless of the amount of leakage.
- I. Disinfection
 - 1. The Contractor shall 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 tank

trucks shall include disinfection of all appurtenances to be used, such as valves, hoses, etc.

2. Preliminary Flushing: The main shall be flushed prior to disinfection. Flushing shall be at a velocity of not less than 3.0 feet per second (fps). Adequate provisions shall be made for drainage of flushing water. The following chart provides the pipe flow rates needed to maintain 3.0 fps velocity for various pipe diameters, based on CL 52 DIP

D (in)	Flow (GPM)
4	130
6	290
8	585
12	1,140
16	2,025
18	2,565
20	3,165
24	4,560

3. Form of Chlorine for Disinfection:
 - a. 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.
 - b. 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.
 - c. Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person who is 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.
4. Application: The hypochlorite solutions shall be applied to the water main with a chemical feed pump specifically 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 safely withstand 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.

5. Method of Chlorine Application:

- a. 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 water line. 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 along the pipe 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 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 pound 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

- b. During the application of chlorine, valves shall be operated or a backflow preventer shall be provided to prevent the treatment dosage from flowing back into the line supplying the water.
- c. 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.
- d. As chlorinated water flows past tees and crosses, related valves and hydrants shall be operated to disinfect appurtenances.
- e. 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.
- f. Chlorinated water shall be de-chlorinated before disposal. Water shall not be allowed to flow into a waterway without neutralizing the disinfectant residual. See the appendix of AWWA C651, C652, and C653 for acceptable neutralization methods.
- g. Chlorine residual testing shall be performed to assure that the heavily chlorinated water has been removed from the pipeline.

J. Bacteriologic Tests:

- 1. 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 along the water line. Samples shall be tested by a State Health Department approved laboratory and results submitted to the Inspector.
- 2. In the case that trench water and/or excessive soil or construction debris has entered the new water main as determined by the Contractor, the Owner, or the Department, bacteriological samples shall be collected 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.
- 3. The Contractor 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 Inspector. The testing laboratory shall submit the results to the Department of Public Utilities.

4. 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 County, but the contractor shall be responsible for the cost of loading, hauling, and discharging the water.
 5. A sampling tap consisting of a corporation cock with metal pipe shall be installed within two feet of the valves which isolate the section of water line to be tested. The corporation stop inlet shall be male one inch in size and the outlet shall have 1-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.
- K. Testing and disinfection of the completed sections shall not relieve the contractor of his responsibility to repair or replace any cracked or defective pipe.

END OF SECTION 4.5

4.6 SANITARY SEWER SYSTEM INSTALLATION

4.6.01 General Requirements

- A. The Contractor shall have a sufficient number of competent workers at the work site at all times to ensure that utility placement is completed in a timely, satisfactory manner.
- B. Take all precautions necessary to ensure that pipes, valves, fittings, manholes, 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.
- C. 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.
- D. Bed pipe as specified in Section 4.3 - Trenching & Backfilling.
- E. Do not lay pipe when weather or trench conditions are unsuitable.
- F. Separation of sanitary sewer lines and water lines shall be in accordance with Virginia Department of Health Regulations and these Standards.
- G. Encase sewer pipelines 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 Details. Installation of the steel casing pipe shall be by jacking, boring or open cut if permitted.
 - 1. Install casings at railroad crossings in accordance with the requirements of AREMA Standards for installation of pipelines carrying nonflammable substances under railway tracks.
 - 2. Install casings per the Standard Details or as otherwise required by the right-of-way owner.
 - 3. The Contractor is responsible for obtaining all required permits from the right-of-way owner prior to beginning work. Copies of the permits shall be submitted to the Department for approval.
 - 4. Casing ends shall be sealed to protect against foreign matter entering casing.
 - 5. Casing pipe shall meet the requirements of Section 5.2 of these Standards.

4.6.02 Gravity Sewer Pipe

- A. Lay gravity sewers 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 Joints: 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 4.3 - Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe offline and grade and sufficient backfill to prevent floating.
- D. Backfilling shall be performed as required by these Standards. Refer to Section 4.3 - Trenching & Backfilling. All sanitary sewer gravity mains buried underground shall have a detectable metallic tracer tape buried in the trench approximately 18 inches above the conduit but no less than 18 inches below grade.
- E. Backfill shall be placed over the pipe immediately after the pipe has been laid.
- F. Provide ductile iron pipe or C900 DR14 PVC pipe where cover over main line sewer pipe is less than 5.5 feet in public roads and 3.5 feet in easements.
- G. The absolute minimum allowable slopes for installed gravity sewer lines are 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 (and larger)	0.05

4.6.03 Sewer Force Main

- A. Force mains shall be installed in accordance with the approved plan and profile drawings. Where no grades are shown on the drawings, force mains shall be installed with a minimum depth of cover of 42 inches over the top of the pipe.
- B. Where grades on the force main plans and profiles conflict with existing pipes or structures, then provide additional depth using a uniform vertical curve to provide proper clearance without the use of fittings. Provide allowance for expansion as directed by the Inspector.
- 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 metallic tracer tape 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 Section 5.2.
- E. Copper tracer wire shall be taped directly to the top of the pipe at maximum interval of 8 feet and within 12" on each side of all fittings 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. Appropriately sized lockable connectors shall be used wherever sections of tracer wire must be joined together. Tracer wire shall be adequately and securely connected to tracer wire access boxes in accordance with the manufacturer's specifications. Tracer wire access boxes are to be utilized and spaced no more than 1,000 feet apart, and at the receiving manhole. A concrete mow collar shall be installed at finished grade around all tracer wire access boxes. Tracer wire shall comply with the product specifications as detailed in Section 5.2.

4.6.04 Joining Pipe

- A. Mechanical joint pipe shall be installed as follows:
 - 1. Thoroughly clean the 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 of 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. Move the gland into position, insert bolts, and make nuts finger tight. Tighten nuts as specified by the manufacturer.

3. Use the tightening pattern specified by the manufacturer. If no specific pattern is specified, progressively 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 1/2 of that listed in AWWA C600 or 1/2 the manufacturer's recommended deflection, whichever is less.
 5. There shall be no joint deflection of PVC pipe.
- B. Push-on joint pipe shall be installed 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 or 1/2 the manufacturer's recommended deflection, whichever is less.
 4. There shall be no joint deflection of PVC pipe.

4.6.05 Thrust Restraint

- A. Provide concrete reaction anchors (thrust blocking) at all points of tie-in to existing pressure pipelines. Provide mechanical joint retainer glands at all fittings, valves, plugs, caps, and other changes in directions or dead ends of pressure pipelines. Joint restraints shall be installed upstream and downstream of each bend, valve, and fitting for the minimum distance determined by the Engineer. Restraint length calculations shall be provided on the drawings.
- B. Thrust blocks shall bear against undisturbed earth. They shall be of the size and shape indicated on the appropriate Standard Detail(s) unless specifically stated otherwise on the construction drawings.
- C. Use restrained joint pipe where indicated on the approved drawings.
- D. Use mechanical joint restraining glands for all mechanical joint pipe as indicated on the drawings to be restrained.

- E. All pressure pipe joints within the fence boundaries at pump stations 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 profiles.

4.6.06 Service Connections

- A. Service connections shall be installed in accordance with this Section of the Standards and the applicable Standard Detail(s).
- B. For new construction, place a main-sized wye fitting and 45-degree bend fitting of the required size wherever a service connection to the sewer line is to be constructed. The wye and bend shall be of the same material as the main. Lay pipe from the connection to the property line on a grade of not less than 1/4 inch per foot for 4-inch pipe or 1/8 inch per foot for 6-inch pipe. Install wye-fitting and cleanout stack at the property line, edge of easement, or as otherwise approved by the Department and shown on the Plans. Provide a short section of pipe with a glue-on fitting on the back of the wye-fitting. Leave sufficient length of pipe to allow the cap to be cut off and the service line extended.
- C. On new construction in subdivisions, clean-out stacks shall extend 36" above existing grade with a glue-on cap installed over the end of the stack. The height of the stack shall be adjusted, and cleanout cap installed when final grading of the yard is complete. See Standard Detail SEW-01b for more information.
- D. For connection to an existing sewer mains 12 inches and smaller, use a compression type wye cast iron saddle at the connection point. Make connections of this type by machine tapping or cutting the pipe and ensure watertight connection. On pipe larger than 12 inches, a straight cast iron saddle may be used.
- E. Service connections at manholes shall be ductile iron or C900, DR-14, PVC pipe. The invert in of the service connection shall be set so that elevation of the crown of the service connection matches that of the outgoing pipe.
- F. Determine the depth of service connections by the deepest of the following:
 - 1. Provide minimum 5 feet of cover at the edge of the road paving or the curb-line.
 - 2. Provide minimum 36 inches of cover at the bottom of ditches.
 - 3. Provide minimum 5 feet of cover at the property line when elevation is higher than the edge of pavement or top of curb.
 - 4. On residential connections where the above conditions cannot be met using a 4-inch pipe at 1/4 inch per foot slope, the line may be changed to a 6-inch pipe at 1/8 inch per foot.

5. Where depth of cover must be less than 36 inches, the 6-inch service line shall be ductile iron encased in concrete. Depth of cover less than 24 inches shall not be permitted.
 6. If a building's lowest finished floor with plumbing fixtures cannot be served by gravity sewer, an ejector pump or grinder pump may be used with prior approval of the Director. Appropriate building permit(s) must be obtained from the Building Inspections Department prior to installation of an individual sewage pump.
- G. Provide ductile iron pipe or C900, DR-14, PVC pipe where cover over service connections is less than 5.5 feet in public right of way and 3.5 feet in easements.

4.6.07 Manhole Connections

- A. Connection to an Existing Manhole: A flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to an existing manhole.
1. The flexible connector shall be installed by coring the manhole wall to the appropriate size. Acceptable connectors are listed in Section 5 of these Standards. Cored holes shall be sized, and connectors installed, in strict accordance with the manufacturer's recommendations.
 2. The connection shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connection manufacturer.
 3. The connector shall be of a size specifically designed for the pipe material and size being utilized for the manhole connection.
 4. This provision shall apply to both gravity sewer lines and service connections.

4.6.08 Testing Gravity Sewer Lines and Manholes

- A. All gauges used for testing shall be calibrated, liquid-filled, gauges with a minimum of a 4-½-inch dial and 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 complete runs of pipe from manhole to manhole. The Contractor shall provide all labor, materials, tools, and equipment necessary to perform the tests. All equipment and methods used shall be acceptable to the Inspector.

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 the Contractor in accordance with the requirements in these Standards, and in the presence of the Inspector.
2. Gravity sewer pipes testing shall be done by air pressure test as specified herein.
3. Air Test: The Contractor shall plug the pipe and shall conduct a low-pressure air test to determine the acceptability of the completed work. The 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. Test Method: The pneumatic plugs used in the test shall have a sealing length equal to or greater than the diameter of the pipe tested. 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 which are 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 of the test 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 deemed excessive, and the section of pipe has failed the test.
6. Sewer lines shall be prepared for the test as follows: Flush and clean the sewer line prior to testing. 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.

7. Ground Water Determination: Install a ½-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.
8. 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 based 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
30	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

9. 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.
10. 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 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.
11. 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.
12. If the pipe to be tested is submerged in ground water, the test pressure shall be increased by 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer, to a maximum of 9 psi.
13. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

- a. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as 250 pounds of force (lb-ft) is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, a sudden expulsion of a poorly installed plug, or of a plug that is partially deflated before the pipe pressure is released, can be extremely dangerous.
 - b. 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.
 - c. No one shall be allowed in manholes during testing.
14. 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 cubic foot per minute per square foot of internal pipe surface, a maximum air loss per test section of 3.5 cubic feet per minute and a minimum significant air loss per test section of 1.0 cubic foot per minute. It applies when testing one pipe diameter only and for convenience ignores the volume of sewer laterals, which in most instances create only insignificant differences in test time.

4.6.09 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 permanently 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 a manhole fails its 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 MANHOLES LESS THAN 8 FEET IN DEPTH.**

	Diameter (inches)		
Depth (feet)	48	60	72
	Time (seconds)		
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 more than 8 feet in depth, or larger than 72 inches in diameter, 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 4 feet or more above pipe crown along the 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 ½ gallon per hour.

4.6.10 Force Main Testing

- A. The Contractor shall supply the pumps, water, calibrated gauges and meters, and all the necessary apparatus for performing the test.
- B. Prior to performing any test, the Contractor must contact the Inspector to schedule a date and time for the test. All tests must be performed in the presence of the Inspector.
- C. 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 1.5 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.
- D. Leak Test: 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:

$L = S * D * P_{0.5} / 13200$ Where:

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.

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

4.6.11 CCTV Inspection

- A. Immediately prior to applying for acceptance by the County, the Contractor must clean all gravity sewer lines and perform video inspection via CCTV. Video Inspections of sewer systems shall be carried out in compliance with the NASSCO PACP reporting format and coding standards, and the requirements of these Standards.
- B. The following items shall be submitted to the Department for review:
 - 1. A letter of CCTV completion, signed by the person(s) who performed the CCTV Inspection.
 - 2. Complete documentation of the CCTV inspection in digital form, on a CD/DVD, memory stick, or other method suitable to the Department.
- C. 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 Inspector for approval.
- D. The Contractor shall be responsible for all traffic control required during the inspections. 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.)
- E. After cleaning, all pipe sections shall be visually inspected by means of closed-circuit television camera. The inspection will be done one section at a time, from manhole to manhole. Any flow in the section being inspected will be suitably controlled as needed. All CCTV inspections shall be performed in accordance with NASSCO PACP standards including the specific date and time of inspection.
- F. 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 Inspector.

- G. 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 pipe 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 pipe section, the inspection shall be considered failed. Additional repairs, cleaning, and inspection will be required.
- H. The camera shall be stopped at each joint and lateral connection, and the head rotated to show a 360-degree picture.
- I. 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 ensure good communications among members of the crew.
- J. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be made above ground by means of a meter device. Marking on the cable, or any other method which requires 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 Inspector. Documentation of CCTV Inspection results shall be as follows:
 - 1. 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 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, debris, the 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 Inspector.
 - 2. 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 from the wall of an adjacent manhole.

- K. Electronic media recordings: The purpose of electronic media recording shall be to supply a visual and audio record of problem areas of the lines for review by the Department. Upon completion of the CCTV inspection, an original electronic media recording of conditions and defects will be delivered to the Inspector.

- L. All CCTV Inspections shall be performed by CCTV personnel who are trained and certified in the use of NASSCO's Pipeline Assessment and Certification Program (PACP)©.

END OF SECTION 4.6

4.7 RECORD DRAWINGS

4.7.01 General

- A. This Section specifies requirements for preparing Record Drawings of public water and sewer facilities and for submitting them to the Department of Public Utilities (DPU) for review and approval.
- B. Record Drawings shall accurately depict the actual locations and elevations of all water and sewer facilities constructed as part of the approved plans.
- C. Facilities shall be located via a field survey using conventional surveying methods and/or GPS, with horizontal datum NAD83 Virginia State Plane South and vertical datum NAVD 88.
- D. Record Drawings shall be based on a field survey and the red-line drawings maintained by the Contractor during the construction process.
- E. Record Drawings shall clearly indicate areas where construction substantially deviated from the approved plans.
- F. The Record Drawings, and all subsequent revisions to the drawings, shall be properly sealed and signed by a licensed Professional Engineer registered in the Commonwealth of Virginia.

4.7.02 Preparation Requirements for Record Drawings

Record Drawings shall be black and white with all Record data distinctly marked, labeled, and clouded in red where it differs from design drawings. Record Drawings shall include the following information, appropriately called out and labeled in a legible format:

- A. Gravity Sewer Lines: Plans and profiles corrected to accurately depict the locations of all gravity sewer lines, including pipe size and material; length; alignment; slope; location(s) and dimensions of all cradles, encasements, and other special construction.
- B. Sanitary Sewer Manholes: Plans and profiles corrected to accurately depict the location of each sanitary sewer manhole including northing and easting coordinates; rim elevation; inverts in and out; diameter; and verification of the type of frame and cover used (standard, vandal-proof, watertight, bolted or gasketed) and if required, acid-resistant lining used (FRP, PVC, or HDPE).
- C. Pressure Sewer Pipes (Force Mains): Plans and Profiles updated to accurately depict the alignment, size, and material of each force main including tie-in points,

and the location and type of each valve and fitting. Northing and Easting coordinates shall be provided for valves and other above-ground appurtenances.

- D. Sanitary Sewer Service Connections and Cleanouts: Plans and Profiles updated to accurately depict each sanitary sewer service connection, service lateral and cleanout, including pipe size and material; northing and easting coordinates of connection point and cleanout; top elevation of cleanout; ground elevation at the cleanout; and invert elevations of the service lateral at the main and at the cleanout.
- E. Oil/Water Separators & Grease Traps: Plans, Profiles and Details updated to accurately depict the location and elevation of each oil/water separator and grease trap, including elevations of access hatch rim(s) and top of slab; northing and easting coordinates of access hatch rim(s) and corners of the structure; internal piping elevations including inverts in and out; detailed information regarding any instance where the installed structure differs from the plan detail; manufacturer and model number; dimensions; total volume capacity; baffle wall location(s); and location(s) and elevation(s) of orifice(s) in baffle wall(s).
- F. Sewage Pump Stations: Site Plan, Plans and Profiles updated to accurately depict the locations, dimensions, and elevations of all structures, buildings, vaults, slabs, fences, etc. associated with the pump station including; finished floor elevation(s) of building(s); top/rim elevation(s) of the wet well, vaults, and other structures; ground elevations at wet well, vaults, and other structures; total wet well depth; bottom elevation of wet well, vaults and other structures; pump controls and alarm elevations; diameter(s) and invert(s) of any/all pipes entering the wet well; inside and outside diameters of wet well; as well as detailed information regarding any instance where construction deviated from the approved Plans and Specifications; and an Engineer's statement verifying that all other pieces of equipment (e.g. guide rails, hatches, pumps, etc.) shown on the plans and specifications are present and installed correctly. Northing and Easting coordinates shall be provided for all property corners, buildings, structures, slabs, fences, gates, and other major above-ground components of the pump station.
- G. Water Lines and Fittings: Plans and profiles updated to accurately depict the location of all water lines and fittings. Water line record drawings shall clearly show and label the alignment, pipe size and material, pipe length, and depth of cover over pipe for all water lines associated with the project.
- H. Water Line Valves, Bends, Tees, and Other Fittings: Plans and Profiles updated to accurately depict, as applicable, the size, type, material, angle (22.5, 45, etc.), direction (vertical, horizontal). Northing & Easting coordinates shall be provided for all valve boxes, hydrants, meter boxes, and other appurtenances visible at the surface.

- I. Fire Hydrants and Flushing Valves: Plans and profiles updated to accurately depict the location of fire hydrants and flushing hydrants, including Northing & Easting coordinates of the hydrant and valve box, as well as elevation at the base of the hydrant. The manufacturer, model, and year of manufacture shall be provided for each fire hydrant.
- J. Other Infrastructure: The Record Drawing Plan and Profile sheets shall also accurately show and label all other pipes, fittings, structures, and appurtenances not mentioned above.
- K. Additional Information: Each plan sheet in the Record Drawings shall have a minimum of 3 Northing/Easting cross points and a note identifying the coordinate system used. Horizontal datum shall be Virginia State Plane South, NAD 83. Vertical datum shall be NAVD 88. Accuracy of data shall be survey-grade.
- L. Project Identification: The appropriate POD, LDP, and/or UTP Number shall be included on each sheet of the Record Drawings.
- M. Materials and Quantities List: The Cover Sheet of the Record Drawings shall include updated charts showing comprehensive materials lists which provide actual quantities installed for: 1) Water pipes, fittings, and appurtenances; and 2) Sewer pipes, fittings, structures, and appurtenances.

4.7.03 Submission of Record Drawings

A complete Record Drawings Submission Package for the project must be prepared and submitted prior to, or along with, the Acceptance Request. The complete package shall be delivered to the Department for review, and shall include the following:

- A. One paper copy and one digital copy in pdf-compatible format, of the Contractor's red-line construction drawings.
- B. Two paper sets of the Record Drawings with seal and signature of the professional engineer or licensed surveyor who prepared the drawings.
- C. Digital file(s) of the Record Drawings in .pdf compatible format.
- D. A single geo-referenced AutoCAD drawing file (.dwg) compatible with the most recent version of AutoCAD LT. The file shall contain all required and relevant as-built information for the project.

END OF SECTION 4.7

5.1 WATER DISTRIBUTION SYSTEM SPECIFICATIONS

5.1.01 General

- A. This section provides specifications for the materials and products which must be used to construct public water facilities in Goochland County, Virginia.
- B. Reference Specifications are referred to by abbreviation as follows:
 - 1. American National Standards Institute ----- ANSI
 - 2. American Railway Engineering Association ----- AREA
 - 3. American Society for Testing and Materials ----- ASTM
 - 4. American Water Works Association ----- AWWA

5.1.02 Underground Pipe

- A. Ductile Iron Pipe
 - 1. Ductile iron pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi. Rubber-gasket joints shall meet the requirements of AWWA C111. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.
 - 2. A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked.
 - 3. Pressure class of pipe shall be increased if the specific installation warrants it.
- B. Ductile Iron Restrained Joint Pipe
 - 1. Ductile iron restrained joint pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi. Rubber-gasket joints shall meet the requirements of AWWA C111. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104. Restrained push-on joints shall utilize a gripper ring, field weldments, or approved equal and shall be designed for a working pressure of 350 psi for sizes 4" through 24".
 - 2. A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked.
 - 3. Pressure class of pipe shall be increased if the specific installation warrants it.

C. PVC Pipe

1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 305) 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. Cell classification shall be 12454-B.
2. Where working pressures over 150 psi are anticipated, ductile iron pipe shall be used.

D. High Density Polyethylene (HDPE) Pipe

1. 3-Inches and Smaller Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a cell classification of 445574C/E and shall be formulated with carbon black and/or ultraviolet stabilizer. 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 maximum dimension ratio of DR-9 and a minimum pressure class PC 250 psi. 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: Pipe shall be manufactured from a PE 4710 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 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall have a maximum dimension ratio of DR-9 and a minimum pressure class PC 250 psi. Pipe larger than 24" nominal diameter shall have the lowest DR, and the highest PR, available for the size of pipe being used. 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 per AWWA C906 and listed as NSF 61. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe.

3. HDPE pipe shall be continuously marked by the manufacturer with permanent printing indicating the following:
 - a. “NSF-PW”
 - b. Nominal size (inches)
 - c. Dimension ratio (DR)
 - d. Pressure rating (psi)
 - e. Material classification (PE 4710)
 - f. Plant, extruder, and operator codes
 - g. Resin supplier code
 - h. Date produced
4. HDPE pipe used for water shall be black in color with permanent blue stripes extruded into the pipe along its entire length or shall be solid blue.

E. Copper Tubing – 2” and Smaller

1. Underground services shall be seamless, annealed copper tubing Type K, in conformance with ASTM B88. Fittings shall be brass with compression joints suitable for direct burial.
2. Above ground, copper tubing shall be seamless hard copper tubing Type L, in conformance with ASTM B88. Fittings shall be brass or wrought copper. Joints shall be threaded or soldered.
3. Solder shall be 95-5 lead free solder meeting the requirements of NSF 61.

5.1.03 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. 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.

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: Butt fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350 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 C901 and C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).
3. Electro-fusion Fittings: Electro-fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. 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 C901 and 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 4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261.

C. Thrust Restraint

1. The Contractor shall install concrete thrust blocks at all tie-in points and as indicated on the approved plans or as directed by the Inspector based upon field conditions. Thrust blocks shall be sized as indicated on the applicable Standard Detail for thrust blocking. 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 on underground ductile iron or PVC piping shall be restrained utilizing approved wedge-action retainer glands. 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. Ductile iron bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the length specified on applicable Standard Detail or as indicated on the drawings, whichever is greater. Approved push-on restraining gaskets or harness type restraints shall be used. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.
4. PVC pipe bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the length specified on applicable Standard Detail or as indicated the drawings, whichever is greater. Harness type restraining devices shall be used on PVC bell and spigot pipe joints.

5.1.04 Above Ground or Exposed Piping

A. Ductile Iron Pipe

1. Ductile iron pipe installed above ground, inside buildings, or in 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 meeting the requirements of ANSI B 16.1. No Uniflange-type flanges are permitted. Outside coating shall be red primer. Gaskets for flanged pipe shall be 1/8-inch-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 above-ground ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110/ANSI A21.10. Fittings shall have a minimum working pressure rating of 250 psi. Unless indicated otherwise on the drawings, fittings shall have Class 125 flanged joints meeting the requirements of ANSI B 16.1. Outside coating shall be red primer. Gaskets for flanged fittings shall be 1/8-inch-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.

C. Flange Adaptors: 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. Uniflanges are not permitted.

5.1.05 Pipe Insulation and Heat Tracing

A. Pipe Insulation

1. Glass Fiber: 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.
2. Vapor Retarder Jacket: 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.
3. Field Applied Jackets
 - a. Field applied jackets shall be aluminum 0.016 inch (0.406 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.
4. 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.

B. Heat Tracing

1. All pipes, valves, equipment, and appurtenances shall be provided with heat tracing where shown; where not shown, heat tracing shall be provided in all cases where such items could be subject to freezing.
2. Heat tracing shall consist of spiral wrapping with electrical heating cables as specified by the manufacturer, and subsequent installation of insulation.

3. Heating cables shall be controlled from thermostats installed in representative locations and shall be accessible for adjustment.
4. 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.
5. 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 heated 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 heating strips 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.

5.1.06 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. 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 (inches)	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

5.1.07 Gate Valves

- A. Gate valves 3 through 12 inches shall open counterclockwise, have a resilient seat and meet the requirements of AWWA C509 or AWWA C515. Valve 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.
 - 1. Except as specifically approved otherwise, 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.
 - 2. Underground valves shall utilize non rising stems, mechanical joint ends with a 2-inch operating nut in accordance with AWWA C111.
 - 3. Gate valves 3 inches and larger when located 6 feet or more above the finish floor or operating platform shall have chain operators.
- B. Gate valves 14 through 24 inches shall open counterclockwise, have a resilient seat and meet the requirements of AWWA C515. Valve body shall be of ductile iron. These valves 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.
 - 1. Underground valves shall have mechanical joint ends, shall open counterclockwise, and shall utilize non rising stems with a 2-inch operating nut in accordance with AWWA C111.
- C. Buried gate valves 2 inches in size shall utilize a non-rising stem, a resilient seat, shall open counterclockwise, and must meet the requirements of AWWA C509. Valve shall be equipped with a 2-inch square AWWA operating unit. Valve ends shall be NPT connections.
- D. Above ground gate valves 2 inches and smaller shall be 150-pound bronze body union bonnet, rising stem gate valves with threaded connections and which open counter-clockwise. Valves shall be Crane Figure 431UB or approved equal.

5.1.08 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-inch 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 inches and larger shall have gear operators. All exposed valves with gear operators shall have a position indicator.

5.1.09 Ball Valves - Above Ground

- A. Ball valves 2 inches and smaller shall be 150 pounds rated, threaded ends, bronze or stainless steel body (stainless steel valves shall be used on stainless steel pipe), full port, lever operated, ball valves, with stainless steel ball and stem, and Teflon seats.

5.1.10 Check Valves

- A. Swing check valves
 - 1. 3 inch and larger
 - a. Check valves 3 inches 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 inches 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.
 - 2. Check valves 2 inches and smaller shall be class 150 bronze or stainless-steel y-pattern swing check valves with threaded ends.
- 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. Wafer type check valves shall not be permitted.

5.1.11 Corporation Stops and Tapping Saddles for Underground Service

- A. Corporation stops shall have either compression end for 1-inch copper tubing. 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.

5.1.12 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.

5.1.13 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.
- B. Valve box covers shall be marked with the word "WATER".
- C. Valves with valve boxes shall have an extended shaft pinned to the 2-inch operating nut. The extension shall terminate 12 inches below finish grade.
- D. Valve boxes outside pavement shall have a 24-inch by 24-inch by 4-inch concrete collar around top of the valve box as per Standard Details.
- E. A Valve Box Adaptor shall be installed between the valve and the valve box.

5.1.14 Combination Air Valves

- A. Combination air valves shall have a minimum of a 1-inch N.P.T. inlet for pipe sizes 16 inches and smaller. For pipes 18" and larger, a 2-inch N.P.T. inlet shall be used. Valves shall be single body, double orifice.
- B. Combination air 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.
- C. Valves shall be installed with a full-size gooseneck on the outlet.
- D. Valves shall have a cast iron body and cover, stainless steel float, Buna-N seat, Delrin lever frame and all other internal parts shall be stainless steel or bronze.
- E. Air release valves shall be suitable for 150 psi working pressure at a minimum.

- F. All air release valve installations shall contain an isolation valve to allow removal of the air release valve for maintenance or replacement while the line is under pressure.
- G. 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.

5.1.15 Reduced Pressure Zone (RPZ) Backflow Preventer

- A. RPZ 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.

5.1.16 Reduced Pressure Detector Assembly (RPDA) Backflow Preventer

- A. RPZ 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 bypass line shall include a meter, small diameter reduced pressure zone assembly and isolation valves. The bypass reduced pressure assembly shall have a single bolted on cover and top mounted test cocks.
- C. 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.

- D. All RPZ backflow preventers shall be installed in strict accordance with the manufacturer's instructions.

5.1.17 Double Check Detector Assembly (DCDA) Backflow Preventer

- A. DCDA backflow preventer assembly shall consist of a main line valve body composed of two (2) independently acting approved poppet-type check modules with replaceable seats and disc rubbers. Servicing of both check modules does not require any special tools and are accessed via a single top entry cover. The device shall be fitted with approved UL Listed OS&Y Gates Valve Assemblies and contain properly located resilient seated test cocks along the main valve body.
- B. The auxiliary bypass line shall contain a water meter that complies with ANSI/AWWA Standard C700 coupled with an approved double check assembly (DC).
- C. The assembly shall meet the requirements of the latest available American Water works Association (AWWA) standards including Std. C510; 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.
- D. All DCDA backflow preventers shall be installed in strict accordance with the manufacturer's instructions.

5.1.18 Sample Taps

- A. All sample taps shall be threadless and lead-free.

5.1.19 Sampling Stations

- A. Sampling Station shall have a 3/4" FIP inlet, and 3/8" unthreaded blow off and sampling bibb. Station shall be enclosed in a lockable, aluminum box with hinged openings. When open, the station shall require no key for operation, and all water flow shall pass through an all stainless steel waterway. Seat rubber and all operational components shall be serviceable and replaceable from above ground with no digging or excavation needed. A secondary valve (stainless steel petcock) shall be located on the evacuation line, independent of the sampling bibb and when open shall allow for evacuation of any water remaining inside the station, via pump or compressed air blow off, to prevent freezing.

5.1.19 Wall Sleeves

- A. Pipes through concrete walls and slabs shall be provided with wall sleeves or penetration seals.

- B. Sleeves shall be sized to contain the outside diameter of the penetrating pipe and the link seal.
- C. Sleeves shall be of adequate thickness to maintain their shape and shall be manufactured by the seal manufacturer.
- D. All sleeves shall have waterstops and be PVC, or steel which is hot dipped galvanized after fabrication.
- E. Where pipe penetrations are added to existing concrete structures, core drilling shall be used. The hole size shall be coordinated with the seal manufacturer.
- F. Core drilling shall be coordinated with structural drawings, ground penetrating radar, or other methods to determine the location of steel reinforcement bars or post tensioning cables within the concrete walls or slabs. Coring shall be located so as to avoid any damage to the structural integrity of the concrete walls or slabs.

5.1.20 Flushing Hydrants

- A. Flushing hydrants shall comply with AWWA C502 standards for “dry barrel” compression type hydrants that open against pressure.
- B. 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.
- C. Flushing hydrants shall be equipped with a threaded or mechanical joint inlet of the size as indicated on the plans and shall have one 2-1/2-inch outlet with cap and chain.

5.1.21 Water Service Accessories

- A. Meter coppersettters shall be provided for all 5/8- inch and 1-inch meters. Each shall have removable pack joints suitable for copper tubing. All coppersettters shall have saddle nuts, padlock wings, and two valves. Copper settters shall be installed in accordance with the applicable Standard Detail(s).
- B. Meter coppersettters shall be provided for all 1-1/2- thru 2 inch- meters. Each shall have removable NPT connections for hard copper tubing adaptors. All coppersettters shall have saddle nuts, padlock wings, and two valves. Meter settters for 1.50-inch and 2-inch meters shall have a lockable bypass. Meters and copper settters shall be installed in accordance with the Standard Drawings.
- C. The meter box shall be in accordance with Standard Drawings.

5.1.22 Hydraulic Operated Control Valves

- A. Hydraulic operated control valves include 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 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.

5.1.23 Tapping Sleeves

- A. Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the drawings. Sleeves shall be two-part stainless steel with stainless steel bolts and nuts, flanged outlet, and a full circumferential gasket. Tapping sleeves shall be for the size and type of pipe specified on the approved plans.

5.1.24 Couplings

- A. 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 intended for use in systems conveying water. All couplings shall be rodded.

5.1.25 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 4-½ inches and shall be equipped with two 2-½-inch hose nozzles and one 4-½-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. Fire hydrant color shall be as required by the Goochland County Code.

5.1.26 Tracer Wire

- A. Tracer wire for open cut pipe installations shall be High Strength, High Flexibility 12 AWG Copper Clad Steel (CCS) wire with minimum 0.030" thickness blue-colored insulation of High Molecular Weight Polyethylene (HMW-PE) and shall be specifically manufactured for use as tracer wire.
- B. Tracer wire for HDD pipe installations shall be Extra High Strength 10AWG Copper Clad Steel (CSS) polyethylene insulated with 0.045" thickness blue-colored insulation of High Molecular Weight Polyethylene (HMW-PE) and shall be specifically manufactured for use as tracer wire.

5.1.27 Connectors for Tracer Wire

- A. Wire connectors for tracer wire on open cut pipe installations shall be Set Screw Pressure type for use with 12AWG wire.
- B. Wire connectors for splicing tracer wire on HDD pipe installations shall be In-line splice type with set screws, a solid brass lug, and a heat-shrink cover, for use on 10AWG wire.
- C. Wire nuts shall not be used on tracer wire.

5.1.28 Tracer Wire Access Boxes

- A. Tracer wire access boxes shall be made of cast iron with a permanently attached 3-inch by 12-inch ABS tube with a flared end to secure it in the ground.
- B. Tracer wire access boxes shall have tamper-resistant cast iron locking lids with stainless steel terminal connectors on the bottom side to which tracer wires are attached.
- C. Tracer wire access box lids shall utilize an AWWA pentagon key for opening.
- D. Sufficient slack shall be coiled inside boxes to allow the removal of the lid and full access to the interior of the box without disconnecting wires.
- E. Lids shall be marked "WATER".

5.1.29 Marking Tape

- A. Tape shall be 3.5 mil polyethylene tape, 3 inches in width, with a 14-gage metallic core, and continuous printed message “Caution – Waterline Buried Below”. Tape shall be primarily blue in color.

5.1.30 Steel 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 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 (VDOT, railroad, etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

5.1.31 Pressure Gages

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

5.1.32 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. In corrosive environments, 316 stainless steel pipe hangers may be required at the discretion of the Director.
- B. Pipes 2-½ inches and larger shall be supported with adjustable floor stand type pipe supports as detailed on the drawings.
- C. Pipes 2 inches 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 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. 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 inches and larger.

H. Additional supports shall be placed at the locations of valves, fittings, flow meters, risers, drops and other devices.

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

1. Maximum of 12 inches from all horizontal and vertical changes in direction.
2. On the suction and discharge of pump piping to eliminate pipe stresses on the pump flanges.
3. On the connections to all equipment to eliminate pipe stresses on the equipment connections and allow equipment removal.
4. On the inlet and outlet piping to the water meter to allow the removal of the water meter.

5. At the location of valves, fittings or other devices that add additional weight to the piping.
6. Additional pipe supports as indicated on the drawings.

5.1.33 Service Saddles

- A. Service saddles shall be stainless steel, with stainless steel double straps and bolts, and tapped for AWWA threads.

END OF SECTION 5.1

5.2 SANITARY SEWER SYSTEM SPECIFICATIONS

5.2.01 General

- A. This section provides specifications for the materials and products which must be used to construct public sewer facilities in Goochland County, Virginia.
- B. Reference Specifications are referred to by abbreviation as follows:
 - 1. American National Standards Institute ----- ANSI
 - 2. American Society for Testing and Materials ----- ASTM
 - 3. American Water Works Association ----- AWWA
 - 4. American Railway Engineering Association ----- AREA

5.2.02 Underground Pressure Pipe

- A. 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-inch 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.
 - 2. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.
 - 3. A minimum of 5% of the pipe furnished shall be gauged for roundness full length and so marked.
 - 4. Pressure class of pipe shall be increased if the specific installation warrants it.
- B. Ductile Iron Restrained Joint Pipe
 - 1. Ductile iron restrained joint pipe shall meet the requirements of AWWA C151 and AWWA C150. Minimum thickness shall be Class 52 with a working pressure of 350 psi.
 - 2. Rubber-gasket joints shall meet the requirements of AWWA C111.
 - 3. Pipe shall have a single cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA C104.
 - 4. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.

5. Restrained push-on joints shall utilize a gripper ring, field weldments, or approved equal and shall be designed for a working pressure of 350 psi for sizes 4" through 24".
6. A minimum of 5% of the pipe furnished for a project shall be gauged for roundness full length and so marked.
7. Pressure class of pipe shall be increased if the specific installation warrants it.

C. Polyvinylchloride (PVC) Pipe

1. PVC pipe shall meet requirements of AWWA C900 (DR-14, CL. 305) for sizes 8 inches and smaller. Joints shall be in accordance with manufacturer's instructions and ASTM D2564, D2464, D2467, D319, and F477.
2. Where working pressures over 150 psi are anticipated ductile iron pipe shall be used. Cell classification shall be 12454-B.

D. High Density Polyethylene (HDPE) Pipe

1. 3-Inches and Smaller Pipe: Pipe shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a cell classification of 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. 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.
2. 4-Inches and Larger Pipe: Pipe shall be manufactured from a PE 4710 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 445574C/E and is formulated with carbon black and/or ultraviolet stabilizer. Pipe shall have a manufacturing standard of ASTM F714. Pipe O.D. size shall be ductile iron pipe size (DIPS). Pipe shall be minimum pressure class 250 psi (DR-9). Pipe larger than 24" nominal diameter shall have the lowest DR, and the highest PR, available for the size of pipe being used. 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 per AWWA C906. Pipe shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe.

3. HDPE pipe shall be continuously marked by the manufacturer with permanent printing indicating the following:
 - a. Nominal size (inches)
 - b. Dimension ratio (DR)
 - c. Pressure rating (psi)
 - d. Material classification (PE 4710)
 - e. Plant, extruder, and operator codes
 - f. Resin supplier code
 - g. Date produced
4. HDPE pipe used for sewer shall be black in color with permanent green stripes extruded into the pipe along its entire length or shall be solid green.

5.2.03 Gravity Pipe

A. Polyvinylchloride (PVC)

1. For pipe sizes 4 through 15 inches, pipe shall meet requirements of ASTM D3034 type PSM SDR-26 or of ASTM F1760 DR-26 having reprocessed-recycled content.
2. For pipe sizes 18 through 36 inches, pipe shall meet requirements of ASTM F679, PS115.
3. Where C900 PVC pipe is specified for use as gravity sewer, it shall meet the requirements in these Standards for PVC waterline.

B. Ductile Iron

1. Ductile iron gravity pipe shall meet the requirements of this Section for ductile iron pressure pipe. Thickness class shall be increased for the specific installation conditions, as determined by the Engineer.

C. Service Connections on Existing Sewer Mains

1. Existing 12” and Smaller Sewer Mains: Compression type wye cast iron saddle with 24-gauge with stainless steel strap, two nickel-bronze T-bolts, and O-ring type gasket.
2. Individual service connections are typically not allowed to gravity sewer lines larger than 12” However, when permitted, a straight cast iron saddle shall be used.

5.2.04 Underground Pressure Pipe 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.
2. Fittings subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.
3. 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.
4. Couplings for underground or buried service lines shall be ductile iron restrained mechanical joint in accordance with the requirements for underground ductile iron 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.
2. Butt Fusion Fittings: Butt fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350 and approved for AWWA use. 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 C901 and C906, shall have a nominal burst value of three and one-half times the Working Pressure Rating (WPR).

3. Electro-fusion Fittings: Electro-fusion fittings shall be PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. 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 C901 and 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 PE4710 HDPE, Cell Classification of 445574C/E as determined by ASTM D3350. 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 Inspector based upon field conditions. Thrust blocks shall be sized as indicated on the appropriate Standard Detail(s). 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 pressure piping shall be restrained. 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. Ductile iron bell and spigot pipe joints shall be restrained on both sides of valves and fittings for the lengths specified on the applicable Standard Detail or as indicated on the drawings, whichever is greater. Approved push-on restraining gaskets or harness type restraints shall be used. Gaskets shall be manufactured by the pipe manufacturer to be compatible with their pipe.

5.2.05 Above Ground or Exposed Pressure Pipe

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 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-inch-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.
2. Pipe subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.

B. Ductile Iron Fittings

1. Fittings for ductile iron pipe shall be flanged ductile iron in accordance with AWWA C110. Fittings up to 30 inches in 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-inch-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. Fittings subject to hydrogen sulfide attack shall have an interior lining of Protecto 401 ceramic epoxy or approved equal.

C. Flange Adaptors: 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. Uniflanges are not permitted.

D. PVC Pipe and Fittings

1. Without special approval from the Department, above ground PVC pipe shall only be used for chemical piping in sizes 1 inch and smaller.
2. Small diameter 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 PVC 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.

E. Stainless Steel Pipe and Fittings

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

5.2.06 Plug Valves

- A. 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 for gravity applications and 100 percent of the full pipe area for pumped applications. Bodies shall be cast iron with welded nickel, raised seats. Valves shall have permanently lubricated corrosion resistant bearings in the bonnet and body.
- B. Packing and packing glands shall be accessible without having to disassemble the valve. Packing shall be adjustable.
- C. 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.
- D. Plug valves shall be gear operated unless otherwise shown or specified and shall open counterclockwise. 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.
- E. Plug valves for direct burial service shall be provided with right angle worm gear operators. Buried valves shall be provided with adjustable valve boxes with extension stems to within 12" of grade.
- F. Valve boxes shall meet the requirements of the Standard Details.
- G. 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 Federal Specification TT-V-51a. Exterior iron or steel surfaces of other valves shall be painted as specified for the pipelines in which they are installed.
- H. 4-inch and larger plug valves must pass a 3-inch spherical solid.

5.2.07 Check Valves

- A. Swing check valves
 - 1. 3 Inches and Larger:
 - a. Check valves 3 inches 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.
 - b. Check valves 3 through 24 inches shall have a 250-psig maximum working pressure.
 - c. Check valves larger than 24 inches shall be designed and specified on a case-by-case basis.
 - d. Check valves shall have an adjustable air decelerator (air cushion) installed on the outside of the valve to control valve closing.
 - e. All check valves shall have a factory installed limit switch to indicate closed position for flow confirmation.
 - 2. Smaller than 3 inches: : Check valves smaller than 3 inches shall be class 150 bronze or stainless-steel y-pattern swing check valves with threaded ends.

5.2.08 Tracer Wire

- A. Tracer wire for open cut pipe installations shall be High Strength, High Flexibility 12 AWG Copper Clad Steel (CCS) wire with minimum 0.030" thickness green-colored insulation of High Molecular Weight Polyethylene (HMW-PE) and shall be specifically manufactured for use as tracer wire.
- B. Tracer wire for HDD pipe installations shall be Extra High Strength 10AWG Copper Clad Steel (CSS) polyethylene insulated with 0.045" thickness green-colored insulation of High Molecular Weight Polyethylene (HMW-PE) and shall be specifically manufactured for use as tracer wire.

5.2.09 Connectors for Tracer Wire

- A. Wire connectors for tracer wire on open cut pipe installations shall be Set Screw Pressure type for use with 12AWG wire.

- B. Wire connectors for splicing tracer wire on HDD pipe installations shall be In-line splice type with set screws, a solid brass lug, and a heat-shrink cover, for use on 10AWG wire.
- C. Wire nuts shall not be used on tracer wire.

5.2.10 Tracer Wire Access Boxes

- A. Tracer wire access boxes shall be made of cast iron with a permanently attached 3-inch by 12-inch ABS tube with a flared end to secure it in the ground.
- B. Tracer wire access boxes shall have tamper-resistant cast iron locking lids with stainless steel terminal connectors on the bottom side to which tracer wires are attached.
- C. Tracer wire access box lids shall utilize an AWWA pentagon key for opening.
- D. Sufficient slack shall be coiled inside boxes to allow the removal of the lid and full access to the interior of the box without disconnecting wires.
- E. Lids shall be marked "SEWER".

5.2.11 Marking Tape

- A. Tape shall be 3.5 mill polyethylene tape, 3 inches in width, with a 14-gauge metallic core, and the continuous printed message, "Caution – Sewer Line Buried Below". Tape shall be primarily green in color.

5.2.12 Steel 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 (VDOT, railroad, etc.) and the Engineer prior to ordering. Spiral weld casing pipe will not be allowed.

5.2.13 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. Manhole joint types shall comply with one of the following:
1. Provide tongue and groove joints in manhole sections with a pre-formed groove in the tongue for placement of an O-ring-type rubber gasket in accordance with the requirements of ASTM C443; or,
 2. Provide butyl-rubber-based preformed flexible sealant at each manhole joint. Butyl rubber sealant shall conform to ASTM C990, paragraph 6.2, and AASHTO M-198.
- C. Acid-resistant liners for new 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. All connections of pipe to the manhole shall be sealed with the liner in a manner which will 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. 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. Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.
 3. HDPE liners: Joints between sections of the liner shall be welded in accordance with the manufacturer's instructions by certified welders. Minimum liner thickness shall be 0.078 inches (2 mm).
- D. Acid-resistant liners for existing manholes shall be 100% solids high-build epoxy.
1. Sewer flow shall be bypassed around or through the existing manhole during preparation, coating, curing, and finishing operations.
 2. The epoxy coating system shall be a minimum of 120 mils thickness.
 3. Re-grout all inlet and outlet lines and benches as required.
 4. The installation of the epoxy coating system shall be in strict accordance with the manufacturer's written instructions.
- E. Manhole steps shall be corrosion-resistant and shall be 1-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 current and potential future connections to the 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.

- F. 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 the Standard Details. 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 as shown on the approved drawings and shall be supplied with the appropriate flexible connectors.
- H. Sealant for manhole frames shall be a one-component polyurethane sealant.
- I. An external wrap of extruded butyl-rubber-based adhesive tape shall be applied around the full circumference of the manhole at all joints between precast sections. Tape shall be at least 6 inches in width, with minimum 50 mil (1.3 mm) thickness, and shall be overlapped at least twice its width. Backing component shall be HDPE. A release paper may be used. The tape shall meet or exceed the requirements of ASTM C877 Type III and ASTM C990.

5.2.14 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, liquid filled, 3.5 to 4-inch diameter case size, accuracy of 1% over the entire dial arc, with a ¼-inch NPT bottom connection. Pressure range shall be as indicated on the drawings.
- C. Gauges shall be graduated so the normal range of operating pressures are in the middle third of the scale.

5.2.15 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 inch in diameter welded to the isolator. On wafer pressure isolator rings with more than one instrument, all connections shall be ½-inch NPT as a minimum. ¼-inch 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 ¼-inch 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

5.2.16 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. In corrosive environments, 316 stainless steel pipe hangers may be required at the discretion of the Director.
- B. Pipes 2-½ inches and larger shall be supported with adjustable floor stand type pipe supports as detailed on the drawings.
- C. Pipes 2 inches and smaller shall be supported from the floor, walls, or ceiling depending on the type of building construction. Supports shall consist of floor stands, wall brackets, or clevis type hangers. Strut and appurtenances shall be stainless steel. 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 size (inches)	½ - ¾	1 - 1 ¼	1 ½ - 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)	½ - ¾	1 - 1 ¼	1 ½ - 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 inches and larger.

G. Additional supports shall be placed at the locations of valves, fittings, flow meters, risers, drops and other devices. additional supports.

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

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

5.2.17 Combination Air Valves

A. Air and vacuum valves shall be specifically designed for operation on sewage or waste media, constructed with cast iron or stainless-steel bodies, type 304 stainless steel floats, bronze trim, and Buna-N seats.

- B. 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.
- C. Valves shall be rated for the maximum working pressure of the pressure pipe system.
- D. Valves shall be installed with a full-size gooseneck on the outlet.

END OF SECTION 5.2

5.3 APPROVED MATERIALS AND MANUFACTURERS - WATER

5.3.01 General

- A. This Section lists the acceptable materials and manufacturers for the pipes, valves, hydrants, fittings, and other appurtenances which must be provided when constructing public water systems in Goochland County, Virginia.
- B. Shop drawings must be submitted for all products to be supplied.

5.3.02 Underground Pipe

- A. Ductile Iron Pipe
 - 1. American Ductile Iron Pipe
 - 2. McWane Ductile
 - 3. U.S. Pipe & Foundry
 - 4. Griffin
- B. Ductile Iron Restrained Joint Pipe
 - 1. Griffin Snap Lock
 - 2. TR Flex
 - 3. American Ductile Flex Ring
- C. Polyvinylchloride (PVC) Pipe
 - 1. Diamond Plastics Corporation
 - 2. IPEX, Inc.
 - 3. North American Pipe Corporation
 - 4. National Pipe & Plastics, Inc.
 - 5. Sanderson Pipe Corporation
- D. Polyethylene Pipe
 - 1. Flying W Plastics
 - 2. ISCO by A.H. McElroy, Inc.
 - 3. AGRU America, Inc.
 - 4. JM Eagle
 - 5. W.L. Plastics

- E. Copper Tubing
 - 1. Cambridge Lee Industries
 - 2. CERRO Flow Products
 - 3. Kobe Wieland Copper Products
 - 4. Mueller Brass Company
 - 5. Wolverine Tube

5.3.03 Underground Fittings

- A. Ductile Iron Mechanical Joint Fittings for PVC and DI pipe
 - 1. The Harrington Corporation (HARCO)
 - 2. SIGMA Corporation
 - 3. Star Pipe Products, Inc.
 - 4. Tyler Union
 - 5. U.S. Pipe & Foundry Company
- B. Polyethylene Pipe Fittings
 - 1. Butt Fusion Fittings:
 - a. ISCO
 - b. AGRU
 - c. JM Eagle
 - d. Elofit
 - e. Integrifuse
 - 2. Electro-fusion Fittings:
 - a. The Harrington Corporation (HARCO)
 - b. Friatec as manufactured by IPEX
 - c. Elofit
 - d. Integrifuse
- C. Thrust Restraint
 - 1. Restrained joint retainer glands for fittings, plugs, caps, tees, and bends with Ductile Iron Pipe
 - a. EBAA Iron Sales, Inc. - Megalug Series 1100
 - b. SIGMA – One Lok SLD
 - c. Star Pipe Products – Stargrip Series 3000
 - 2. Ductile iron bell and spigot pipe joint restraints
 - a. EBAA Iron Sales, Inc. – Megalug Series
 - b. SIGMA – One Lok
 - c. Star Pipe Products – Stargrip Series 3100P

- d. U.S. Pipe – Field Lok 350 gaskets may be used in lieu of other mechanical joint restraints.
- 3. Restrained joint retainer glands for fittings, plugs, caps, tees, and bends with PVC Pipe
 - a. EBAA Iron Sales, Inc. - Megalug Series 2000
 - b. SIGMA – One Lok SLC
 - c. Star Pipe Products – Stargrip Series 4000
- 4. PVC pipe bell and spigot joints
 - a. EBAA Iron Sales, Inc. - Megalug Series 1500
 - b. SIGMA – One Lok
 - c. Star Pipe Products – Stargrip Series 4100P

5.3.04 Above Ground or Exposed Piping

- A. Ductile Iron Pipe
 - 1. American Ductile Iron Pipe
 - 2. Griffin Pipe Products
 - 3. U.S. Pipe & Foundry
- B. Ductile Iron Fittings
 - 1. The Harrington Corporation (HARCO)
 - 2. SIGMA Corporation
 - 3. Star Pipe Products, Inc.
 - 4. U.S. Pipe & Foundry Company
- C. Flange Adaptors:
 - 1. EBAA Iron Sales, Inc. – 2100 Megaflange
 - 2. JCM model 301R

5.3.05 Pipe Insulation and Heat Tracing

- A. Pipe Insulation
 - 1. Johns Manville Micro-Lok with AP-T Plus vapor retarder or approved equal.
- B. Heat Tracing
 - 1. Electric heat tracing systems and components shall be as manufactured by Chromalox or approved equal.

5.3.06 Temporary Above Ground Pipe and Fittings

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

5.3.07 Gate Valves

- A. Gate valves 3 through 12 inches
 - 1. Mueller series 2360
 - 2. Kennedy series KS-RW
 - 3. M & H Valve Company series 7000 or approved equal.
- B. Gate valves 14 through 24 inches
 - 1. Mueller series 2361
 - 2. Kennedy series KS-RW
 - 3. M & H Valve Company series 7000 or approved equal.
- C. Buried gate valves 2 inches in size
 - 1. Muller series 2360 or approved equal.
- D. Above ground gate valves 2 inches and smaller
 - 1. Crane Figure 431UB or approved equal.

5.3.08 Butterfly Valves

- A. Butterfly Valves 16 inches and larger.
 - 1. Mueller Linesal XP
 - 2. Kennedy series 4500
 - 3. M & H CL250

5.3.09 Ball Valves – Above Ground

- A. Ball valves 2 inches and smaller
 - 1. Crane figure 9201 (bronze body)
 - 2. Crane figure 9231 (stainless steel)

5.3.10 Check Valves

- A. Swing Check Valves
 - 1. 3 inch and larger:
 - a. APCO Series CVS 250
 - b. Val-Matic Series 7800
 - c. Milliken Series 8501
 - 2. Smaller than 3 inches:
 - a. Crane figure 137 (bronze)
 - b. Crane Aloyco figure 49
- B. Silent check valves
 - 1. Golbe style silent check valves
 - a. Cla-Val 581 Series
 - b. APCO globe style series 600
 - c. Milliken series 821A

5.3.11 Corporation Stops and Tapping Saddles for Underground Service

- A. Corporation stops
 - 1. Ford Ballcorp
 - 2. AY McDonald
- B. Tapping saddles
 - 1. Ford Style FC202
 - 2. Smith-Blair 317 Ductile Iron Service Saddle

5.3.12 Above Ground or Exposed Taps

- A. Not used

5.3.13 Valve Boxes

- A. Valve Boxes
 - 1. Bingham and Taylor
 - 2. Tyler Union
 - 3. Capitol Foundry
 - 4. Star Pipe
 - 5. SIGMA

5.3.14 Combination Air Valves

- A. 1-inch size air release valves
 - 1. APCO model 143C
 - 2. Val-Matic model 201C.2
 - 3. Cla-Val 36 Series
 - 4. GA Industries Figure 945
- B. 2-inch size air release
 - 1. APCO model 145C
 - 2. Val-Matic model 202C.2
 - 3. Cla-Val 36 Series
 - 4. GA Industries Figure 945

5.3.15 Reduced Pressure Zone (RPZ) Backflow Preventer

- A. RPZ backflow preventer
 - 1. Watts
 - 2. Wilkins
 - 3. Febco
 - 4. Conbraco

5.3.16 Reduced Pressure Detector Assembly (RPDA) Backflow Preventer

- A. RPDA backflow preventer
 - 1. Watts
 - 2. Wilkins
 - 3. Febco
 - 4. Conbraco

5.3.17 Double Check Detector Assembly (DCDA) Backflow Preventer

- A. DCDA backflow preventer
 - 1. Watts
 - 2. Wilkins
 - 3. Febco
 - 4. Conbraco

5.3.18 Sample Taps

- A. Threadless sample tap
 - 1. Matco Norca
 - 2. Kupferle

5.3.19 Sampling Stations

- A. Above Ground Sample Stations
 - 1. Kupferle Eclipse #88-SS
 - 2. Mueller Hydro-Guard with stainless steel piping components
- B. Below Ground Sampling Stations (where permitted)
 - 1. Mueller Hydro-Guard

5.3.20 Wall Sleeves

- A. Link-Seal as manufactured by Thunderline Corporation of Wayne, Michigan.

5.3.21 Flushing Hydrants

- A. 2-inch Main Guard Model #78 as manufactured by Kupferle Foundry Company
- B. 2-inch Aquarius "One-O-One" HH
- C. Mueller model A-411

5.3.22 Water Service Accessories

- A. Meter Coppersettors for 5/8-inch thru 1-inch meters
 - 1. Ford series 270
 - 2. Mueller copper meter setter
 - 3. A.Y. McDonald series 727 & 728
- B. Meter Coppersettors for all 1-1/2- thru 2 inch- meters
 - 1. Mueller 300 Ball Angle meter valve with setter B-2423
 - 2. A.Y. McDonald series 720
- C. Meter box
 - 1. Standard
 - a. Hubbell
 - 2. Meter box within paved drive location (may only be used with specific permission from DPU)
 - a. Hubbell
 - 3. Meter box cover
 - a. Hubbell

5.3.23 Hydraulic Operated Control Valves

- A. Hydraulic operated control valves, to include 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
 - 1. Cla-Val
 - 2. GA Industries

5.3.24 Tapping sleeves

- A. Fabricated Stainless Steel Sleeves with Stainless Steel Bolts and Nuts
 - 1. Ford FAST (4"-30")
 - 2. J.C.M. Industries #432 ESS (4" - 48")
 - 3. ROMAC SST III (4" - 30")
 - 4. Smith Blair Model #662 (4" - 30")

5.3.25 Couplings

- A. Bolted, sleeve-type couplings, reducing or transition couplings, and flanged coupling adapters for above ground or exposed service
 - 1. Dresser Manufacturing Division of Dresser Industries
 - 2. Smith-Blair
 - 3. Ford Meter Box Company
 - 4. Cascade Waterworks Manufacturing Company (styles CRC and CRCA)

5.3.26 Fire Hydrants

- A. Fire Hydrants
 - 1. American Darling – Mark 73-5
 - 2. Clow Medallion
 - 3. Kennedy “K81D” (Dual rated AWWA/ULFM hydrant)
 - 4. M & H Style 929 Reliant
 - 5. Mueller Centurion A-421
 - 6. U.S. Pipe- Metropolitan 250 (Model 94)
- B. Fire hydrant paint
 - 1. Tnemec
 - 2. Rust-Oleum

5.3.27 Tracer Wire

- A. Open Cut Direct Bury Tracer Wire
 - 1. Copperhead Industries – HS-1230 CCS
 - 2. Agave Wire Ltd – APHS-1201 High Strength CCS PE30
 - 3. Pro-Line Safety Products – PRO-TRACE 12 AWG HS-CCS-PE30
- B. Tracer Wire for HDD Installations
 - 1. Copperhead Industries – SoloShot 1045 EHS
 - 2. Agave Wire Ltd – BT-1001 Extra High Strength CCS
 - 3. Pro-Line Safety Products– PRO-TRACE HDD-CCS-PE45

5.3.28 Connectors for Tracer Wire

- A. Wire Connectors for Direct Bury
 - 1. Copperhead Industries - SnakeBite
 - 2. Pro-Line Safety Products – PRO-TRACE TW
 - 3. Tracer Wire Technologies – Tracer-Lock Connector
- B. Wire Connectors for HDD Installations
 - 1. Copperhead Industries - SC-PB-01
 - B.

5.3.29 Tracer Wire Access Boxes

- A. 2 ½” shaft tracer wire access boxes
 - 1. P200 Test as manufactured by Bingham & Taylor

5.3.30 Marking Tape

- A. 3.5 mil polyethylene tape, 3 inches in width, with a 14-gage metallic core
 - 1. Seton Safety and Identification
 - 2. Presco
 - 3. Pro-Line

5.3.31 Steel Casing Pipe

- A. No manufacturer specified

5.3.32 Pressure Gages

- A. Pressure Gages
 - 1. Ashcroft stainless steel case 1009

5.3.33 Pipe Supports

- A. Supports for pipes 2-½ inches and larger
 - 1. Standon Model S89 flange support
 - 2. Standon Model S96 cradle support

B. Support for pipes 2 inches and smaller shall be manufactured by

1. Unistrut Building Systems
2. B-Line

5.3.34 Service Saddles

A. Service saddles shall be as manufactured by

1. Cascade
2. Mueller
3. Romac

END OF SECTION 5.3

5.4 APPROVED MATERIALS AND MANUFACTURERS – SEWER

5.4.01 General

- A. This Section lists the acceptable materials and manufacturers for all the pipes, valves, fittings, manholes and other appurtenances which must be provided when constructing public sewage collection and conveyance systems in Goochland County, Virginia.
- B. Shop drawings must be submitted for all products to be supplied.

5.4.02 Underground Pressure Pipe

- A. Ductile Iron Pipe
 - 1. American Ductile Iron Pipe
 - 2. McWane Ductile
 - 3. U.S. Pipe & Foundry
- B. Ductile Iron Restrained Joint Pipe
 - 1. Griffin Snap Lock
 - 2. TR Flex
 - 3. American Ductile Flex Ring
- C. Polyvinylchloride (PVC) Pipe
 - 1. Diamond Plastics Corporation
 - 2. IPEX, Inc.
 - 3. North American Pipe Corporation
 - 4. National Pipe & Plastics, Inc.
 - 5. Sanderson Pipe Corporation
- D. Polyethylene Pipe
 - 1. Flying W Plastics
 - 2. ISCO by A.H. McElroy, Inc.
 - 3. AGRU America, Inc.
 - 4. JM Eagle
 - 5. W.L. Plastics

5.4.03 Gravity Pipe

- A. Polyvinylchloride (PVC)
 - 1. Diamond Plastics Corporation
 - 2. IPEX, Inc.
 - 3. North American Pipe Corporation
 - 4. National Pipe & Plastics, Inc.

- B. Ductile Iron
 - 1. American Ductile Iron Pipe
 - 2. McWane Ductile
 - 3. U.S. Pipe & Foundry
- C. Service Connection on Existing Sewer Mains
 - 1. Existing 12” and Smaller Sewer Mains: Geneco
 - 2. Existing Sewer Mains Larger Than 12”: No manufacturer specified.

5.4.04 Underground Pressure Pipe Fittings

- A. Ductile Iron Mechanical Joint Fittings for PVC and DI pipe
 - 1. U.S. Pipe & Foundry Company
 - 2. Tyler Union
 - 3. The Harrington Corporation (HARCO)
 - 4. SIGMA Corporation
 - 5. Star Pipe Products, Inc.
- B. Polyethylene Pipe Fittings
 - 1. Butt Fusion Fittings:
 - a. ISCO
 - b. AGRU
 - c. JM Eagle
 - d. Elofit
 - e. Integrifuse
 - 2. Electro-fusion Fittings:
 - a. The Harrington Corporation (HARCO)
 - b. Friatec as manufactured by IPEX
 - c. Elofit
 - d. Itegrifuse
- C. Thrust Restraint
 - 1. Restrained joint retainer glands for fittings, plugs, caps, tees, and bends with Ductile Iron Pipe
 - a. EBAA Iron Sales, Inc. - Megalug Series 1100
 - b. SIGMA – One Lok SLD
 - c. Star Pipe Products – Stargrip Series 3000
 - 2. Ductile iron bell and spigot pipe joint restraints
 - a. EBAA Iron Sales, Inc. - Megalug Series
 - b. SIGMA – One Lok
 - c. Star Pipe Products – Stargrip Series 3100P
 - d. U.S. Pipe – Field Lok 350 gaskets may be used in lieu of other mechanical joint restraints.

3. Restrained joint retainer glands for fittings, plugs, caps, tees, and bends with PVC Pipe
 - a. EBAA Iron Sales, Inc. - Megalug Series 2000
 - b. SIGMA – One Lok SLC
 - c. Star Pipe Products – Stargrip Series 4000
4. PVC pipe bell and spigot joints
 - a. EBAA Iron Sales, Inc. - Megalug Series 1500
 - b. SIGMA – One Lok
 - c. Star Pipe Products – Stargrip Series 4100P

5.4.05 Above Ground or Exposed Pressure Pipe

A. Ductile Iron Pipe

1. American Ductile Iron Pipe
2. McWane Ductile
3. U.S. Pipe & Foundry

B. Ductile Iron Fittings

1. Flanged Fittings
 - a. U.S. Pipe & Foundry Company
 - b. Tyler Union
 - c. The Harrington Corporation (HARCO)
 - d. SIGMA Corporation
 - e. Star Pipe Products, Inc.

C. Flange Adaptors:

1. EBAA Iron Sales, Inc. – 2100 Megaflange
2. JCM model 301R

D. PVC Pipe and Fittings

1. PVC Sanitary Sewer Fittings (socket weld schedule 80)
 - a. GPK Products, Inc.
 - b. The Harrington Corporation (HARCO)
 - c. IPEX, Inc.
 - d. Multi-Fittings
 - e. Nyloplast USA, Inc.
 - f. Royal Municipal Solutions
 - g. Vassallo

E. Stainless Steel Pipe and Fittings

1. No manufacturer specified. Approved by DPU on a case by case basis.

5.4.06 Plug Valves

- A. Plug Valves
 - 1. Dezurik PEC (gravity) or PEF (pumped)
 - 2. Milliken Millcentric (gravity) or Full/100% Port (pumped)

5.4.07 Check Valves

- A. Swing Check Valves
 - 1. 3 Inches and Larger:
 - a. APCO Series CVS 250
 - b. Val-Matic Series 7800
 - c. Milliken Series 8501
 - 2. Smaller than 3 inches:
 - a. Crane Figure 137 (bronze)
 - b. Crane Aloyco Figure 49

5.4.08 Tracer Wire

- A. Open Cut Direct Bury Tracer Wire
 - 1. Copperhead Industries – HS-1230 CCS
 - 2. Agave Wire Ltd – APHS-1201 High Strength CCS PE30
 - 3. Pro-Line Safety Products – PRO-TRACE 12 AWG HS-CCS-PE30
- B. Tracer Wire for HDD Installations
 - 1. Copperhead Industries – SoloShot 1045 EHS
 - 2. Agave Wire Ltd – BT-1001 Extra High Strength CCS
 - 3. Pro-Line Safety Products – PRO-TRACE HDD-CCS-PE45

5.4.09 Connectors for Tracer Wires

- A. Wire Connectors for Direct Bury
 - 1. Copperhead Industries – SnakeBite
 - 2. Pro-Line Safety Products – PRO-TRACE TW
 - 3. Tracer Wire Technologies – Tracer-Lock Connector
- B. Wire Connectors for HDD Installations
 - 1. Copperhead Industries – SC-PB-01

5.4.10 Tracer Wire Access Boxes

- A. 2 1/2" shaft tracer wire access boxes
 - 1. P200 Test as manufactured by Bingham & Taylor

5.4.11 Marking Tape

- A. 3.5 mil polyethylene tape, 3 inches in width, with a 14-gage metallic core
 - 1. Seton Safety and Identification style 48288
 - 2. Presco
 - 3. Pro-Line

5.4.12 Steel Casing Pipe

- A. No manufacturer specified

5.4.13 Manholes

- A. Precast Manholes
 - 1. Concrete Pipe & Precast
 - 2. Concrete Specialties, Inc.
 - 3. Contractor's Precast
 - 4. Nansemond Pre-cast Concrete Co., Inc.
 - 5. Tindall Concrete Products, Inc.
 - 6. Winchester Building Supply Co., Inc.
- B. Gasket
 - 1. As provided by manhole manufacturer
- C. Acid-resistant liners for new manholes.
 - 1. FRP liners
 - a. Dion No. 6694.
 - 2. PVC liners
 - a. Amercoat "T-Lock Amer-Plate"
 - 3. HDPE liners
 - a. AGRU "Sure Grip" HDPE Concrete Protective Liner
- D. Acid-resistant liners for existing manholes.
 - 1. Epoxy liner
 - a. Raven 405
- E. Manhole steps
 - 1. American Step Company
 - a. Model #ML-10 (Standard Grade)
 - 2. Bowco Industries, Inc.
 - a. Model #93810 (48" and 54" Dia. M.H.'s)
 - b. Model #93813 (60" Dia. M.H.'s and Larger)

3. Cosmos North America
 - a. Model # US-10-OH
 4. MA Industries, Inc.
 - a. Style No. PSI-PF
 5. Press Seal
 - a. Model #P-10938 (48" and 54" Dia. M.H. 's)
 - ~~b.~~ Model #P-14850 (60" Dia. M.H. 's and Larger)
- F. Manhole frame and covers
1. East Jordan Iron Works
 2. Neenah Foundry
 3. Capitol Foundry
- G. Manhole flexible connectors
1. Kor-N-Seal, Press-Seal with a stainless-steel expander ring
- H. Sealant for manhole frames
1. Sika "Sikaflex" Series 1A.
- I. External Joint Wrap
1. Press-Seal Corporation
 2. Concrete Sealants, Inc.

5.4.14 Pressure Gauges

- A. Pressure Gauges
1. Ashcroft 1009S

5.4.15 Wafer Pressure Isolators Ring (Sensor Ring)

- A. Wafer pressure isolator rings
1. Onyx Valve Co model PSW
 2. Red Valve Company Series 40

5.4.16 Pipe Supports

- A. Supports for pipes 2-½ inches and larger
1. Standon Model S89 flange support
 2. Standon Model S96 cradle support
- B. Supports for pipes 2 inches and smaller
1. Unistrut Building Systems
 2. B-Line

5.4.17 Combination Air Valves

A. Combination Air Valves

1. DeZURIK APCO Series 440
2. Cla Val Models 36WW
3. GA Industries Figures 942
4. Valmatic VM-800 Series

END OF SECTION 5.4

6.1 REQUIREMENTS FOR PRIVATE DEVELOPMENT

6.1.01 Purpose and Applicability

- A. Except as otherwise noted in these Standards, this Section includes requirements which are specific to private land development projects.
- B. These Standards apply in their entirety to all private development projects.

6.1.02 General Requirements for Public Water and Sewer Projects

- A. The Developer/Owner of any Project for which public water and/or sewer service is required shall be responsible for preparing Water and Sewer Plans for the necessary extensions, expansions, and/or modifications to public utilities systems in accordance with DPU Standards and all applicable Federal, State, and Local requirements. The design shall be performed under the direction of a registered professional engineer with a current registration in the Commonwealth of Virginia in accordance with applicable Chapters of Title 54.1 of the Code of Virginia, 1950, as amended. Where applicable, certain design tasks may be performed under the direction of a certified land surveyor in accordance with Sec. 54.1-408 of the above- cited code.
- B. The design of all water and sewer infrastructure shall conform to the latest versions of the Virginia Department of Environmental Quality *Sewage Collection and Treatment (SCAT) Regulations (9VAC25-790)*, the Virginia Department of Health *Waterworks Regulations (12VAC5-590)*, and the applicable requirements of other State and Federal Agencies having jurisdiction.
- C. All design and construction work shall conform to the requirements of these Standards and Specifications (“Standards”) of the Goochland County Department of Public Utilities (hereinafter referred to as “Department” or “DPU”). Where the requirements of the State and County are in conflict, the more restrictive requirements shall govern.
- D. The Developer shall be responsible for obtaining the review and necessary approvals of Water and Sewer Plans by any/all applicable County, State, and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the Department prior to final approval of the Plans by the Department of Public Utilities.
- 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 future potential development of property(ies) beyond the development or subdivision in question.

- F. The Developer is required to design and construct the necessary water and sewer infrastructure for his Project, properly sized and at appropriate location(s) to permit future extensions to be made at the limits of said Project. To the greatest extent possible, elevations and inverts of sewer systems shall be designed and constructed such that future extensions can serve the entire area that naturally drains towards the system.
- G. As determined by DPU, water and sewer utilities shall be designed and constructed to the limits of the development so that future extensions to adjoining properties will not disrupt existing improvements.
- H. Sewer designs shall include documentation of the adequacy of downstream facilities. This includes all downstream gravity sewers, sewage pump stations, and the receiving wastewater treatment plant. Drawings shall include the name of the facility and the facility owner's name and address for any downstream pump stations, as well as for the receiving wastewater treatment plant.
- I. Water designs shall include documentation of the adequacy of the overall water system. This includes all existing and proposed water lines, pressure regulating valves, and booster pump stations. Drawings shall include the name of the facility and the facility owner's name and address for any control valves or booster stations.
- J. Water and Sewer Plans for all Projects that may impact existing or proposed public water or sewer utilities infrastructure shall be submitted to the Department of Public Utilities for review and approval.
- K. 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 Owner's expense on the water service line serving the establishment.
 - 1. The water meter will be used by DPU for the purpose of computing sewer usage charges.
 - 2. The water meter and meter enclosure must meet the requirements of these Standards and must be installed on the water service line from the private well to the establishment.
 - 3. The water meter shall be placed in a location that is accessible by DPU and approved by the Utility Engineer.
 - 4. The appropriate sewer connection fees and other applicable charges shall be paid before issuance of a connection permit for the establishment.
- L. Requests for temporary water and/or sewer service for construction trailers shall be directed to the Utility Engineer.

- M. All existing water and sewer services to the Project parcel(s) shall be shown on the Plans. If existing services will no longer be utilized after construction is completed, they shall be included on a demolition plan and shall be abandoned as follows:
1. Water services shall be abandoned by severing the service line at the corporation stop or tee (i.e., at the main line), installing a plug, and closing any associated valve(s).
 2. Sewer laterals shall be properly plugged at the main unless approved otherwise.
- N. A limited number of hydrant meters are available for construction purposes and wash downs only. These are offered on a first-come, first-served basis. Contact the DPU office for details.

6.1.03 Laws and Regulations

- A. The Developer/Owner shall keep fully informed of all State and Federal laws and local ordinances, and regulations which may in any manner affect those employed or engaged in the Work, or which in any way may affect the conduct of the Work, and of all such orders or decrees of bodies or tribunals having jurisdiction or authority over same.
- B. The Developer/Owner 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 by his Employees, Contractors, Consultants, or any other person or entity to which he has delegated any part of the Work.
- 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 Developer/Owner shall be responsible for assuring that the Contractor performs 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.

6.1.04 Plan Review Process

- A. When a Plan of Development (POD) or Land Disturbance Plan (LDP) is Required
1. For Projects that require a POD/LDP, the Water and Sewer Plans shall be included as part of the plan set submitted to the County with the POD/LDP application.
 2. The POD/LDP application shall include a Utilities Design Folder. This Design Folder shall contain the following documents, as applicable, which may not have been included on the Water and Sewer Plans:
 - a. Engineering Report with support calculations
 - b. System Layout Plan
 - c. Overall Water and Sewer Plan
 - d. Information Sheet(s) for Utility Agreement(s)
 - e. Plan Review Checklist
 - f. Domestic Meter Sizing Form
 - g. Complete Water Model results
 - h. Fire Flow Estimate Form
 - i. Notice of Intent to Discharge Non-Domestic Wastewater
 - j. Any other design documentation related to the Plans.
 3. Prior to approval of the Water and Sewer Plans, a Utility Agreement or Agreements must be prepared by the Owner/Develop using the appropriate template. An original, signed, Agreement must be submitted to the Department for review. Since the Agreement(s) must be executed by the Owner and the County prior to approval of the Plans or issuance of Building Permits, it is recommended that the Owner prepare and submit all necessary Agreements as early in the process possible to avoid potential delays.
 4. For phased Projects, the Developer shall prepare an Overall Water and Sewer Plan (Overall Plan) for the Project. The Overall Plan shall be submitted to the Department prior to, or coincident with, submission of Water and Sewer Plans for the first phase of the Project. All comments

and issues related to the Overall Plan must be addressed, and approval from DPU received, before any other plans for the Project are approved.

5. When all administrative and technical requirements have been satisfied, the Department will approve the Water and Sewer Plans for the Project. It shall be noted that DPU approval of the Plans does not constitute County approval of any POD or LDP and shall not be interpreted as permission to start construction of water and/or sewer infrastructure.
6. The Developer must receive final approval from the County of the POD/LDP prior to applying for a Utility Construction Permit (UTL).
7. Once applicable Utility Agreement(s) has/have been executed, the appropriate Surety has been posted, and any required off-site easements have been recorded, the Owner may apply for a Utility Construction Permit (UTL) for the Project.
8. Shop drawings as described elsewhere in these Standards must be submitted to DPU, reviewed, and accepted prior to start of construction. To avoid potential delays in construction, the Department recommends these be submitted with the UTL application package.
9. After issuance of a UTL and prior to start of construction, the Owner or the Contractor must contact DPU to schedule a pre-construction meeting. A copy of the UTL will be provided to the Owner and/or the Contractor at the pre-construction meeting. Construction shall not commence until a pre-construction meeting has been held.
10. Proposed revisions to the approved Water and Sewer Plans shall be submitted directly to the Department. The submission package for the revised plans shall include:
 - a. A transmittal letter written by the Design Engineer that clearly describes and justifies the proposed revisions.
 - b. Two paper copies of the revised Water and Sewer Plans that clearly indicate the proposed revisions by highlighting them in yellow and providing detailed notes and labels describing the revisions.

B. Water and Sewer Plans That Include Only Utility Improvements (UTP)

1. The Utility Plan (UTP) process is for “stand-alone” Water and Sewer Plans that are not part of a POD/LDP or other development plan. Offsite Water and Sewer improvements required for a development project often fall into this category.

2. Prior to preparation of a UTP, the Developer or his Engineer shall schedule a meeting with DPU to define the scope of the Project and the extent of the improvements to be included on the UTP.
3. Water and Sewer Plans subject to the UTP process shall be submitted directly to DPU. A complete Utilities Design Folder shall be submitted to the Department along with the Plans. The Utilities Design Folder shall contain, as applicable, the following documents that may or may not have been included on the utility plans:
 - a. Engineering Report with supporting calculations
 - b. System Layout Plan
 - c. Overall Water and Sewer Plan
 - d. Information Sheet(s) for Utility Agreement(s)
 - e. Plan Review Checklist
 - f. Domestic Meter Sizing Form
 - g. Water model
 - h. Fire Flow Estimate Form
 - i. Notice of Intent to Discharge Non-Domestic Wastewater
 - j. Any other design documentation related to the Plans.
4. The Owner or his Engineer shall submit the following for review and approval: two paper sets of the complete application and one digital version (.pdf or compatible) of the documents included in said application. Applications for sewage pumping stations or other major facilities may require additional submissions.
5. DPU shall route a copy of the Water and Sewer Plans to the County Department of Community Development's Environmental Division for review. The Plans will not be approved by DPU until all comments from the Environmental Division have been addressed.
6. Once the Plans have been approved by DPU, the applicable Utility Agreement(s) has/have been executed, the appropriate Surety has been posted, and any required off-site easements have been recorded, the Owner may apply for a Utility Construction Permit (UTL) for the Project.
7. Shop drawings as described elsewhere in these Standards must be submitted to DPU, reviewed, and accepted prior to start of construction.

To avoid potential delays in construction, the Department recommends these be submitted with the UTL application package.

8. After the issuance of a UTL, and prior to start of construction, the Owner or the Contractor must contact DPU to schedule a pre-construction meeting. A copy of the Utility Permit will be provided to the Owner and/or Contractor at the pre-construction meeting. Construction shall not commence until a pre-construction meeting has been held.
9. Proposed revisions to the approved Water and Sewer Plans shall be submitted directly to the Department. The submission package for the revised plans shall include:
 - a. A transmittal letter written by the Design Engineer that clearly describes and justifies the proposed revisions.
 - b. Two paper copies of the revised Water and Sewer plans that clearly indicate the proposed revisions by highlighting them in yellow and providing detailed notes and labels describing the revisions.

6.1.05 Engineering Report and System Layout Map

A. Engineering Report

1. Except as noted below, an Engineering Report shall be prepared by the Developer's Engineer for every project that involves construction of new water and/or sewer facilities to be owned and operated by Goochland County. An Engineering Report is not required for a minor sewer extension. A minor sewer extension is defined as follows:
 - a. Fewer than 15 residential lots are to be served by the extension.
 - b. No offsite areas are served by the extension, and
 - c. The diameter of the sewer line(s) does not exceed 8 inches.
2. When required, the Engineering Report shall be submitted to, and must be approved by, the Department of Public Utilities (DPU), prior to submission of any Water and Sewer Plans.
3. The Engineering Report shall include the following:
 - a. Projected water demand and sewage flows generated by the Project, as applicable.
 - b. A System Layout Map showing all proposed construction together with enough of the surrounding area to clearly outline the

interrelationship of the two.

- c. Proposed sizing of sewer lines with calculations showing they are designed to serve the entire sewer shed or service area.
- d. Proposed sizing of water lines with calculations (water model results) showing they are adequate for domestic and fire flows, including any applicable off-site areas to be served.
- e. Existing and proposed developments shall be shown as well as existing and proposed utilities.
- f. Where phased development is contemplated, the extent of each phase shall be clearly delineated.
- g. All other design calculations related to the Water and Sewer Plans.
- h. A complete list of all off-site easements needed to construct the Project, including Tax Map Numbers, current landowner information, total parcel area, and total area within proposed easements.
- i. Additional requirements shall be imposed as detailed in other divisions of these Standards and as required by DPU.

B. System Layout Map

1. The System Layout Map shall delineate the sewer shed area boundaries for sewer Projects and pressure zone boundaries for water Projects. The Project area(s) shall be clearly shown and identified within these defined boundaries.
2. Using the Comprehensive Plan, Utilities Master Plan, and other available data, the System Layout Map shall show present and future development, proposed interim and future utilities, and any existing utilities that will be affected by or effect the proposed utilities.
3. Existing and proposed ground elevations shall be shown at contour intervals not exceeding 5 feet unless otherwise approved.
4. Proposed utilities and easements necessary to serve properties adjacent to the Project parcel(s) shall be shown on the map.

6.1.06 Federal, State, and Local Approvals

- A. 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.
- B. Plans for erosion and sediment control must be approved by the County before a DPU Utility Construction Permit (UTL) will be issued for construction of water and sewer facilities. A preconstruction meeting personnel from the County Environmental Department is required at the project site prior to the start of construction.
- C. Where VDOT Right-of-Way (ROW) is used, the Contractor shall obtain a VDOT Land Use Permit before construction is started. The Contractor shall capture a video recording of the ROW and adjacent properties to assess the condition and provide a guideline for restoration of the property after completion. Copies of the video recordings shall be submitted to the County before the start of construction.
- D. All wetlands shall be indicated on the Plans. The Contractor shall obtain all required permits from all authorities having jurisdiction, prior to going through, under, or in any way impacting a wetland.

6.1.07 Easements

- A. The Developer/Owner shall be responsible for obtaining all easements and is responsible for any/all easement acquisition costs.
- B. Where construction is to be performed within off-site easements, the Contractor shall capture a digital video recording of the easements and adjacent areas to assess the existing conditions and provide a guideline for restoration of the property after completion. Copies of the video recordings shall be submitted to the County before the start of construction.
- C. Offsite utility easements shall be recorded prior to the start of construction. All other utility easements shall be recorded prior to Final Acceptance by the County.

6.1.08 Permits

- A. The Developer must obtain all required Federal, State, and Local licenses and permits and pay all charges and expenses connected with the Work and be responsible for all damages to persons or property that may occur in connection with the prosecution of the Work.
- B. A Utility Construction Permit (UTL) issued by the Department is required prior to the start of construction.
- C. Misunderstanding or ignorance of any law, regulation, or requirement shall not be considered a valid reason for failure to secure the necessary permits.

6.1.09 Project Meetings

- A. The Developer or Contractor shall invite the DPU Inspector to all project meetings regarding water and sewer utilities or related issues.

6.1.10 Submittals

- A. Prior to issuance of a construction permit, all information necessary to give a comprehensive idea of the Work shall be shown on the Plans. Shop Drawings, Working Drawings, and other pertinent information (the Submittals) shall be prepared for all equipment and materials to be used in construction. The Submittals shall meet all requirements of Section 4.1.15 of these Standards. Any work performed or materials ordered prior to DPU acceptance of the Submittals shall be at the sole risk of the Owner.
- B. It is expressly understood that acceptance of the Submittals by DPU does not constitute approval, and in no way relieves the Owner from responsibility for errors or omissions in dimensions or quantities or for failure to meet all applicable Standards.

6.1.11 Quality Control

- A. It is the intent of these Standards to describe definitively and fully the character of materials and workmanship required for the Work, and to require first class work and new materials in all aspects of the Project.
- B. The Owner shall ensure that the Contractor employs careful and competent superintendents, foremen, and workmen.
- C. The Owner shall ensure that the equipment and tools used by the Contractor are in good repair and safe to use.

- D. The Owner shall ensure that the Contractor personally supervises 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. All orders and instructions given to the Superintendent shall have the same force and meaning as if given to the Contractor or in person. The Owner shall ensure that the Superintendent or Contractor is on site at all times while work is being performed, including all times when Subcontractors are working.
- E. During inclement weather, no work shall be done except as can be done satisfactorily and in a workmanlike manner to secure first class construction throughout.
- F. If unforeseen conditions arise during Construction, the Contractor shall notify the Inspector and Engineer.
- G. Any proposed deviations from the Plans shall be submitted to the Department for review and approval prior to execution.
- H. Testing Laboratory Services: Tests called for other than by public authorities shall be made by approved independent laboratories with the full cooperation of the Contractor.
- I. Additional Testing Services: DPU shall have the authority to require additional testing services to assure the Work complies with the Plans and these Standards. This testing shall be performed at the Owner's expense.

6.1.12 Discrepancies

- A. Any discrepancies found between the site conditions, the Plans, and the County's Standards, and/or any inconsistencies or ambiguities in the Plans or Specifications shall be immediately reported to the Department and to the Developer's Engineer in writing. The Owner shall have the Developer's Engineer promptly correct such inconsistencies or ambiguities in writing for approval by the Department. Work done by the Contractor after discovery of such discrepancies, inconsistencies or ambiguities, but prior to final resolution, shall be done at the Owner's risk.

6.1.13 Responsibilities

- A. The Developer/Owner is responsible for the Contractor's work.
- B. The Contractor shall take all precautions to prevent injuries to persons and property in or about the Work.
- C. Upon completion of construction of public utilities, and prior to applying for any form of acceptance, the Developer shall submit to DPU a statement signed by a licensed professional engineer certifying that the construction work was

completed in substantial accordance with the approved Plans and these Standards, revised only as approved by DPU. This statement is called a Construction Completion Statement, and it shall be based upon inspections performed or supervised by the certifying licensed professional engineer during and after construction. These inspections must be adequate to ensure the truth and accuracy of the Construction Completion Statement.

- D. The Developer/Owner shall repair, restore, and/or replace all damaged work that occurs or exists prior to Final Acceptance.

END OF SECTION 6.1