St. Mary's County
Metropolitan Commission

www.metcom.org

Design Manual
Technical Specifications
Standards for Construction Details

Effective July 11, 2019

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St. Mary's County Metropolitan Commission Design Manual
Update Effective 7/11/19
TRANSITIONAL PROVISIONS

Transitional Provisions to be known as "grandfathering" provisions are hereby adopted to provide for the continuance of certain development activities.

Plan Submissions on or after 7/11/19*	Old Design Manual (Effective 9/9/10)	New Design Manual (Effective 7/11/19)	Project Status
Pre-Application		✓	No Design
TEC Concept, Site Plan , Subdivision, CWSP Amendment		✓	No Design
Design (1st review - Approval)** (Plan review after concept approval)		✓	•% Design ~ 75% •Submittal = 1
Design (2nd review - Approval)** Plans received for subsequent reviews who's 1st review was prior to 7/11/19*. Plans submitted for 1st review prior to 7/11/19 will have a maximum of two (2) years from the Design Manual's effective date to receive final plan approval under the prior 2010 Manual.	✓		•% Design ~ 90-95% •Submittal = 2+
Record Plat and/or **Permitting** Will follow the Design Manual under which final plan approval was granted	✓	✓	•Permits •Construction •Sales

*Submission package must be complete, to include but not limited to review fees, plan sets, cost estimate, and completed checklist.

**From the date of final approval all projects will have two years in which to be under construction (i.e. PWA and bonding in place, if applicable, and received construction permit or connection permit approval at the MetCom pre-construction meeting). Final plan approvals received prior to 7/11/19 are eligible for one 2 year extension under the provisions of the 9/9/10 manual. Please note the Sediment and Erosion control plan must remain current.

Please note that all projects are required to use the current cost estimate form unless a PWA has been exicuted or construction/connection permit has been issued.

Note:

1. Special Cases will be reviewed under criteria outlined in section 24.4.2 a-d of the Subdivision Ordinance and approved by the following committee:

A. Director

B. Chief Engineer

C. Chief of Facilities and Operations

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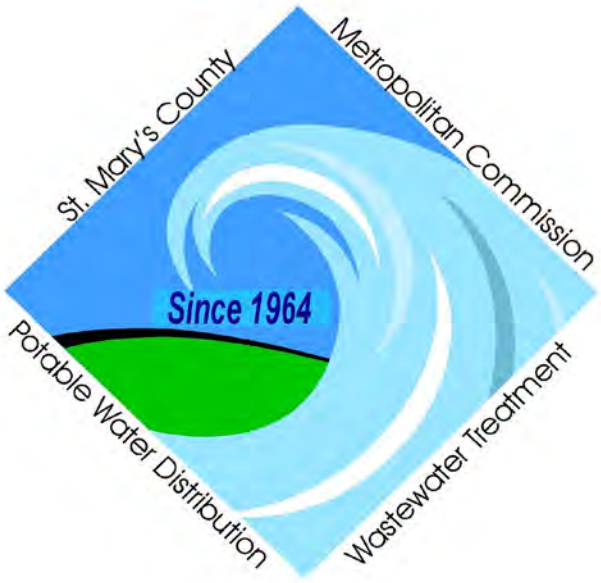
TABLE OF CONTENTS

CHAPTER 5 WASTEWATER PUMPING STATION DESIGN

APPENDIX

CHAPTER 1

GENERAL



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CHAPTER 1

GENERAL

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CHAPTER 1

GENERAL

1.1 Introduction

A. History

1. St. Mary's County Metropolitan Commission (MetCom or Commission) was created by the State Legislature in 1957 as a quasi - governmental, non profit body, to supply water and sewer service to the citizens of St. Mary's County. Located in Southern Maryland, the Commission has been providing service since 1964.

2. In accordance with Section 113-1 of the Code of Public Local Laws of St. Mary's County, MetCom is governed by a board of Commissioners consisting of seven (7) voting members, and one non-voting member. Voting members represent Election Districts and are appointed by the Commissioners of St. Mary's County to serve three year staggered terms.

B. Authorization

1. St. Mary's County Metropolitan Commission is authorized under Section 113-2 of the Code of Public Local Laws of St. Mary's County as noted below:

2. The members of the Commission are a body politic and corporate, by the name of the "St. Mary's County Metropolitan Commission" (referred to elsewhere in this chapter as the "Commission"), with the right to use a common seal, to sue and be sued and to do any and all other corporate acts for the purpose of carrying out the provisions of this chapter, including, without limiting the generality of the foregoing, the right and power to make and enter into all contracts or agreements as the Commission determines with the federal government, the State of Maryland or any agency or instrumentality of either thereof or with any municipal corporation, county, private corporation, co-partnership, association or individual, on terms and conditions which the Commission approves, relating to the performance of the Commission's duties, the execution of its rights and powers, the use by the federal government, the state government or any federal or state agency, municipal corporation, county or private entity or individual of any water supply or sewerage system constructed or acquired by the Commission under this chapter or the services there from or the facilities thereof or the use by the Commission of any water supply or sewerage systems owned or operated other than by the Commission.

3. The St. Mary's County Metropolitan Commission has the authority to adopt rules, regulations and requirements pertaining to public water or sewer systems by virtue of Section 113-11 of the Code of Public Local Laws of St. Mary's County.

C. Purpose of the Manual

1. The Design Manual is intended to provide a summary of information, procedures, criteria and practices, which are applicable to the undertaking of public water and sewer projects within St. Mary's County. The procedural aspects presented represent current Commission practices, which to some degree may be considered fluid as these standards are in continuous evolution, subject to both administrative and legislative action at federal, state and local governmental levels. The design criteria and engineering practices set forth in this manual shall be considered firm requirements for the development of water and wastewater projects for St. Mary's County.

2. The engineering requirements included in this manual are intended to assist land developers and engineers with designing and building public water and wastewater facilities within St. Mary's County. Developer Projects and Capital Projects, sponsored by private Developers and the County administration, respectively, shall conform to the procedures, requirements and criteria set forth in this manual.

3. The provisions of this Design Manual are minimum standards necessary to accomplish the safe and planned development of water and sewer systems in St. Mary's County, as determined by the St. Mary's Metropolitan Commission Commissioners, and nothing herein is intended to prevent any development or land use from exceeding the minimums. Should the interpretation and application of any requirements in this Design Manual be found to be in conflict with those imposed by other provisions of law, the more restrictive or higher standards shall prevail.

4. The manual is not intended to restrict the Designer's opportunity to create innovative, practical and economical designs for water and sewer system improvements; rather, it is intended to assist the Designer in completing the projects efficiently and economically within the framework of design parameters established herein.

D. **Waivers**

1. If the Designer for any reason finds it necessary or desirable to use procedures, standards or criteria other than those included in this manual, the Designer must apply to the Commission for a waiver of the design requirements. A request for a waiver is to be addressed to the Chief Engineer and shall, at a minimum, contain a narrative indicating the design objective and the justification for the request. Approval or denial of the waiver request will be by return letter signed by the Chief Engineer.

2. If the Designer does not agree with the decision by the Chief Engineer, the Designer may appeal the Chief Engineer's decision to the Metropolitan Commission's Director.

3. If the Designer does not agree with the decision by the Director, the Designer may petition to the Metropolitan Commission's Board of Commissioners. The decision by the Board of Commissioners will be final.

E. **Abbreviations**

AASHTO	American Association of State Highway & Transportation Officials
ABMA	American Bearing Manufacturers Association
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
ATS	Automatic Transfer Switch
AWWA	American Water Works Association
BOCA	Building Officials and Code Administrators
CAD	Computer-aided Drafting
CFR	Code of Federal Regulations
CIB	Capital Improvement Budget
COMAR	Code of Maryland
CWSP	Comprehensive Water and Sewer Plan
DFT	Dry Film Thickness
DHC	Drop House Connection
DIP	Ductile Iron Pipe
DPW&T	Department of Public Works & Transportation
EDU	Equivalent Dwelling Unit
ENR	Engineering News Record
FAA	Federal Aviation Administration
HDPE	High Density Polyethylene
HGL	Hydraulic Grade Line

HMI	Human Machine Interface
IBC	International Building Code
IBOCA	International Building Officials and Code Administrators
LED	Light Emitting Diode
LUGM	Land Use and Growth Management
MAA	Maryland Aviation Administration
MCC	Motor Control Center
MDE	Maryland Department of the Environment
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PCCP	Prestressed Concrete Cylinder Pipe
PIV	Post Indicator Valve
PLC	Program Logic Controller
PLS	Professional Land Surveyor
PRV	Pressure Reducing Valves
PVC	Polyvinyl Chloride
PWA	Public Works Agreement
RCP	Reinforced Concrete Pipe
RPM	Rotations Per Minute
RTU	Remote Telemetry Unit
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SHA	State Highway Administration
SHC	Sewer House Connection
TS&V	Tapping Sleeve & Valve
VFD	Variable Frequency Drives
WHC	Water House Connection

F. **Definitions**

Whenever the words defined in this section, or pronouns used in their stead occur in the contract, they shall have the meanings here given:

1. ADDENDUM - Written or graphic instruments issued prior to the bid opening of the Contract, which modifies or interprets the Contract Documents.

2. APPROVED, ACCEPTABLE - Whenever the words “approved” or “acceptable”, or words of like import are used in the drawings or

specifications, it shall be understood that "Approved by or Acceptable to" the Chief Engineer is intended, unless otherwise stated.

3. AVERAGE DAY DEMAND - The volume of water used in the year divided by 365 days, expressed in gallons or million gallons.

4. AVERAGE DAY RATE - The water used during the Average Day Demand expressed in gallons per day (gpd) or million gallons per day (mgd) or divided by 1,440 minutes and expressed in gallons per minute (gpm).

5. AVERAGE DAY FLOW RATE – The volume of wastewater generated in a year divided by 365, expressed in gallons per day (gpd) or million gallons per day (mgd).

6. BID - The offer of the bidder submitted on the prescribed bid form to perform the prescribed work and to furnish the prescribed labor and materials in accordance with a set of Contract Specifications and/or Documents, for the consideration of payment at the unit and/or lump sum price stated and submitted on the prescribed forms.

7. BID ITEM - An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of all work and furnishing of all labor, equipment and materials, described herein or described in any supplemental specifications or Special Provisions.

8. BID SECURITY - The security designated in the Bid, to be furnished by the bidder as a guarantee of good faith to enter into a Contract with the Commission, if the work of constructing the improvement is awarded to him. The Bid Security may be a bid bond or certified check.

9. BIDDER - Any individual, firm or corporation submitting a bid for the prescribed work contemplated, acting directly or through a duly authorized representative.

10. BUILDING SEWER – A sanitary sewer, which conveys wastewater, from a residential, commercial or industrial structure to the public sewer. The building sewer extends from the structure being served to the public right-of-way or easement line.

11. CELLAR ELEVATION – Cellar elevation or basement floor elevation. Abbreviated CE or BE.

12. CHANGE ORDER - A written order to the Contractor, signed by the Director of Procurement on behalf of the Owner, ordering a change in the work from that originally shown by the plans and specifications that has

been found necessary. If the work is of a nature involving an adjustment of unit price, a Supplemental Agreement shall be executed. Change Orders duly signed and executed by the Contractor and Commission constitute authorized modifications of the Contract.

13. CHIEF ENGINEER - Chief Engineer of the St. Mary's County Metropolitan Commission.

14. COLLECTOR SEWER – A sanitary sewer constructed to transport wastewater to an interceptor sanitary sewer. A collector sewer is a public sewer main designed to serve one or more customers. All collector sewers shall start and end with a structure.

15. COMMISSION - The St. Mary's County Metropolitan Commission (MetCom).

16. CONSTRUCTION DRAWING – see contract drawings.

17. CONSTRUCTION EASEMENT - The area secured for temporary use and/or modification for the purpose of facilitating work to be accomplished during construction.

18. CONTRACT - The written agreement executed between the Commission and the successful bidder, covering the performance of the work and the furnishing of labor and materials, by which the Contractor is bound to perform the work and furnish the labor and materials, and by which the Commission is obligated to compensate him therefore at the mutually established and accepted rate or price.

19. CONTRACT BOND - The approved form of security executed by the Contractor and his Surety or Sureties, guaranteeing complete execution of the Contract and all supplemental agreements and changes pertaining thereto. “Contract Bond” shall mean the same as “Performance Bond.”

19. CONTRACT DOCUMENTS - shall include the invitation for bids, instructions to bidders, bid contract and contract bond, specifications, supplemental specifications, all general or special provisions, general and detailed plans, and notice to proceed; also, any written change orders, written mutual understandings and agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof.

20. CONTRACT DRAWINGS - show the location, dimensions and sizes of the materials on the lines and slopes, at the depths with the connections and the manner in which they are to be placed as called for by the Specifications

outlining the work and the materials to be provided for and placed under the contract, or in accordance with such changes as may be approved from time to time during the progress of work, as hereinafter provided.

21. CONTRACT ITEM - The obligation of the Contractor, including the performance of all work and furnishing of all labor and the materials described in the respective articles or sections of the Specifications and Contract or in the Special Provision which are made a part thereof.

22. CONTRACT TIME - The number of working days or calendar days shown in the bid, indicating the time allowed for the completion of the work contemplated in the contract and any modification thereto.

23. CONTRACTOR - The party of the second part, or the agent appointed to act for the said party, entering into the contract for the performance of the work required by it.

24. COUNTY – St. Mary's County, Maryland.

25. DESIGNER - A certified Professional Engineer

26. DESIGN FLOW - The minimum flowrate required to satisfy the following demand and pressure conditions during a 24-hour period, expressed in gpm or mgd:

Maximum Day Demand:	35 psi minimum at curb
Peak Hour Demand:	35 psi minimum at curb
Maximum Day + Fire Flow Rate:	20 psi minimum at curb

27. DESIGN FLOW RATE – The design flow rate is the sum of the peaked average day flow rate for the service area plus an infiltration and inflow allowance.

28. DISTRIBUTION MAINS - Water mains connecting the transmission mains to the water house connections. The distribution mains provide area wide fire protection. Generally, the distribution mains will be in a grid or branched configuration.

29. DROP HOUSE CONNECTION (DHC) – A sewer house connection (SHC) that extends vertically from the collector sewer and then horizontally to the building sewer at the property line.

30. ENGINEER - The Registered Professional Engineer or a duly authorized agent thereof, contracted by the Commission to provide any engineering services that the Commission may require or authorize.

31. ENGINEERING REPORT – Report that establishes the scope of the project and identifies the key design criteria to be used and which the construction plans and specifications can be checked against.

32. ENGINEER'S COST ESTIMATE – An estimate of probable construction cost prepared by the designer based on the prepared plans and specifications.

33. ESTABLISHED GRADE - The profile grade as anticipated and approved for future construction in order to meet geometric criteria approved by established standards of construction.

34. EQUIVALENT DWELLING UNIT - The units of measure that standardizes all land use categories (housing, retail, office, food service, etc.) to the level of demand created by one single-family dwelling unit.

35. FINAL ACCEPTANCE – The date certified by the Chief Engineer when all work contained in the Contract has been completed, including outstanding items of work that were not required by the Chief Engineer for the Certificate of Operational Acceptance.

36. FIXED-PRICE ITEMS - The unit prices established and prescribed by the County to compensate for the cost of work and materials that may be necessary for the proper completion of the contract, and the quantities of which are not amenable to reliable quantitative estimation prior to the construction. The fixed-price items are shown on the bid sheets with estimated quantities, fixed price, and the estimated total cost imprinted prior to the issuance of the contract documents to bidders.

37. FORCE MAIN – A pressurized sanitary sewer that conveys wastewater from a pumping station to a higher elevation in the sewer system from which gravity flow may resume.

38. GREEN TECHNOLOGY – A method or use of materials, specifically in the construction and use of buildings that reduce the negative impacts to the environment through the use of low energy fixtures, recycled and/or regional materials and design features.

39. INSPECTOR – The authorized representative of the Commission assigned to make detailed inspection of any or all portions of the Work or materials therefore.

40. INTERCEPTOR SEWER – A sanitary sewer used to transport wastewater from collector sewers within a drainage basin to another interceptor sewer or a treatment plant.

41. MAXIMUM DAY DEMAND - The largest volume of water used in one day during the year, expressed in gallons or million gallons.

42. MAXIMUM DAY RATE - The volume of water used during the Maximum Day Demand expressed in gallons per day (gpd) or million gallons per day (mgd) or divided by 1,440 minutes and expressed in gallons per minute (gpm).

43. NOTICE TO PROCEED - A written notice to the Contractor of the date on which the contract period begins.

44. OPERATIONAL ACCEPANCE – That date certified by the Chief Engineer when a project is operationally complete in accordance with the contract documents and the Contractor has completed all punch work which may have been identified in the operational walkthrough. The maintenance period may begin as specified under the contract documents.

45. OWNER – The entity or entities that own the property on which facilities will be placed or construction activities will occur.

46. PEAK HOUR DEMAND – The largest volume of water used in one hour during the year expressed in gallons or million gallons. The Peak Hour Demand usually occurs during the Maximum Day Demand.

47. PEAK HOUR RATE - The Peak Hour Demand volume divided by 60 minutes, expressed in gpm; or multiplied by 24 hours, expressed as mgd.

48. PEAKING FACTOR – Ratio of peak flowrate to average flowrate.

49. PERPETUAL EASEMENT - The area secured and reserved by the Commission for right-of-use in constructing and maintaining proposed work and appurtenances thereto.

50. PHASING – The sequencing of work to accommodate portions of the project that may be constructed prior to beginning other sections or portions of the project.

51. PROJECT – The undertaking to be performed as provided in the Contract Documents.

52. PROVIDE – Means Furnish and Install, complete and in place.

53. ROCK – Any indurated material that requires drilling, wedging, blasting, or other methods of brute force to excavate.

54. SEWER HOUSE CONNECTION (SHC) – A sanitary sewer which conveys wastewater from a building sewer to a collector sewer. The SHC extends from the collector sewer to the public right-of-way or easement line.

55. SKETCH PLAN – Preliminary plan that identifies the limits of the project and key elements.

56. SPECIAL PROVISIONS - Special clauses supplemental to these specifications, setting forth requirements peculiar to the specific work included in the contract documents and right-of-way agreements.

57. SPECIFICATIONS - The direction, provisions and requirements contained in these Standard Specifications, together with all written agreements made and/or to be made, pertaining to the method and manner of performing the work, or to the quantities and qualities of the materials to be furnished under the contract.

58. STANDARD DETAILS – Commission details showing standard elements of construction, methods, and materials for use on Commission contracts.

59. SUB-CONTRACTOR - Any individual firm or corporation undertaking the engineering or construction of a part of the work under the terms of the Contract, by virtue of an agreement with the Contractor, who, prior to such undertaking, received the consent of the Surety and the approval of the Commission.

60. SURETY - The corporate body approved by the Commission which is bound with and for the Contractor who is primarily liable and which engages to be responsible for his payment of all debts pertaining to and for his acceptable performance of the work for which he has contracted.

61. TRANSMISSION MAINS - Large diameter water mains that convey water from the supply source to the storage facilities and the distribution mains.

62. WATER HOUSE CONNECTION (WHC) - A potable water line that provides public water from a public water main to a customer for both consumptive use and on site fire protection. The WHC extends from the public water main to the public right-of-way or easement line or to the meter.

63. WORK – Any and all obligations, duties, and responsibilities necessary for the successful completion of the Project assigned to or undertaken by the Contractor under the Contract Documents, labor, materials, equipment and other incidentals and the furnishing thereof.

1.2 Projects Defined

A. Developer Projects

1. A typical developer project originates when a developer undertakes the subdivision of a parcel of land, as set forth in the County Subdivision Regulations. If the proposed development is in a properly classified area according to the Comprehensive Water and Sewer Plan (CWSP), which designates when and what public water and/or sewage facilities are to be constructed, the development may proceed if other pertinent requirements are met. The developer will be required to underwrite the cost of construction of any public water and sewer utilities. Subsequent requirements include the preparation of some or all of the following: hydro-geologic study, feasibility or site location studies, engineering report, construction plans and specifications, right-of-way documents, tap agreements or other legal documents and the stakeout and inspection of the construction work. Normally, a developer project is represented by a signed contract between the developer and the Commission and is termed a Public Works Agreement (PWA).

2. St. Mary's County Department of Land Use and Growth Management (LUGM) is responsible for coordinating development activities and allocating EDUs in the County. Applicants are recommended to coordinate development projects with the LUGM office and reference their website at *www.co.saint-marys.md.us/lugm*

3. Water and/or sewer improvements may be necessary and the designs shall be prepared in accordance with this Design Manual.

B. Capital Projects

A Capital Project may originate by any of several administrative means, but the common identifying feature distinguishing it from a developer project is that the funds for the implementation of the project are allocated by the annual update of the Capital Improvement Budget (CIB) process within the Commission in accordance with Section 113-30 of the Code of Public Local Laws of St. Mary's County. Capital projects may involve the installation, repair, replacement, extension, expansion and/or upgrade of major elements of the water or sewer system, such as: water supply and treatment, water well, transmission and

storage, sewer mains and outfalls, collection; pumping stations, interceptors, and treatment facilities.

1.3 Project Inception

A. Developer Projects

St. Mary's County Department of Land Use and Growth Management (LUGM) is responsible for coordinating development activities in the County. Applicants are recommended to coordinate development projects with the LUGM office and reference their website at:

www.co.saint-marys.md.us/lugm

B. Capital Projects

Capital projects will be defined and schedules developed as part of the scope of services to be prepared for each project.

1.4 Engineering Reports

A. Applicability

1. The requirement for an engineering report is applicable to Developer Projects and Capital Projects alike whenever water or sewer system extensions or improvements are proposed. In accordance with the Comprehensive Zoning Ordinance Section 70.9.1a, any project with more than 25 EDU's or any project with a facility such as a pump station or water tank will require an engineering report. In addition, an engineering report may be required under certain circumstances not involving system extensions or improvements or for projects with less than 25 EDU's. When required by the Commission, a detailed analysis and investigation shall be performed to determine the performance of the existing system or to evaluate the impact that proposed additions or special uses will have on the system.

2. The report shall be prepared by a Professional Engineer (hereinafter referred to as the "Designer"), experienced in water and sewer systems who is licensed to perform such services in the State of Maryland. The report shall be signed and sealed by a Professional Engineer of the firm by whom the report is prepared.

B. **Purpose**

1. The engineering report is intended to be a concise presentation of all relevant project facts together with a proposal for satisfying the needs of the project. The report shall be addressed to the Chief Engineer and delivered to the designated project manager. The report shall be presented in an organized manner so that the Director, his staff, County officials and other interested agencies may quickly identify and comprehend all aspects of the project including, but not limited to, the purpose, scope, cost and scheduling of the project. The Designer is expected to provide the level of detail as required by the latest edition of the St. Mary's County Comprehensive Water and Sewerage Plan.

2. The report shall characterize the project, which was previously described in broad and general terms, to one of finite definition, scope and content. The report is a prerequisite to undertaking the development of detailed design and construction plans. The report may also serve other purposes simultaneously so as to:

    a. Provide a historical record of the engineering principles and criteria under which the project was designed and constructed.

    b. Form the basis for acceptance, rejection or modification of the scope of the Met Com project.

    c. Provide a basis for legislative or administrative action on scheduling or funding for publicly funded projects.

    d. Provide necessary details to guide preparation of construction documents.

    e. Provide a basis for correlating the project with other Commission projects.

    f. Provide an analysis and a program for the operation and maintenance of any part of a facility or system.

C. **Report Content**

1. **General**

    a. Reports shall be presented in a neat and legible manner. They shall be submitted on 8½-inch x 11-inch bond paper from any standard word processor, suitable for reproduction. Brief reports may be published in letter form, properly identified and with attachments referenced in the

text. Lengthy or complex reports shall be suitably bound on the left edge and shall include a cover with appropriate identification of the Designer, project name, owner and date. Unless otherwise stipulated, the Designer shall provide three (3) copies of final approved design on Developer Projects, and ten (10) copies of reports on Capital Projects. Reports shall be delivered to the Commission's designated project coordinator.

b. In considering the preparation of the report on water and sewer facilities, the Designer shall perform the following tasks:

- Become familiar with existing conditions
- Consider the impact that the proposed improvements will have on the system
- Offer proposals to satisfy project needs after they have been carefully evaluated for performance and cost

c. The Designer shall present a concise discussion of all relevant factors that led to the report conclusions and recommendations.

d. It is understood that all required subject matter for reports cannot usually be determined in advance of the research and development, as is necessary to identify all potential project issues. However, through experience and practice it is recognized that there are certain categories of information which, when properly addressed, will ensure all factors are considered prior to establishing appropriate conclusions. The text of the report will usually include a discussion of some or all of the following topics as applicable:

- Location, origin, purpose and scope of project
- Existing project conditions
- Population projections and projected needs
- Design analysis including all design criteria employed
- Design computations
- Function, layout and siting requirements of proposed facilities
- All alternatives to primary proposal
- Cost estimates and comparison of alternatives including rights-of-way requirements and costs
- Required permits and approvals of other agencies
- Conclusions and recommendations
- Schedule for implementation
- Project illustrations

e. The addition or elimination of subject matter for the report is within the authority of the Commission, whenever the nature of the project dictates.

2. **Design Analysis**

a. General

i. In developing design requirements for elements of a water or sewer system, the Designer shall refer to the St. Mary's County Comprehensive Water and Sewerage Plan to ascertain both the extent of existing or planned facilities in the service area and their relationship to the project under consideration. One or more maps shall be prepared showing the project location and the relationship of major elements of the system. The project map(s) shall be developed based on the following criteria:

- Displayed at a scale of 1" = 600′ minimum or 1" = 200′ maximum.
- Include a reasonable area surrounding the project
- Show significant topographical features such as roads, railroad lines, water courses, power transmission routes, political boundaries, water pressure zone limits, drainage divides and zoning
- Show the location, size and extent of the existing system(s) being addressed in the report
- Show locations of all proposed system additions
- All design notations used as a basis for computing system loads, such as drainage area or service area limits by zoning, future extensions of pipe systems or networks, other Capital Projects and any public improvements contemplated by other governmental agencies shall be superimposed on the report map

ii. For water and sewer facilities identified in the Comprehensive Water and Sewerage Plan, the Commission may elect to provide the Designer with specific design requirements determined as a result of previous engineering analysis. In such cases, the Designer will incorporate these requirements into the design report and will reference the letter or other documentation by which the requirements are

conveyed to the Designer from the Commission. For example, the Commission may specify system flow rates to be used in sizing pump stations and sewer lines or water transmission main sizes based on a previous hydraulic analysis.

3. **Design Criteria and System Layout**

All systems shall be designed based on the guidelines and criteria established by this manual. The following chapters provide relevant design information regarding system layout and construction plan requirements for each respective system component:

- Chapter 2: Water Mains
- Chapter 3: Water Pumping Stations, Well Houses and Water Tower Design
- Chapter 4: Sewer Mains
- Chapter 5: Wastewater Pumping Station Design

For facilities that require pumping, a detailed analysis shall be performed on the following topics:

- Pump size and power requirements balanced by economical pipe sizes
- Existing and future pumping capacity requirements
- Capacity to upgrade
- Surge control
- Secondary emergency power requirements
- Alarms
- SCADA

4. **Wastewater Pretreatment Requirements**

In cases where the engineering report provides for the design of sewer facilities for a specific non-domestic user of the sewer system, the report must address wastewater pretreatment requirements, as required by the Commission. Pretreatment requirements are established during site development plan review or during building permit review. Pretreatment facilities are required if the quality of the wastewater to be discharged would be detrimental to the Commission's conveyance or treatment systems. Pretreatment facilities must conform to applicable State and Local design requirements.

5. **Design Computations**

Design computations shall be developed for all features of the proposed system and shall be in sufficient detail to enable the Commission to make an expeditious review of the methods and criteria employed and the corresponding results obtained. In particular, see Chapter 2, "Water Mains" for water demand and hydraulic calculations and Chapter 4, "Sewer Mains" for wastewater flow calculations. Design computations shall be submitted with the report.

6. **Design Life of Facilities**

Design of system components will ordinarily be performed on the basis of the affected area being fully populated in accordance with population density determined from zoning. The Designer shall examine operating conditions using existing population and other intermediate population levels to ensure the satisfactory operation of the system throughout the design life of the system. The full development potential is determined based on a complete zoning analysis of the service area as described previously in "Design Analysis". In determining whether or not a facility should be initially constructed to meet 20-year or full development demands, the following issues shall be addressed in the engineering analysis of the proposed project:

a. Present worth analysis comparing the cost of phased implementation (construction of parallel mains, incremental pump station expansion, etc.) with the cost of a facility initially providing capacity for full development. For the purpose of economic analysis, full development is to be projected for a 40-year period.

b. System hydraulics considering such factors as differences in pump or pipe sizes required for 20-year and full development flows, head losses, retention time, etc.

c. System limitations considering the advisability of having parallel facilities to provide for limited flow capacity during maintenance or repair periods.

d. Construction limitations considering the difficulties involved with constructing parallel facilities after initial construction is complete.

e. System design life considering the useful life of the facility. Pump stations shall be designed for 20 years, collector mains for 40 years and interceptor mains for 100 years.

7. **Alignment Issues**

Water and sewer lines are generally extended within public right-of-ways wherever feasible. This is because most properties to be served by these utilities have frontage on public roads, facilitating direct connections to the public water and sewer system by consumers. Fire hydrants are also located alongside roadways to permit direct access by emergency equipment. As proposed systems increase in complexity, other factors such as topography, economy of sizing, construction costs, power requirements for pumping, maintenance considerations and conflicts with other utilities must be considered during design. The Designer shall evaluate alternative designs that provide a design with overall lowest cost and least impact on natural and manmade features. The Designer's report shall include life cycle cost comparisons for all alternatives considered.

8. **Construction Cost Estimates**

The cost of all facilities addressed in the report shall be tabulated in a clear and concise manner and shall be derived from recognized sources. The Cost Estimate shall be based on the Metcom Standard of Itemized Construction Cost included in the Appendix. If the item is not listed then the Estimate shall be based on current bid, estimates shall be based on current bid prices for comparable work in the locale of the project with consideration of soil conditions, water table, etc., and shall reflect quotations from suppliers of equipment and materials whenever appropriate. The cost estimates shall be in the form and format as directed by the Commission. Whenever alternative solutions involve different types of facilities such as a gravity system versus a pumped system, cost comparisons are more truly representative when analyzed to include capital, operation and maintenance costs on a life cycle basis, using reasonable interest rates. Current construction costs shall be adjusted and projected to the planned construction year as indicated in the project schedule with consideration of the effects of current inflation rates. The factors used in these projections shall be clearly stated.

9. **Project Schedule**

A project schedule shall be prepared by the Designer and included in the report. For Developer Projects, the schedule may be statements in the text of the letter report describing the Developer's estimate as to when the various phases of the development will be ready to accommodate the water and sewer construction program and the target date for completing the development and for occupancy. For Capital Projects, the Designer shall prepare a schedule in bar graph form displaying the best estimate of when the major elements of the project will be initiated and completed. As appropriate to a given project, the schedule shall include the following time considerations and tasks:

- Preliminary Design Period
- 50% for pipeline design and 60% for pumping station designs
- Review by the Commission
- Geotechnical and Corrosion Control Reports
- Rights-of-Way, Easement and/or Property Documentation
- Final Design (95% Complete)
- Final Commission Review & Approval
- Obtaining Permits
- Advertising and Bidding
- Award of Construction Contract
- Material Availability/Delivery
- Construction Period
- Other Special Items Affecting Schedules

The project schedule shall indicate the critical path, including required completion date and target dates for each phase, which must be met in order to achieve the schedule. In addition, any procedure, which can advance the completion date, such as pre-purchase of materials and equipment and a division of the project into two or more construction contracts, shall be identified.

10. **Illustrations**

An engineering report is considerably enhanced by the inclusion of maps, graphs, diagrams and charts to illustrate and amplify issues presented in the text. Schematic drawings showing arrangements of site development, piping, appurtenances, special structures and the like, will help to convey what the Designer is considering and will tend to expedite the review and approval process as well as providing a firm basis for proceeding with the construction plans.

1.5 Preparation of Construction Plans

A. General

Contract documents for construction projects in St. Mary's County are commonly comprised of construction plans and the construction specifications. Taken together, these documents form the basis for the construction contract between the owner and contractor. Contract documents are prepared by the Design Engineer, who is responsible for a complete description of all work to be performed, in accordance with the Standard Specifications. The Design Engineer remains responsible for adequately designing, detailing, and specifying through the

Special Provisions and Specifications, all contract-specific materials and methods of construction not described in the Standard Specifications.

B. **Purpose**

1. The primary purpose of construction plans is to show the size, horizontal and vertical location and type of materials and structures to be installed as part of a water or sewer system. The construction plans must be developed in sufficient detail to depict the improvements and their spatial relationship with both existing conditions and planned future improvements.

2. This section sets forth requirements for information to be placed on construction plans. When completed according to Commission standards and properly implemented in construction, the original plans for water and sewer facilities form a permanent record of the completed work and the materials employed on the project. When modified with as-built notations, the plans provide a comprehensive and accurate statement as to where the facilities are located, the materials used and their relationship to other important improvements.

3. In order for the Commission to provide necessary maintenance activities, including emergency repairs, etc., it is necessary that the plans are clearly drawn, can be accurately scaled and show all information necessary to be included as a permanent record. In addition, water and sewer plans are utilized in many other record-keeping activities by the Commission that requires standardized accurate information. One of the most common uses of record drawings, other than for repair information, is for remodeling portions of the system. In these cases, the record drawings may be used for the re-evaluation of design capacities in the light of changed conditions after the original project was completed.

4. Construction plans shall clearly designate the facilities or portions of the facilities that are proposed to be privately maintained by the Developer or other agencies. The plans shall provide all information, if known, as to who is to be contacted in the event of an emergency, complete with name, address and telephone number(s) of individual(s), firm(s), partnership(s), etc., who are responsible for maintenance of the private system. If not known at the time of plan preparation, this information shall be provided on the construction permit.

C. Drafting and Graphic Standards

1. General

    a. All plans shall meet the St. Mary's County Department of Public Works & Transportation (DPW&T) format guidelines as shown on the DPW&T website (www.co.saint-marys.md.us/dpw). If not shown on the website, or if the following is more stringent, the following shall be used:

    b. Sheet Size, Borders and Materials

    All water and sewer construction projects shall be prepared on 24-inch x 36-inch drafting paper. Borders shall be ½-inch on all sides with the exception of the left side, which shall be 1 ½ inches, with standard title block. All drafting and lettering shall be performed directly on the original plans and no reproductions, rub-on or adhesive materials shall be used. Minimal hand drafting shall be limited to minor revisions.

2. Computer-aided Drafting (CAD)

    All requirements of this section, "Drafting and Graphic Standards," shall be met. Plotters used for CAD shall be equipped with technical ballpoint pens, standard drafting pens or an electronic printer device.

3. Scale

    Water and sewer plans should be drawn on a scale of 1" = 50'; the scale may be increased or decreased depending on the complexity of the site at the approval of the Commission. Water and sewer profiles are typically drawn to accompany the plan layout and shall be shown below the applicable plan layout on each sheet. For Developer Projects, the complete layout of the piping system may be shown in the plan view drawing. Profiles shall then be shown on a separate sheet and cross-referenced to the appropriate plan. Profiles shall be drawn to a horizontal scale of 1"= 50' and a vertical scale of 1" = 5'.

4. Symbols and Abbreviations

    Symbols and abbreviations shall be clearly defined in a legend on the title sheet or for a project involving multiple disciplines, such as mechanical, electrical, structural and architectural, on the first sheet of each discipline in which they are used. If symbols fail to convey the required information clearly, they shall not be used.

5. Lettering

   Vertical lettering shall be used throughout. Lettering shall be uniform, neat in appearance, free of stylization and large enough to be read when reduced for County use. Lettering for titles, sub-titles and notes placed on the drawings shall be the size as shown in the "General Drafting Standards" in the Appendix. All notes, descriptions, etc. shall be minimum No. 4 (4/32-inch) in size and shall be either all upper case or all lower case. Proper names only shall be capitalized. Construction notes shall not be placed in shaded areas. Crowding of notes into a small space shall be avoided. Leaders shall be used to identify the object to which each note refers. All lettering in the same contract shall be of the same style.

6. Vicinity and Location Maps and Initial Drawing

   a. The first sheet of all projects shall include a location map at 1–inch = 600 feet and a vicinity map at 1-inch = 2000 feet or as appropriate if the scope of the project warrant different scaling. When a set of contract plans contain only one or two sheets, the vicinity map shall be placed at the upper right portion of the first plan sheet in a space measuring 8½-inches vertically by 11-inches horizontally. If the vicinity map cannot fit in the 8½ x 11-inch space or whenever there are 3 or more sheets to the contract, then the first sheet shall be designed as a title sheet with the vicinity map centered on the plan.

   ~~b.~~ For Capital Projects, the vicinity map shall, in addition to the above, show the contract number, the location, size and adjacent existing water and sewer facilities and proposed facilities.

   c. Provide under the vicinity map an informational block containing the following: number of lots and parcels serviced, number of water house connections, number of sewer house connections, use of buildings/structures, drainage area, treatment plant service area. An EDU tabulation shall be included under the informational block.

   d. In addition to the vicinity map, the initial plan shall show the contract title, contract number and capital project number. The initial plan shall also include a tabulation of materials with columns for bid quantity, as-built quantity and material/supplier. If the project is divided into two or more contracts, each associated contract shall be identified on the vicinity map. Likewise, the plan coverage of each sheet of the construction plans shall be shown on

the vicinity map with its corresponding sheet number for ready reference. For projects with more than three plans (total), a complete sheet index shall also be provided on the title sheet indicating the data shown on each sheet.

e. When space permits, the first plan of a set shall also show the General Notes pertaining to the contract. If the notes cannot be placed on the initial sheet, a note shall be included on the initial sheet indicating on which sheet the General Notes appear.
f. A note shall be included in the General Notes stating that the manipulation of valves by any party other than representatives of the Commission is prohibited.

g. The LUGM number shall be on all sheets.

7. Information Required on Each Construction Plan

a. The purpose of the contract plans is to portray graphically to the review agencies, project engineer and contractor the nature and extent of the proposed work and the conditions under which the work is to be performed. All information that can best be shown by plans and their accompanying dimensions and notes should be shown on the contract plans or appropriate reference to the Commission's Standard Details made where applicable. Lengthy written descriptions or requirements regarding the work are best included in the specifications, and therefore, shall not be repeated on the plans.

b. Each sheet shall have a title block along the lower right border of the sheet. The title block shall show the project name, sheet title, contract number, scale, 600-scale reference map number and block numbers, date, sheet number and signature blocks for the DPW&T and/or the LUGM as well as a signature block for Health Department (if necessary) and Soil Conservation District. Sheets shall be numbered sequentially 1 through X, where X is the total number of sheets in the contract.

c. The professional engineer's seal, original signature and registration number belonging to the Designer responsible for the design, registered in the State of Maryland, shall be shown on the title block of the first sheet and each finished sheet of the set of plans. The date on which seal and signature were affixed to the plans shall be shown in the same location on all the sheets. The Designer's seal, signature, registration number and date of

signature shall also be shown on the first page of the project specifications.

d. The cover sheet shall have a revision box in the title block. The revision box shall be as shown on the "Standard Reference Plan" in the Appendix A. The revision box shall document all revisions after the Designer's seal and signature has been affixed to the plan.

e. A tabulation of benchmark descriptions, elevations and northing and easting coordinates shall be shown on the cover sheet for a minimum of two benchmarks.

f. Each plan sheet and location map shall have a north arrow, and each plan sheet shall be in the Maryland State Plane. Plan sheets shall be oriented so that the north arrow points toward the top or toward the right side of the sheet, or toward the upper right quadrant of the sheet.

g. The limits of the contract shall be clearly shown on all plans.

h. All plans in the same contract shall be cross-referenced by ascending numbers. Match lines shall be used when data continues on an additional sheet or sheets. Data shall be cut off at the match line.

8. Checklists

The Designer shall fully complete the "Water and Sewer Construction Plan Review Checklist" or the "Sketch Plan Submittal Form" checklist(s) for each sewer and water project, as applicable. The Designer shall verify that all information detailed on the checklist is shown on the plans. The appropriate checklist shall be completed and attached to each set of plans submitted for review. This shall apply to all Capital Projects as well as Developer Projects. The checklist is available from the MetCom website.

9. Certifications

a. An owner's certification must be included on plans for water and sewer only. This certification shall be as follows:

"I hereby certify that all construction will be in accordance with the St. Mary's County Metropolitan Commission's Design Manual and these plans as approved.
*Signature*_____ *Date*_____*."*

b. Effective July 1, 2007, a Maryland Professional Engineer must include a Professional Certification when signing and sealing plans and drawings.

This additional certification is intended to promote awareness among Maryland professional engineers of the status of their engineers' license and reduce the occurrences of practicing engineering with an expired license. Include the certification below to documents signed and sealed by a Maryland Professional Engineer.

The title block, certification, seal and signature shall appear close to each other. The certification shall be as follows:

"Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. _____, Expiration Date: _____."

1.6 Preparation of Construction Specifications

A. General

The Commission's standard specifications have been developed for Capital projects and for Developer sewer pump stations, wells and water towers. The specifications may be different for a Capital project than for a Developer project.

B. Developer Projects

1. Developer projects, by their nature, are funded privately. Therefore, the contractual requirements between the Developer and the Developer's contractor are independent of the technical specification requirements of interest to MetCom. Developer projects shall use MetCom's standard technical specifications. Developer prepared specifications are required to be submitted with final construction plans only.

2. The Designer shall submit three completed copies of the bound specifications. The final specification shall have the Designer's Professional Engineer's seal, signature, date of signature and certification on the title page.

C. Capital Projects

1. Non-standard specifications, special provisions, proposal form, contract and bond forms and other designated items, when required by the Commission, shall be developed by the Designer specifically for each project and shall be published in booklet form. A draft of the project specifications for Capital Projects shall be submitted with each plan submittal for review by the Commission.

2. Upon completion of the construction plans for water and sewer projects, the Designer is required to provide the necessary non-standard specifications to accompany the plans. At this stage of the project, the Designer should be able to finalize most of the non-standard portions of the specification with the possible exception of items relating to permits or easement commitments. When all details of the specifications are completed, the Designer shall

submit the stipulated number of copies of the complete and bound specifications for Capital projects. The final specification shall have the Designer's Professional Engineer's seal, signature, date of signature and certification on the title page.

3. The Standard Specifications format is to be used in the preparation of the non-standard specification sections.

1.7 Construction Requirements

A. Acquisition

1. For Developer Projects, the Developer shall be responsible for acquiring all right-of-way and easements required for the work proposed. The Developer, or his designee, shall prepare all applications to SHA and MDE and submit to MetCom for signature prior to submitting to SHA and/or MDE.

2. For Capital Projects, the Commission will acquire the right-of-way and easements.

B. Location

1. Right-of-way locations shall be regulated, in general, by the location of the utility for which they are being provided. However, before establishing the location of utilities for which right-of-way will be necessary, the design engineer shall consider the property owners' interests in positioning the right-of-way. Undue splitting and angling across property shall be avoided. Right-of-way location shall be fixed by surveys.

2. Drainage and utility easement may not be located concurrent with landscape buffer yards, forest retention areas or ingress and egress easements unless prior approval is obtained from the Commission.

3. Private water and sewer services which cross lot lines shall be located within a private drainage and utility easement. Such easements shall be shown on the construction drawings and shall be noted as private drainage and utility easements.

C. Width

The width of the right-of-way and easements shall be sufficient to allow proper access and maintenance of the utility for which it is provided. Right-of-way and easements widths must be provided as follows:

1. Sanitary sewers, force mains, and water mains shall be centered within a minimum twenty-foot (20') wide easement. Utilities located adjacent and parallel to lot lines shall be centered within a thirty-foot (30') wide easement.

2. Centerline of utilities shall be no less than ten feet (10') from the edge of right-of-way line.

3. Multiple utility installation – a minimum of an extra five foot (5') width for each additional utility shall be added to the required utility width.

4. Landscaping

   Generally, planting of trees within 20 feet of water and sewer facilities will not be allowed within right-of-ways, drainage easements and utility easements which contain water and sewer utilities. Ornamental shrubs may be approved within the above restrictions as determined by the Commission.

D. **Location of Adjoining Utilities (Other than Water and Sewer)**

The Commission will review and approve design drawings of utilities, other than water and sewer utilities, when any portion of the proposed utility is within five feet of an existing or proposed water/sewer utility. The horizontal clearance between the proposed utility and existing/future water and sewer utilities will be evaluated on a case-by-case basis by the Commission. In general, the following shall be provided:

1. Minimum vertical clearance (outside of pipe to outside of pipe) from water mains, water house connections, sanitary sewers and sewer house connections shall be one and a half (1.5) foot.

2. Minimum horizontal clearance (outside pipe to outside pipe) parallel to water mains and sanitary sewers shall be five (5) feet.

3. Open trenching will not be allowed within eight (8) feet behind fire hydrants and water main bends. Directional drilling behind fire hydrants or water main bends shall extend a minimum of five (5) feet beyond such facilities.

4. Limits of utility vaults shall be horizontally located a minimum of five (5) feet from any water or sewer facility. Electric transformers shall be a minimum of ten (10) feet from any water or sewer main.

E. **Permits**

1. Developer Projects

The Developer is responsible for the preparation and submission of all required County, State and Federal permits and the cost thereof. All such permits shall be obtained from the applicable agency prior to construction. Building permits will not be issued until as-built plans of the proposed water and sewer infrastructure have been reviewed, approved, and operationally accepted.

2. Capital Projects

For Capital Projects, the scope of work will identify which permits are the responsibility of the Designer and which are the responsibility of the Commission.

F. **Executed Public Works Utility Agreement**

The Public Works Agreement, covering the financial aspects of public construction in the proposed development must be executed before the construction process can commence.

G. **Construction Permits**

All construction permits shall be acquired before the construction process can commence.

H. **Connection Permits**

All water and sewer infrastructure must be complete and operationally accepted before any connection permits can be approved.

1.8 As-Built Requirements

A. General

After the water and sewer plans have been signed by the Commission, the original water and sewer plans and all prints thereof become the property of St. Mary's County Metropolitan Commission. During construction, the Contractor and the Commission's inspector, acting together, will maintain a set of as-built or redlined prints of the water and sewer plans. Following construction, the original water and sewer plans shall be revised to reflect the as-built conditions in accordance with the current As-Built Requirements, along with CCVT results and flow test results from all new fire hydrants. The flow testing must be coordinated with MetCom's Operations Department. See the Appendices or our website for MetCom As-Built Requirements.

B. Electronic Files

All plans shall be prepared in electronic format, therefore, in addition to the modifications to the original water and sewer plans, the Commission will require

that the electronic files be modified to reflect the as-built conditions and delivered to the Commission in paper or electronic format.

C. Replacement Drawings

Plans bearing original signatures and dates of approval are important for the Commission's historical records. However, there may be rare instances where extensive modifications to a plan may render the plan illegible. In order to insure that the plans are clear and legible for operation and maintenance purposes, the Commission may require that a completely new plan with modifications be developed for the as-built plan. The plan shall be noted as "**AS-BUILT REPLACEMENT SHEET**" above the title block on the lower right-hand corner of the plan and dated and shall be included along with the original plan.

END OF CHAPTER 1

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CHAPTER 2

WATER MAIN DESIGN

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CHAPTER 2

WATER MAIN DESIGN

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CHAPTER 2

WATER MAIN DESIGN

2.1 General

A. Responsibility of the Designer

This chapter addresses the selection and use of design criteria and practices applicable to the design of water system projects in St. Mary's County. The subject matter discussed includes the layout of piping systems, selection and employment of pipeline materials and the use of appurtenances. While the requirements described for the various aspects of design will include and cover the majority of conditions encountered, there is no intention to relieve the Designer of responsibility to recognize when conditions are not favorable for the application of standards. The Designer must be continually alert to conditions that cannot be satisfied by the application of these standard criteria.

B. Deviation from Design Manual

It is not possible to include in this manual all features of design and drafting, which are necessary to accomplish the development of construction documents for all projects. Although it is the Designer's responsibility to exercise professional judgment in the acceptance or use of the standards or features of design included herein, the Designer shall recognize that they are given to assist in the development of the project in the manner preferred by the Commission. Deviations from the design standards must be brought to the attention of the Chief Engineer and must be justified, in writing, from an engineering evaluation, which includes consideration of life cycle costs and maintenance requirements. Approval or denial of the waiver requests will be by return letter signed by the Chief Engineer.

2.2 Design Criteria

A. General

The water design criteria presented herein shall apply to Developer Projects as well as Commission funded Capital Projects.

B. Pre-Design Meeting

Developer Projects

Prior to commencing any work, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics that are particularly important in the development of the Engineering Report and subsequent design of the project as given in Section 1.4.

For projects which require minor extensions of the public water and sewer systems, the pre-design meeting may take the form of a preliminary water and sewer plan showing the general layout of the utilities in relation to the proposed development. The plan shall be accompanied by a letter report, which shall include general information about the project, design criteria used, alternatives investigated and the cost estimates for all alternatives. The plan shall be submitted after the Planning Commission has approved the preliminary plan for the development.

Developer Projects involving more than 25 EDU's will be required to submit a comprehensive utility plan along with the engineering report unless waived by the Chief Engineer. Following the comprehensive sketch plan approval, the Designer shall submit to the Chief Engineer a comprehensive utility plan showing the location and size of the water and sewer utilities within the development. The comprehensive utility plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

If the construction of the utilities within a development is to be phased, the Designer shall provide a phasing plan showing the phasing and timing of the construction of the utilities. The phasing plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

During each phase of the development, the public water and sewer systems must be able to support the design flow requirements noted in the Design Manual. The Designer shall provide calculations (computer simulations) for each phase of the development. The water system must be capable of supporting the maximum day demand rate plus a two-hour fire flow while maintaining the minimum required pressure for each phase of the development.

Three copies of the preliminary utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. Following approval, the comprehensive utility plan and phasing plan cannot be revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes

to the preliminary utility plan and phasing plan shall be noted in the revision blocks.

Capital Projects

In accordance with the scope of services, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics that are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Preliminary or prior reports prepared by the Commission.
2. Development of population projections and water demands.
3. Sizing of major system components.
4. Applicable plumbing codes.
5. Limit of project and future extension, if planned.
6. Route selection and location of pipe in public right-of-way.
7. Pipe materials and appurtenances.
8. Design criteria to be used.
9. Both design constraints due to and anticipated interaction with existing utilities, particularly if those utilities employ cathodic protection systems.
10. Soil conditions that may affect infiltration and inflow in pipes and appurtenances.
11. Bedding requirements.
12. Method of crossing roads, railroads and streams.
13. Special topographic conditions affecting design such as slopes, streams, floodplain and stream crossings.
14. Special permitting issues created by the presence of wetlands, rare and endangered species, historical and/or archaeological artifacts.
15. Easement requirements.
16. Conditions affecting traffic maintenance and control.
17. Identification of any storage facilities in the network that might be affected by the project.
18. Requirements for new or upgraded telemetry systems.

During each phase of the development, the public water and sewer systems must be able to support the design flow requirements noted in the Design Manual. The Designer shall provide calculations (computer simulations) for each phase of the development. The water system must be capable of supporting the maximum day demand rate plus a two-hour fire flow while maintaining the minimum required pressure for each phase of the development.

Copies, in accordance with the scope of services, of the preliminary utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. Following approval, the comprehensive utility plan and phasing plan cannot be

revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes to the preliminary utility plan and phasing plan shall be noted in the revision blocks.

C. Design Calculations

1. General

   All population densities required for determining water demands are to be determined based on the St. Mary's County Metropolitan Commission Table of Equivalent Dwelling Units. The average day demand for a service area is the sum of the average day demands for the residential, institutional, commercial and industrial components within the service area. Similarly, the maximum day demand for a service area is the sum of the maximum day demands for the residential, institutional, commercial and industrial components within the service area.

2. Residential

   For residential flows, average day demands shall be determined by multiplying the applicable population densities by the average day demand indicated in the Table of Equivalent Dwelling Units as found in the Appendix. Maximum day and peak hour demands shall be determined by multiplying the applicable average day demand by a 1.5 peaking factor.

3. Institutional, Commercial and Industrial Demands

   For institutional, commercial and industrial flows, the estimation of average daily water consumption demands vary greatly dependent on the type of facility. With the exception of industries using process water, the fire demand generally is the major component of the design demand used to size distribution main extensions and service connections to buildings having sprinkler systems. The Designer shall determine the design flows based on building capacity, type of use, number of persons using the facility, projected processes, etc. Whichever estimate of design flows is greater shall be used for design purposes. When more specific information is unavailable, the Table of Equivalent Dwelling Units shall be used to determine the average day demand.

   Maximum day and peak hour demands shall be determined by multiplying the applicable average day demand by a peaking factor of 4.

4. Fire Flow Rates: The required fire flow rates shall be calculated using Table 2.1.

TABLE 2.1: FIRE HYDRANT FLOW RATES FOR DESIGN

Land Use	Design Fire Flow Rates (gpm)
Residential (one and two family)	500
Commercial, Industrial, Educational, Institutional, Residential (multi-family)	1,000*

*The special use of a property may require a higher flow rate that is to be accommodated by on site storage. Higher fire flow rates (and storage requirements) may be specified by the Owner, Fire Marshal's Office, or the Department of Land Use and Growth Management.

The water system storage facilities shall be considered at their minimum elevation when determining fire flow residual pressures.

5. Surge Pressures: Surge pressures shall be calculated using Table 2.2.

TABLE 2.2
MAXIMUM PERMISSIBLE SURGE PRESSURES

Pipe Diameter (in)	Surge Pressure (lb/in^2)
4 to 10	120
12 to 14	110
16 to 18	100
20	90
24	85
30 and above	80

The Designer shall exercise judgment in determining whether a detailed surge analysis is necessary. Conditions warranting a surge analysis may include the following:

- Impact of a power failure, pump start up or quick closure of discharge valves at water pumping station.
- Impact of water column separation.
- Rapid closure of in-line valves.
- Rapid closure of fire hydrants.
- Inadvertent, rapid closure of altitude valves at storage tanks.

6. Hydrostatic Pressure and Leak Tests

   Hydrostatic leak tests shall also be performed as stipulated in the standard specifications. Test pressures to be induced at the high point of the test section shall be based on the static gradient within the pressure zone the pipe is to be installed in, but never less than 100 psi.

   The hydrostatic test pressures for pressure and leak tests shall be in accordance with AWWA Standard C600.

D. Pipeline Alignment

1. General

   The Designer has the responsibility to identify where factors of good planning and design are in conflict with these guidelines and requirements of other agencies. The proposed alignment must be the best overall design. Failure to identify conflicts during the preliminary design may result in delays and possibly costly changes.

   Consideration must be given to space requirements for future utilities, particularly sanitary sewers and storm drains. In the absence of sewer or storm drain design, the Designer shall recommend the space requirements of the sewer or drainage facilities and provide the necessary clearances. This requirement is particularly important at roadway intersections.

   The Designer shall identify and locate all existing and underground facilities before selecting the location of the pipeline. When plans of existing facilities are insufficient to accurately locate existing underground obstructions, the designer shall request the Chief Engineer for permission to perform test pit excavations to uncover the subject facility so that the horizontal and vertical positions of existing utilities can be accurately determined. The timing and location of test pits and or soil borings should be discussed during the Pre-Design Meeting. If approved, the Designer will be responsible for providing all traffic control and public safety measures necessary to locate the utilities and restore the surface. The Designer shall coordinate the test pit operations and provide a field survey crew to physically locate the subject facility. A utility permit will be required from the Department of Public Works and Transportation for all test pit excavations in County roads. Test pits in State Highways require a SHA Utility Permit.

2. Horizontal Alignment - Location

The horizontal alignment shall take into account the following general alignment guidelines. Pipelines larger than 12 inches in diameter may have other limitations and requirements that alter these general alignment guidelines.

a. Extensions of distribution mains will normally be in a grid pattern with interconnecting nodes at street intersections. Water mains shall be extended along right-of-ways and roads the full length of the property to allow for future extension of abutting properties except in cases where the abutting property is outside of the service area (no planned service) according to the Comprehensive Water and Sewerage Plan.

b. In the layout of distribution mains, non-looped situations shall be avoided. All mains both internal to the project and external shall be continued to the nearest point of connection as directed by the Chief Engineer. Where temporary non-looped connections are appropriate, the main shall be terminated so as to facilitate connection or extension in the future with minimal inconvenience to the existing system and terminate with a hydrant to allow for flushing. In situations where non-looped mains cannot be reasonably avoided, the following criteria shall prevail:

1) The water distribution system for residential areas where fire protection is to be provided shall meet the following criteria.
   i. The maximum length of fire hydrant leads on a 6-inch main shall be 25 feet from the main.
   ii. The maximum length of non-looped 8-inch mains shall be limited to the length that will allow the required flow to all services and hydrants or 2,500 feet. However, if the Chief Engineer determines that the non-looped condition will exist for an unacceptable length of time (for example, a line extension that is dependent on future development which has not been initiated), the network must be extended to provide for immediate looping of the system or an alternate design prepared.
   iii. All easements shall be provided where required by the Chief Engineer for the looping of the public water system.

2) The water distribution mains for institutional, commercial and industrial areas where fire protection is to be provided shall meet the following criteria. The minimum size shall be 8-inch, except for fire hydrant leads less than 25 feet and service connections. The maximum lengths of non-looped 8-inch mains and non-looped 12-inch mains shall be 800 feet and 2,000 feet, respectively unless determined by the modeling to be less. The shortest length shall

govern. All easements shall be provided where required by the Chief Engineer for the looping of the public water system.

c. In existing developments where roads are paved, and without curbs, the water main is generally placed outside the edge of paving and inside the right-of-way line in a location having the least conflict with existing utilities. This alignment shall be on the high side of the street, or on the side opposite the one reserved for the sewer main. When existing underground utilities are in place such as gas, telephone, or electric, water mains are normally placed on the same side so as to preserve space for sewers clear of these obstructions.

d. The alignment within existing areas (streets or roads), shall avoid high traffic volume roads, if other options are available. The alignment shall be designed to allow the construction of the pipeline without the need to have road closings. When a water main is required to cross a St. Mary's County road, the Designer, after considering the type and condition of the road, traffic volumes, disruption to traffic, possible conflicts with existing utilities, and specific conditions on the project site, shall recommend whether to open cut, tunnel, directional drill, or jack and bore the utility across the roadway, on a case by case basis. The agency owning the roadway to be crossed shall make the final decision as to the method to be used and the approved method shall be noted on the plans by the Designer.

e. In existing areas (streets or roads) the alignment shall also try to avoid the removal of trees or landscaped areas. In parks and public rights-of-way where location of the water main would require removal of trees, the Designer shall obtain the approval of the appropriate agency or agencies for tree removal. When the pipeline must be located outside the road right-of-way, the alignment shall be located to minimize disruption to environmental features. In addition to trees, the alignment shall attempt to avoid steep slopes, wetlands and other sensitive areas. The alignment shall follow the property lines as much as possible.

f. When existing roadways are involved, the horizontal alignment of the road must be evaluated for acceptable geometry and the water main designed with respect to these possible roadway improvements to avoid costly relocations. The Designer shall evaluate the plan geometry of the road with respect to movement of traffic and available right-of-way width for the accommodation of the pipeline. If easements must be acquired for the main, a recommendation shall be provided to the Chief Engineer as to whether additional rights-of-way shall be acquired for future roadway modifications.

g. Water main easements are routinely acquired during the subdivision process for the future extensions of the water system to serve adjacent properties. Where the future extension of the water main would undermine a foundation of a structure, a water main shall be constructed as part of the subdivision. In residential subdivisions where an easement is required between two adjacent lots for the extension of the water system, a water main shall be provided within the easement between the adjacent lots. The water main shall extend the full length of the easement between the lots. A minimum distance of ten (10) feet must be maintained from all structures.

h. In cases where only a utility easement is required to be extended to the limits of the property being developed in order to provide future service to an adjacent property, that easement shall be cleared and otherwise prepared for the future extension of the main.

i. Where water and/or sewer mains leave the public road right-of-way, an all-weather access roadway is required.

j. Within private roads, public water mains shall be located within the paved roadway sections, whenever possible, and shall have a 5-foot minimum separation from other utilities.

k. In Developer Projects where all new facilities are to be constructed, and in existing developments with curbs, water mains are usually placed 7 feet from the centerline of the street and on the side nearest the higher ground. Mains shall be located within the pavement area, wherever possible, and no less than 5 feet from face of curb or proposed curb and shall have a 5-foot minimum separation from other utilities.

l. In Developer Projects, the design of the public water, sewer and storm drain utilities within proposed developments shall be prepared concurrently to ensure compatibility of the utilities. If public water and sewer mains cannot be located within the paved roadway section, the Designer shall request a waiver of the design standards and provide reasons why the standards can not be met.

3. Vertical Alignment - Location

The vertical alignment shall take into account the following general alignment guidelines:

a. The minimum ground cover required over a water main is 3’-6” and is measured from the outside top of pipe to the actual ground surface in existing developments. In new subdivisions, when grading and paving is

to be accomplished as part of the project, the cover is measured from the top of the pipe to finished grade.

b. When existing roadways are involved, the vertical alignment of the road must be evaluated for acceptable geometry and the main designed with respect to possible roadway improvements to avoid costly relocations. Acceptable geometry shall be determined by current roadway design standards. Where existing conditions are sub-standard, the Designer shall superimpose an improved grade on the profile and shall use this grade in the vertical positioning of the main where applicable. When a centerline road grade is thus established by the Designer, the main shall be designed to maintain the necessary cover below existing ground where fills are indicated and below the proposed grade where cuts are indicated. Plan and profile realignment must be considered in a coordinated manner. When the Designer establishes or uses a proposed centerline grade by others in connection with a water main design layout, the Designer shall identify the origin of this grade on the profile.

4. Sizing

Distribution mains shall be sized to provide the required design flow rate and residual pressures as identified and approved in the Engineering Report with a minimum size of 8-inches in diameter for mains with fire hydrants. Four-inch mains may be permitted in cul-de-sacs without hydrants with the approval of the Chief Engineer.

5. Cover

Minimum final ground cover over water mains shall be 3' - 6", except at crossings over other utilities where a minimum final cover of 3' - 0"shall be maintained. The maximum ground cover permitted over distribution mains is 8' – 0" unless approved by the Chief Engineer. In areas outside of existing or planned streets, cover shall be measured from existing grade. The Designer shall thoroughly investigate, and make suitable allowances for likely changes to existing topography. Such changes include future erosion of streambeds or grading of lots.

6. Clearances

   Sewer and water line clearances shall be as specified in Recommended Standards for Water Works (Ten State Standards). If not specified in the Ten States Standards a minimum of one-foot clearance from other utilities shall be maintained except for natural gas lines. A minimum of five-feet of clearance shall be maintained between water lines and natural gas lines. Water lines shall be above sewer and storm drain lines. If this requirement is not achievable then a full segment of water main pipe shall be centered directly under the crossing and the water main shall be encased in concrete 10 feet on either side of the crossing.

E. Water Mains: Plan

1. Water main plans shall be drawn to a minimum scale of 1" = 50'. The plan set shall include an overall plan view of the entire site showing the water and sewer layout.

2. All proposed pipe shall be shown and symbolized as shown in the legend.

3. All pipe sizes shall be clearly identified. The pipeline and appurtenances shall be carefully dimensioned in the plan view of the plans, so that the horizontal alignment is clearly identified and fixed. Fittings shall be shown by symbols and identified by appropriate notation. Appurtenances shall be called by symbols and notes and dimensioned in respect to pipeline stationing.

4. Water House Connections (WHC's) shall be shown in the plan view as a pipe from the main to the property line.

5. The horizontal (and vertical) alignment changes of water mains must be made to follow changes in street alignment or to pass safely over, under or around obstructions. These changes in alignment may be made by the insertions of bends, joint deflections or beveled end pipe. The degree of deflections at joints, the length of pipe sections and the radius of the centerline curve of the pipe must be noted on the plans.

6. The overall plan must show all current and future property lines, easements and water mains associated with the project or adjoining property.

F. Water Mains: Profile

1. Profiles for water main are drawn to accompany the plan and shall be shown below the applicable plan layout on each sheet. For Developer Projects, the complete layout of the piping system may be shown in the plan view drawings. Profiles shall then be shown on a separate sheet and cross-

referenced to the appropriate plan. For small Developer Projects, the profiles may be shown below the plan views on the same sheet.

2. Profiles shall be drawn to a minimum horizontal scale of 1" = 50' and a vertical scale of 1" = 5'.
3. Water mains and services should cross over sewer and stormdrain lines at crossings. If the water must cross under any sewer or stormdrain a full segment of water pipe shall be centered directly under the crossing and the water main shall be encased in concrete for 10 feet on either side of the crossing.
4. Pipe diameters and pipe type shall be called out.
5. Stations and invert elevations shall be provided on the water line profile at fittings and at all vertical and horizontal deflections.
6. Profiles within Proposed Roads:

   In developing the profile information for water pipelines in proposed roads, the proposed centerline grade and stations of the roadway are to be used as the reference line for both the horizontal and vertical plane. Stations along the street centerline are to be established in plan and these stations and corresponding elevations are to be transferred in true scale to the profile. Water main stations are projected in plan onto the centerline of the road and plotted in respect to this projection on the profile. Following this procedure means that the plan stations of the water main cannot be accurately scaled on the profile when there is any deviation from a tangent alignment in plan. Invert elevations are set to maintain no less than 3’-6” of pipe cover.

7. Profiles Within or Outside Existing Roads:

   In developing the profile information within or outside existing roads, the centerline length of the water main in plan shall be used for the profile stationing, which will provide true length profiles. For existing roads that do not conform to Department of Public Works and Transportation guidelines, a centerline road grade conforming to the design standards is to be shown on the profile and identified as “possible future centerline road grade.” On a combined water and sewer project, the sewer shall be projected onto the water pipeline centerline.

8. Changes in vertical alignment of water mains shall be achieved by fittings, joint deflections or beveled joints. When changes in alignment are made in the horizontal and vertical plane simultaneously, the degree of change in both planes shall be indicated. The total joint deflection shall not exceed 80% of the manufacturer’s maximum recommended deflection measured from the axis of the pipe.

9. For pipelines smaller than 24-inches in diameter, the pipeline profile may be shown with curves.

10. For pipelines 24 inches in diameter and larger, the pipeline shall be shown as a series of straight lines with deflections. The deflections shall be based on twenty (20) foot intervals with stations and invert elevations given at each deflection. When the pipeline is designed with no deflections, the stations and invert elevations shall be provided at fifty (50) foot intervals.

11. Utilities that cross water mains shall be plotted to horizontal and vertical scale and identified so as to advise the Contractor of their specific locations. Stations and invert elevations shall be provided at every pipeline crossing for each pipe shown. If the elevation of the existing pipeline to be crossed is unknown and it is likely to have a significant impact on the water main vertical alignment, the Designer shall arrange to have a test pit excavated to determine the exact horizontal and vertical location of the existing utility or utilities.

12. The type of fitting, the stationing of the fitting and the fitting invert elevation shall be shown on the profile if plan and profile are on separate sheets.

13. Vertical deflections required to facilitate crossing of irregularities in terrain, such as rivers, streams, ditches, swales, etc. and to maintain clearance at other underground obstructions, shall be detailed at a larger scale showing existing and/or proposed grade, horizontal station, and invert elevations at each vertical fitting and joint deflection point and shall be with the approval of the Chief Engineer.

14. Existing and proposed ground lines shall be shown where applicable as well as the source from which the information was acquired. The following information as minimum requirements shall be shown on the profile.

    a. Road names – when plan and profile are on separate sheets
    b. Existing ground elevation line
    c. Proposed ground elevation line

G. Pipeline Materials

1. Pipeline materials and installation practices employed by the Commission are based on providing the maximum service capability with the least costs of installation and maintenance. Pipelines have a prolonged service life when properly designed and installed. There are many factors which must be considered in the selection and employment of design principles to reduce or eliminate failure and resulting costly repairs.

2. In the interest of fair and open competition, the Designer shall make recommendations and prepare plans to permit the widest range of employment of different materials and appurtenances consistent with the principles of economy and performance. The Designer is responsible for recommending specific materials and appurtenances required to correct potentially detrimental effects due to adverse site conditions that would render some products unacceptable.

3. Allowable water pipe materials for routine projects are Ductile Iron Pipe (DIP), Prestressed Concrete Cylinder Pipe (PCCP), Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) and Copper Pipe meeting the requirements of the Standard Specifications. Generally, for pipelines smaller than 36", only DIP, PVC, HDPE and copper tubing are used in the public water system. Fittings for PVC shall be DIP. PCCP, in addition to DIP, will be considered for transmission mains. The following tabulation shows the types of pipe that may be employed within the range of sizes or uses noted:

TABLE 2.3 PIPE MATERIALS

Pipe Material (Abbreviation) (Specification)	Diameter (in)
Distribution & Transmission Mains	
Ductile Iron Pipe & Fittings (DIP) Class 52 (AWWA C-151, C-153, C-110)	4" and larger
HDPE w/ Copper wire (AWWA C906)	1¼ " – 10"
PVC w/ Copper wire (Class 150 AWWA C900) (PVC 1120 ASTM D2241)	4" -10" <4"
Service Lines – House Connections	
Copper Pipe (Federal Specification) (WW-T-Type K)	1¼ " through 2"
HDPE w/ Copper wire (AWWA C906)	1¼" through 3"
Ductile Iron Pipe & Fittings (DIP) (AWWA C-151, C-153)	4" through 12"
PVC w/ Copper wire (Class 150) (AWWA C900)	4" through 10"

Ductile iron pipe shall have a double standard thickness cement lining. Pipe materials other than those listed in the above table may be selected when specialized functions are to be satisfied. The use of alternate pipe materials must be approved by the Chief Engineer. When alternate pipe materials are to be used, the appropriate specifications shall be adhered to in the design.

4. HDPE mains shall be given a relaxation period of 24 hours.

5. The Designer shall indicate the pipe class designation in the General Notes on the plans and in the Special Provisions. Changes in the pipe class shall be shown with the limits defined on the pipeline profile. Selection of pipe class and wall thickness shall be as follows:

   a. Copper Tubing, Type K

      The copper tubing in the Standard Specifications is suitable for normal system pressures and earth cover.

   b. DIP

      The Standard Specifications use the "special" wall thickness classes of DIP (e.g. class 50, 51, etc.), given in AWWA C150. A special thickness class of 52 shall be used unless the Designer determines that an alternate special thickness class is required due to a special application (see below). The alternate must be calculated in accordance with the method given in AWWA Standard C150/ANSI A.21.50. The thickness of the selected class shall be equal to or greater than class 52, as the calculations require. In no case shall the pipe thickness be less than class 52. Pipe thickness, in combination with the pipe bedding, must be sufficient to resist excess deflection and bending stress, compensate for negative manufacturing tolerances and withstand internal operating and surge pressures.

      Calculations shall be performed conservatively, based on using a Type 1 Laying Condition as defined in AWWA C-150. Where field conditions are expected to be moderate, the unit weight of soil shall be 120 pounds per cubic foot (pcf) and the truck load shall be a single AASHTO H-20 truck on unpaved road or flexible pavement with a 1.5 impact factor. A trench/bedding detail shall be placed on the plans.

   c. DIP Wall Thickness for Special Applications

      The wall thickness of DIP for the following special applications is not covered by the Standard Specifications. Additional consideration/calculations are required as indicated above and Special Provisions shall be included to specify the appropriate pipe:

      1) Shallow cover, less than three feet six inches (3' – 6").
      2) Vehicular or equipment loading greater than AASHTO H-20 or HS-20 load configuration.
      3) Operating pressures greater than those normally encountered in the water distribution system.
      4) Excessive surge pressures. Pressures given in Table 2.3, "Maximum Permissible Surge Pressures," shall be considered excessive and should be avoided if possible:

H. Types of Joints

1. General

   Pipe joints shall be in accordance with the Standard Specifications.

2. Ductile Iron Pipe (DIP)

   a. Pipe joints shall be push-on bell, unless otherwise noted on the plans or the Standard Details.

      1) Allowable pipe joints for buried DIP shall be mechanical joint bell, plain end (for mechanical joint or push-on), push-on bell, or push-on bell with proprietary restrained joints as approved by the Chief Engineer.

      2) Buried flange joints are generally not allowed because of the rigidity of the joint; however, the use of buried insulated flanged joints is permissible for corrosion control on a case-by-case basis. This type of joint requires a minimum DIP special thickness class 53 DIP and the flanges are threaded and screwed on the pipe by the manufacturer. When the design requires insulating joints, a short piece of flanged pipe (flanged x plain end) shall be used. A detail for insulated joints shall be included on the plans.

   b. Joints for fittings shall be in accordance with the Standard Specifications and AWWA C153/C110. Allowable joint ends on fittings shall be mechanical joint bell, plain end (for mechanical joint or push-on), push-on bell or push-on bell with proprietary restrained joints as approved by the Chief Engineer.

   c. When laying out a pipeline alignment, the Designer shall design the pipeline using push-on joint pipe, with mechanical joint fittings.

   d. When the design requires special restrained joints, the Designer shall submit the design of joints used for restraining the pipeline for review by the Chief Engineer.

   e. All mechanical joints shall be secured by mega-lugs.

3. HDPE

   a. Pipe joints shall be fused in accordance with AWWA C900 and C905.

I. Fittings

1. General

    a. The employment of properly designed concrete thrust blocks (buttresses and anchors) at fittings is of great importance. Details of these buttresses and anchors are shown in the Standard Details and are to be employed in all cases compatible with the design conditions. Where field conditions will not permit the use of buttresses and anchors, restrained joints using tie rods or harnessing may be employed, as approved by the Chief Engineer.

2. Bends

    a. The water main alignment shall minimize the use of bends. The Designer shall try to align the pipeline by deflecting the pipe joints. Deflecting the joints on bends is not permitted, unless design calculations for restraining the bend for the additional joint deflections are submitted.

    b. Allowable bends are as follows: 1/8th or 45 degrees, 1/16th or 22.5 degrees and 1/32th or 11.25 degrees. 1/4th or 90 degree bends in the horizontal plane shall be used only upon approval. 1/4th or 90 degree bends are not permitted in the vertical plane.

    c. Bends designed to be rotated in both the horizontal and vertical plane require special pipe restraint. The Designer must submit design calculations to the Chief Engineer for review and approval.

3. Tees

    a. The connecting branch pipe must be perpendicular ninety degrees (90°) to the mainline pipe.

    b. The Designer shall use a tapping sleeve and valve (TS&V) when connecting to an existing main having more than ten (10) domestic services that would be placed out of service during the installation of a tee.

    c. No joint deflections are permitted at the branch connection of the tee.

    d. Tees that are designed to be rotated greater than five degrees (5°) in the vertical plane may require special pipe restraint.

4. Cross

    a. A cross is required for two perpendicular extensions, in close proximity, from the main pipeline. Tees shall not be used in lieu of crosses, unless the

connections are spaced far enough apart. If the design requires connections on both sides of the pipeline and a cross cannot be used, the spacing between the tees shall be a minimum of ten (10) feet apart.

b. A valve shall be installed on each branch, strapped to the cross. The branch connections of the cross must be extended a minimum of one full length of pipe on both sides of the cross, with the required standard thrust blocking on the ends. If a branch connection of a cross cannot be extended, the Designer shall utilize two tees, properly spaced, with valves strapped to the tees and the required standard thrust blocking.

c. If the alignment from the cross requires using a reducer on one side of the cross, the Designer shall provide special pipe restraints for any unbalanced forces due to the reducer.

5. Reducers

a. Reducers are required for reducing the pipeline size. The Designer shall avoid using reducers on short runs of pipe, if the cost of downsizing the pipeline, which includes the reducer, pipe restraints for reducer, house connection taps with saddles, etc., exceeds the cost of the larger diameter pipeline.

b. Reducers may require special pipe restraint for unbalanced forces.

c. When reducing the pipe size on 16-inch and larger diameter pipelines, the profile must be examined to determine if the reducer will create a high point at the large end of the reducer. This must be corrected with the use of an eccentric reducer.

6. Solid Sleeves and Mechanical Couplings

a. Generally, mechanical joint solid sleeves shall be used for burial conditions and mechanical couplings with tie rods shall be used in vaults and structures. Any sleeve 12” in diameter or greater shall have a ground penetrating radar test completed to locate any voids.

J. Connections

1. General

Where connections to existing mains are to be made, the Chief Engineer will determine during the preliminary review whether the main shall remain in service necessitating the use of a TS&V or whether a specific shut down period can be accommodated for making the connections.

2. Tapping Sleeve and Valve (TS&V)

In general, a TS&V will be used for connections 8-inches and larger in diameter, if the existing line serves more than 10 dwellings. The main being tapped must be at least one pipe size larger than the branch main. If the branch main is the same size as the main line, then a tee shall be cut into the main line. The as-built plans and contract files shall be checked to ascertain the existing pipe class or thickness to design the appropriate compatible tapping sleeve and gasket. If the class or thickness of the existing pipeline cannot be identified, the Contractor shall be required to test pit the pipeline to determine the pipe outside diameter.. The location of the tapping sleeve on DIP shall be designed so that the centerline of the connecting pipeline is a minimum of five (5) feet from the face of any existing bell joints. TS&V's shall be restrained or blocked in the same manner as a tee.

K. Relocation of Water Pipelines – Capital Projects

1. General

When designing the relocation of a water main, the Designer shall consider such matters as environmental impact, maintenance of pedestrian and vehicular traffic, maintenance of existing and proposed utility services, constructability and system maintenance. In addition to the following, the design shall follow the requirements for water pipelines as stated elsewhere in this manual.

2. Alignment - Horizontal and Vertical

a. When selecting an alignment, the existing pipeline and services must be maintained and stay in service until the relocated pipeline is ready for final connection to the existing main. The final connection must be designed to allow a quick shutdown and transfer of services, so that water service is not disrupted for an extended period.

b. The relocated pipeline shall have a minimum ten (10) feet, centerline to centerline, horizontal clearance from the existing main, if the existing main is to remain in service during construction of the new main.

c. The relocated pipeline shall have a minimum one (1) foot vertical clearance between the existing pipeline that will be abandoned by the relocation.

d. The relocated alignment shall not disturb the existing blocking/restraints on the existing pipeline that is in service. Pipe restraints shall be designed for the relocated pipeline. If the shutdown time is limited, the design will require a quick-type blocking for restraining the relocated pipeline.

e. The design of the relocated pipeline must provide for continuous service until the relocated pipeline is placed in service. At that time all tie-ins and transfer of WHCs between the existing temporary bypass pipeline and the relocated pipeline shall be made.

f. The Designer must contact the Chief Engineer for limitations on shutdowns of the existing pipeline. Conceptual approval from the Chief Engineer must be obtained if the Designer determines the existing pipeline must be replaced in the same location/alignment, which may require an extended shutdown period or provisions for temporary service.

g. Abandonment of the existing pipeline, structures and/or appurtenances shall be shown on the plans, indicating the limits of abandonment and description of the facility to be abandoned and the method of abandonment.

h. When large portions of the service area will be affected by the relocation or when service will be interrupted for extended periods, the Chief Engineer may require the use of linestops to reduce or eliminate the disruption time.

2.3 Appurtenances

A. General

There are numerous appurtenances incorporated in pipelines to ensure satisfactory and trouble-free performance and to provide a measure of control when emergency conditions prevail.

B. Valves

1. The placement of valves in a water distribution system at strategic locations is foremost in the control of the system. It is the responsibility of the Designer to ensure that the valves are located so that minimal disruption of water service will occur during maintenance, emergency conditions and future extension work.

2. Valves shall be provided at the intersection of water mains. A valve shall be placed on the outlet side of any cross or any tee. In a grid network, normally the number of valves will be the same as the number of pipes at the

intersection. Where there are one or more dead ends, a valve on each pipe at an intersection shall be provided.

A sufficient number of valves shall be installed so that a break or other failure will not affect more than one-quarter of a mile (1/4 mile) of arterial mains, five hundred feet (500') of mains in commercial districts, or eight hundred feet (800') of mains in other districts.

3. For high traffic volume intersections, to avoid disturbance to traffic flow and for ease of operation, valves shall be located outside the intersection on the projection of the street right-of-way line. The exception to this is where a branch main is considerably smaller, 4-inches or more than the major main, in which case the branch valve is placed as close as possible to the larger main and strapped. When a branch pipeline is not extended or stops at the road right-of-way line, the valve shall be located at the connection to the mainline pipeline. Valves on mains located in places other than street intersections are to be placed near fire hydrants for ease of location by field personnel.

4. Water valves shall be mechanical joint.

5. Valves shall be provided on mains between intersections and on dead end mains as noted below:

Main Size	Maximum Valve Spacing
6"to 12" (Residential Use)	800 feet
8" to 12" (Residential Land Use)	1,000 feet
8" to 12" (Other Land Use)	1,200 feet
14" to 16" (with WHCs)	1,200 feet
14" to 16" (no WHCs)	2,000 feet
Over 16"	3,000 feet

On dead end mains for which no extension will be made in the future (cul-de-sacs), valves shall be provided after the last fire hydrant (except when the fire hydrant is within 200 feet of the end of the water main).

6. When the existing system requires a number of domestic services to be shut down during the installation of a connection, an additional valve shall be installed next to the connection on the mainline pipeline to reduce the number of domestic services placed out of water during any future shutdown.

7. All valves 4-inches to 24-inches in diameter shall be resilient seated gate valves and comply with the Standard Specifications. Valves larger than 16-inches in diameter may be direct buried butterfly valves where the depth of

cover precludes the use of vertically installed gate valves. All butterfly valves shall conform to AWWA C504.

8. Valve stem extensions are required when the top of the valve's operating nut exceeds three and one half (3 ½) feet of cover. The Designer shall provide a note on the drawings that valve stem extensions shall be provided.

9. The pipeline vertical alignment at the valve shall be designed as nearly parallel with the road grade as possible so that the valve may be installed upright and perpendicular to the road grade. The adjusted vertical alignment at the valve shall be shown on the profile. When a valve is to be located on a pipeline that is not level, the Designer shall check the pipe slope and depth of the valve to verify that the buried valves will be operable.

C. Valve Vaults

1. Valve vaults are required on a case-by-case basis.

2. During the preliminary design, the Designer shall submit the vault layout for approval by the Chief Engineer.

3. All piping within the vault shall have flanged joints.

4. A mechanical coupling or mechanical joint solid sleeve shall be included in the vault piping, for the removal of the valve, pipe, and fittings within the vault. A mechanical coupling requires special pipe restraints. A mechanical joint solid sleeve requires the joints to be restrained, using Megalugs or retainer glands. The Designer shall determine the appropriate form of restraint based on the pressure rating requirements for each type of restraining joint.

5. The inside dimension of the vaults shall be determined by the dimensions of the piping assembly (valves, pipes, and fittings) that is required in the vault.

6. On the profile, the Designer must determine the invert of the pipeline using the design depth shown on the details for the valve vaults.

7. The valve shall be restrained in the closed position.

D. Fire Hydrants

1. The Commission has adopted standard details for fire hydrant installation. These requirements are shown in the Standard Details and include the size of hydrant, valve, and lead, location of the hydrant with respect to the edge of the curb or road, valve location, bury length and joint restraint.

2. Normally, hydrants placed within developed sites are part of the public system; however, in certain instances, hydrants become part of the internal fire protection system and require specific arrangements and/or agreements with the Commission.

3. All hydrant barrels shall be a minimum of five and one quarter (5 1/4) inches in diameter and the connection (lead) from the main to the hydrant and the valve shall be six (6) inches in diameter. Six-inch fire hydrant leads shall be no more than twenty-five feet (25') in length unless otherwise approved by the Chief Engineer.

4. No services are to be tapped from the fire hydrant lead.

5. Hydrants shall be located three (3) feet behind the back of the curb or two (2) feet behind the sidewalk on curbed streets. Hydrants shall be located within twelve (12) feet of the limit of stabilized shoulder or pavement of open section roads. Where the location behind the sidewalk or on an open section road places the hydrant less than five (5) feet from the road right-of-way/property line, the Designer shall obtain a utility easement from the property owner.

6. Hydrant valves shall be located next to the tee on all fire hydrant leads.

7. The bury length required for each fire and blow-off hydrant shall be noted on the plans. The bury length shall be determined by the vertical distance from the applicable existing or proposed grade at the hydrant to the invert of the branch of the tee in the main line. The accuracy of this length is to be given to the nearest half (0.50) of a foot. The main line tee elevation shall be designed to provide for a level run from the main to the hydrant and maintain adequate cover over the hydrant lead. For this reason, the minimum bury length is four (4) feet. The maximum bury length is eight (8) feet and additional length will require the Chief Engineer's approval. The invert elevation and station of the hydrant tee on the main line shall be noted on the profile. The bury line elevation and bury length of the hydrant shall be noted in the plan view. For installation on existing grades, bury lengths shall be determined from field surveys.

8. Profiles will be required in the following cases:

    a. When the fire hydrant lead crosses other utilities, except when it is clear from the profile of the water main that the hydrant lead has sufficient clearance.

    b. When the grade/ground line at the hydrant location and over the hydrant lead is not the same as the mainline pipe.

c. Fire hydrant leads should not have bends, offsets, etc. between the fire hydrant tee and the fire hydrant if at all possible.

9. Where bends are required for fire hydrant leads, the Designer shall use smooth transition, restrained, s-bends specifically designed for hydrant use.

10. Hydrants shall be restrained at every joint with mechanical joint restraints from the tee through to the hydrant or by a combination of mechanical joint restraints, ¾-inch threaded steel bars, and concrete buttresses.

11. Hydrants shall be located along roadways with a spacing of 450 feet in one and two-family dwelling unit areas and a hydrant spacing of 300 feet in all other areas. Hydrant spacing is measured along the water main. Hydrants may be required to be located at closer intervals if the existing or proposed buildings are located at a distance greater than normal from the roadway.

12. A fire hydrant shall be located at the neck of all cul-de-sacs or tee turnarounds where the water main terminates within the roadway. When planning fire hydrant placement, the Designer shall first position a fire hydrant at the neck of each cul-de-sac having a terminating water line; and then, measure the required distance for the next fire hydrant placement. As always, fire hydrants shall be located at intersections whenever possible. In many cases, it will be necessary to place a fire hydrant at both the neck of the cul-de-sac and at a nearby intersection, even if the distance between the two fire hydrants is closer than the required spacing.

13. Fire hydrants must be carefully placed to prevent interference with pedestrian and vehicular movement and to be accessible to Fire Department vehicles. Hydrants are usually located at the point of curvature of curbs at intersections and at common property lines, clear of driveway entrances.

14. Fire hydrants, if not placed behind a protective curb, shall be protected by bollards in areas such as parking lots, where they are exposed to damage by vehicular traffic.

E. Blow-off Connections

1. Flush type hydrants, for use as a blow-off for maintenance activities, flushing and periodic removal of accumulated sediments shall be installed at the lowest elevation point of a water main system. They shall also be placed at the end of all dead-end mains that do not have a fire hydrant. A witness post shall be located near all blow-off connections.

2. Fire hydrants may be utilized for permanent blow-offs when the location requirements for both types of hydrants are accommodated. If a fire hydrant

is used in lieu of a blow-off, the hydrant lead must be set within two feet of the end of the water main.

3. If possible, the blow-off shall be located as close as possible to an existing/proposed sanitary sewer manhole to allow for the disposal of the chlorinated water into the manhole. Under no conditions can the blow-off discharge piping be connected directly to a storm drain pipe or sanitary sewer pipe and/or any type of storm drain or sanitary sewer structure (inlet, manhole, etc.).

F. Air Valves

1. General

   a. Under normal operating pressures within the distribution system encountered in St. Mary's County, very little air is expected to accumulate.

      Fire hydrants set at summits can be manually operated to release or admit air under filling or emptying conditions. Furthermore, since the collapse of water lines from negative pressures resulting from draining or a main break is normally not a factor with the type of pipe ordinarily employed, air vacuum valves may not be required under ordinary conditions in the distribution system.

   b. Air release valves and air vacuum valves are two basic types of air valves that are utilized to prevent or reduce the occurrence of air pockets and vacuum conditions, respectively, within pipelines. The two types of valves can be joined together to form a combination air valve that performs the functions of both. Air release valves contain a small discharge orifice (1/2 inch or less) that allows the escape of accumulated air under normal pipeline operating conditions. Air vacuum valves contain a large discharge orifice (1/2 inch or larger) that allows the escape of large quantities of air during line filling and permits air to enter during line draining, with relatively small pressure differentials across the valves.

   c. Air valves shall be stainless steel as noted in the specifications.

2. Connecting the air release valve, air vacuum valves or combination air release and vacuum valve to the main pipeline shall be as follows:

   a. For a valve with a 2-inch inlet or smaller, use a tapped corporation stop.

b. The air release valve or combination air release and vacuum valve shall be centered on a twenty (20) foot length of pipe, with both ends of the pipe section having the same elevation.

3. For air valve manhole and valve construction, details see the Standard Details. The following shall be shown on the plans for air valves: the size of valve and orifice size. The following shall be shown on the plans for combination air release and air vacuum valves:

   a. Size of both valves
   b. Orifice size of the air release valve
   c. Model numbers
   d. Piping layout
   e. Pressure rating of the gate valve which shall be provided between the air vacuum valve and the air release valve.

   The water main and manhole shall be designed at sufficient depth to accommodate access and maintenance of the air release, air vacuum or combination air release and air vacuum valve.

G. Specialty Valves

1. Water zone division valves shall be provided when directed by the Chief Engineer. The following information shall be provided on the drawings:

   a. Label the valve as a division valve and indicate size.
   b. Show the pressure zone lines and indicate the zone pressure on each side of the valve.
   c. Indicate if the valve shall be normally closed or open.

2. Altitude Valves

   a. Altitude valves are designed for installation at water storage facilities (elevated tanks, standpipes or reservoirs) to control the water level at a specified level and prevent overflow.

   b. The Chief Engineer shall determine the need for and the type of altitude valve required for a facility. The Designer shall design a vault to house the valve and appurtenances and shall locate the vault outside of a traffic area. The vault shall contain a watertight, H-20 load sustaining, equipment access hatch designed directly over the center of the altitude valve, large enough to permit the removal of the valve. A watertight, H-20 load sustaining, personnel access hatch shall also be provided, with a minimum 36" by 36" opening.

c. Gate valves shall be provided on each side of the altitude valve for maintenance or removal of the altitude valve. A bypass shall also be provided around the altitude valve with a gate valve, which will normally be closed in service.

3. Pressure Reducing Valves (PRV)

a. A pressure reducing valve shall be designed whenever a water pipeline of high working pressure needs to be reduced to lower working pressure. The Commission utilizes individual PRV's and system PRV's. Individual PRV's are designed to reduce the incoming pressure on a single WHC for a single property. System PRV's are publicly owned and operated and are designed to reduce the pressure within the public water system. The Designer shall determine if the project requires installation of individual PRV's or the installation of a system PRV and vault.

b. Individual PRV's

The St. Mary's County Plumbing and Gas Code require the installation of an individual PRV and an approved relief device after the meter when the static pressure is over eighty-five (85) psi. The Designer shall identify on the plans, all lots where the static pressure will exceed eighty-five (85) psi. The location of the PRV shall be in the service line after its entrance to the building.

c. System PRVs

Under normal operating pressures within the distribution system in St. Mary's County, system PRV's are not needed. If a system PRV is required, the Designer shall determine the appropriate location for the PRV and submit the hydraulic analysis and proposed PRV location to the Chief Engineer for approval. After approval, the Designer shall determine the required sizes, type and pressure setting for the PRV.

For system PRV's, two PRV's are installed, one to handle peak fire flows and the other to handle low flows. Usually, the smaller PRV is adjusted for a discharge pressure setting of five (5) psi above the setting of the larger PRV so that the smaller PRV will handle the low flow requirements. The large PRV opens only when demands exceed the capacity of the smaller PRV and the pressure drops to the pressure setting of the large PRV.

A vault shall be designed to house the system PRV and appurtenances. An equipment access opening of sufficient size shall be designed directly over the center of the PRV. Where two PRV's are required, the hatch shall be

placed over the larger of the two PRV's. A personnel access hatch shall be provided with a 36-inch by 36-inch opening. The hatches shall be designed as watertight hatches and capable of sustaining an H20 load.

Gate valves shall be provided on each side of the PRV, for maintenance or removal of the PRV. Typically, the PRV is located on a branch line off of the primary water main between two tee connections. The branch from the first tee extends through the PRV vault and back to the second tee connection at the primary main. A divisional (gate) valve, normally closed, is installed between the two tee connections on the primary main, which act as a bypass line to the PRV and vault.

Three (3) inch and larger PRV's shall have flanged ends and the pressure rating shall be designed similar to gate valves, class 125 ANSI valves. PRV's, smaller than 3-inches, shall have threaded ends (National Pipe Threads). The setting information for the PRV's shall be noted on the plans.

In most cases, when PRV's are required, the installation of a pressure relief valve will also be required.

4. Pressure Relief Valves

   a. Pressure relief valves are designed to protect the water pipeline against excessive pressure and shall be used in conditions where the water pipeline has a pressure reducing valve connection from a higher pressure zone. The Chief Engineer will notify the Designer if the project requires the installation of a pressure relief valve and vault.

   b. A vault shall be designed to house the valve and appurtenances with hatches for equipment and personnel. The vault shall be similar to that required for the pressure reducing valve.

   c. An isolation gate valve shall be installed on the pressure side of the pressure relief valve at the branch connection to the mainline water pipe. The discharge of the pressure relief valve shall be designed to discharge to the atmosphere. The discharge piping shall not connect directly into a storm drain inlet, manhole or structure. The discharge end of the pipe shall have a flap valve to eliminate any potential cross-connection condition. Provide an end wall for the discharge piping in the location of the flap valve.

   d. The pressure setting information for the pressure relief valves shall be noted on the plans.

5. Post Indicator Valve (PIV)

    a. Post Indicator Valves are above ground extensions for Fire Department use and are required on all commercial, industrial, and multi-family sprinkler systems. The PIV shall be located at least 25 feet from the building in a grassed area.

H. Tunnels and Casing Sleeves

1. Water mains are placed in tunnels or casing sleeves under railroads and highways or in other locations where open cut excavation is not allowed or is excessive in cost.

2. Steel liner plates shall be hot dipped galvanized and coated with bitumastic material according to the Standard Specifications. Steel casing sleeves shall be lined with bitumastic material, on the inside only, according to the Standard Specifications.

3. HDPE casings may be used with the approval of the State Highway Administration.

4. The ends of casing sleeves shall be bulkheaded to prevent the entry of foreign objects. The water main included within the casing or tunnel shall be anchored and designed for all internal and external forces, which can be transmitted without consideration of the casing pipe. The water main within the casing shall have restrained joints. The annular space between the casing pipe and the water main shall be filled with sand. Joints in the main shall be placed immediately outside the bulkhead to allow flexibility and to relieve shear stresses on the pipe.

5. Grouting plugs shall be provided in tunnel liners and steel casing sleeves 36 inches in diameter and larger, to facilitate pressure grouting of the annular space outside of the tunnel.

6. Water mains under state roads shall be installed in a sleeve as required by the State Highway Administration.

I. Horizontal Directional Drilling

1. Horizontal directional drilling (HDD) may be required to be used to minimize traffic disruption, restoration or as a requirement of an approving agency.

2. The contractor must perform subsurface investigations to determine the applicability of HDD and to determine groundwater depths.

2.4 Water House Connections

A. General

Water house connections (WHC's) provide the connections from the distribution main to the consumer's system at a convenient point along the property line. Small WHC's extend from the main to the property line using flexible pipe, terminating with a valve at the property line. All services are metered and the current practice for the Commission on new services is to place meters at the property line for single family homes; individual meters for each townhome and condo unit shall be placed in a meter room; a meter for each multi-family apartment building shall be placed in a meter room; and in a mechanical room for commercial property. Except for the meters, the Commission's construction work, as well as its liability for the WHC, stops at the property line.

B. Single Family Residences

1. WHCs shall be shown in the plan view as a pipe off of the mainline pipe to the front property line of the dwelling or building and shall be within the roadway right-of-way. Occasionally, water mains may be constructed within public easements abutting or extending through a property. WHCs may be provided to properties abutting the public easement in which the water main is constructed. In this case, the public WHC extends from the water main to the edge of the public easement.

2. The location for a single WHC is generally at the center of the lot frontage unless the existing well location permits a more accurate setting, and must be a minimum of 10 feet from the location selected for the sewer house connection. If possible, the WHCs shall be no closer than ten (10) feet to the edge of the side property lines. The water service connection shall originate at the water main with the installation of an appropriate saddle, corporation stop, one and one-quarter-inch (1¼"), or larger, (size will vary based on sprinkler requirements) Type K copper tubing and the in-ground meter installation (at the property line). The in-ground meter installation shall consist of a Ford coppersetter with angle ball valve, angle dual check valve, pit setter and frame, and cover.

3. All adjacent improved lots which are not a part of the proposed development but which could be served by the water main shall be provided with an appropriately sized service connection. The location of each service connection shall be clearly shown on the engineering plans.

4. All WHCs shall be designed a minimum 5' - 0" clear horizontally from permanent structures and other utility appurtenances such as storm drain

inlets, street lighting poles, transformers, etc. and adjacent parallel piping, with the exception of SHCs.

5. All water meters shall be encased in concrete when located within 3 feet of a paved driveway.

C. Multi-family, Commercial and Industrial Facilities

1. The size of the WHC is based on the usage requirements of each building as determined by the Designer. The St. Mary's County Plumbing and Gasfitting Code shall be used for estimating demands.

2. The Designer shall submit computations to justify the sizing of the WHC. Automatic sprinkler systems shall be installed in all buildings in accordance with LUGM requirements and shall be in accordance with the plumbing code. Sprinkler lead design and construction shall be in accordance with NFPA 13 and NFPA 13R. Dual one-way check valves shall be placed in the sprinkler leads so that under no circumstance can water from the building sprinkler system piping reverse flow into the domestic service pipelines.

3. WHCs or service connections for on-site water systems (3-inch and larger) must be located based on the design of the on-site system. The design of the connection will be typical of a small diameter water pipeline and shall be based on the design requirements for water pipelines.

4. Where large meters (1 1/2-inch to 12-inches in size) are required, the Designer will be required to submit the flow calculations to substantiate the meter sizing to the Chief Engineer.

5. WHCs or service connections to accommodate fire flows require a special design for each installation. Approved backflow preventers with metered bypass or compound meters are required when fire flows are included in the WHC. Compound meters are employed when design flow rates to a building, or groups of buildings, are high enough to require their installation to obtain accurate meter readings under all flow rates.

D. Limits of Public Water House Connections (in Public Rights-of-Way)

1. WHCs 2-inch and smaller

    a. The WHC for inside meter settings shall terminate at the property line with a curb stop and a two-foot stub. The curb stop must not be located within a curb or gutter section, and it must be located in a public easement

or right-of-way. The Designer shall avoid locating the curb stop within a sidewalk, driveway or any other paved surfaces.

b. On rural roads, when the right-of-way limit ends at the edge of the paving or at the curb or gutter lines, the Designer will be required to provide the Commission with a right-of-way or easement for the WHC.

c. The WHC for outside meter settings shall terminate within the roadway right of way at the location shown in the Standard Details with an outside meter vault containing all internal piping and a two-foot stub.

d. On private roads, water easements shall be sufficiently wide to accommodate curb stops outside the paved area and within the public easement.

2. WHCs 4-inch and larger

a. The WHC for inside meter settings shall terminate within the roadway right-of-way or public easement at the location shown and in the manner illustrated in Standard Details.

b. The WHC for outside meter settings shall terminate within the roadway right-of-way or public easement at the location shown in the Standard Details with a pre-cast or cast-in-place concrete vault with all internal piping (see Standard Details for piping layout and vault dimensions).

E. Location of Meters

Any water meter located within 3 feet of any traffic-bearing surface shall be encased with concrete. Please refer to the detail for more information.

1. WHCs 2-inch and smaller

a. WHCs 2" and smaller shall be designed to accommodate outside meter settings unless otherwise specified by the Chief Engineer during the preliminary design phase. The Designer must obtain approval from the Chief Engineer for any or all outside meter settings that are not specified by the Commission.

b. The Designer shall avoid locating the outside meter setting within driveways or other paved surfaces whenever possible. The preferred location of the outside meter setting is in a grass area within the road right-of-way and outside of traffic bearing areas.

c. Provide a minimum 5' - 0" horizontal clearance between meter setting and all permanent structures such as storm drain inlets, street light poles, other utility appurtenances and pipelines.

d. Properties with private on-site water house connections longer than 200 feet shall require an outside meter vault located at the property line.

2. WHCs 4-inch and larger

a. During the preliminary design phase, the Designer shall coordinate the location of the meter with the Chief Engineer (Inside or outside the dwelling/building). Also, see the requirements for large water meters in the St. Mary's County Plumbing and Gas Code.

3. All meters larger than 5/8-inch x ¾-inch must be purchased by the owner from a Commission-approved vendor.

F. Allowable Pipe Material for WHCs (See Table 2.3 Pipe Materials)

1. For WHCs 2-inch and smaller, the pipe material shall be copper or PVC with tracer wire.

2. For WHCs 4-inch and larger, the pipe material shall be DIP or PVC copper tracer wire.

G. Cover

The normal minimum cover over WHC's shall be 3'-6" except at crossings over other utilities, where a minimum cover of 3'-0" shall be maintained. The maximum ground cover permitted over WHCs is 6'-0."

END OF CHAPTER 2

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CHAPTER 3

WATER PUMPING STATIONS, WELL HOUSES AND WATER TOWER DESIGN

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CHAPTER 3

WATER PUMPING STATIONS, WELL HOUSES AND WATER TOWER DESIGN

3.1 Introduction

This Chapter includes the criteria and guidelines for designing water pumping stations, well houses and water towers in St. Mary's County. All new water pump stations, well houses and water towers shall incorporate GREEN technology when possible.

To the extent practical, designs shall conform to the design standards given herein as well as the latest publication of the "Recommended Standards for Water Works" (Ten-State Standards). The design standards shall be applied to design conditions in a careful and thoughtful fashion. Deviations from the design standards must be brought to the attention of the Chief Engineer. Requests for waivers of either the design manual or Ten-State Standards must be justified to the Chief Engineer, in writing, from an engineering evaluation standpoint and include consideration of life cycle costs and ease of maintenance. Approval or denial of the waiver request will be by return letter signed by the Chief Engineer.

3.2 Regulations

Water pumping stations shall comply with all relevant guidelines issued by the Maryland Department of the Environment (MDE). Buildings shall comply with applicable International Building Code (IBC) and St. Mary's County building codes as well as permitting requirements of the St. Mary's County Department of Land Use and Growth Management. Other regulations governing facilities and construction shall be adhered to, including regulations published by the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), National Electric Code (NEC), Maryland Plumbing Code and others as applicable.

3.3 Permits and Approvals

See Chapter 1 in this manual for applicable permit requirements. In addition, for any above ground structure, the Designer shall make all applications for and obtain the required building and grading permits prior to bidding of the project.

3.4 Design Phases

A. Engineering Report

The Engineering Report shall include the description of design criteria to be utilized, preliminary flow computations, design calculations, calculated system curves, surge protection analysis/recommendation, identification of land acquisition and easement requirements, number of property owners involved,

listing of permit requirements, and cost estimate based on unit costs for major elements of work. In addition, the following design criteria shall be developed:

1. Site Development (identify any conflicts with county agency requirements, identify conditions and requirements necessary for development).

2. Conflicts with Existing Utilities.

3. Structural Design.

4. Architectural Design (evaluate compatibility with surrounding community).

5. Complete Hydraulic Analysis (Pump and system curves, design conditions, operating scenarios). The analysis shall include 24 and 48 hour extended period simulations of the water distribution system performance using average day demand, maximum day demand and peak hour demand for both current and full development, including fire flow.

6. Pump Selection (type of pumps, number of pumps, size of pumps for initial and ultimate design conditions).

7. Pump Controls (constant or variable speed controls, on/off controls, telemetering, etc.).

8. Power Requirements (availability, cost to provide service, etc.).

9. Corrosion Control.

10. Noise Control.

11. Secondary Power Supply.

12. Construction Timeline.

13. Once the Engineering Report has been approved by the Chief Engineer, design of the facilities may proceed. Milestone submittals of design plans and specifications shall be made at 30%, 60%, 95% and Final Design.

B. Design Plans & Specifications

At a minimum, the following information shall be supplied at the milestone submittals:

30% Submittal: Site Plan, Design Schematics (showing station layout and major equipment), Specification Table of Contents

60% Submittal: Complete civil, mechanical and structural design plans and preliminary technical specifications

95% Submittal: Complete design for all disciplines including electrical and architectural plans and details. Complete specifications including front end documentation. This phase should represent complete, bid-ready contract documents from the Designer.

Final Design: The 95% Submittal with the Chief Engineer's final comments incorporated.

C. Cost Estimate

At each formal submittal and at the conclusion of the design process, the Designer shall prepare a detailed cost estimate for the pumping station. This estimate shall be developed for each major category of work including civil, mechanical, electrical, structural, architectural work and contingent cost.

3.5 Hydraulic Computations

A. Planning Period

Water pumping station design conditions shall, at minimum, accommodate a 20-year planning horizon. For all pumping stations, consideration shall be given to future upgrading flexibility necessary to accommodate design conditions beyond the normal planning horizon. This is especially important for larger stations.

B. Maximum and Average Day Demands

Water pumping stations shall be designed to pump the flow at the pressure determined by house count and non-domestic user inventory with allowances made for remaining undeveloped areas. Population densities and per capita demands shall be as established by facility plans or in their absence, in agreement with the Chief Engineer. Institutional, commercial and industrial demands shall be determined by a study of the establishment. The Chief Engineer shall be consulted for future domestic and non-domestic land use and population densities. A service area map and tabulation of the design flow shall appear on the plans. The map and tabulations shall show initial and ultimate service areas.

C. Hydraulic Analysis

Water pumping stations must satisfy the hydraulic conditions of the system. A complete hydraulic analysis of each water pumping station is required. During the study phase, the Designer shall consult with the Chief Engineer for the requirements of the hydraulic analysis. At a minimum, the Designer shall perform 24 and 48 hour extended period computer simulations using average day demand, maximum day demand and peak hour demand for both current and full development conditions. Fire flows shall be analyzed during maximum day rate for both initial and full development conditions.

The hourly demand ratios used in the 24 and 48 hour extended period simulations for average day demand and maximum day demand shall be based on actual MetCom average day demand and maximum day demand records, or as directed by the Chief Engineer. Hourly demand ratios shall be calculated by dividing each hour's water demand by that day's average hourly water demand. The highest hourly ratio experienced during the maximum day demand is the peak hour demand ratio for that water pressure zone. The hourly demand ratios may differ between water pressure zones. During the extended period simulations, all water pressure zones shall be connected to allow modeling of pumping station suction pressures and storage tank refill rates. Fire flows shall be modeled as a single event assuming a maximum day demand ratio of 1.0 and a 2-hour fire event at the flow rates listed in Table 2.1 with all water storage facilities assumed empty for an isolated or stand-alone system.

The hydraulic analysis shall be presented in a clear, logical and easy to understand format and shall relate to the proposed construction drawings. If construction drawings are not available at the time of the analysis then to scale drawings shall be prepared with street names to locate the proposed system.

D. Design Flow Rate and Pressure

The design flow and pressure for water pumping stations shall meet the following requirements during the 24 and 48-hour extended period computer simulations:

Maximum Day Demand:	35 psi minimum at curb
Peak Hour Demand:	35 psi minimum at curb
Maximum Day Rate + Fire Flow Rate:	35 psi minimum at curb

E. Pump and System Curves

The Designer shall show pump and system curves on the plans to scale. System curve characteristics for each design condition shall be determined by the Hazen-

Williams formula for piping head loss in conjunction with the MetCom water model.

The pump selection shall be reviewed for both the initial and maximum design year conditions.

The following pump and system curves shall be shown on the plans:

1. System Curve for Maximum Day Demand for the design year.

2. System Curve for Average Day Demand for the design year.

3. System Curve for Average Day Demand for the initial year of station operation.

4. Pump Curve for single pump operation and multiple pump operation where station has three or more pumps.

In addition, the Designer shall list next to the curves the pump design criteria including pump motor horsepower, efficiency, NPSHR at design points and RPM. Pump and system curves shall be shown for new water main conditions.

F. Number of Pumps

Water pumping stations shall be capable of pumping the maximum day demand with the largest single pump out of service.

G. Pump Selection Criteria

Avoid applications where pumps must operate in an adverse area of their performance curve. Design for maximum efficiency at the operating point. Examples would be pumps operating at very low flows and high heads, near shutoff heads or "runout" conditions. These conditions can result in excessive hydraulic loading or cavitation damage to impellers, casings and shafts, rapid bearing and mechanical seal wear and high vibration. Under no circumstances shall a pump be specified operating outside of its recommended range.

H. Variable Frequency Drives (VFDs)

VFDs or other methods approved by the Chief Engineer may be used to achieve minimum flow conditions below the full speed operating range of the pumps.

I. Water Hammer

The potential impact of water hammer shall be evaluated. If the combined effects of static head and water hammer do not exceed the weakest piping system component working pressure by a safety factor of 1.1, no special provisions need to be included to control water hammer. Where the maximum water hammer pressure exceeds the weakest piping system component working pressure by a safety factor of 1.1, the Designer shall strengthen those elements affected, re-evaluate pipe size and velocities or select an appropriate device to control water hammer. Hydraulically operated, time adjustable pump check service valves and spring type, oil-cushioned elbow hydraulic surge relief valves are the preferred choices of the Commission for controlling the effects of water hammer. No pressure vessel/surge tank type devices will be acceptable. The decision to strengthen piping system components instead of utilizing a water hammer control device or different pipe size shall be based upon a life cycle cost economic comparison.

3.6 Design Criteria for Water Pumping Stations

All water pumping stations shall be of the type in which the structures are formed and poured on site (cast-in-place concrete construction) with a masonry superstructure or pre-cast structure. The pumps, piping, controls, and electrical gear shall be housed in a single building. The emergency generator may be included or under separate nearby cover.

Water pumping stations shall be designed as long-term (greater than 20 years) facilities and shall include room for anticipated expansion. Where available, the electric power provided shall be 240 volts and 3 phase but as a minimum shall be 208 volts and 3 phase.

Designers are encouraged to utilize energy and maintenance saving materials including, but not limited to, skylights, low or no-maintenance landscaping.

A. Site Design

1. Location: Water pumping stations shall be located as far as possible from populated areas. Natural screening and remoteness of the site shall be primary elements of site selection wherever possible. Where pump stations are sited in proximity to developed areas, the architecture shall be compatible with the surrounding area. Building aspects such as generator exhaust and ventilation fan noises shall be considered. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties.

2. Land Acquisition: Land required for pumping stations, including necessary vehicular access routes to an existing or proposed public roadway shall be owned in fee simple by the Commission. As part of this process, a boundary survey of the property is required together with a record plat and a metes and

bounds description of the parcel unless otherwise approved by the Commission's Attorney. In determining the space requirements for the facility, particular attention should be given to the width provided for the access road to insure adequate space for grading and drainage within the access road right-of-way. Sufficient room shall be provided for future maintenance of wells, tanks, towers, and generators. Vehicle access shall be provided with adequate turning radii for well rigs, truck-mounted cranes and other large equipment that might be expected to be on site.

3. Topography: Adjacent areas potentially served by the water pumping station must also be considered. Water pumping station site selection shall also be compatible with suitable site access and soil capability with respect to land grading in conjunction with site development. Existing contours and other topography shall be shown for the entire site including a 100-foot minimum width outside of the proposed property boundary. Contour interval shall be two-foot, unless otherwise approved by the Chief Engineer.

4. Floodplain: Water pumping stations shall be sited to remain operational and permit access during a 100-year return frequency flood. The pumping station top slab elevation shall be set a minimum of three-feet above the 100-year floodplain elevation. The access road shall be above the 10-year return flood level.

5. Wetlands: Avoid direct impacts wherever possible and minimize impacts to wetland buffer areas. Buffer areas include 25 feet beyond non-tidal wetlands.

6. Grading: Water pumping station grades shall prevent local ponding, provide positive drainage away from structures and generally be limited to no greater than 4 percent slopes. Stone surfaces around paved areas shall provide proper site drainage at slopes of 10 percent or less. Land grading outside of the water pump station perimeter fence shall not exceed 3 to 1 slopes; 4 to 1 slope maximums are desirable. Lesser slopes wherever possible are preferred. Site grading design shall be compatible with slope stability for the soils encountered. Slope stabilization shall be appropriate for the degree of slope and soil conditions. The use of retaining walls on or adjacent to the water pumping station site is not permitted. Access drive slopes shall be a maximum of 7 percent at any point along the centerline of the drive.

7. Sediment Control: A sediment control plan shall be provided in accordance with the Subdivision Regulations.

8. At least two test borings shall be taken at the building location to determine soil types, rock, water table elevations, soil bearing values, etc. Standard penetration tests shall be taken at intervals not to exceed five (5) feet. Borings shall be taken to a depth of not less than fifteen (15) feet below the bottom of

the proposed structure. Borings shall be taken deeper as necessary, depending on soil conditions.

9. Landscaping: Landscaping shall meet County requirements for buffers.

10. Site Security: Pumping station sites shall be fenced with black vinyl coated chainlink fencing, black vinyl coated post and black hardware, and a 12-foot wide double leaf locking gate for vehicle access. Three strands of barbed wire on angled barb arms shall be included for a total height of eight feet (six feet of fabric with three strands of barbed wire). In predominately residential areas the fence may be eight feet high fabric without barbed wire with the approval of the Chief Engineer. Additional property line fencing may be required as determined by the Chief Engineer. The pumping station building shall have exterior lighting controlled by motion detectors. The pumping station doors shall be 16-guage steel with locks keyed as specified by the Chief Engineer. The building shall be provided with an entry alarm connected to the station SCADA system.

11. Paving: Pumping station sites shall have a paved access road and a minimum of two parking spaces. The access road shall have sufficient room and turn-around area, if turn around area is required by the Chief Engineer, to allow access by maintenance trucks. The turning area in a pumping station site shall have a minimum radius of 48 feet. The turning area may be outside of the fenced area but must be on a Commission parcel. Pumping station access roads shall be used exclusively for pumping station maintenance and access.

12. Station Sign: A permanent sign shall be provided at each pumping station stating the Station Name, Street Address and Emergency Telephone Number. The sign must meet St. Mary's County 911 addressing system.

B. Structures

1. Pumping Station Design/Architectural Standards: Pumping stations shall be architecturally compatible with surrounding structures and shall not have slate roofs. Pumping stations shall be of pre-cast concrete walls and concrete roof or shall be pre-cast concrete and shall be designed to be vandal-proof. Wood or asphalt shingles are not permitted. There shall be no exposed woodwork on the outside of the building. All exterior woodwork shall have a vinyl or aluminum coating. The pumping station shall have a lightning protection system. Provisions shall be made in the structure for traversing bridge cranes of adequate capacity to facilitate the removal of pumps, motors, valves and all other related heavy equipment. Doors shall be bulletproof and constructed of heavy duty metal with deadbolts and locks keyed to the Commission standard.

Exterior lights shall be vandal proof, wall-mounted, energy-efficient controlled by motion detectors and an on-off switch. Pumping stations shall be provided with outside non-freeze hose bibbs. Ventilation openings shall be protected with aluminum louvers with birdscreens. Buildings must comply with applicable IBC and St. Mary's County building codes and the latest revisions thereof.

a. Pump Room

Pumps and piping shall be located at grade with parallel suction and discharge headers. Pumps shall be of the horizontal style placed on individual concrete bases. Floor shall be sloped to floor drains piped to a sump. Each water pump shall have a floor drain located next to it. Pump baseplate drains shall be piped to adjacent floor drains. A building sump with sump pump with piping leading to the nearest sewer shall be provided, if a sewer is available. The pump room shall be furnished with a service sink with both hot and cold water, and inside hose bibb.

All electrical and control equipment shall be located at least three (3) feet above the floor.

b. Generator Area

A separate generator area shall be provided for housing the emergency generator and fuel tank. The generator slab/ floor shall be located a minimum of three (3) feet above the 100-year flood elevation. If the generator is in a room, it shall have a roll-up metal garage door for access and shall be equipped with a floor drain located outside the fuel spillage containment area, piped to the building sump. The generator area shall be supplied with hose bibb, hose rack and 50 feet of rubber hose.

Alternatively, the generator may be in a separate, self-contained enclosure.

2. Heating and Ventilation: The pump, control and generator rooms shall be heated by electric unit heaters with integral thermostats sized to maintain a minimum inside temperature of 55 degrees Fahrenheit. Ventilation shall be by means of wall or ceiling mounted exhaust fans with backdraft dampers operated by thermostats and freezestats and intake louvers with motor operated dampers.

Ventilation shall be designed for a minimum of six (6) air changes per hour. Each room shall have a dedicated exhaust fan(s). Ventilation shall be sufficient to remove heat generated by the pump motors and controls. Provisions shall be made to ensure against condensation forming on controls and other major items of equipment.

C. Equipment

1. Yard Valves: Yard valves shall be buried resilient seat gate valves complying with the Standard Specifications with operating nut and roadway valve box at grade.

2. Station Bypass: Water pumping stations shall be provided with bypass connections in the form of two (2) fire hydrants, one on each of the suction and discharge lines of the station. Hydrants shall be labeled suction and discharge, respectively. The hydrants shall be located adjacent to the parking area and shall be no more than 50 feet apart for easy setup of temporary pumps for pump around capability so that the tower can be emptied or filled.

3. Interior Piping: All interior water piping shall be ductile iron, thickness Class 53, with flanged fittings. Flanges shall be integrally cast on pipe or factory assembled screwed-on with proper bonding compound. Manifolds shall include flexible couplings for ease of installation and removal and also for expansion and contraction of the piping system. Arrangement of piping and equipment within the station should be made with adequate space for maintenance, repair and removal or replacement of equipment, as well as to safeguard personnel working in the station. Piping shall be adequately supported. Control and instrumentation piping shall be copper or stainless steel. Chemical feed piping shall be clear PVC.

4. Interior Valves: Each water pump shall have isolation valves to permit the removal or maintenance of the pumps without affecting the operation of the remaining pumps. Isolation valves shall be resilient seat gate valves. Valves larger than 6-inch shall have geared operators with handwheels. Handwheels shall be marked with an open arrow. Each pump shall have a hydraulically operated, time adjustable pump check service valve to prevent backflow through inoperative pumps. In accordance with the criteria for water hammer control, pump check service valves shall be of the type and strength required to eliminate water hammer damage. Surge relief valves shall also be provided on the suction and discharge headers of the station and piped to the nearest public sewer with an air gap, where available.

5. Pressure Gauges: Pressure gauges for direct reading of line conditions shall be placed on both the suction and discharge of each pump, on the main discharge header piping after the last pump, and on the suction header as it enters the building. Pressure gauges shall be oil-filled type, have a minimum 3½-inch diameter face and be equipped with snubbers. Accuracy shall be to within 0.5% of pressure. Pressure gauges shall have a range such that the normal operating pressure is near the middle of the gauge.

6. Flow Metering: All water pumping stations shall have a venturi type flow meter utilizing differential pressure for reading flow or impeller type meters. Accuracy shall be within 0.5% of flow range. All flow meters shall be placed in accordance with the manufacturer's recommendations.

7. Transfer Pumping Units: All water pumps shall rotate clockwise as viewed from the motor end. Pump bearings shall have a minimum 100,000 hours ABMA-10 bearing life. Pump motors shall operate on, 3 phase, 60 cycle electrical service and at a speed no higher than 1780 rpm. Pump discharge velocities shall be between 5 and 15 feet per second. Pump inlet pressure shall be maintained at a sufficient level to avoid cavitation. Pump motor horsepower shall be sufficient to prevent motor overload under all possible conditions. Water pumps and motors shall be suitable for continuous duty. All pumps shall be factory witness tested and approved prior to shipment. Water pumps shall meet the requirements of the Hydraulic Institute for vibration. Pumps shall be one of the following types:

   - In-Line Split Case (Horizontal)
   - End Suction (Horizontal)

   The pump casing/volute, impeller, seal housing and motor housing shall be of cast iron construction. Impeller shall be cast iron or bronze. The pump's casing and impeller shall be fitted with replaceable hardened bronze or stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the Chief Engineer's option, other pump materials may be required to suit a particular application.

   Pumps shall have the following additional features:

   a. Stainless steel shaft.

   b. NSF approved fusion bonded epoxy coating (interior).

   c. Flexible shaft coupling and removable OSHA-compliant shaft guard.

   d. Mechanical shaft seals cooled and lubricated by the pumped fluid.

   e. Premium efficiency motors shall be specified (where commercially available) for all three-phase pump motors.

D. Electrical and Controls

1. Electrical Design: All electrical designs and components shall be in strict accordance with all applicable St. Mary's County Codes. Electrical design shall be such that phase out protection shall be provided so that the power will automatically switch off in the event of a loss of any one phase. The electrical plans shall include, but not be limited to, the following:

    a. Complete plan layout indicating all conduit, wire sizes and equipment locations including lighting and other appurtenances. Incoming electrical service on the pumping station site shall be underground and within concrete encased conduits.

    b. Complete plan layout showing motor control center (MCC), size and location of all motor starters, circuit breakers and automatic transfer switch (ATS).

    c. Installation details of equipment that are wall mounted or suspended from the ceiling, or otherwise required for clarity.

    d. Single line diagrams incorporating all electrical components required for operation of the facility.

    e. Complete lighting schedule noting model, size, location and installation data as well as appurtenances. Vandal-proof exterior lighting shall be provided.

    f. Complete control and telemetry diagrams.

    g. Elevation of control panels with equipment and mounting dimensions and notes identifying each component.

    h. Complete circuit breaker schedule indicating size and identifying each circuit.

    i. Ventilation schedule noting fan size, operating conditions, location, model, installation data, etc. The ventilation schedule shall also outline louver data including size, material, fixed or motorized.

    j. Secondary power facilities and alarm equipment shall be designed so that they may be manually activated for periodic maintenance checks to ensure proper operation.

    k. Provide a legend of all symbols used for the above.

2. Lightning and Surge Protection: The Designer shall provide lightning and surge protection at the water pumping station. The lightning and surge protection shall comply with the latest editions of all applicable codes and standards.

3. Backup Power: All water pumping stations shall be provided with emergency generators or a secondary independent power feed with automatic transfer switches. Emergency generators shall be sized to provide full station operation. Emergency generators shall be diesel driven with fuel storage on the underside of the generator in a belly tank if practical or in a separate storage tank. Fuel spillage protection shall be provided. Tank size shall be suitable for 24-hours of generator operation at full load. When emergency generators are located inside the pumping station building, they shall be mounted on vibration isolators, with a fuel tank fill connection to the outside. Generator engine exhaust shall be provided with a critical grade silencer and piped to the outside of the generator room. Generator exhaust shall face away from nearby neighbors. If this is not possible, a baffle wall shall be constructed in front of the generator exhaust to deflect the noise.

   The generator shall be fueled by natural gas. If natural gas is unavailable and a new service cannot be obtained, propane may be used. If either natural gas or propane is not feasible, a diesel fuel-powered generator shall be provided.

4. Controls & Alarms: The pumps shall be controlled by one of the following means depending on the service for which the station is intended:

   - Tank Level
   - Pressure
   - Flow Rate

   Tank Level controlled stations employ the use of pressure transducers to turn pumps on and off depending on level in a water storage tank.

   Pressure controlled stations employ the use of pressure transducers to turn pumps on and off to maintain a desired system pressure. The controller shall turn pumps on and off, and vary speed as necessary, to maintain adequate discharge pressure out of the station.

   Flow Rate controlled stations employ the use of flow meters to turn pumps on and off to maintain a desired flow rate.

   All water pumping stations shall have high discharge pressure and low suction pressure pump cut-out switches that will shut all pumps down regardless of operating mode if either of the two settings are encountered. An alarm signal to the SCADA system shall be transmitted for either of the two conditions.

Stations may be designed with more than one method of control depending on the specific requirements of the service area. For example, a Tank Level controlled station may also be designed with a pressure control system to enable that station to maintain a certain pressure in the system when the tank is out of service. The method of station control shall be approved by the Chief Engineer prior to design.

All stations shall have smoke and carbon monoxide detectors and alarms. SCADA base and tower shall be provided at each site.

5. SCADA: At a minimum, the following shall be provided at each pumping station:
    a. Pump On (each pump)
    b. Pump Fail Alarm (each pump)
    c. High Tank Level Alarm (for Tank Level controlled stations)
    d. Low Tank Level Alarm (for Tank Level controlled stations)
    e. Low Suction Pressure
    f. High Discharge Pressure
    g. Loss of Primary Power
    h. Generator/Secondary Power On
    i. Building Intrusion Alarm
    j. Pump Control Valve Failure
    k. Telemetry Failure
    l. Antenna Tower

    The Chief Engineer shall specify the method of communications and the specific brands of hardware and software to be used. A minimum of five (5) spare inputs and five (5) spare outputs shall be provided with the telemetry system. The Chief Engineer may require additional telemetry and SCADA communications at a particular station.

    The Designer shall obtain from the Chief Engineer any information necessary for proper system communication, which may be applicable. RTUs shall be programmable logic controller (PLC) based as complimentary to the Commission's SCADA system. TCU's may also be required.

E. Painting and Coating

All exposed piping, pump equipment and appurtenances shall be epoxy painted. Painting systems and colors shall be submitted to the Chief Engineer for approval. All interior walls of the pumping station building that are above grade shall be painted. Interior walls that are below grade shall be left unpainted.

F. Disinfection

All piping, pumps and appurtenances shall be disinfected prior to placing in service in accordance with applicable AWWA standards.

G. Miscellaneous

1. Operations and Maintenance Manual: Three (3) complete operations and maintenance manuals shall be provided for each pumping station. Manuals should contain approved shop drawings, catalog cut sheets, description of operation including various control sequences or any other special operational details incorporated in the pumping station design, equipment model and serial numbers, installation instructions, maintenance schedules, list of recommended spare parts, warranties, names and telephone numbers for local equipment representatives, for each item of equipment.

3.7 Production Wells:

A. General

The design professional is directed to Section 02555 “Production Wells” of MetCom’s Standard Specifications for Construction, and the following:

1. General well appurtenances - The following well appurtenances are required:

    a. A pitless adapter shall be provided.

    b. A sampling tap shall be provided for raw water sampling within the well house piping.

    c. Adequate control switches, etc., for the pumping equipment shall be provided.

    d. A water meter is required to determine water production for each well and the meter shall be located upstream of the well blow-off.

e. The well casing shall extend at least 12 inches above the concrete floor or apron surrounding the well and above the 100-year floodplain elevation.

f. Adequate support for the well pump and drop pipe shall be provided.

g. Each well casing shall be equipped with a drawdown gauge, airline, and appurtenances for measuring the change in the elevation of the water level in the well and a conduit for level transducer from the well to the well house.

h. Wellhead protection shall be provided.

2. Submersible pumps: Where a submersible pump is used, the top of the casing shall be effectively sealed against entrance of water under all conditions of vibration or movement of conductors or cables.

3. Discharge piping: The discharge piping shall be provided with separate means to pump (blowoff) water of unsatisfactory quality to a point away from the groundwater source and toward the stormwater management system, but shall not be directly connected to a sewer. The discharge line shall:

   a. Have control valves located above the pump well house floor,

   b. Be protected against freezing,

   c. Be valved to permit testing and control of each well,

   d. Have watertight joints.

   e. Have all exposed valves protected,

   f. Have erosion protection at the point of waste discharge.

4. Well apron surrounding the well shall meet the following requirements:

   a. Be of good quality concrete with adequate reinforcement,

   b. Be a minimum of six inches in thickness,

   c. Extend a minimum of three feet in all directions from the well,

   d. Slope at least 1/4 inch per foot towards a screened four-inch floor drain to atmosphere.

3.8 Potable Water Storage Facilities

A. General

The materials and designs used for finished water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel and concrete structures shall follow the most current available American Water Works Association standards concerning steel and concrete tanks, standpipes, reservoirs, and elevated tanks except as may be modified herein.

1. Location of finished water storage facilities

    a. The bottom of ground level reservoirs, storage tanks and standpipes should be placed a minimum of one foot above the 100-year flood elevation.

    b. Buried tanks are not permitted.

    c. The site shall be large enough to permit construction of the facility, maintenance for painting and have a right-of-way to the nearest public road.

    d. All sites shall have electrical service providing a minimum of 208 volts/3 phase, or 240 volts/3 phase where available, service or as required by the Chief Engineer.

2. Obstructions to air navigation

    a. For structures within a 3 nautical mile radius of a public-use airport, the design professional shall be governed by the latest revision of COMAR Paragraph 11.03.05.05; shall contact the MAA Office of Regional Aviation Assistance, telephone 410-859-7064; and shall complete Federal Aviation Administration (FAA) Form 7460-1 as required by Part 77 of the Federal Air Regulations and deliver the completed form to the MAA.

    b. For structures within a 4 nautical mile radius of a military airport submit to the FAA.

3. Safety - The safety of employees shall be considered in the design of the storage structure. As a minimum, such matters shall conform to pertinent building codes, laws, and regulations of the area where the storage structure is constructed.

    a. Ladders, ladder guards, balcony railings, and safe location of entrance hatches shall be provided.

b. Elevated tanks with riser pipes over eight inches in diameter shall have protective bars over the riser opening inside the tank.

c. Ladders must meet the minimum requirements of OSHA 29 CFR Part 1910.

d. Requirements for safety belts, fall protection cables and harnesses shall be included in the specifications.

e. Lighting, pumps and cathodic protection system equipment shall meet the requirements of the National Electric Code. Lights shall be LED.

4. Grading - The area surrounding a ground level structure shall be graded in a manner that will prevent surface water from standing within 50 feet of the structure.

5. Drainage for roof or cover - The roof or cover of the storage structure should be well drained, but downspout pipes shall not enter or pass through the reservoir.

6. Drains

   a. No drain on a water storage structure shall have a direct connection to a sewer or storm drain.

   b. All finished water storage structures shall be equipped with separate drains discharging to the atmosphere. Drainage of finished water storage structures to the distribution system through inlet/outlet piping shall not be allowed.

7. Freezing - All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which will interfere with proper functioning.

8. Internal catwalk - Every catwalk over finished water in a storage structure shall have a solid floor with raised edges so designed that shoe scrapings and dirt will not fall into the water.

B. Storage Tanks

1. Types of tanks permitted:

   a. Ground level shall be glass-lined steel bolted tanks, with an external level gauge.

   b. Steel, multi-leg tanks shall be used for volumes less than 100,000 gallons.

c. Welded steel, single pedestal spheroid elevated tanks shall be used for 100,000 to 1,000,000 gallons.

d. Composite concrete/steel tanks shall be used for any tank greater than 1,000,000 gallons.

e. All tanks must meet the latest AWWA standards.

f. All tanks shall provide a mounting system for cellular antennas.

g. Exceptions to the above must be given in writing by the Chief Engineer

2. Welded steel tanks - Design shall follow the provisions of AWWA Standard D100, "Welded Steel Tanks for Water Storage" modified as follows:

   a. Tanks should be designed for Seismic Zone 0.

   b. All permanent attachments to the tank shall be made prior to the hydrotest.

   c. The alternative design basis presented in AWWA D100 will not be used unless approved by the Chief Engineer.

   d. Aluminum dome roofs shall be used only by approval of the Chief Engineer.

   e. Tanks shall be provided with remote level sensing and recording equipment with telemetry to the MetCom Operations Office.

   f. The design professional will specify that the Contractor will furnish at a minimum, the information listed in AWWA D100, Forward, Paragraph III.B.1. or III.B.2. as appropriate.

   g. Silt stops are not required for welded steel tanks.

   h. Disinfection shall be performed by the contractor.

3. Factory-coated bolted steel tanks - Design shall follow the provisions of AWWA Standard D103, "Factory-Coated Bolted Steel Tanks" modified as follows:

   a. Tanks shall be designed for Seismic Zone 0.

   b. Coatings for bolted tanks are usually proprietary, and each tank manufacturer is different. The coating shall, therefore, be a consideration in the selection of a manufacturer.

c. Foundations shall be installed by the Contractor.

d. Foundation selection in AWWA D103, Section 11.4, shall be based on site soil conditions.

e. Aluminum dome roofs shall be used only by approval of the Chief Engineer.

f. Silt stops are not required for factory-coated bolted steel tanks.

g. Tanks shall be provided with remote level sensing and recording equipment with telemetry to the MetCom Operations Office.

h. Disinfection will be performed by the contractor in accordance with Section 3.8 E-1 of this manual.

i. The design professional will specify that the Contractor will furnish, at a minimum, the information listed in AWWA D103, Forward, Paragraph IV.

C. Coatings and Linings for Steel Tanks

Selection of coating and lining systems for steel tanks shall follow the provisions of AWWA Standard D102, "Coating Steel Water Storage Tanks", modified as follows:

1. Use outside coating system No. 6 except the dry film thickness (DFT) of the system selected should be a minimum of 9 mils.

2. Use inside coating system No. 2, Paint 2, except the dry film thickness (DFT) of the system selected should be a minimum of 13 mils.

3. Roller application is the preferred method of application.

4. Dry film thickness (DFT) is the preferred method to determine acceptability.

5. The design professional shall specify that the contractor submit an affidavit of compliance that all materials and work comply with the applicable requirements of AWWA Standard D102.

6. The design professional shall list in the project specifications all federal, state and local regulations regarding environmental issues.

7. The design professional shall specify that the contractor will furnish for approval submittals for the coatings manufacturer, application method, materials, and material safety data sheets.

D. Cleaning

All finished water storage facilities shall be cleaned to remove all dirt and loose materials prior to disinfection of the structure. Only potable water shall be used to clean and rinse the water storage facilities. All equipment including brooms, brushes, spray equipment, and workmen's boots shall be disinfected before they are used to clean the storage facilities.

E. Disinfecting and Testing

1. Disinfection - All potable water storage facilities shall be satisfactorily disinfected in accordance with AWWA Standard C652, Chlorination Method 1, using calcium hypochlorite, prior to being placed in operation. The disinfection of the storage facilities shall be repeated until it is determined, by bacteriological testing, that the water is free of coliform bacteria.

2. Testing - Testing of the water following disinfection shall be performed in accordance with AWWA Standard C652.

F. Cathodic Protection

If, at the direction of the Chief Engineer, cathodic protection is required the design shall follow the provisions of AWWA Standard D104, "Automatically Controlled, Impressed Current Cathodic Protection for the Interior of Steel Water Tanks", modified as follows:

1. The design professional shall retain the services of a NACE International (National Association of Corrosion Engineers) certified corrosion engineer to design the cathodic protection system.

2. The design professional shall specify that the contractor shall furnish an affidavit of compliance for all applicable provisions of AWWA D104.

3. The design professional shall use the Type A - IR drop-free potential measurement system.

4. Long life anodes with a minimum life of 20 years shall be specified.

5. The anode suspension system shall be a buoyant spider-type rope system with a design life of 20 years, minimum.

G. Flexible Membrane Lining and Floating Cover Materials

Design shall follow the provisions of AWWA Standard D130, "Flexible-Membrane-Lining and Floating-Cover Materials for Potable Water Storage", modified as follows:

1. The design professional shall specify that the contractor furnish an affidavit of compliance for all installed materials.

H. Distribution Storage

1. Pressure variation - The maximum variation between high and low water levels in finished water storage structures which float on a distribution system should not exceed 30 feet. Large diameter, shallow depth reservoirs are preferable over small diameter, deep depth reservoirs.

2. Level controls - Adequate controls shall be provided to maintain levels in distribution system storage structures at all times.

    a. A telemetering system and recording equipment should be provided, to MetCom's Operation Office, for the transmission and recording of storage levels in the distribution system.

    b. Altitude valves or equivalent controls may be required for subsequent structures on the system.

    c. Overflow, low level and pump malfunction warnings or alarms should be transmitted to the MetCom Operations Office.

3. Pressure tanks - Pressure tanks shall not be used for distribution storage systems. Pressure tanks may be used for small community systems if approved by the Chief Engineer.

4. Hydropneumatic tanks for small systems and ground storage tanks shall be sized to provide a usable volume equivalent to a minimum of two hours of domestic demand

CHAPTER 4

SEWER MAIN DESIGN

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CHAPTER 4

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SEWER MAIN DESIGN

4.1 Introduction

A. Responsibility of the Designer

This chapter addresses the selection and use of design criteria and practices applicable to the design of sewer system projects in St. Mary's County. The subject matter discussed includes the layout of piping systems, the selection and employment of pipeline materials and the use of appurtenances. While the requirements described for the various aspects of design will include and cover the majority of conditions encountered, there is no intention to relieve the Designer of responsibility to recognize when conditions are not favorable for the application of standards. In the preparation of the contract documents, the Designer shall take into account such matters as environmental impact, maintenance of pedestrian and vehicular traffic, maintenance of existing and proposed utility services, constructability, and system maintenance and shall produce the overall most cost-effective design. The Designer must be continually alert to conditions that cannot be satisfied by the application of these standard criteria.

B. Limitation of Topics Presented in Design Manual

It is not possible to include in this manual all features of design and drafting, which are necessary to accomplish the development of construction documents for all projects. The topics addressed are limited to those that will help the Designer perform most tasks in an efficient manner and comply with Commission practice. Although it is the Designer's responsibility to exercise professional judgment in the acceptance or use of the standards or features of design included herein, the Designer shall recognize that they are given to assist in the development of the project in the manner preferred by the Commission. Deviations from the design standards must be brought to the attention of the Chief Engineer. Waivers from the design manual must be justified to the Chief Engineer, in writing, from an engineering evaluation standpoint that includes consideration of life cycle costs and ease of maintenance. Approval or denial of the waiver requests will be by return letter signed by the Chief Engineer.

4.2 Design Criteria

A. General

The sizing of major components of the Commission sewer collection and conveyance system such as major pumping stations, force mains and interceptor sewers are generally the responsibility of the Metropolitan Commission.

B. Developer Projects

Prior to commencing any work, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics which are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Preliminary or prior reports prepared by the Commission, if applicable
2. Sizing of major system components
3. Applicable plumbing codes
4. Route selection and location of pipe in public right-of-way
5. Pipe materials and appurtenances
6. Design criteria to be used
7. Design constraints due to anticipated interaction with existing utilities
8. Soil conditions that may affect infiltration and inflow in pipes and appurtenances
9. Bedding requirements
10. Special topographic conditions affecting design such as slopes, streams, floodplain and stream crossings
11. Special permitting issues created by the presence of wetlands, rare and endangered species, historical and/or archaeological artifacts
12. Easement requirements
13. Conditions affecting traffic maintenance and control
14. Requirements for new or upgraded telemetry systems

For projects which require minor extensions of the public water and sewer systems, the pre-design meeting may take the form of a preliminary water and sewer plan showing the general layout of the utilities in relation to the proposed development. The plan shall be accompanied by a letter report, which shall include general information about the project, design criteria used, alternatives investigated and the cost estimates for all alternatives. The plan shall be submitted after the sketch plan for the development has been approved by the Planning Commission.

Developer Projects involving more than 25 EDU's will be required to submit a comprehensive utility plan along with the engineering report unless waived by the Chief Engineer. The comprehensive utility plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

If the construction of the utilities within a development is to be phased, the Designer shall provide a phasing plan showing the phasing and timing of the construction of the utilities. The phasing plan shall be signed and sealed by a professional engineer registered in the State of Maryland. The phasing plan must be approved by the LUGM office.

During each phase of the development, the public water and sewer systems must be able to support the design flow requirements noted in the Design Manual. The Designer shall provide calculations for each phase of the development. For sewer systems, all downstream facilities must be sized to support the flows from each phase of the development. All improvements to collector sewers, interceptor sewers, wastewater pumping stations, force mains, and treatment facilities required to convey and treat wastewater from that phase must be in service prior to any units from that phase connecting to the public sewer system.

Three copies of the comprehensive utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. The comprehensive utility plan and phasing plan shall have standard Commission water and sewer title blocks with approval signature lines.

Following approval, the comprehensive utility plan and phasing plan cannot be revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes to the comprehensive utility plan and phasing plan shall be noted in the revision blocks.

C. Capital Projects

In accordance with the scope of services, the Designer is encouraged to schedule a pre-design meeting with the Chief Engineer to discuss any topics which are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Preliminary or prior reports prepared by the Commission, if applicable
2. Development of population projections and wastewater flows
3. Sizing of major system components
4. Applicable plumbing codes
5. Limit of project and future extension, if planned

6. Route selection and location of pipe in public right-of-way
7. Pipe materials and appurtenances
8. Design criteria to be used
9. Both design constraints due to and anticipated interaction with existing utilities
10. Soil conditions that may affect infiltration and inflow in pipes and appurtenances
11. Bedding requirements
12. Special topographic conditions affecting design such as slopes, streams, floodplain and stream crossings
13. Special permitting issues created by the presence of wetlands, rare and endangered species, historical and/or archaeological artifacts
14. Easement requirements
15. Conditions affecting traffic maintenance and control

Copies, in accordance with the scope of services, of the comprehensive utility plan, phasing plan and engineering report shall be provided to the Chief Engineer. Following approval, the comprehensive utility plan and phasing plan cannot be revised without the authorization of the Chief Engineer. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes to the comprehensive utility plan and phasing plan shall be noted in the revision blocks.

D. Wastewater Flow Calculations

1. General

   All components of the sewer system shall be sized to handle the design flow rate for the contributing area. The design flow rate shall be the sum of the peaked residential, peaked institutional, peaked industrial and peaked commercial flow rates for the service area plus the corresponding infiltration and inflow components within the service area.

2. Residential Flow Rates

   Residential average day flow rates shall be determined by using the EDU table in the Appendix. The ratio of peak residential wastewater flow to average day residential wastewater flow is given by the empirical curve published by the Maryland State Department of Health and Mental Hygiene, now the Maryland Department of the Environment (MDE). A copy of the curve is included in the Appendix, “Diagram for Converting Average Daily Domestic Flow to Peak Flow”.

All design computations for residential flow rates shall include the indicated allowance for inflow and infiltration. However, the Designer is cautioned not to include infiltration rates when determining peak residential flow rates since infiltration flows are considered to be constant flow rates. The design flow rate for residential areas is the peak residential flow rate plus the residential infiltration/inflow flow rate.

3. Commercial, Industrial and Institutional Flow Rates

Commercial, industrial and institutional average day flow rates shall be determined based on the information given in the EDU table in the Appendix.

All industrial, commercial and institutional design flow rates shall be calculated independently of residential design flow rates. Peaking factors for such facilities shall be determined by an analysis of historical data for such facilities. If such information is unavailable, the industrial, commercial and institutional wastewater design flow rates shall be determined by applying a peaking factor of 2 to the average day flow rate.

4.3 Gravity Sewer Main Design

A. Hydraulic Calculations

1. General

The Chief Engineer reserves the right to determine sizing of major wastewater conveyance lines and pumping facilities.

For extensions or improvements to the public sewer system serving more than 25 EDU's, or for critical areas of the public sewer system, the Chief Engineer may require the Designer to provide hydraulic calculations on the proposed sewer system improvements and the effects of the proposed improvements on the existing downstream sewer system. The Designer shall consult the Chief Engineer for information regarding available flow measurements, drainage area boundaries and other operational considerations. The hydraulic calculations on the proposed sewer system improvements and the effects on the downstream sewers shall be submitted to the Chief Engineer for review and approval.

The Manning Equation shall be used to determine the hydraulic capacity for all gravity systems. (See Table 4.1, "Manning 'n' Coefficients"). The Designer shall submit design data and calculations for all sewer projects, whether they are the work of others (properly referenced) or the Designer's own work. The design data and computations shall include average and peak

flow rates, infiltration/inflow rates and design flow rates. Design computations for all special structures shall be submitted.

2. Pipeline Size

   The size of the sanitary sewer shall be sufficient to carry the design flow rate with the hydraulic gradient coincident with or below the crown of the pipe. The design flow rate of the sewer shall not exceed the pipe capacity at full flow. Sanitary sewer designs allowing surcharging are not permitted. All sewer sizes shall be determined by the following Equation of Continuity relationship:

   $Q = AV$
   where:
   Q = quantity of wastewater in cfs (design flow)
   A = required cross sectional area of conduit in sq. ft.
   V = velocity in feet per second

   All sewer sizes shall continually increase progressing downstream.

3. Flow Velocity

   Pipeline velocities shall be determined by the Manning formula:

   $$V = \frac{1.486\, r^{2/3}\, s^{1/2}}{n}$$

   where:
   V = velocity in feet per second
   n = coefficient of roughness
   (see Table 4.1 "Manning "n" Coefficients")
   s = slope of the hydraulic gradient in feet per foot
   r = hydraulic radius = cross sectional area of liquid divided by wetted perimeter of the pipeline

Table 4.1: Manning "n" Coefficients

Pipe type (abbreviation)	"n" Coefficient
Polyvinyl Chloride (PVC)	0.010
Ductile Iron Pipe (DIP)	0.013
Reinforced Concrete Pipe (RCP)	0.013
High Density Polyethylene (HDPE)	0.010

Laying pipes on slopes that provide minimum velocities shall be avoided whenever possible. Minimum velocities of 2.0 feet per second at design flow shall be provided whenever possible. Velocities of less than 2.0 feet per second will be permitted only with written authorization of the Chief Engineer. When pipelines are flowing less than half full, the fluid velocity shall be examined on the basis of partial flow relationships and the pipeline shall be sloped to maintain minimum velocities under the design flow conditions.

Slopes producing design velocities greater than 10 feet per second shall be avoided whenever possible. Pipeline slopes exceeding 10%-20% are permitted only with the approval of the Chief Engineer. If practical, suitable drop manholes or other methods of dissipating energy and reducing eroding velocities shall be provided as approved by the Chief Engineer.

B. Pipeline Alignment

1. General

The layout of a gravity sewer system of collectors and interceptors is a function of the topography. The Facility Plan shows the existing and planned major wastewater facilities, along with the location and service areas of pump stations. The design of sewer subsystems relying on pumping stations not indicated on the Facility Plan must be approved by the Chief Engineer. Collector and interceptor systems shall be prepared to service all areas up to the drainage area limits and no further unless specifically authorized. The plan and vertical arrangement of the sewer system shall provide for future connections within the drainage area limits. The design shall accommodate future service requirements, while minimizing both expense and modifications to the existing system.

The Designer has the responsibility to identify where good planning and design are in conflict with these guidelines and the requirements of other agencies. The proposed alignment must be the best overall design. Failure to identify conflicts during the preliminary design may result in delays and possible costly changes. Consideration must be given to space requirements for future utilities, particularly water and storm drains. In the absence of water and storm drain design, the Designer shall recommend the space requirements for future water or drainage facilities and provide the necessary clearances. This requirement is particularly important at roadway intersections.

When plans of existing facilities are insufficient to accurately locate existing underground obstructions, the Designer shall request permission from the Commission to perform test pit excavations to uncover the subject facilities so that the horizontal and vertical positions of existing utilities can be accurately

determined. If such permission is granted, the Designer shall be responsible for providing all traffic control and public safety measures necessary to locate the utilities and restore the surface. The Designer shall coordinate the test pit operations and provide a field survey crew to physically locate the subject facility.

2. Horizontal Alignment-Location

   The horizontal alignment shall take into account the following general alignment guidelines:

   a. Due to the greater depth of the sewer in relation to most other utilities, the location for the sewer main shall be given first priority.

   b. Sanitary sewers shall be designed with a straight horizontal alignment between manholes.

   c. For Developer Projects, the design of the public water, sewer and storm drain utilities within proposed developments shall be prepared concurrently to ensure compatibility of the utilities. If public water and sewer mains cannot be located within the paved roadway section, the Designer shall request a waiver of these design standards from the Chief Engineer, providing reasons why the standards cannot be met.

   d. In new developments where sewers are constructed in advance of the road pavements, the sewer shall be placed on the lower side of the street, 7 feet from the street centerline. On curved streets, this location must be compromised, since straight horizontal alignments are required between manholes, except as noted above. Where curbs will exist, the sewer shall be placed no less than 5 feet from the face of the curb. The sewer may be placed on the high side of the street if the number of house connections makes it cost effective.

   e. Sewer main easements are routinely acquired during the subdivision process for the future extensions of the sewer system to serve adjacent properties.

   f. Where the future extension of the sewer main would undermine the foundation of a structure, all such sewer mains shall be constructed as part of the subdivision.

   g. In residential developments where easements are required between two adjacent lots for the extension of the sewer system, a sewer main shall be provided within the easement between the adjacent lots. The sewer main shall extend the full length of the easement between the lots.

h. In cases where a utility easement is required to be extended to the limits of the property being developed to provide future service to an adjacent property, that easement shall be cleared of trees and otherwise prepared for the future extension of the main.

i. Where water and/or sewer mains leave the public road right-of-way, an all-weather access roadway is required.

j. Within private roads, public sewer mains shall be located within the paved roadway sections, whenever possible, and shall have a 5-foot minimum separation from other utilities.

k. In Developer Projects where all new facilities are to be constructed, and in existing developments with curbs, sewer mains are usually placed 7 feet from the centerline of the street and on the side nearest to the lower ground. Mains shall be located within the pavement area, wherever possible, and no less than 5 feet from face of curb or proposed curb and shall have a 5-foot minimum separation from other utilities.

l. In Developer Projects, the design of the public water, sewer and storm drain utilities within proposed developments shall be prepared concurrently to ensure compatibility of the utilities. If public water and sewer mains cannot be located within the paved roadway section, the Designer shall request a waiver of the design standards and provide reasons why the standards can not be met.

m. Sewer mains shall be designed to minimize disruption to environmental features. The Designer shall take into account all existing environmental factors and avoid disturbance of sensitive areas, whenever possible.

n. The sewer alignment within existing areas (streets or roads) shall avoid high traffic volume roads if other options are available. The alignment shall be designed to allow the construction of the pipeline without the need to have road closings. When a sewer main or lateral connection is required to cross a County road, the Designer shall recommend whether to open cut, tunnel or bore and jack the utility across the roadway after considering the type and condition of the road, traffic volumes, disruption to traffic, possible conflicts with existing utilities, and specific conditions on the project site.

o. In existing areas (streets or roads), the alignment shall attempt to avoid the removal of trees or landscaped areas. In parks and public rights-of-way where the location of the sewer main would require the removal of trees, the Designer shall obtain the approval of the appropriate agency (SHA or

DPW&T) for tree removal. When the pipeline must be located outside of the road right-of-way, the alignment shall minimize disruption to environmental features. In addition to trees, the alignment shall try to avoid steep slopes, wetlands and other sensitive areas. The alignment shall follow the property lines as much as possible.

p. When existing roadways are involved, the horizontal alignment of the road must be evaluated for acceptable geometry and the sewer main designed in respect to these possible roadway improvements to avoid costly future relocations. The Designer shall evaluate the plan geometry of the road with respect to movement of traffic and available right-of-way width for the accommodation of the pipeline. If easements must be acquired for the main, a recommendation shall be provided to the Chief Engineer as to whether additional rights-of-way should be acquired for future roadway modifications.

q. Where existing sewer mains are too shallow or do not contain adequate capacity for new incoming sewers, the existing sewers shall be redesigned as required and all existing connections shall be reconnected to the new sewer.

r. Within private roads, public sewer mains shall be located within the paved roadway sections wherever possible and an easement provided to MetCom.

s. Sewers and appurtenances shall not be placed in existing or proposed storm water management facility locations.

3. Vertical Alignment

a. Grades

The vertical position of gravity sewers is determined by the rate of slope between the unit to be served and the collector sewer, the rate of slope of the ground along the course of the pipeline and by the existence of obstructions that cannot be economically relocated. All sewer grades shall be established as to require the least excavation while satisfying minimum and maximum velocity requirements, design flow conditions, clearances, and depth requirements. All sanitary sewers shall be designed on a continuous grade between manholes. Table 4.2, “Minimum Allowable Sewer Slopes”, indicates the minimum slopes permitted.

Table 4.2: Minimum Allowable Sewer Slopes

Pipe Diameter	Minimum Slope in feet per 100 feet
8” Terminal Main	0.72
8”	0.40
10”	0.28
12”	0.22
14” and larger	Slope to provide min 2.0 ft/s velocity at the design flow rate

The minimum size for all collector and interceptor sewers shall be 8-inches in diameter. The minimum slopes noted above are required to maintain a velocity greater than 2.0 ft/s based upon a Mannings “n” coefficient (roughness) of 0.010 when the pipes are flowing full or half full.

Sewer house connections (SHCs) shall have the minimum slopes as shown in the Sewer House Connections section of this design manual. For gravity systems, pipeline layout is directly affected by minimum acceptable fluid velocities as determined by the design flow, pipe size, slope and applicable Manning “n” coefficients (roughness).

The maximum slope for all sewers shall be 6%.

Where different diameter pipes meet at manholes, the crown of all upstream pipes shall be set at the same elevation as the crown of the downstream pipe unless hydraulic gradient computations require a higher setting.

b. Sewer Depths: General

The collector sewer shall be designed at a sufficient depth to provide gravity sewer service to the basement or lowest floor level of all buildings unless the sewer line becomes excessively deep (over 10 feet) in order to serve the basements or otherwise directed by the Chief Engineer. In some cases injector pumps may be necessary in some basements in order for them to be served. These injector pumps will be internal to the building and will not be owned by MetCom and will be the responsibility of the homeowner. The minimum cover over any sewer or SHC within the road right-of-way or public easements shall be 4 feet. Where storm drains have not been designed or installed, each SHC shall have a minimum cover of 6.5 feet within the street right-of-way. The required service depth at the collector sewer shall be determined by the following criteria:

1) Improved Lots

Unless test pitted, the building sewer coming from existing houses shall be assumed to have an invert elevation 2.5 feet below the lowest floor elevation at the exterior wall. The invert elevation of the SHC at the collector sewer shall be calculated as follows:
$E = BE - 2.5' - (L_{SHC} \times G_{SHC})$
where:
E = invert elevation of SHC at collector sewer (ft.)
BE = basement elevation or lowest finished floor elevation (ft.)
L_{SHC} = required length from existing structure to the sewer main (ft.)
G_{SHC} = required building sewer and SHC grade (ft/ft)
(see Section 4.6.D)

When the septic tank is located in the rear of the existing structure, "L" shall be measured from the center rear of the building around the structure to the collector sewer in the street.

2) Unimproved Lots (Residential)

On vacant lots, in addition to providing an invert elevation of the SHC at the property line in the sewer profile, the basement elevation or the minimum service elevation shall also be shown on the plans for each lot to be served to the nearest 100^{th} of a foot (denoted thus: BE = 423.67 or FF= 432.02), which shall represent the lowest floor elevation that may be serviced by gravity. In determining this elevation, it shall be assumed that any future structure will be constructed so that gravity sewer service shall be available to the most distant part of the lot or property within the building restriction line.

3) Unimproved Lots (Commercial/Industrial)

For commercial and industrial sites, the Designer shall determine a reasonable sewer service elevation, taking into account the probable size of the building and the extent of gravity service required. Unless specific information is available regarding future development plans, it must be assumed that a large structure such as a warehouse may occupy the lot with the building located at the most distant part of the lot within the building restriction line. The sewer service elevation determined shall be shown on the plans as "minimum service elevation".

4) New Developments

In new developments, when subdivision plans include lot grading and structure elevations, the sewer shall be designed to serve the lowest floor level of each structure. When site plans have not been prepared, the sewer shall be designed in the same manner as for unimproved residential lots, with the minimum basement elevations shown on the plans to the nearest 100^{th} of a foot (denoted thus: BE = 423.67 or FF= 432.02). For townhouse developments, the minimum basement elevations may be shown in tabular form.

c. Sewer Depths at Stream Crossings

Where a sewer parallels a water course, the Designer shall ensure that the proposed sewer depth will be adequate to facilitate future crossings of the stream while maintaining a minimum 3 feet of cover over any future stream crossings. The centerline of the adjacent stream bottom shall be indicated on the sewer main profile if the sewer is located within 25 feet of the stream.

Where sewer pipes cross streams, the crossing angle shall be as near to 90 degrees as possible, and the crossing pipe shall be set at an elevation to provide a minimum of 3 feet of cover over the pipe. Ductile iron pipe, Class 52, shall be employed for the stream crossing and shall extend from manhole to manhole.

4. Sewer Surcharge Protection

In order to ensure that pumping station malfunctions will not result in wastewater backing up into nearby residences, the Designer of collection systems connected to a pumping station shall:

a. Determine the rim elevation of the lowest manhole upstream from the pumping station that is not required to have a watertight frame and cover assembly.

b. Identify all basement elevations lower than the manhole frame and cover established in Item a. above.

c. Identify first floor elevations lower than the manhole frame and cover established in Item a above.

d. Identify vacant lots having a ground elevation lower than the manhole frame and cover established in Item a. above.

e. Provide on the plans for all dwellings, structures, and lots identified in Items b, c and d stating the following: “This lot may be subject to wastewater backup in the event of a pumping station malfunction. A back water valve is required on the private building sewer serving this lot.”

C. Sewer Mains: Plan

1. Sewer plans shall be drawn to a minimum horizontal scale of 1" = 50'.

2. All proposed pipelines shall be shown and symbolized as noted in the Standard Details. More specifically, the pipe is to be identified by two evenly shaded parallel lines. Pipelines 24-inches in diameter and smaller shall be shown symbolically as two feet wide as a minimum, based on a scale of 1" = 50'. Pipelines over 24-inches in diameter shall be shown to scale.

3. The plan location of the pipeline and appurtenances shall be carefully dimensioned so that its route is clearly identified. Appurtenances shall be called by symbols and notes and dimensioned both in respect to pipeline arrangement and in respect to required positions in relation to surface features in accordance with DPW&T standards.

4. Manholes shall not be shaded. Manholes shall be numbered in consecutive order with the numbers placed within a standard circle. The slope of the frame and cover shall conform to the proposed finished grade and shall be protected from sheet runoff. The type of manhole shall conform to the Standard Details.

5. All pipe sizes shall be clearly identified together with flow directional arrows.

6. A restoration schedule shall be provided on the plans. The table shall cover the entire limits of the project and include restoration of all disturbed surfaces including roadways, grassed areas, driveways and open space. Where more than one material is required for restoration of the surface at a location (i.e. bituminous pavement to the right of the pipeline and sod to the left of the pipeline), the limits shall be noted and the material replaced in kind. Soil Conservation District requirements may supersede the above items.

7. Sewer House Connections (SHCs)

   The following provides a description of the required design information for SHCs that must be provided on the sewer plans.

   a. All new SHCs shall be indicated in plan by a single heavy line with a wye at the collector sewer. All SHC are required to be made into a 6” x 6” horizontal wye, unless approval to connect into the vertical riser is obtained from the Chief Engineer prior to time on connection. A formal

request form must be submitted and approved. The request form can be found in Appendix. All SHCs shall be extended to the property line and denoted by size (6-inch or 8-inch) and type (SHC or DHC). All proposed invert elevations of clean outs shall be indicated at the property line.

SHC inverts for townhouses and apartments may be shown in tabular form with the locations of the inverts well defined. Clean-outs shall be shown on the plan.

b. All buildings that cannot be served or are limited to first floor service shall be clearly noted on the plans. All such service limitations must be approved by the Chief Engineer.

c. Service connections to properties in low areas that may experience flooding in the event of wastewater backups and/or surcharging of main line sewers shall be identified as such. The plans shall note that preventive measures, as required by the International Building Code, provided by the property owner when the connection is made to the system by the plumber. See Section 4.3.B.4, "Sewer Surcharge Protection" for analysis requirements.

d. On vacant lots, minimum service elevations must be calculated as described in Section 4.3, "Vertical Alignment". This minimum service elevation must be provided on the plans in addition to the invert elevation of the SHC at the property line.

e. All percent grades for the SHC shall be indicated on the plans if the design grade for a SHC is either less than or greater than 2%.

D. Sewer Mains: Profile

1. Profiles shall be drawn for all public sewer mains at a minimum scale of 1" = 50' horizontal and 1" = 5' vertical.

2. Profiles shall be shown below the sewer plan view wherever possible. For Developer Projects, the complete layout of the piping system may be shown in the plan view drawings. Profiles shall then be shown on a separate sheet and cross referenced to the appropriate plan sheet.

3. Manholes in profile shall be numbered to correspond to the manhole numbering on the plan. The numbers shall be within a standard circle together with the manhole top elevation.

4. Minimum cover of 4 feet over gravity sewer mains.

5. Profiles Within Proposed Roads

   The methods for developing sewer profiles are identical with those described for water mains with the resultant opportunity to utilize a single profile arrangement for combined water and sewer projects. As in the case of the water mains, sewer lines and manholes to be located within proposed roadways shall be projected onto the centerline of stationing of the roadway even though the true stationing is developed between manholes. This procedure means that the scaled length of the sewer lines in the profiles will not equal the true length as shown in the plan view. On a combined water and sewer project, each utility shall be projected onto the centerline road grade. Manhole rim elevations shall be called out on the plans.

   If the sewer is outside of the proposed paved area then a proposed finished grade above the sewer shall be shown.

6. Profiles Within or Outside Existing Roads

   In developing the profile information within or outside existing roads, the centerline length of the sewer main in plan shall be used for the profile stationing, which will provide true length profiles. For existing roads that do not conform to DPW & T guidelines, a centerline road grade conforming to the design standards is to be shown on the profile and identified as "possible future centerline road grade." On a combined water and sewer project, the sewer shall be projected onto the water pipeline centerline.

7. Sewer and water line clearances shall be as specified in Recommended Standards for Water Works (Ten State Standards). A minimum of one-foot clearance from other utilities shall be maintained except for natural gas lines. A minimum of five-feet of clearance shall be maintained between water lines and natural gas lines. Water lines shall be above sewer and storm drain lines.

8. Utilities that cross sewer mains shall be plotted to horizontal and vertical scale and identified so as to advise the contractor of their specific locations. Stations and invert elevations shall be provided at every pipeline crossing for each pipe shown. If the elevation of the existing pipeline to be crossed is unknown and it is likely to have a significant impact on the sewer main vertical alignment, the Designer shall arrange to have a test pit excavated to determine the exact horizontal and vertical location of the existing utility or utilities.

9. For each SHC, a light vertical line shall be drawn from the collector sewer to the elevation of the SHC at the property line. All SHCs shall be shown as intersecting pipes in the profile. The applicable finished floor or basement

elevation of the dwelling to be served shall be shown at the appropriate elevation relative to the house connection, and to the correct vertical scale.

10. The date of the survey used to establish ground lines shall be noted on the profile. Existing and proposed ground lines shall be shown where applicable as well as the source from which the information was acquired. The following information as minimum requirements shall be shown on the profile:

    a. Road names – when plan and profile are on separate sheets.
    b. Existing ground elevation line
    c. Proposed ground elevation line
    d. Utilities, existing and proposed
    e. Pipe diameters and pipe type shown
    f. Stations and invert elevations shall be provided on the profile at all vertical and horizontal deflections.
    g. Limits of restrained joints for force mains.
    h. Limits of concrete encasement.

Table 4.3: Sewer Hydraulic Information

Information	Symbol	Units
Pipeline Diameter	NA	Inches
Pipeline Slope	NA	%
Pipeline Capacity	Q_{cap}	MGD or CFS
Design "n" value	N	NA
Velocity at Capacity*	V_{cap}	FPS
Design Flow*	Q_{des}	MGD or CFS
Velocity at Design Flow*	V_{des}	FPS

* For interceptors or collector sewers serving more than 25 EDU's or collector sewers receiving pumped flows

11. The sewer hydraulic information indicated in Table 4.3, above, shall be provided in the profile for each segment of sewer between manholes. When this design procedure is followed, it will be apparent where slight adjustments in invert slopes will provide a pipeline capacity closer to the total system capacity. In this way, restrictions due to a single, flat grade set within the larger system of manholes and pipe lengths may be avoided.

12. Excessive pipe slopes that may induce stripping of hydrogen sulfide will not be permitted. The Chief Engineer may require sulfide analysis calculations.

4.4 Pipeline Materials

A. General

Pipeline design practices and materials used in sewer systems for the Commission are employed to ensure maximum service capability with the least costs of installation and maintenance. Factors that determine the equivalency of pipe materials include the following:

1. Structural strength under field conditions.

2. Hydraulic capacity as determined by the roughness coefficient as used in the Manning formula for pipeline velocities.

3. Characteristics of existing site conditions, which may have detrimental effects on pipe materials.

4. Characteristics of wastewater, which may have detrimental effects on pipe materials.

The Designer must be aware of the particular properties of each type of pipe so as to include or exclude the possibility of its employment under the greatest range of applications, leaving the construction contractor as many options as possible for the selection of the type of pipe to be installed. Any special design features and/or special materials required due to the specific nature of the project shall be submitted for approval to the Chief Engineer. The Designer shall thoroughly stipulate in the Specifications and show on the plans which types of pipe materials are acceptable for the various applications on each project.

The following Table 4.4, “Sewer Pipe Materials” indicates the pipe materials that are acceptable to the Chief Engineer for interceptor and collector sewer construction. These materials are acceptable when supplied in accordance with the material and installation requirements of the Standard Specifications and this design manual.

Table 4.4: Sewer Pipe Materials

Pipe Type (abbreviation)	Specification	Diameter Range	Design Standard
Polyvinyl Chloride (PVC)	SDR 35 meeting ASTM D3034 ASTM F679	4" – 15" >15"	AWWA M23 AWWA M23
Ductile Iron (DIP) Glass lined epoxy coated	AWWA C151	8" and larger	AWWA C150
High Density Polyethylene (HDPE)	ASTM D3035 or ASTM F714	2" – 24"	ASCE Manual No. 60

Notes: See Sewer House Connections, Materials for acceptable SHC pipe materials

5. Special Circumstances

   a. In addition to the types of pipe shown above, other pipe materials may be considered on a case-by-case basis when recommended by the Designer and approved by the Chief Engineer. For special projects or conditions, the Designer and the Chief Engineer may select pipe manufactured to industry standards other than those listed in the Standard Specifications.

   b. The Chief Engineer will require the use of DIP under the following circumstances:

      1) When sewer depths exceed 18 feet.

      2) For all open cut stream crossings.

      3) Sewers within casing pipes or tunnels shall be restrained DIP.

      4) When flow velocities exceed 10 feet per second.

      5) When pipeline slopes exceed 20% (Designer shall also provide for pipe anchors when necessary).

   c. In areas where significant hydrogen sulfide concentrations are expected to exist, such as downstream from a pumping station or pressure sewer discharge, hydrogen sulfide resistant materials such as PVC shall be used

if available in the required diameter. If PVC is not an option in the required diameter, the Designer shall investigate other solutions such as glass lined or epoxy coated DIP, HDPE or other special protective linings or materials.

d. Application of corrosion resistant materials indicated in paragraph c) above shall be required in other areas anticipated to be particularly aggressive to concrete, such as sewers which will handle industrial effluents, high temperature discharges and leachate from sanitary landfills.

B. Pipe Thickness Design

1. General

The acceptable installation depths discussed below for the various pipelines are based on the standard bedding, backfill, trench width and all other criteria indicated in the Standard Specifications. Even within these given parameters, the Designer shall be responsible for all pipe designs. For special applications that differ from those detailed in the Standard Specifications and the design criteria of this manual, a special analysis must be performed to determine the appropriate pipe thickness and/or increased bedding conditions and submitted to the Chief Engineer for approval. If such analysis is required, the pipe strength requirements for in-place trench conditions shall be determined by the design standards indicated in Table 4.4, "Sewer Pipe Materials," for each pipe material. The following design criteria shall be utilized for pipe thickness design:

a. The maximum and minimum pipe depths along the pipeline alignment;

b. A unit weight of soil of 120 lb/cf unless site specific soil information is available indicating otherwise;

c. A trench bedding condition one "type" or "class" lower than actually specified for installation.

2. Polyvinyl Chloride (PVC) Pipe

The PVC pipe specified in the Standard Specifications is suitable for standard buried applications from four (4) feet to eighteen (18) feet of earth cover when installed using the specified bedding, backfill and compaction requirements detailed in the Standard Specifications. For situations requiring greater than eighteen (18) feet depth or for shallow installations less than four (4) feet, DIP shall be used.

3. Ductile Iron Pipe (DIP)

DIP for sanitary sewers and force mains shall be special thickness Class 52. For loading situations such as depths greater than eighteen (18) feet, less than four (4) feet, or where other extreme loadings are anticipated, thickness design shall be based on the design methods outlined in AWWA C150.

4.5 Gravity Sewer Appurtenances

A. Manholes

1. General

a. Within the sewer pipeline system, the most significant appurtenance is the manhole. Manholes are employed for several functional requirements and to ensure their ability to perform these functions, their design features have been standardized. The design requirements for all manhole structures are provided in the Standard Details. All manholes shall be designed as pre-cast concrete structures. Inverts of manholes are generally constructed of brick carefully configured to provide smooth channels for both through-flow and directional changes. Pre-cast manhole channels are an acceptable alternative to brick channels. Manhole inserts are required at all manholes except those with watertight frames and covers.

b. Inverts are formed to receive future flows when the direction and grade of future connections are identified in the design process. When a future extension from the manhole is to be provided, a formed invert channel and a 5-foot long stubbed connection shall be provided from the manhole.

c. Manholes represent a significant potential source for infiltration and therefore, waterproofing is a standard feature. The exterior of all precast manhole sections shall be coated with coal tar epoxy and all joints shall be gasketed as required by the Standard Specifications. Standard heavy traffic manhole frames and covers shall be used on all manholes. Manhole cover inserts are required on all manholes except those with watertight covers.

d. Manholes shall be kept away from inconvenient or inappropriate locations such as curbs, gutters, ditches, vehicular parking area, athletic and playing fields, near buildings and the like.

e. The top of manholes placed in cross-country areas shall be set at a height equal to or above grade as recommended by the Designer based on actual site conditions. All such manholes shall be set a maximum of 18-inches above existing grade elevations.

f. When the manhole is within a 100-year floodplain, a raised watertight frame and cover shall be provided. Watertight frames and covers may be required in low-lying areas or areas prone to flooding.

g. When the pipe size entering and exiting manholes are the same, a minimum drop between invert in and invert out shall be 0.10 foot. The maximum drop between invert in and invert out shall be one (1) foot. For pipelines of different sizes, the pipeline crowns shall be matched. For manholes where vertical drops are required, see Section 4.5.B, "Drop Manholes."

2. Manhole Spacing

Manholes shall be installed under the following circumstances:

a. Change in horizontal direction or vertical grade
b. Change in pipe size
c. Change in pipe material
d. Pipeline junctions
e. At spacings not to exceed 350 feet for sewers less than 30-inches in diameter and 600 feet for sewers 30-inches in diameter and greater per Ten State Standards
f. At the terminal end of all sewers
g. At locations along the sewer where future extensions are planned
h. At any additional place required by the Chief Engineer for maintenance, sampling, venting or flow measurement purposes
i. At transitions from private to public sewer mains

3. Manhole Size

The minimum manhole size for all gravity sewer pipelines shall be 4 feet in diameter. For pipeline sizes of 24-36 inches in diameter, a minimum 5 feet in diameter manhole shall be utilized. For pipelines greater than 36-inches in diameter, the Designer shall submit design drawings and details of the manholes to the Chief Engineer for approval prior to placement of the details on the plans.

Manholes over 15 feet in depth shall be 5 feet in diameter or larger depending on pipe size.

4. Manhole Channels

Typical manhole channels are illustrated in the Standard Details. If channeling for standard manholes is required that differs in geometry from those configurations shown in the Standard Details, the Designer shall detail the

channel on the plans, showing curve data, invert and bench elevations, bench slopes, etc. This effort shall also be provided for all manholes over 5 feet in diameter, bend structures and junction chambers. Manhole channels shall not have a centerline radius of less than 2.5 times the pipe diameter.

5. Manhole Linings

   The Designer must take into consideration the use of special invert and manhole lining materials when significant hydrogen sulfide (H_2S) concentrations are anticipated. In addition, the use of drop manholes is discouraged when hydrogen sulfide is present or likely in the wastewater. The use of spray-on manhole liners shall be approved by the Chief Engineer.

6. Deep Manholes

   The manhole depth is defined from the lowest invert to the top of the frame and cover. An intermediate landing is to be provided for all manholes greater than 18 feet in depth and at 10-foot intervals when the manhole depth exceeds 25 feet. In addition, if the manhole depth exceeds 20 feet, the Designer shall take into consideration the following design requirements:

   a. Check the manhole for flotation.

   b. Verify that the groundwater pressure on the precast concrete manhole section joints will not exceed the requirements of ASTM C 443 and the Standard Specifications.

   c. Verify that the groundwater pressure on the pipe to manhole connections will not exceed the requirements of ASTM C 923 and the Standard Specifications.

   d. Identify any modifications necessary to the standard manhole details as a result of the manhole depth and groundwater pressure.

B. Drop Manholes

Design details as well as maximum and minimum allowable drops are indicated for drop manholes in the Standard Details for various sewer sizes. When the drop required is less than the minimum indicated on the standard details (2'-0" or 2'-6", depending on pipe size), no drop manhole is required. In lieu of a drop manhole, the slopes of the connecting pipelines and manhole channel shall be adjusted to limit the difference between the invert in and invert out of the manhole to less than one foot.

All drop manholes shall typically utilize outside drop connections. Inside drop connections to existing manholes shall only be considered when there is imminent damage to existing utilities or structures in construction of an outside drop connection.

All use of inside drop connections will require the approval of the Chief Engineer. A 5' manhole shall be used if more than one (1) inside drop connection is proposed in any single manhole.

C. Inverted Siphons

1. General

Inverted siphons are considered for use when it is necessary to maintain a suitable protective ground cover over a pipeline or to reduce extensive trench depths when an obstruction to the preferred grade requires a lowering of the sewer for a significant distance. Inverted siphons should be avoided wherever possible. Inverted siphons will only be permitted with the approval of the Chief Engineer. The Designer shall provide all required specialized details to the Chief Engineer for approval.

a. Design

When a siphon is determined to be an acceptable design alternative, at least two pipes shall be provided with a minimum pipe size of 6-inches. One redundant pipe shall be provided for bypass capacity, for emergencies or when the other pipeline is taken out of service. Each pipe shall be capable of carrying the full design flow rate. In pipe sizes 6-inch to 24-inch in diameter, restrained DIP shall be used.

Siphons shall be designed preferably for a minimum velocity of 4 fps at the design flow rate with an absolute minimum velocity of 3 fps. The capacity of the inverted siphon shall not be less than the capacity of the sewer system upstream of the siphon. Sufficient hydraulic head shall be available to pass the design flow without submergence of the upstream sewer. All hydraulic calculations shall utilize the Manning's equation.

Inlet and outlet structures shall be designed with valve arrangements to facilitate flushing of each siphon line and to minimize maintenance. All inverted siphons shall be designed with inlet and outlet vaults. Vaults shall contain sluice gates on the inlet and outlet of each barrel and shall have clear access from above for maintenance. Sluice gates shall have operators on top of the vaults.

b. Alignment

The horizontal and vertical alignments of an inverted siphon shall be maintained as straight as possible. Abrupt alignment changes shall be avoided.

D. Connections Into Existing Systems

1. General

   All connections into the existing public sewer system are subject to the approval of the Chief Engineer. The Designer shall provide on the plans all applicable notes and details for any required connections to an existing system. All connection designs must address all issues regarding maintaining flow in the existing system at all times. See the Standard Details for typical connection details.

2. Connections Into an Existing Manhole

   If the existing manhole within the sewer system has an existing stub connection, the Designer shall match the existing pipe material or remove the connection if the existing pipe material is not one of the approved pipe materials. If the existing manhole does not have an existing opening or a knockout for a future connection, the manhole shall be cored, the invert channel formed and a field gasket connector installed to secure the new sewer to the existing manhole as illustrated in the Standard Details for Construction.

   When there is not sufficient clearance between the existing pipe openings in the manhole and the new pipe opening, the Designer may provide a design for the sewer to enter the existing manhole offset from the manhole centerline. The Designer shall provide all required details, dimensions, etc. to the Chief Engineer for approval.

3. Connections Into an Existing Sewer

   If a new manhole must be designed over an existing sewer, the Designer shall refer to the Standard Details. The following items shall be considered when designing a connection into an existing sewer:

   a. When the existing sewer is above the new pipeline, the Designer must submit details of the connecting manhole to the Chief Engineer for approval for the connection between the new manhole and the existing sewer.

   b. Manhole drop connections may be designed for connections into an existing sewer when the drop connection is for the new pipeline.

4.6 Sewer House Connections (SHCs)

A. General

SHCs are to be provided to connect individual buildings to the collector sewer main.

All SHC configurations are connected to the main line by a combination of fittings including wyes, tees and bends as indicated in the Standard Details. SHCs shall be indicated in plan and profile.

B. Location

1. The Commission owned portion of sanitary sewer house connections shall be built to the property line. It is the practice of the Commission to provide a SHC at the time of initial sewer construction to all properties having frontage on the collector sewer. All such properties shall be provided with a capped cleanout at the property line as shown in the Standard Details.

2. All SHCs for improved lots shall be located so as to readily serve the basement or lowest floor of the existing dwellings or buildings in a cost effective manner. All SHCs for unimproved lots shall be located at the low point of the lot. Where the location or depth of the sewer main is established by the Critical Area, this connection shall be located by the Designer in the most advantageous position to minimize costs to the Commission while providing basement service to the lot. In non-critical areas, the actual location of the SHC shall be determined by the property owner in the field prior to construction as long as it is compatible with the system as designed. However, it shall be the responsibility of the Designer to propose a feasible location for the SHC based on the location of existing wells, septic tank facilities, topography and other features.

3. In developments where an easement is required between two adjacent lots for the extension of a SHC, the SHC shall be constructed within the easement between the adjacent lots as part of the development. The SHC shall extend the full length of the easement between the lots.

C. Size

The size of all SHCs shall be 6-inch depending on the land use type and the discharge flow requirements established by the Designer. Additional sizes may be considered by the Chief Engineer.

D. Grades

SHCs shall be designed for a 2% minimum grade. If this rate of slope results in an excessively deep collector sewer, a reduction in the SHC slope may be considered by the Chief Engineer. The maximum allowable grade for a SHC shall be 5% or that approved by the Chief Engineer. All SHCs designed on a grade of less than or greater than 2% shall be noted on the plans.

E. Depth

All SHCs shall be installed at the required depths to provide gravity service to the basement of each lot served.

F. Type

All SHCs shall be of the single service type. A twin SHC shall not be used unless approved by the Chief Engineer. A Drop House Connection (DHC) shall be provided when the invert of the SHC at the collector sewer is greater than 2 feet higher than the invert of the collector sewer when the house connection is extended from the house at a 2% grade to the sewer main. Where conditions permit, the Designer may use a 45° DHC if approved by the Chief Engineer.

In specifying a 45° DHC, the Designer shall ensure that the use of a 45° DHC will not preclude or interfere with the placement of future utilities.

G. Materials

The following Table 4.5, "SHC Materials" shows pipe materials that are acceptable to the Chief Engineer for SHCs when supplied meeting the material and installation requirements of the Standard Specifications.

Table 4.5: SHC Materials

Pipe Type (abbreviation)	Specification
Polyvinyl Chloride (PVC)	SDR 35 meeting ASTM D3034
Ductile Iron (DIP)	AWWA C151
High Density Polyethylene (HDPE)	AWWA C905

For all new sewer construction, SHCs shall be of the same material as the sewer. For existing sewers, SHCs shall be either PVC or DIP subject to the approval of the Chief Engineer.

H. Appurtenances

Cleanouts shall be provided on all SHCs at the property line on the homeowner's side.

Cleanouts shall be as shown in the Standard Details and in plan view.

I. Manhole Connections

SHCs can be installed as a drop house connection using an outside drop at the manhole. See Section 4.4.B, "Drop Manholes" of this Chapter for information regarding drop manhole connections.

Multiple SHCs installations into a single manhole are subject to the approval of the Chief Engineer. The following information shall be considered when making multiple connections:

1. A maximum of three (3) SHC installations will be permitted into any one manhole.
2. SHCs shall not enter the manhole at an angle less than 90 degrees to the downstream flow direction.
3. The centerline of the SHCs shall pass through the centerline of the manhole.
4. When radial installation is not possible, a maximum of two (2) parallel SHCs may be installed at any one manhole.
5. See the Standard Details for information regarding multiple radial and parallel SHCs installations.

J. Structural Considerations

Minimum and maximum permissible SHC depths shall be in accordance with the guidelines of this Chapter when installed in accordance with the standard bedding, backfill, trench width and all other criteria indicated in the Standard Specifications. In all cases, proper bedding shall be provided for SHCs.

4.7 Force Main Design

A. Hydraulic Calculations

1. General

- Force mains shall be designed based on the existing and/or future pumps.
- A minimum scouring velocity of 2.0 feet per second shall be provided at the design pumping rate.

- The minimum force main size shall be four (4) inches in diameter for "high" pressure and one and a half (1.5) inches in diameter for "low" pressure.
- The need for air and vacuum relief valves shall be evaluated. The use of air and vacuum relief valves shall be minimized as much as possible by adjusting the force main profile to minimize high points.
- Force mains may be constructed of DIP, HDPE or PVC.

The design of a wastewater force main must be coordinated with the design of the wastewater pumping station. The proposed alignment and profile of the force main shall be developed. The profile shall depict the changes in force main elevations. The Designer shall strive to achieve a vertical profile that rises continuously from the pumping station toward the transition manhole. The system curve for the force main, showing the total energy losses associated with the range of possible pumping rates, shall be developed. Using the system curve, the Hydraulic Grade Line (HGL) profiles can be developed.

The Hazen-Williams equation shall be used for estimating friction losses in force mains. Minor losses at transitions and bends shall also be added in the determination of the total energy losses. The HW coefficient of roughness ("C" factors) for force mains shall be as follows:

Material	**"C" Factor**
DIP (Glass –lined)	120
HDPE	130
PVC	130

The use of HDPE pipe is allowable for directional drill applications if approved by the Chief Engineer. The use of PVC is allowed for corrosion control protection and if approved by the Chief Engineer.

The Hazen-Williams factors indicated are representative of long-term design values for the system. The Designer shall check all pump station and force main selections for the anticipated lower headlosses (higher C value) that are typical of newer pipelines to ensure the satisfactory operation throughout the design life of the system.

a. HGL profiles shall be developed for the various flow scenarios planned for the pumping station. All HGL profiles shall be provided on the plans separately from the standard force main design profiles. Such profiles shall be condensed at a scale of 1"=200' horizontal; 1"=20' vertical and shall indicate hydraulic gradients, flows, force main velocities, design friction coefficients, existing ground, proposed pipe invert elevations and all other pertinent data.

b. The static head shall be based on the difference in vertical elevations between the lowest "normal pump stop" level in the wet well and the point the force main discharges to the gravity sewer or at the highest point along the system, whichever is higher.

2. Size

Force main size shall be based on the required pipe's maximum carrying capacity to convey the design flow rate at permissible velocities, while minimizing life cycle costs including construction, maintenance and pumping costs. The minimum force main size shall be four (4) inches in diameter for "high" pressure and one and a half (1.5) inches in diameter for "low" pressure.

3. Velocity

Design velocities in force mains shall be between 2.0 to 6.0 feet per second (fps). A minimum velocity of 3 fps-3.5 fps shall be required to re-suspend any solids within force mains that have multiple high and low points. The maximum velocity shall be based on the ultimate design pumping rate.

B. Force Main: Plan

Force mains shall be located within public road rights-of-way whenever possible. The design location of the force main shall be as described for a water main with the following exceptions:

When installed parallel to a water main, the force main shall be designed per the horizontal and vertical clearances indicated between water and sewer mains as specified in Recommended Standards for Water Works (Ten State Standards). Water mains and water house connections shall be placed higher than the force main. A minimum of one and a half (1.5)-foot clearance from other utilities shall be maintained except for natural gas lines. A minimum of 5-feet of clearance shall be maintained between force mains and natural gas lines.

When installed parallel to an existing sewer pipeline, provide 10 feet minimum horizontal clearance.

C. Force Main: Profile

The profile layout for a force main shall be as described for a water main in with the following exceptions:

1. Ideally, the force main shall be designed without intermediate high points and with the top of the force main being below the hydraulic grade line at the

minimum pumping rate so that air release valves will not be needed. If the elimination of high points is not feasible or if the design requires long, relatively flat vertical alignments, the design may require air release and air and vacuum valves.

2. Blowoffs along 4-inch and larger force mains are required where the force main contains a depressed section between two high points.

3. Continuous uphill pumping is preferred for a force main, where the force main discharge point to the gravity sewer is at a higher elevation than the rest of the system, so as to keep the force main full.

4. Force mains with intermediate high points above the gravity sewer discharge point can create partial vacuum conditions in the force main under circumstances such as draining conditions that occur due to intermittent pumping or when the HGL profile drops below the pipeline profile. The Designer shall provide appropriate air release and air vacuum valves to protect the force main against damage under these conditions.

5. Downhill pumping is prohibited.

6. All force mains shall have a minimum 4.5-foot and maximum 6-foot depth of cover. In street rights-of-way, cover shall be measured from the top of the force main to the proposed grade, or in cases when the proposed grade is above the existing ground surface, the depth of cover shall be measured from the existing ground line. In easements across private property, future development in the area shall be given consideration when developing the force main profile and possible future development grades shall be evaluated to ensure that the minimum depth of cover is met.

7. The top of the force main and its appurtenances shall generally be designed to be lower than the HGL.

D. Pipeline Materials

1. Allowable force main materials for routine projects are indicated in the Standard Specifications. HDPE will only be considered for directional drill installations in certain circumstances such as unavoidable conflicts with existing utilities, crossing sensitive areas and corrosive soils. The use of HDPE shall require the approval of the Chief Engineer. PVC C900 Certa-Lok is also used for force mains.

2. Special consideration shall be given to the character of industrial wastes before selecting the types of material and/or coatings for force mains. External loading, corrosive soils, abrasive wastes, foundations, minimizing the number

of joints, and similar problems shall also be investigated. Joints shall be as specified in the Standard Specifications.

E. Types of Joints/Fittings

Allowable pipe joints and fittings shall be as described in Water Main Design. Force mains shall be anchored at all fittings by restrained joints or buttress construction. The operating pressure and the surge pressure shall be considered in designing thrust restraint.

F. Appurtenances

1. Air Release and Air and Vacuum Valves

   Force mains shall ideally be designed to rise continuously in profile from the pumping station to the point of discharge. To minimize installation and maintenance costs, the Designer shall evaluate the feasibility of eliminating intermediate high points by installing the main deeper below grade. Where this is not practical, the Designer shall include automatic combination air and vacuum valves at the intermediate high points to expel accumulated air under pressure, to allow air into force mains to prevent vacuum conditions and expel larger quantities of air when the mains are filled. Valves on wastewater force mains shall be specifically manufactured for wastewater service, be sized according to manufacturer's recommendations, include quick-connect flushing hoses, and shall be placed in pre-cast manholes per the Standard Details. The following guidelines shall be used to locate combination air and vacuum valves:

   a. Peaks in pipeline profiles
   b. Abrupt increases in downward slopes
   c. Abrupt decreases in upward slopes
   d. Long ascents - 1,500 ft. to 3,000 ft. intervals
   e. Long descents - 1,500 ft. to 3,000 ft. intervals
   f. Long horizontal - 1,500 ft. to 3,000 ft. intervals

2. Flushing Connections

   A flushing connection shall be located at all low points along the force main; spacing is not to exceed 400 feet. The flushing connection shall be designed to allow the Commission to clean the force main in a manner appropriate to their equipment. A witness post shall be located at all flushing connections.

3. Transition Manholes

   The connection between the force main and gravity sewer shall be designed with a transition manhole. The termination of the force main in the transition manhole

shall be designed so that the force main will be flowing full at all times. See the Standard Details for transition manhole details.

a. The invert of the gravity sewer shall be designed one (1) inch above the crown or top of the force main.

b. When the force main is 12-inches in diameter and larger, the Designer shall provide a means to protect maintenance personnel from falling into the pipeline at its connection to the manhole.

c. The interior of the transition manhole and at least one hundred feet of force main leading up to the transition manhole shall be coated to resist hydrogen sulfide corrosion.

d. The interior of the gravity sewer pipeline after the force main discharges into a gravity system shall be coated to resist Hydrogen Sulfide corrosion if it is other than PVC pipe.

e. All transition manholes shall have a watertight frame and cover.

f. There shall be no branch laterals or SHCs at a transition manhole.

4. Witness Posts

   A witness post shall be located at all flushing connections and at all road crossings.

G. Water Hammer

When the velocity of a fluid is changed, a phenomenon known as water hammer may result, leading to fractures of pipe and fittings and other damage. This condition is especially serious on long force mains or where static pumping heads are high.

The Designer shall prepare a complete study of each force main design in conjunction with the related pumping station. A written detailed analysis along with supporting calculations shall be submitted to the Chief Engineer for approval during the engineering report phase of the project. This analysis shall include, and is not necessarily limited to the following:

1. Transient pressures due to water hammer and the effect of these pressures on the entire system.
2. Investigation of the pipeline profile to determine the possibility of water column separation.
3. Reverse rotation characteristics of the pumps.
4. Shut-off characteristics of the proposed pump control valves.
5. A computer analysis of the transient pressures combined with the total system characteristics.

6. Substantiation for the use of surge valves, when necessary, listing recommended size and computed discharge pressures.

   When the maximum transient pressure plus the static head is greater than the working pressure strength of the pipe, the Designer shall perform an economic evaluation of alternatives to increase the design working pressure of the force main, including fittings, valves and all necessary restraints and buttress requirements. The Designer of the force main shall coordinate this evaluation with the pumping station Designer to determine the least expensive method for controlling water hammer pressure.

4.8 Low Pressure Sewer Systems

A. Hydraulic Calculations

1. General

   The design of a low pressure sewer system is similar to the design of a large pumping station and force main. See Section 4.7 for any items not described in this section.

   Simplex, or single pump, systems are typically used for residential units. Duplex, or two pump, systems shall be required for commercial, multi-family and higher flow sites where a simplex will not be adequate or the redundancy of a second pump is required as determined by the Chief Engineer.

   The use of HDPE and PVC pipes are allowable for low pressure sewer systems.

   The Hazen-Williams factors indicated are representative of long-term design values for the system. The Designer shall check all pump station and force main selections for the anticipated lower headlosses (higher C value) that are typical of newer pipelines to ensure the satisfactory operation throughout the design life of the system.

   HGL profiles shall be developed for the various flow scenarios planned for the system and shall be shown as described in Section 4.7.

2. Size

   Main size shall be based on the maximum carrying capacity of the pipe to convey the design flow rate at permissible velocities, while minimizing life cycle costs including construction, maintenance and pumping costs. The minimum main size shall be two (2) inches in diameter unless approved by the Chief Engineer.

3. Velocity

Design velocities in force mains shall be between 2 to 6 feet per second (fps). A minimum velocity of 3 fps shall be required to re-suspend any solids within force mains that have multiple high and low points. The maximum velocity shall be based on the ultimate design pumping rate.

B. Main: Plan

1. Mains shall be located as described above for force mains.

2. The grinder pump shall be located as close to the connecting sewer main as allowable by gravity flow from the house or building. It is preferred for the grinder pump to be located on the property line if possible. The electric panel that supplies the grinder pump shall be located within line of sight from the grinder pump. The location of this panel needs to be clearly shown on the plans. The grinder pump shall be installed at the time of connection to the sewer system.

C. Main: Profile

1. The profile layout for a low pressure sewer system main shall be as described above for a force main.

D. Pipeline Materials

1. Allowable low pressure sewer systems main materials shall meet the requirements for force main materials.

E. Types of Joints/Fittings

Allowable pipe joints and fittings shall be as described in Chapter 2, "Water Main Design." Mains shall be anchored at all fittings by restrained joints or buttress construction. The operating pressure and the surge pressure shall be considered in designing thrust restraint.

F. Appurtenances

1. Valve Pits

   Valve pits shall be in conformance with the manufacturer's recommendations and shall be located on each property.

2. Flushing Connections

   A flushing connection shall be located at all low points along the main, spacing is not to exceed 400 feet. The flushing connection shall be designed to allow the Commission to clean the main in a manner appropriate to their equipment. A witness post shall be located at all flushing connections.

3. Witness Posts

A witness post shall be located at all flushing connections and at all road crossings.

4.9 Vacuum System Design

A. Hydraulic Calculations

1. General

   The design of a vacuum system must be coordinated with the design of the receiving wastewater pumping station. The proposed alignment and profile of the vacuum main shall be developed. The profile shall depict the changes in vacuum main elevations. The Designer shall strive to achieve a profile that falls continuously along the collection system, with intermediate vertical steps (sawtooth), toward the pumping station. Design of the force main from the pumping station to the discharge point shall be in accordance with Section 4.7 above.

   The use of HDPE pipe is allowable for directional drill applications if approved by the Chief Engineer. The use of PVC is allowed for corrosion control protection if approved by the Chief Engineer.

   The Hazen-Williams factors indicated are representative of long-term design values for the system. The Designer shall check all pump station and vacuum main selections for the anticipated lower headlosses (higher C value) that are typical of newer pipelines to ensure the satisfactory operation throughout the design life of the system.

   HGL profiles shall be developed for the various flow scenarios planned for the system. All HGL profiles shall be provided on the plans separately from the standard vacuum main design profiles. Such profiles shall be condensed at a scale of 1”=200’ horizontal; 1”=20’ vertical and shall indicate hydraulic gradients, flows, vacuum main velocities, design friction coefficients, existing ground, proposed pipe invert elevations and all other pertinent data.

2. Size

   Vacuum main size shall be based on the maximum carrying capacity of the pipe to convey the design flow rate at permissible velocities, while minimizing life cycle costs including construction, maintenance and pumping costs. The minimum vacuum main size shall be four (4) inches in diameter unless approved by the Chief Engineer.

3. Velocity

   Design velocities in vacuum mains may be between 12 to 15 feet per second (fps).

B. Vacuum Main: Plan

1. Vacuum mains shall be located as described above for force mains.

C. Vacuum Main: Profile

1. The profile layout for a vacuum main shall be as described above in for a force main.

D. Pipeline Materials

1. Allowable vacuum main materials shall meet the requirements for force main materials.

E. Types of Joints/Fittings

Allowable pipe joints and fittings shall be as described in Chapter 2, "Water Main Design." Vacuum mains shall be anchored at all fittings by restrained joints or buttress construction. The operating pressure and the surge pressure shall be considered in designing thrust restraint.

F. Appurtenances

1. Valve Pits

   Valve pits shall be in conformance with the manufacturer's recommendations and shall be located on each property.

2. Flushing Connections

   If required by the Chief Engineer, the Designer shall provide a flushing connection on the vacuum main. The flushing connection shall be designed to allow the Commission to clean the vacuum main in a manner appropriate to their equipment. Therefore, the spacing of flushing connections and the size shall be determined by the Chief Engineer.

3. Vacuum Station

   The vacuum pump station shall meet the requirements of Chapter 5 with the addition of a minimum of two vacuum pumps adequately sized for the vacuum system, a collection tank and appropriate controls.

4.10 Hydrogen Sulfide Analysis

A. Analysis

Sulfides are produced when wastewater does not have a sufficient supply of oxygen.

This is especially true downstream from a pump station or pressure sewer/force main discharge. These situations may result in the release of hydrogen sulfide (H_2S) that may corrode concrete manholes, concrete pipe, concrete lined pipe or ferrous pipe materials.

The Designer shall evaluate the design of all proposed wastewater and grinder pump force mains to determine the sulfide control method and materials best suited in each case. The following Pomeroy equation shall be utilized for the calculation of sulfide generation in closed force main piping systems:

$S_2 = S_1 + (M)(t)\ (EBOD)\ [(4/D)+1.57]$

where:

S_2 = Effluent sulfide concentration from force main (mg/l)

S_1 = Influent sulfide concentration from wetwell (mg/l)

M = Empirical coefficient for sulfide production=0.0003 m/d

t = time (days)

$EBOD = (BOD_5)[1.07_{(T-20)}]$

T = wastewater temperature (degrees C)

D = force main diameter (meters)

B. Design Considerations

If sulfide concentrations for a system are predicted at concentrations greater than 1.0 mg/l, the Designer shall include provisions to either neutralize the hydrogen sulfide at the pumping station or protect the piping and structures downstream of where the force main discharges into the gravity system. The following general design considerations are for systems where 1.0 mg/l is anticipated to be exceeded.

1. The use of drop manholes is discouraged when it is found or predicted that Hydrogen Sulfide (H_2S) is already present or likely in the wastewater.

2. Where substantial concentrations of sulfide cannot be avoided, the structure at the junction of the force main and gravity sewer must be constructed or protected with acid resistant materials. All interior surfaces and inverts of sanitary sewer manholes within 100 feet downstream of either a force main or

grinder pump discharge shall be coated with a hydrogen sulfide resistant material such as H_2S resistant epoxy paints, polyvinyl chloride (PVC), polypropylene (PP) and high-density polyethylene (HDPE). In addition, hydrogen sulfide protection shall be provided downstream of a force main or grinder pump discharge where significant turbulence may be caused due to a drop manhole, severe pipeline slopes or any other sources of turbulence within a sewer system. Protection must be provided to all surfaces exposed to the sulfides. All applications of specialized coatings and liners are subject to the review and approval of the Chief Engineer. See the Standard Specifications for all coating and lining material requirements.

3. For references purposes, the Designer may use the latest publication from the U.S. Environmental Protection Agency for design guidelines in evaluating the sulfide generation.

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CHAPTER 5

WASTEWATER PUMPING STATION DESIGN

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CHAPTER 5
WASTEWATER PUMPING STATION DESIGN

5.1 Introduction

This Chapter includes the criteria and guidelines for designing wastewater pumping stations in St. Mary's County. All new wastewater pumping stations shall incorporate GREEN technology when possible.

To the extent practical, designs shall conform to the design standards given herein as well as the latest publication of the "Recommended Standards for Wastewater Facilities" (Ten-State Standards). The design standards shall be applied to design conditions in a careful and thoughtful fashion. Deviations from the design standards must be brought to the attention of the Chief Engineer. Requests for waivers of either the design manual or Ten-State Standards must be justified to the Chief Engineer, in writing, from an engineering evaluation standpoint and include consideration of life cycle costs and ease of maintenance. Approval or denial of the waiver request will be by return letter signed by the Chief Engineer.

5.2 Regulations

Wastewater pumping stations must satisfy the regulations of agencies having jurisdiction.

Wastewater pumping stations shall conform to the latest addition of the "Recommended Standards for Wastewater Facilities" (aka. 10-State Standards) as well as the latest addition of MDE's "Design Guidelines for Sewerage Facilities." Buildings shall comply with applicable IBOCA and St. Mary's County building code requirements as well as any permitting requirements of the St. Mary's County Department of Land Use and Growth Management. Other regulations governing facilities and construction shall be adhered to, including regulations published by the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), National Electric Code (NEC), State of Maryland Plumbing Code and others as applicable.

5.3 Permits and Approvals

Refer to Chapter 1 in this manual for applicable permit requirements. In addition, for any above ground structure, the Designer shall make all applications for and obtain the required building and grading permits prior to bidding of the project.

5.4 Design Phases

A. Engineering Report

The engineering report shall include the description of design criteria to be utilized, preliminary flow computations, design calculations, calculated system curves, surge protection analysis/recommendation, identification of land acquisition and easement requirements, number of property owners involved, listing of permit requirements and cost estimate based on unit costs for major elements of work. In addition, the following design criteria shall be developed:

1. Site Development
2. Structural Design
3. Architectural Design
4. Hydraulic Analysis
5. Mechanical Design
6. Electrical Design
7. Process and Instrumentation Control
8. Corrosion Control
9. Odor Control
10. Noise Control
11. Secondary Power Supply
12. Skid-mounted standby pump.

Once the engineering report has been approved by the Chief Engineer, design of the facilities may proceed. Milestone submittals of design plans and specifications shall be made at 30%, 60%, 95% and Final Design.

B. Design Plans & Specifications

At a minimum, the following information shall be supplied at the milestone submittals:

30% Submittal: Site Plan, Design Schematics (showing station layout and major equipment), Specification Table of Contents.

60% Submittal: Complete civil, mechanical and structural design plans and preliminary technical specifications.

95% Submittal: Complete design for all disciplines including electrical and architectural plans and details. Complete specifications including front end documentation. This phase should

represent complete, bid-ready contract documents from the Designer.

Final Design: The 95% Submittal with the Chief Engineer's final comments incorporated.

C. Cost Estimate

At each formal submittal and at the conclusion of the design process, the Designer shall prepare a detailed cost estimate for the pumping station. This estimate shall be developed for each major category of work including civil, mechanical, electrical, structural, architectural work and contingent cost.

5.5 Types of Wastewater Pumping Stations and Selection

St. Mary's County wastewater pumping stations are divided into two categories, small (less than 250 gpm) and large (greater than 250 gpm). The types of stations allowed and in order of preference are described below along with acceptable selection criteria. All pump stations shall be equipped with a channel mounted macerator.

Suction Lift: Suction Lift stations are defined as stations where the pumps are located above the water level of the wet well and hence must employ some means of lifting the wastewater to the pumps in order for the pumps to be primed.

Suction lift stations shall not be used for suction lifts (water level in wet well to centerline of pump volute) greater than 18 feet or motor sizes greater than 20 Hp.

Submersible: Submersible stations are defined as stations where the pumps are "submerged" in the wet well. Because the pumps operate under water in the wet well, there is no need for a separate pump room. Guide rails enable the pump to be raised and lowered into place without requiring entry by personnel under normal circumstances. Submersible stations shall not be used for wet well depths greater than 25 feet or motor sizes greater than 10 Hp except for special low flow conditions.

Package: Package pumping stations are defined as wet well/dry well pumping stations in which the pumps, suction and discharge piping, pump dry well, electrical equipment and connections are pre-assembled by a single manufacturer and then erected on-site by the Contractor.

Package pumping stations with metal, dry well chambers are not acceptable.

Pre-cast concrete or fiberglass dry well chambers will be permitted. The pumping station wet well may or may not be supplied by the package manufacturer.

Package pumping stations shall not be used for wet well depths greater than 25 feet.

Conventional: Conventional pumping stations are defined here as pumping stations in which the wet well and dry well structures are assembled or constructed on site and are typically used for flows greater than 250 gpm. The preferred method of construction is for the Contractor to use pre-cast concrete sections. However, if the configuration or sizes would make this unfeasible then cast-in-place concrete sections will be permitted with the approval of MetCom. All of the piping, valves, wiring and controls are assembled on-site by the Contractor.

5.6 Hydraulic Computations

A. Design Flow Rate

Wastewater pumping stations must satisfy the design flow rate. The design flow rate is the peak flow rate for the service area plus the I/I allowance. The design of wastewater pumping stations shall consider existing and projected peak flow rates and wastewater composition. Wastewater pumping stations shall be designed to pump the peak flow for existing and future users plus the I/I allowance. In developed areas, population shall be determined by house count and non-domestic user inventory with allowances made for remaining undeveloped tributary areas. Population densities and per capita flows shall be as established by Facility Plans or in their absence, in agreement with the Comprehensive Water and Sewerage Plan or as instructed by the Chief Engineer. Institutional, commercial and industrial flows shall be determined by a study of similar types of establishments.

The Chief Engineer shall be consulted for future domestic and non-domestic land use and population densities. A drainage area map and tabulation of the design flow shall appear on the plans. The map and tabulations shall show initial and ultimate drainage areas and wastewater flows.

B. Wastewater Composition

Wastewater composition can vary widely depending upon the proportion of design flow generated by non-domestic users. Non-domestic user wastewater composition shall be investigated and the results included in the Engineering Report provided to the Chief Engineer. Adequate consideration and all necessary provisions shall be taken to ensure that wastewater pumping station equipment and materials are suitable for the anticipated composition of the wastewater.

Consultation with the Chief Engineer is required in the event that the wastewater composition affects standard material and equipment requirements.

C. Number of Pumps

Wastewater pumping stations shall be capable of pumping the design flow rate with the largest single pump out of service.

D. Wetwell Sizing

Wetwells shall be sized in accordance with MDE requirements.

E. Hydraulic Analysis

Wastewater pumping stations must satisfy the hydraulic conditions of the system. The Designer shall perform a complete hydraulic analysis of each wastewater pumping station. The hydraulic analysis shall consider potential impacts on existing force mains, gravity sewers and pumping stations when the new pumping station is added to the system. See Chapter 4, “Sewer Main Design,” for force main design requirements and analyses that must be performed in conjunction with the pumping station design.

Wastewater pumping stations shall be designed to operate at the appropriate discharge head and flow rate.

F. Pump and System Curves

System curve (Head vs. Flow) characteristics shall be determined by the Hazen-Williams formula for piping head loss. The pump/system curve shall be shown on the plans to scale. The pump/system curve shall show the following information at a minimum:

- Static Head
- Pipe Friction Losses
- Pump Curve
- Pump Horsepower, Efficiency and RPM

Pump / system curves shall be shown for single pump operation, as well as for multiple pump operation in stations having three or more pumps. Hazen-Williams "C" factors used in evaluating pump and system curves shall be in accordance with the guidelines given in Chapter 4, “Hydraulic Calculations,” of this manual for various pipe materials.

G. Water Hammer

The potential impact of water hammer shall be evaluated. If the combined effects of static head and water hammer do not exceed the weakest piping system component working pressure by a safety factor of 1.1, no special provisions need to be included to control water hammer. Where the maximum water hammer pressure exceeds the weakest piping system component working pressure by a safety factor of 1.1, strengthen those elements affected, reevaluate pipe size and velocities or select an appropriate device to control water hammer. No pressure vessel/surge tank type devices will be acceptable. The decision to strengthen piping system components instead of utilizing a water hammer control device or different pipe size shall be based upon a life cycle cost economic comparison.

H. Pump Selection Criteria

Provide proper wet well design and suction line design per Hydraulic Institute Standards to avoid cavitation. The Designer shall perform a net positive suction head available (NPSHA) analysis and include this information in the pump specification.

The NPSHA shall be calculated for the expected design flows and shall exceed the pump manufacturer's requirements by an added margin of safety of not less than five (5) feet. Pumps shall be selected to have their maximum efficiency at the operating point. Under no circumstances shall a pump be specified to operate outside of its published recommended range. Examples would be pumps operating at very low flows and high heads, near shutoff heads, or "runout" conditions (maximum possible flow rate of the pump). These conditions can result in excessive hydraulic loading or cavitation damage to impellers, casings and shafts, rapid bearing and mechanical seal wear, and high vibration. The Designer shall avoid the selection of pumps whose curves are flat (i.e. small changes in head resulting in large changes in flow rate).

5.7 Large Wastewater Pumping Stations

Conventional wastewater pumping stations shall be engineered to meet the requirements of these guidelines, as well as any supplemental guidelines imposed by the Chief Engineer on a case-by-case basis. These stations will have a wet well/dry well configuration and be of pre-cast or cast-in-place concrete construction. Conventional pumping stations shall be designed as long-term (greater than 20 years) facilities. The design of conventional stations shall include room for anticipated expansion. The following guidelines and features shall be incorporated in the design of these stations:

A. Site Design

1. Location: Wastewater pumping stations shall be located as far as possible from populated areas. Natural screening and remoteness of the site shall be primary elements of site selection wherever possible. Where pumping stations are sited in proximity to developed areas, the architecture of the station shall be compatible with the surrounding area. Predominant wind direction for potential odor dispersion and building aspects such as generator exhaust and ventilation fan noises shall be considered. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties.

2. Land Acquisition: Land required for pumping stations, including necessary vehicular access routes to an existing or proposed public roadway shall be owned in fee simple by the Commission. As part of this process, a boundary survey of the property is required together with a record plat and a metes and bounds description of the parcel. In determining the space requirements for the facility, particular attention shall be given to the width provided for the access road to ensure adequate space for grading and drainage within the access road right-of-way and easy access for maintenance and delivery trucks.

3. Topography: Sewers tributary to wastewater pumping stations commonly dominate site selection. Adjacent drainage areas potentially served by the wastewater pumping station must also be considered. Wastewater pumping station site selection shall also be compatible with suitable site access, and soil capability with respect to land grading in conjunction with site development. Existing contours and other topography shall be shown for the entire site including a 100-foot minimum width outside of the proposed property boundary.

   Contour interval shall be two-foot, unless otherwise approved by the Chief Engineer.

4. Floodplain: Wastewater pumping stations shall be sited to remain operational and permit access during a 100-year return frequency flood. The pumping station top slab elevation shall be set a minimum of three-feet above the 100-year floodplain elevation. The access road shall be above the 10-year return flood level elevation.

5. Wetlands: Avoid direct impacts wherever possible and minimize impacts to wetland buffer areas. Buffer areas include the first 25 feet beyond non-tidal wetlands.

6. Grading: Wastewater pumping station grades shall prevent local ponding, provide positive drainage away from structures and generally be limited to no greater than 4 percent slopes. Stone surfaces around paved areas shall provide proper site drainage at slopes 10 percent or less. Land grading outside of the wastewater pump station perimeter fence shall not exceed 3 to 1 slopes; 4 to 1 slope maximums are desirable. Lesser slopes wherever possible are preferred.

   Site grading design shall be compatible with slope stability for the soils encountered. Slope stabilization shall be appropriate for the degree of slope and soil conditions. The use of retaining walls on or immediately adjacent to the wastewater pumping station site is not permitted. Access drive slopes shall be a maximum of 7 percent at any point along the centerline of the drive.

7. Sediment Control: A sediment control plan shall be provided and approval obtained from the Soil Conservation Service (SCS).

8. At least two test borings shall be taken, one at the proposed wetwell location and one at the proposed building to determine soil types, rock, water table elevations, soil bearing values, etc. Standard penetration tests shall be taken at intervals not to exceed five (5) feet. Borings shall be taken to a depth of not less than fifteen (15) feet below the bottom of the proposed structure. Borings shall be taken deeper as necessary, depending on soil conditions.

9. Landscaping: Landscaping shall meet County requirements for buffers and shall consist of low maintenance shrubs and trees for screening.

10. Site Security: Pumping station sites shall be fenced with black vinyl coated chainlink fencing, black vinyl coated post and black hardware, and a 12-foot wide double leaf locking gate for vehicle access. Three strands of barbed wire on angled barb arms, shall be included for a total height of seven feet (six feet of fabric with one foot of barbed wire) or shall be eight feet high fabric without barbed wire. Additional property line fencing may be required as determined by the Chief Engineer. The pumping station building shall have exterior lighting controlled by motion detectors. The pumping station doors shall be 16-gauge steel with locks keyed as specified by the Chief Engineer. The building shall be provided with an entry alarm connected to the station SCADA.

11. Paving: Pumping station sites shall have a paved access road and a minimum of two parking spaces. The access road shall have sufficient room and turn-around area so as to allow access to the wet well by maintenance boom and vacuum trucks.

The turning area in a pumping station site shall have a minimum turning radius of 50 feet. Pumping station access roads shall be used exclusively for pumping station maintenance and access.

12. Station Sign: A permanent sign shall be provided at each pumping station stating the station name, street address and emergency telephone number. The sign must meet St. Mary's County 911 addressing system.

13. Pumping stations shall not be located directly downstream of any stormwater management facility discharge. Site grading shall direct surface water away from the structure.

14. DIP shall be used inside the pump station vaults and PVC can be used outside of the vault.

B. Structures

1. Wet Well Design: Wet wells shall be considered a hazardous environment, classified as NEC Class I, Division I for explosive gases. Wet wells shall be designed and constructed to be as hazard free as possible, and corrosion-resistant materials shall be used throughout. All materials and equipment used in wet wells shall meet NEC Class I, Division I standards, with the exception of control floats.

   Conduits between the junction box and control building shall be sealed at the junction box with explosion-proof seals. Conduits carrying float cables between the junction box and the wet well shall be sealed with explosion-proof seals. Junction box is to be placed outside of the wet well.

   a. Structure: Wastewater pumping station wet wells shall be constructed of reinforced concrete. Wastewater pumping station wet wells shall consist of reinforced concrete base slabs, riser sections/walls and top slabs. Wet wells shall have an interior epoxy paint finish and exterior elastomeric membrane waterproofing. The bottom of the wet well shall be grouted to a minimum slope of 45 degrees toward the pump suction inlet.

      Wet wells shall be adequately designed to prevent flotation. The wet well size and depth shall be as required to accommodate the influent sewer, as well as pump suction submergence as recommended by Hydraulic Institute Standards. The required working volume and preferred intervals between influent sewer and control elevations shall be determined as follows:

      Wet wells shall be designed for a minimum pump cycle time of 15 minutes as defined by the following formula:

$T = 4V/Q$

where:

T = Pump Cycle Time (time between pump starts) in Minutes

V = Volume of wet well between the lead pump start and pump stop elevations, in gallons

Q = Pump rate of the lead pump, in gallons per minute

The detention period for wastewater in the wet well shall not exceed 30 minutes at the average flow rate for the initial, intermediate and ultimate design years. When initial average flows are insufficient to actuate the pumps within a 30-minute period, temporary removable appurtenances shall be placed in the wet well or the adjustable floats for pump start shall be lowered. Wet wells shall be deep enough to accommodate the control elevation points.

b. Access: Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be 36-inch by 36-inch minimum size and as large as necessary to allow removal of equipment from the wet well.

c. Ventilation: Wet wells shall be provided with a separate ventilation system and shall be sized to provide a minimum of 30 complete air changes per hour. In addition to manual control, time clock operation of fans shall be provided to allow a minimum of two (2) complete air changes per hour.

   Ventilation shall be accomplished by the introduction of fresh air into the wet well under positive pressure. The fan shall be installed outdoors. The fan assembly and housing shall be corrosion-resistant and weatherproofed. The entrance hatch to the wet well shall be provided with a limit switch to energize the fan whenever the hatch is open. The fan shall be direct drive.

d. Access: Access to the wet wells shall be located a minimum of 12-inches above finished grade.

2. Dry Well Design: Dry wells shall consist of reinforced concrete construction. Dry wells shall have exterior elastomeric membrane waterproofing.

   The dry well floor shall be sloped to a sump. A sump pump with piping to the wet well shall be provided and sump pump alarms are required. Sump pump piping shall contain a check valve to prevent siphoning from the wet well. The pump suction isolation valve shall have a hand wheel with an operating

stem extending up to the control room. The hand wheels shall be marked with an open arrow. A surge relief valve, if required, shall be placed on the discharge header before the pipe leaves the station. Surge relief piping shall be piped to the wet well.

a. Access: Dry well access shall be via a staircase with all necessary landings and handrails per OSHA requirements. Equipment hatches for the pumps shall be located in the top slab and directly above the pumps. Traversing monorails with cranes of adequate capacity shall be provided above the dry well to facilitate removal of the pumps, motors, valves and all other related equipment. Grating (catwalks) shall be provided in the dry well to facilitate access to all piping without climbing over pipes, equipment, etc.

b. Ventilation: Dry wells shall be provided with a separate ventilating system and shall be sized to provide a minimum of 10 complete air changes per hour. In addition to manual control, time clock operation of fans shall be provided to allow a minimum of four (4) complete air changes per hour.

   Ventilation shall be accomplished by the introduction of fresh air into the dry well under positive pressure. The dry well ventilation system shall under no circumstances be connected to the wet well ventilation system and shall be away from any source of contamination.

   Ventilation shall be automatically activated whenever the dry well lighting is energized and/or the access door is opened and the station is occupied by personnel.

3. Influent Manhole: An influent manhole collecting all of the gravity sewers that flow to the pumping station shall be provided. The influent manhole shall be located on the pumping station site. A gravity sewer shall carry wastewater from the influent manhole to the wet well. The influent manhole shall be capable of being isolated from the pumping station wet well.

4. Influent Grinder/Macerator: An influent wastewater channel mounted grinder/macerator (grinder) shall be provided. The influent grinder shall be of the vertical twin rotor type and be located in either the influent manhole or in the wet well. The influent grinder shall be capable of being lifted out of the wet well or manhole by means of stainless steel guide rails without entering. The influent grinder motor shall be explosion proof and rated NEMA 4X. The grinder shall be timer operated with an upstream high water level override.

5. Pumping Station Design/Architectural Standards: Pumping stations shall be architecturally compatible with surrounding structures and shall not have slate roofs. Pumping stations shall be of pre-cast concrete walls and concrete roof or shall be pre-cast concrete and shall be designed to be vandal-proof. Wood

or asphalt shingles are not permitted. There shall be no exposed woodwork on the outside of the building. All exterior woodwork shall have a vinyl or aluminum coating. The pumping station shall have a lightning protection system. Provisions shall be made in the structure for traversing bridge cranes of adequate capacity to facilitate the removal of pumps, motors, valves and all other related heavy equipment. Doors shall be constructed of heavy duty metal with deadbolts and locks keyed to the Commission standard.

The building shall be a minimum of 10 feet by 12 feet and shall include a work bench and wall cabinets for storage.

The finished floor and all electrical equipment shall be located at least three feet above the 100-year flood elevation. Ventilation openings shall be protected with aluminum louvers with bird screens. Floors shall be sloped to floor drains piped to the influent manhole or wet well. The building shall be furnished with a service sink with both hot and cold water, on-demand hot water heater, outside non-freeze hose bibb, small desk with chair, and telephone line. The Chief Engineer may require in some instances that a toilet room with waste piped to the influent manhole or wet well also be provided. The building shall conform to all St. Mary's County building codes and zoning regulations.

a. Control Room

   Electrical equipment shall be located above grade in a control room above the dry well. The control room shall be designed with adequate space to accommodate future upgrades.

b. Toilet Room

   In some instances, a toilet room shall be provided with toilet, lavatory, on-demand hot water heater, towel dispenser, soap dispenser and mirror.

c. Generator Area

   If a permanently mounted pump-around is not appropriate for the type of system proposed, a separate generator area shall be provided for the emergency generator and fuel tank. The generator area shall be located a minimum of three (3) feet above the 100-year flood elevation.

6. Pumping Station Building Heating and Ventilation: The building shall be heated by electric unit heaters with integral thermostats sized to maintain a minimum inside temperature of 55 degrees Fahrenheit. Ventilation shall be by means of wall mounted exhaust fans with backdraft dampers operated by thermostats and freezestats and intake louvers with motor operated dampers.

Ventilation shall be designed for a minimum of six (6) air changes per hour. Provisions shall also be made, if applicable, to ensure against condensation forming on controls and other major items of equipment.

C. Equipment

1. Yard Valves: Yard valves shall be buried plug valves complying with the Commission's Standard Specifications and Details for Construction with operating nut and roadway valve box at grade.

2. Station Bypass: If a permanently mounted pump around is not provided, the wastewater pumping station shall be provided with an auxiliary force main connection downstream of the station in addition to the influent manhole described above to enable the station wet well to be taken off-line for periodic maintenance or repairs. The connection shall use a plug valve or resilient seat gate valve for isolation. The point of connection shall be conveniently located with respect to the wet well.

3. Interior Piping: All interior wastewater piping shall be DIP, Class 53, with flanged fittings. Flanges shall be integrally cast on pipe or factory assembled screwed-on with proper bonding compound. Manifolds shall include flexible couplings for make-up and for expansion and contraction of the piping system.

   Flexible couplings shall be provided on the suction and discharge of each pump.

   Arrangement of piping and equipment within the station shall be made with adequate space for maintenance, repair, removal or replacement of equipment, as well as to safeguard personnel working in the station. Piping shall be adequately supported. Control and instrumentation piping shall be copper or stainless steel.

4. Valves: Each wastewater pump shall have isolation valves on the suction and discharge to permit the removal or maintenance of the pumps without affecting the operation of the remaining pumps. Interior isolation valves shall be plug valves. The pumping station isolation valve shall be provided with a handwheel, extension stem and operating nut to allow access from the Control Room floor. The handwheel shall be marked with an open arrow. Each pump shall have a hydraulically operated, time adjustable pump check service valve or a swing check valve to prevent backflow through inoperative pumps. In accordance with the criteria for water hammer control, pump check service valves shall be of the type and strength required to eliminate water hammer damage. Isolation and check valves may be located either inside the pumping station building or in a separate valve vault. Pump isolation or check valves

shall not be located in the wet well. Spring type, oil cushioned elbow surge relief valves, when required, shall be provided on the discharge header of the station and be piped to the wet well.

5. Pressure Gauges: Pressure gauges for direct reading of line conditions shall be placed on both the suction and discharge of each pump and on the main discharge header piping after the last pump. Pressure gauges shall be oil-filled type, have a minimum 3 ½-inch diameter face and be equipped with snubbers and diaphragms.

   Accuracy shall be to within 0.5% of pressure. Pressure gauges shall have a range such that the normal operating pressure is near the middle of the gauge.

6. Flow Metering: All wastewater pumping stations shall have polyurethane lined magnetic type flow meters with a replacement spool piece or bypass line provided to enable the pumping station to operate when the meter is being serviced.

   Magnetic flow meters shall be provided with grounding rings and isolation valves. Accuracy shall be to within 1% of flow. All flow meters shall have an adequate straight run of pipe both upstream and downstream of the meter in accordance with the manufacturer's recommendations. A seven (7) day circular chart recorder with totalizer and indicator recorder in units of gpm shall also be provided.

7. Pumping Units: Wastewater pump suction and discharge shall be 4-inch minimum diameter. All wastewater pumps shall rotate clockwise as viewed from the motor end. Wastewater pumps shall be centrifugal non-clog solids handling pumps capable of passing a 3-inch sphere and meet all requirements of MDE.

   The pump bearings shall have a minimum 100,000 hours ABMA-10 bearing life. The pump motors shall operate on 460 volt, 3 phase, 60 cycle electrical service and at a speed no higher than 1780 rpm. The pump motor horsepower shall be sufficient to prevent motor overload under all possible conditions. The pumps shall meet the vibration performance specifications of the Hydraulic Institute (HI). All wastewater pumps shall be factory witness tested and approved prior to shipment. All wastewater pumps must pass an on-site vibration test performed by an independent vibration testing company prior to acceptance. Wastewater pumps and motors shall be suitable for continuous duty. Pumps shall be of the types listed below.

   a. Dry Well Wastewater Pumps (conventional and package stations only):

Pumps shall be of the dry pit submersible design. The pump casing/volute, impeller, support base, suction elbow, seal housing/motor adapter and motor housing shall be of cast iron construction. The pump's casing and impeller shall be fitted with replaceable hardened stainless steel wear rings to maintain sealing efficiency between the volute and the impeller. At the option of the Chief Engineer, other pump materials may be required to suit a particular application. Each pump discharge volute casing and suction elbow shall be provided with an inspection and clean out opening.

b. Dry pit submersible wastewater pumps shall have the following additional features:

1) One piece backhead and motor adapter with impeller adjustment cap screws.

2) Solid full diameter stainless steel shaft with no shaft sleeve or solid large diameter high strength alloy steel shaft with stainless steel shaft sleeve having a tapered end with a keyway to receive the impeller.

3) Double mechanical shaft seals cooled and lubricated by potable water through a cleanable seal filter assembly and provided with a mechanical seal vent with petcock. Oil cooled may be provided with the approval of the Chief Engineer.

4) Premium Efficiency motors shall be specified (where commercially available) for all three-phase pump motors. Dry Pit submersible wastewater pumps shall be designed for continuous operation in air for application in a dry well. The motors for dry pit applications shall be capable of a minimum of eight (8) starts per hour in air.

The pumps/motors shall also be designed to function continuously in a submerged condition should the dry well become flooded. Motor cooling shall be via cooling water jacket, submersible-rated air-over motor cooling fan or positively forced oil cooling. Variable drive units shall be provided when feasible.

D. Electrical and Controls

1. Electrical Design: All electrical designs and components shall be in strict accordance with all applicable National and County Code requirements. Electrical design shall be such that phase out protection shall be provided so that the power will automatically switch off in the event of a loss of any one phase. Incoming electrical service shall be underground with electric meters installed outside the pumping station building. The electrical plans shall include, but not be limited to, the following:

a. Complete plan layout indicating all conduit, wire sizes and equipment locations including lighting and other appurtenances. Incoming electrical service on the pumping station site shall be underground and within concrete encased conduits.

b. Installation details of equipment that are wall mounted, or suspended from the ceiling or otherwise required for clarity.

c. Single line diagrams incorporating all electrical components required for operation of the facility.

d. Complete lighting schedule noting model, size, location and installation data as well as appurtenances. Vandal proof exterior lighting shall be provided.

e. Complete control and SCADA diagrams.

f. Elevation of control panels with equipment and mounting dimensions and notes identifying each component.

g. Complete circuit breaker schedule indicating size and identifying each circuit.

h. Ventilation schedule noting fan size, operating conditions, location, model, installation data, etc. The ventilation schedule shall also outline louver data including size, material, fixed or motorized.

i. Secondary power facilities and alarm equipment shall be designed so that they may be manually activated for periodic maintenance checks to ensure proper operation.

j. Provide a legend of all symbols used for the above.

2. Lightning and Surge Protection: The Designer shall provide lightning and surge protection at the wastewater pumping station. The lightning and surge protection shall comply with the latest editions of all applicable codes and standards.

3. Backup Power (when permanently mounted pump around is not provided): All wastewater pumping stations shall be provided with either emergency generators or a secondary power feed with automatic transfer switches as described in MDE guidelines. Emergency generators shall be sized to maintain full station operation. Emergency generators shall be diesel driven with fuel storage on the underside of the generator in a belly tank or outside

the building in an above ground storage tank. Fuel spillage protection shall be provided. Tank size shall be suitable for a minimum of 24 hours of generator operation at full load. When emergency generators are located inside the pumping station building, they shall be mounted on vibration isolators, with a fuel tank fill connection to the outside. Generator engine exhaust shall be provided with a critical grade silencer and piped to the outside of the control building. Generator exhaust shall face away from nearby neighbors. If this is not possible, a baffle wall shall be constructed in front of the generator exhaust to deflect the noise.

Generators shall be fueled by natural gas. If natural gas is unavailable and a new service cannot be obtained, propane may be used. If either natural gas or propane is not feasible, a diesel fuel powered generator shall be provided.

4. Controls and Alarms: The pumps shall be controlled by means of either an ultrasonic or submersible level transmitter. The transmitter shall be programmed to turn the pumps on or off at various levels in the wet well as described below.

   The lead and lag pumps shall alternate automatically with every pumping cycle. Ultrasonic level transmitter sensors shall be mounted near the top of the wet well and be removable without entering the wet well. The transmitter shall also report the level in the wet well on an indicator located inside of the station. The pumping station shall also have a back-up mercury float switch control system with floats for turning the individual pumps on and off if the ultrasonic level transmitter malfunctions. Pumps shall have back-up floats to maintain the "safe pumping capacity" (i.e. largest pump out of service) of the station. The back-up floats shall be wired directly into the TCU. The controls shall be designed so that upon a malfunction of the ultrasonic level transmitter control system, control shall be transferred to the back-up float control system and an alarm transmitted to the Commission. Pump control shall then continue to operate on the float control system until manually reset back to the primary ultrasonic level system.

   A separate manual control shall also be provided so that the pumps may be manually activated or shut down, thereby overriding the automatic controls. An exception to this override shall occur when the station shuts down due to a loss of phase from the primary or secondary power sources. Each control system shall have an individual circuit breaker.

   All equipment shall be provided with pilot lighting indicating "on" and "off" operating status and lights shall be green and red, respectively, and be located at a central control panel. Indicator lights for the pumps shall be located on the outside of each starter cabinet.

5. SCADA: At a minimum, the following SCADA shall be provided at each pumping station:

    a. Pump On (each pump)
    b. Pump Failure Alarm (each pump)
    c. Control Valve Failure Alarm (each control valve)
    d. High Wet Well Water Level Alarm
    e. Low Wet Well Water Level Alarm
    f. Loss of Primary Power Alarm
    g. Generator/Secondary Power On
    h. Telemetry Failure Alarm
    i. Antenna Tower

    A minimum of five (5) spare inputs and five (5) spare outputs shall be provided with the SCADA system. The Chief Engineer may require additional telemetry and SCADA communications at a particular station.

    The Designer shall obtain from the Chief Engineer any information necessary for proper system communication, which may be applicable.

E. Painting and Coating

All exposed piping, pump equipment and appurtenances shall be painted with epoxy coating. All pumping station control rooms shall be painted. Pumping station dry wells shall not be painted. Wet wells shall be coated as described in previous sections of this chapter. Painting system and colors shall be submitted to the Chief Engineer for approval. All pumping station floors shall have floor hardeners.

F. Miscellaneous

1. Odor Control: An odor control system shall be provided when required by the Chief Engineer. The type of odor control system to be used at a particular station must be approved by the Chief Engineer prior to design. Odor control systems shall be designed to mitigate odors from the wet well and influent manhole.

Acceptable methods include, but are not limited to: carbon adsorption (air scrubbing), chemical addition at the wet well or influent manhole, and soil odor filters.

Wastewater pumping stations should be designed to minimize the possible formation of odors by limiting wet well detention times and avoiding turbulence in manholes and wet wells which cause odors to be released.

2. Operations and Maintenance Manual: Three (3) complete operations and maintenance manuals shall be provided for each pumping station. Manuals should contain approved shop drawings, catalog cut sheets, description of operation including various control sequences or any other special operational details incorporated in the pumping station design, equipment model and serial numbers, installation instructions, maintenance schedules, list of recommended spare parts, warranties, names and telephone numbers for local equipment representatives, for each item of equipment.

5.8 Small Wastewater Pumping Stations

A. General

Design criteria for small wastewater pumping stations shall be the same as for conventional stations described above except where specifically stated otherwise.

B. Suction Lift Stations

1. Pumping Station Configuration: Suction Lift pumping stations shall be designed with the pumps mounted directly above the wet well and shall have suction pipes that are straight. Suction Lift stations shall satisfy pump NPSH requirements.

   Suction Lift stations shall have suction lift no greater than 18 feet. Two-stage pumping is not acceptable. The pumping station building shall contain all electrical and control equipment as described in the preceding sections of this chapter. The wet well and pumps shall be located adjacent to the pumping station building. The wet well and pumps shall be covered by a canopy roof structure that is attached to the pumping station building and is of the same construction as the pumping station building roof. The emergency generator shall be located outside of the pumping station building in a weatherproof, sound insulated enclosure.

2. Wet Well Design: Suction Lift pumping station wet wells shall be designed for pre-cast concrete construction. Wet well coating and design features shall

be the same as described for conventional pumping stations except as described below.

a. Access: Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be 36-inch by 36-inch minimum unobstructed size and as large as necessary to allow removal of equipment from the wet well.

b. Ventilation: Wet well ventilation for suction lift pumping stations shall be the same as for conventional pumping stations.

3. Suction Lift Wastewater Pumps: Pump volute, impeller and motor housing shall be of cast iron construction. The pump volute casing and impeller shall be fitted with replaceable stainless steel wear rings to maintain sealing efficiency between the pump volute and impeller. At the Chief Engineer's option, other special pump materials may be required for a particular application. All nuts, bolts and screws shall be stainless steel. Both vacuum prime and self-priming suction lift pump styles are acceptable.

4. Flow Meter Vault: A flow meter meeting all the same requirements as for conventional pumping stations shall be located in a pre-cast concrete vault located on the pumping station site with an adequate straight run of pipe both before and after the vault as required by the flow meter manufacturer. The flow meter vault shall be coated on the outside with elastomeric membrane waterproofing. The flow meter vault shall be equipped with an aluminum access hatch. Ventilation shall be by means of two gooseneck openings at the top of the vault. The floor of the flow meter vault shall be sloped to a sump with a drain open to gravel when required.

C. Submersible Stations

1. Pumping Station Configuration: Submersible pumping stations shall be designed with an equipment hatch in the top slab for pump removal, non-sparking, stainless steel, guide rails and manway hatch. Pumps shall be of the wet pit submersible type. The pumping station building shall contain all electrical and control equipment and a toilet room as described in the preceding sections of this chapter. The wet well and pumps shall be located adjacent to the pumping station building. If applicable, the emergency generator shall be located outside of the pumping station building in a weatherproof, sound insulated enclosure.

2. Wet Well Design: Submersible pumping station wet wells shall be designed for pre-cast concrete construction. Wet well coating and design features shall be the same as described for conventional pumping stations except as described below.

a. Access: Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be 36-inch by 36-inch minimum unobstructed size and as large as necessary to allow removal of pumps from the wet well.

b. Ventilation: Wet well ventilation for submersible pumping stations shall be the same as for conventional pumping stations.

c. Size: The wet well size and depth shall be as required to accommodate the influent sewer, as well as for complete pump submergence.

3. Wet Pit Submersible Wastewater Pumps: Pump volute, impeller and motor housing shall be of cast iron construction. The pump volute casing and impeller shall be fitted with replaceable stainless steel wear rings to maintain sealing efficiency between the pump volute and impeller. At the Chief Engineer's option, other special pump materials may be required for a particular application. The motor shaft shall be a single piece heat-treated high strength alloy steel or high strength stainless steel having a tapered end with keyway to receive the impeller. All nuts, bolts and screws shall be stainless steel. The motor shall be Class F insulated (minimum) and sealed from the pump by independent double mechanical seals.

   The upper and lower mechanical seal shall run in an oil chamber. The upper seal shall be a stationary tungsten-carbide seal with rotating carbon ring. The lower seal shall be one stationary and one positively driven rotating tungsten-carbide ring. All mating surfaces where watertight sealing is required shall be machined and fitted with a rubber O-ring. The machining of mating surfaces shall provide metal to metal bearing on sealing surfaces without crushing the O-ring.

4. Valve Vault: Pump check and isolation valves meeting all the same requirements as for conventional pumping stations shall be located in a pre-cast concrete vault adjacent to the wet well. The valve vault shall be coated on the outside with elastomeric membrane waterproofing. The valve vault shall be equipped with an aluminum access hatch. Ventilation shall be by means of two gooseneck openings at the top of the vault. The floor of the valve vault shall be sloped to a sump with a drain open to gravel.

5. Flow Meter Vault: A flow meter meeting all the same requirements as for conventional pumping stations shall be located in a pre-cast concrete vault located on the pumping station site with adequate straight run of pipe both before and after the vault as required by the flow meter manufacturer. The flow meter vault shall be coated on the outside with elastomeric membrane waterproofing. The flow meter vault shall be equipped with an aluminum

access hatch and an access ladder to the bottom. The access ladder shall have safety extension poles at the top. Ventilation shall be by means of two gooseneck openings at the top of the vault. The floor of the flow meter vault shall be sloped to a sump with a drain open to gravel.

5.9 Package Stations

1. Pumping Station Configuration: Package pumping stations shall be of a wet well/dry well configuration. Electrical equipment shall be located at grade in a pumping station building erected above the pump chamber. Access hatches for the pumps shall be located in the floor slab of the pumping station building. Pumps shall be of the dry-pit submersible type. The pumping station building shall contain all electrical and control equipment and a toilet room as described in the preceding sections of this chapter. If applicable, an emergency generator shall be located outside of the pumping station building in a weatherproof, sound insulated enclosure.

2. Wet Well Design: Package pumping station wet wells shall be designed for pre-cast concrete construction or equal. Wet well coating and design features shall be the same as described for conventional pumping stations except as described below.

    a. Access: Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be 36-inch by 36-inch minimum unobstructed size and as large as necessary to allow removal of equipment from the wet well.

    b. Ventilation: Wet well ventilation for package pumping stations shall be the same as for conventional pumping stations.

3. Dry Well Design: Dry wells shall be of pre-cast reinforced concrete construction.

    Dry wells shall have exterior elastomeric membrane waterproofing. The dry well floor shall be sloped to a sump. A sump pump with piping to the wet well shall be provided. Sump pump piping shall contain a check valve to prevent siphoning from the wet well. A surge relief valve, if required, shall be placed on the discharge header before the pipe leaves the station. Surge relief piping shall be piped to the wet well.

    a. Access: Dry well access shall be via a staircase with all necessary landings and handrails per OSHA requirements. Equipment hatches for the pumps shall be located in the top slab and directly above the pumps. Grating (catwalks) shall be provided in the dry well to facilitate access to all piping without climbing over pipes, equipment, etc.

b. Ventilation: Dry well ventilation for package pumping stations shall be the same as for conventional pumping stations.

End of Chapter 5

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St. Mary's County Metropolitan Commission

www.metcom.org

Appendix

Effective July 11, 2019

23121 Camden Way, California, MD 20619
Telephone: 301-737-7400
Website: www.metcom.org

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APPENDIX TABLE OF CONTENTS

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ST. MARY'S COUNTY METROPOLITAN COMMISSION
TABLE OF EQUIVALENT DWELLING UNITS
Adopted May 1, 2022

CLASSIFICATIONS	Gallons Per Day/EDU[1,2]
INSTITUTIONAL	
Elementary School	4 gpd/person
Middle School	6 gpd/person
High School	8 gpd/person
Child Day Care/Nursery School	6 gpd/person
Hospital or Nursing/Group Home	125 gpd/bed
College/University with classrooms only	Gross s.f. x 0.03=___gpd
College/University Residence Halls (includes bathrooms, dining hall, and gym; stadiums not included)	125 gpd/resident
SUBDIVISION RESIDENTIAL - One Dwelling	250 gpd
MULTI-UNIT RESIDENTIAL*	
1 Trailer Space	250 gpd
1 Apartment/unit with 3+ bedrooms	250 gpd
1 Apartment/unit with 2 or less bedrooms	125 gpd
1 Condominium/unit	250 gpd
*Apartments, residential condominiums, housing projects for seniors can be designed based on 200 gpd/unit, but will be billed based on 250 gpd/unit	
COMMERCIAL/INDUSTRIAL	
Animal Boarding/Kennel/Shelter	25 gpd per run and/or room
Auto Dealership	Gross s.f. x 0.08=____gpd
Bakery/Food Retail Store/Commercial Kitchen (Stand Alone)/Food Processing (No seating)	Gross s.f. x 0.15=____gpd
Bank	Gross s.f. x 0.04=____gpd
Bar - No Health Dept. Food Permit required (see Restaurant or Social Hall if food services are provided)	5 gpd/seat
Barber Shop	Gross s.f. x 0.20=____gpd
Beauty Salon/Nail Salon/Spa	Gross s.f. x 0.35=____gpd
Bed & Breakfasts (All other uses calculated as identified by LUGM)	1 EDU for up to 8 attached bedrooms including owner's suite
Campgrounds	
Cottages for seasonal use	50 gpd/unit
Tent Camp Sites	35 gpd/site
RV Site	35 gpd/site
Car Wash - Self Service Bay	250 gpd/bay
Car Wash - Recycled Bay	2,500 gpd/bay
Car Wash - Non-Recycled Bay	4,000 gpd/bay
Church (Worship center maximum allocation of 3 EDUs based on the maximum capacity; all additional uses will be calculated using the classifications outlined in the EDU Table)	1 gpd/person
Commercial Condominium (Billing charges based on 250 gpd/unit)	Gross s.f. x 0.03=____gpd
Drug Store (Not to exceed 2 EDU's)	Gross s.f. x 0.13=____gpd
Fire Department/Rescue Squad (Includes bays, offices, classroom area; all additional uses will be calculated using the classifications outlined in the EDU Table)	Gross s.f x 0.015=___gpd
Food Carryout (With no indoor seating, i.e. donut, ice cream, some fast food)	Gross s.f. x 1.00=____gpd
Funeral Home (With embalming services)	Gross s.f. x 0.31=____gpd
Funeral Home (No embalming service)	Gross s.f. x 0.02=____gpd
Garage/Service Station (No Food Service)	Gross s.f. x 0.04=____gpd
Gas Station/Convenience Store (With Food Service)	Gross s.f. x 0.35=____gpd
Laundry & Cleaner (Professional service facilities)	Gross s.f. x 0.31=____gpd
Laundromat (Self-serve facilities)	Gross s.f. x 2.00=____gpd
Library	Gross s.f. x 0.03=____gpd

Originally adopted October 1, 1977; Revised: July 1, 1981, September 13, 2007, October 11, 2007, and March 1, 2009.

ST. MARY'S COUNTY METROPOLITAN COMMISSION
TABLE OF EQUIVALENT DWELLING UNITS
Adopted May 1, 2022

CLASSIFICATIONS	Gallons Per Day/EDU[1,2]
Manufacturing (Commercial and Agricultural)	Gross s.f. x 0.05=____gpd
Marina (per slip)	25 gpd/slip
Medical Office Building[4]	Gross s.f. x 0.13=____gpd
Motel/Hotel Unit	63 gpd/room
Motel/Hotel Unit Efficiencies (with kitchen facilities; extended stay)	125 gpd/room
Museum	Gross s.f. x 0.015=____gpd
Office Building[5]	Gross s.f. x 0.03=____gpd
Pet Groomer	Gross s.f. x 0.35=____gpd
Post Office (Community - not to exceed 2 EDU's)	Gross s.f. x 0.09=____gpd
Public Restrooms (Based on gross square footage of each public restroom building)	Gross s.f. x 0.015=____gpd
Recreational Facility	--
Theatre/Sports Arena/Recreational Facility (No food service)	1 gpd/seat
Theatre/Sports Arena/Recreational Facility (With food service)	5 gpd/seat
Health Club (i.e. Gym/Fitness Facility)	Gross s.f. x 0.02=____gpd
Public Park based on fixture table below	Fixture Table Below
Restaurant (Requires Health Dept. Food Permit)	13 gpd/seat
Retail/Dept. Store (stand-alone) less than 12,000 s.f. (Sq. ft. for accessory uses subtracted from store total and calculated by category of use)	Gross s.f. x 0.03=____gpd
Retail/Dept. Store (stand-alone) greater than 12,000 s.f. (Sq. ft. for accessory uses subtracted from store total and calculated by category of use)	Gross s.f. x 0.02=____gpd
Shopping Center/Strip Mall (mixed use or uncertain)[6]	Gross s.f. x 0.18=____gpd
Social Hall/Meeting Rooms (for rental i.e. Elks, Knights of Columbus etc.)	Gross s.f. x 0.07=____gpd
Supermarket	Gross s.f. x 0.05=____gpd
Swimming Pool 500 gpd/pool minimum **or** based on fixture table below	500 gpd minimum
Warehouse/Hangar	Gross s.f. x 0.015=____gpd

An alternative method used to project average daily flows generated from commercial establishments, public service buildings or dwelling units can be figured on the basis of total floor area, number of building units or service seats multiplied by a statistical factor[3].

FLOW PROJECTION FOR USES WHERE THE SIZE OF THE FACILITY MAY NOT BE PROPORTIONAL TO THE POTENTIAL FLOWS

Type of Fixture	Proposed Gallons per Day per Fixture
Showers	200
Baths	300
Lavatories	100
Toilets	98
Urinals	65
Sinks	33

Flow Projection for country clubs and similar type establishments may be made on the basis of plumbing fixtures with the approval of the Chief Engineer. The related statistical flow figures per unit of plumbing fixture are shown in the tables above.

Determination of EDU's for proposed uses not listed in this document will be determined on a case-by-case basis by the Chief Engineer. Not withstanding the guiding factors listed elsewhere in this table, the Chief Engineer at his/her discretion, may establish flow projections for specific properties on a case-by-case basis, at rates lower than those published on this table, if in the Chief Engineer's opinion the owner has demonstrated that significantly less water should be used and/or significantly less sewage should be produced by a specific building or use because of the proposed utilization of water saving technology or because the owner has demonstrated that similar buildings in other locations use significantly less water and/or produce significantly less sewage.

Originally adopted October 1, 1977; Revised: July 1, 1981, September 13, 2007, October 11, 2007, and March 1, 2009.

ST. MARY'S COUNTY METROPOLITAN COMMISSION
TABLE OF EQUIVALENT DWELLING UNITS
Adopted May 1, 2022

[1] Equivalent Dwelling Unit (EDU) is based on the average daily water use and the average daily volume of sewage produced by a single family home. Billing and allocation of EDUs are based on 250 gpd/EDU. Fraction of an EDU gets rounded up to the nearest whole number.

[2] For design purposes an EDU is based on 300 gpd for water, and 250 gpd for sewer.

[3] Adopted from the MDE "Wastewater Capacity Management Plan Guidance Document" and the Anne Arundel County "Flows Estimate for Capital Facility Connection Charges"

[4] Includes doctor, dental, physical therapist, and veterinary offices

[5] Each condominium office unit to be a minimum of 1 EDU. Separate units (no shared facilities) within the same building shall require a minimum of 1 EDU per unit.

[6] EDU's assigned for individual units within a shopping center to be adjusted based upon actual occupancy

Originally adopted October 1, 1977; Revised: July 1, 1981, September 13, 2007, October 11, 2007, and March 1, 2009.

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St. Mary's County Metropolitan Commission
23121 Camden Way, California, MD 20619

Serving St. Mary's County
Potable Water Distribution - Wastewater Collection / Treatment

Phone: 301-737-7400
FAX: 301-737-7458

STAFF ONLY
INITIALS: _____
DATE: _____

WATER AND SEWER CONSTRUCTION PLAN REVIEW CHECKLIST

MINIMUM REQUIREMENTS

Instructions: All Water and Sewer Construction Plan submissions shall at a ***minimum*** *contain the requirements stated below. Any construction plan submissions brought to the St. Mary's County Metropolitan Commission with missing or incomplete information may be rejected and not reviewed until all necessary information has been provided. It should be noted that not all items contained below will necessarily be required for every project.*

Consulting Engineer shall place one of the following marks (as appropriate) on each line (METCOM reviewer shall verify each mark): ***N/A*** *- not applicable* ✓ *- provided*

Note: The following checklist is provided to assist the design engineer in developing a complete utility plan set to expedite the review process. All water and/or sewer construction plans submitted for review are to include a copy of this checklist signed by a MD registered Professional Engineer. ***Submittals without a completed checklist and/or review fees will be returned without review or comments****. Compliance with the checklist, however, in no way is meant to relieve the design professional of responsibility for project design.*

PROJECT NAME: _____

DEVELOPER: _____

ENGINEERING FIRM: _____

ADDRESS: _____

PHONE: _____ **FAX**: _____

DEPT. OF LAND USE AND GROWTH MANAGEMENT (LUGM) NUMBER: _____

SUBMITTAL #_____ **DATE:** _____/_____/_____

A. General Requirements

_____ 1. Each page is signed, sealed and dated by a MD Registered Professional Engineer.

_____ 2. EDU's have been determined and are indicated on plans.

Number of EDU's = _____

_____ 3. Construction Plan Review Fees (including $100 Administrative Fee) are enclosed or have already been submitted to METCOM.

Type:_____ Basis: $_____+ $_____x_____Lots/EDUs = $_____.
+ $100 (Admin)
Total Due = $_____.

_____ 4. A minimum of two sets of construction plans are enclosed for METCOM review.
* 3 sets are needed for final approval.

_____ 5. A METCOM stamp approval block (3 in. x 3 in.) is provided on each page where water and sewer approvals are required (open area - no signature line is required).

_____ 6. All drawings in a set of construction plans are the same size sheet, and are 36 in. wide by 24 in. high. Drawings have a 1 ½ in. margin on the left edge and have a ½ inch margin along the top, bottom and right edges.

_____ 7. North arrow and 3 grid ticks are provided on each plan sheet.

_____ 8. Plans and Profiles contain sufficient vertical and horizontal references and information to allow stakeout and construction of proposed work by reference to the plans alone.

_____ 9. Profiles have a horizontal scale of 1in. = 50ft. and a vertical scale of 1in. = 5ft. Scale is clearly marked.

_____ 10. Profiles are located under the corresponding plans on the same sheet.

_____ 11. Profiles for all water and sewer mains are shown.

_____ 12. Stationing is shown on plans. Stationing on plans increase from left to right across the drawing. (Road centerline stationing can be used when water/sewer lines are located in/along roads).

_____ 13. Call-out locations are provided for fire hydrants, meter settings, blow-offs, manholes, clean-outs, tees, bends, valves, reducers, grinder pumps, flushing connections and witness posts.

_____ 14. Existing and proposed grade over the mains are indicated on the profile.

_____ 15. Minimum of 10ft. of horizontal separation between sanitary sewer and water lines is maintained.

_____ 16. Minimum of 5ft. horizontal separation from storm drain structures or other utility structures is maintained.

_____ 17. Minimum 1.5ft. vertical clearance from all crossing utilities is maintained.

_____ 18. Proposed and existing water and sewer utilities are accurately and clearly shown on the plan and profiles using standard symbols and accentuated by bold, heavy line weight to distinguish it from other utilities.

_____ 19. All public right-of-ways and easements are shown and dimensioned. Where water and/or sewer mains leave the public road right-of-way, an all weather access roadway is provided.

_____ 20. All lot lines are clearly shown.

_____ 21. All specifications, shop drawings, design data and calculations, are provided on an 8 ½ x 11 in. sheet, bound in a folder suitable for filing, and labeled for identification by the title, LUGM number, tax map, grid and parcel.

B. Title Sheet

_____ 1. Vicinity Map – Minimum Scale 1 in. = 2000 ft., with clearly labeled intersecting roadway names is provided.

_____ 2. Vicinity Map shows major roads or streets, major streams, towns, large institutions, north arrow, etc. and the site location. The site to be constructed is shaded.

_____ 3. Location Plan – Scale 1 in. = 600 ft. Location Plan shows overall subdivision layout to scale, section limits, right-of-ways, adjacent subdivisions, property owners, existing and proposed street names, and at least two (2) permanent bench mark locations and descriptions. The section to be constructed is clearly labeled.

_____ 4. Title Information – Subdivision/site name, type of plan, section number, phase, election district, County and State is provided.

_____ 5. Owner's certificate, name and address, with the owner's name printed under the signature line is provided and signed.

_____ 6. Engineer's and/or surveyor's certificate, name, address, phone number, signature, and seal is provided and signed.

_____ 7. A legend is provided of the specific graphic special symbols applicable to the project. Standard symbols are used to the fullest extent possible.

_____ 8. List of abbreviations applicable to the project are provided.

_____ 9. Horizontal and vertical control references are specified (State plane, U.S. Coast & Geodetic Surveys, etc.). Must be NAD 83, NAVD 88.

_____ 10. Source of the topography used for the preparation of the plans is provided.

_____ 11. Revision block includes the date and reference of each revision.

_____ 12. LUGM control number is provided.

_____ 13. Sheet index is provided.

C. General Notes

At a minimum, the following General Notes for Water and Sewer Construction have been provided:

_____ 1. All water and sewer construction shall be done in accordance with the St. Mary's County Metropolitan Commission Standards and Specifications for Water and Sewerage Construction. Contractor to contact the Engineering Department, St. Mary's County Metropolitan Commission, forty-eight (48) hours prior to start of construction. Phone number 301-737-7400. Contractor to also contact the Engineering Department before restarting work after work has stopped for more than five days.

_____ 2. All fire hydrants that are set in the ground, that are not yet operational, shall have an "out of service" disk placed on the 4 ½" discharge outlet. It shall be the responsibility of the Contractor to furnish and install the "Out of Service" disk.

_____ 3. Contractor shall not tap or otherwise penetrate existing water or sewer main lines without prior approval from METCOM. Contractor is responsible to avoid spillage of raw sewage. Contractor shall provide all sewer plugging and pumping equipment necessary to avoid spillage. Violations are subject to fines and penalties and will be enforced to the full extent of the Law.

_____ 4. Contractor is responsible for maintenance of traffic on existing roadways in accordance with St. Mary's County and S.H.A. Standard Specifications latest edition.

_____ 5. Water and sewer main construction shall not commence until involved roadways, storm drains, and utility easements have been graded and contoured to approximately final grade. Property corners of all lots are required to be staked by a licensed surveyor prior to installing water and sewer service connections.

_____ 6. Only the amount of trench that can be opened, worked in and then stabilized in a work day shall be done so. If stabilization does not occur at the end of the work day, then appropriate erosion controls, sediment controls and safety controls shall be installed.

_____ 7. A Pre-Construction meeting is required prior to start of construction. Materials delivered to the site for water and sewer construction must be inspected prior to start of work.

_____ 8. All pipes shall be cleaned before they are laid and shall be kept clean until acceptance of the completed work by METCOM. Open ends of pipes shall be fitted with water tight stoppers to prevent entrance of foreign matter when pipe-laying operations are interrupted.

_____ 9. No person shall make a connection of roof downspouts, exterior foundation drains, areaway drains, or other sources of surface runoff or groundwater to a building sewer or building drain, which in turn, is connected directly or indirectly to a public sanitary sewer.

_____ 10. All backflow devices shall comply with the National Standard Plumbing Code and The St. Mary's County Metropolitan Commission Cross Connection Control Program. The backflow devices shall comply with the proposed use's health hazard level as specified in the National Standard Plumbing Code.

D. General Sewer Plan and Profile Requirements

_____ 1. A minimum 20 ft. easement width centered over the main is clearly shown and identified.

_____ 2. Direction of flow is shown on the plans.

_____ 3. Manhole and sewer pipe schedule is provided.

_____ 4. The following sewer main data and calculations are enclosed: wastewater flow projections (average, peak and design flows); projected velocities and pressures within the pipelines; pumping station and wet well design (if applicable).

_____ 5. Sewer allocation table is provided.

_____ 6. Minimum velocity of 2 ft/s is maintained. Minimum velocities are based on the average flow, including infiltration for gravity sewer. Force main velocities are determined by pump performance and pipe sizes.

_____ 7. All sewer main crossings with other utilities are properly shown and called-out with minimum clearance dimensioned. Minimum vertical clearance of 1.5 feet from other utilities and/or storm drains is shown.

_____ 8. Sewer mains shall be a minimum of 1.5 feet below water main to prevent conflicts with service laterals and crossings.

_____ 9. Manholes in low lying areas have watertight lids.

_____ 10. Provide the floor elevation for the lowest level of the proposed structure, whether it be commercial or residential, that will be served by a SHC.

E. Collecting Sewers (Gravity)

_____ 1. Pipe sizes and material type is shown on plans (D.I.P. if the depth is greater than 18 feet).

_____ 2. Collecting sewers are a minimum of 8 inches in diameter and are designed to carry present and projected future flows.

_____ 3. Gravity sewer is placed at a 0.4% grade. (Grades between 0.4% and 6% may be approved on a case-by-case basis only.)

_____ 4. Minimum cover on gravity sewer is 4 ft.

_____ 5. A 6 in. water tight clean out is provided for each sewer service connection. A road bearing clean-out is provided in areas of vehicular traffic.

_____ 6. A terminal manhole is provided at the end of each line.

F. Sewers, Force Main (Pressure Sewers)

_____ 1. All force main sewer pipe is either PVC (DR-18 or SDR-21), HDPE (DR-11), or DIP (CL-52).

_____ 2. Minimum size of force mains shall be four (4) inches in diameter for “high” pressure systems and one and a half (1.5) inches in diameter for “low” pressure systems.

_____ 3. Minimum cover above force mains is 4.5 ft. Maximum cover is 6 ft.

_____ 4. An automatic air and vacuum relief valve is placed at each high point along the force main pipeline.

_____ 5. A continuous positive or negative grade, not less than 0.2%, is maintained between each high point of the force main and a successive low point.

_____ 6. Low point clean outs and flushing connections are fabricated as shown in the Standard Detail.

_____ 7. Flushing connections are provided at a 400 foot maximum spacing as well as at the end of the force main.

_____ 8. Witness posts are provided at flushing connections and road crossings.

_____ 9. Force mains enter the gravity sewer system at a point not more than 2 ft. above the receiving manhole invert.

_____ 10. Tapping sleeve and valves are provided when making service connections to an existing sewer main. The main being tapped is at least one pipe size larger than the branch main.

_____ 11. When a proposed force main is connecting with an existing force main then a check valve will be required at the connection.

G. Water Plan and Profile Requirements

_____ 1. Water main sizes are indicated (minimum of 8 in. for fire protection). A fire hydrant or blow-off (with witness post) is provided at the end of all mains.

_____ 2. Water main materials are indicated PVC (DR-18 or SDR-21), HDPE (DR-11), or DIP (CL-52)

_____ 3. Water valves are spaced at a maximum of 800 ft. for 8 in. and 12 in. lines.

_____ 4. Single water services are provided to each dwelling, business, warehouse or proposed lots, buildings and parcels.

_____ 5. Fire hydrants are spaced at a maximum of 450ft. for single family residential developments and a maximum of 300ft. for multi-family and commercial developments, and within 100 feet of any Siamese building connection. The bury depth is provided on the profile.

_____ 6. Where a water main is in a casing under a roadway or crosses under a stream bed, valves are placed on each side.

_____ 7. All valves, tees, bends, fire hydrants, etc. are shown with a symbol and called-out with size, type and station. Valves immediately adjacent to tees do not need stations.

_____ 8. There are no 90 degree bends shown on any water main.

_____ 9. The following water main data and design calculations are enclosed: average day, maximum day, and peak hour demands, fire flow requirements, future requirements, probable pressures, losses, and computations for determining pipe sizes.

_____ 10. Water Allocation Table with fire flow requirements is shown.

_____ 11. Minimum cover of 42 in. for water mains is maintained.

_____ 12. Three (3) valves are provided at each water main tee. Four (4) valves are provided at each water main cross.

_____ 13. Tapping sleeve and valves are provided when making service connections to existing water main. The main being tapped is at least one pipe size larger than the branch main. (If the branch main is the same size as the main line, then a tee shall be cut into the main line.)

Applicant's Certification

I, the undersigned, hereby certify that the attached Water and Sewer Construction Plans include all items required by the St. Mary's County Metropolitan Commission. I understand that if any of the items required are found to be missing from the submittal, the Water and Sewer Plan will not be acceptable for approval and will be returned as incomplete. I am aware of these criteria and will accept all responsibility for delays due to incomplete submittals. I am enclosing an explanation for each item which I feel is not required and, therefore, has not been included in this submittal package.

_____ _____

Professional Engineer's Signature Date

_____

Professional Engineer's Printed Name SEAL

MD LICENCED PROFESSIONAL ENGINEER MUST SIGN AND SEAL THIS CHECKLIST

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PUBLIC WORKS AGREEMENT

This Public Works Agreement, is executed this _____ day of _____, 20____, by and between the St. Mary's County Metropolitan Commission (hereinafter, the "Commission"), and _____, (hereinafter, the "Developer"), and _____, (hereinafter, the "Owner"), and _____, (the "1st Lien Holder"), and _____, (the "2nd Lien Holder"), and _____ (the "Issuer of Letter of Credit or Bond").

WITNESSETH

WHEREAS, the Commission is responsible for all public water and sewerage projects in St. Mary's County, Maryland (the "County"); and,

WHEREAS, the Owner is the owner in fee simple of all that lot, tract or parcel of land located St. Mary's County, Maryland, subject to this Agreement, more particularly described as Exhibit **D**, attached hereto and incorporated herein, (hereinafter referred to as the "Property"); and,

WHEREAS, the Developer is developing the Property as a project known and further described as **NAME OF PROJECT, (**hereinafter referred to as the "Project"); and,

WHEREAS, the Developer, either by requirement of St. Mary's County or by choice, intends to construct certain central sewage facilities and/or central water facilities (the "Facilities"), to serve the Project. The Facilities shall include all water and sewer improvements to be made by the Developer, including those on-site and any improvements required or intended to be made off-site; and,

WHEREAS, the Developer seeks the approval of the Commission for the construction of the Facilities; and,

WHEREAS, the Concept Plan for the development of the Project has been submitted to and approved by the Board of County Commissioners of St. Mary's County or their duly appointed agent; and

WHEREAS, Developer has designed the Facilities in accordance with the St. Mary's County Standard Specifications for Water and Sewerage Construction, the Comprehensive Water and Sewerage Plan for St. Mary's County and any other rules, regulations, directives or special instructions issued by the Commission for the State of Maryland and/or the Federal Government; and

WHEREAS, Developer has submitted a statement, attached hereto and incorporated herein as Exhibits **A&B,** setting forth a proposed phasing schedule for the construction of the Facilities and a proposed schedule of completion for said phase or phases, said statement having been approved by the Commission. The Developer has also submitted an itemized engineer's estimate of the cost to construct the Facilities (the "Engineer's Cost Estimate"), which has been approved by the Commission; and

WHEREAS, Developer has furnished a Performance and Payment Bond or an Irrevocable Letter of Credit with a minimum two year expiration date to be renewed automatically or without interruption, which has been approved by the Commission, a copy of which is attached hereto and incorporated herein as Exhibit **C ,** payable to the Commission, its successors and assigns, in an amount of **$000.00**, conditioned that the Developer shall well and truly perform and fulfill the covenants, conditioned and terms of this Agreement, and shall assure payment for all materials utilized and work performed, all of which shall remain in force until the expiration of the warranty period as set forth in Paragraph **EIGHTH**; and

WHEREAS, Developer has conveyed unto the Commission any and all required interest in the Property necessary to complete the construction of the Facilities within the Project, including all necessary fee simple interests, as well as easements, rights-of-way and rights-of-entry, as required by the Commission and as more particularly shown and described on Exhibit **D** attached hereto and incorporated herein; and

WHEREAS, as further specified upon the said Exhibit **D** , upon recordation of the final plat of subdivision for the Project, if applicable, Developer shall convey, by reference upon said final plat, all those standard utility easements as may be required by all applicable local, State and Federal regulations, to provide for the construction, installation, maintenance, repair and inspection of any water distribution and/or sewer collection lines and appurtenances, to the extent that any such lines and appurtenances are a part of the Facilities; and

WHEREAS, all parties holding a lien against the Property and/or any party which has issued a letter of credit, identified first herein above, hold an interest in the Property; and

WHEREAS, Owner, if different from Developer, has joined in the execution of theses presents to acknowledge the obligations of the Developer set forth herein;

NOW THERFORE THE PARTIES HERETO AGREE AS FOLLOWS:

FIRST: If necessary, the Commission shall grant unto the Developer a right of entry onto the Commission Property for the purpose of construction and maintenance of the Facilities provided, however, that Developer hold the Commission harmless for and indemnifies the Commission against any and all losses or damages incurred by the Commission during such time as Developer occupies such Commission Property, and further provided that Developer maintains sufficient and appropriate insurance coverage, naming the Commission as an additional insured, to adequately protect all interests of the Commission.

SECOND: Developer shall construct all of the Facilities according to the phasing and completion schedules set forth on Exhibits A and B, and in the case of multi-phased projects, no phase beyond the first phase shall be commenced until the Facilities constructed under any of the previous phases have been approved and accepted by the Commission.

THIRD: Developer shall construct the Facilities in accordance with final plans and specifications for the Project, and amendments thereto, as approved by the Commission (the "Final Plans"). In the event that Final Plans have not been approved at the time of execution of this Agreement, no work in connection with the construction of the Facilities shall be commenced prior to the approval by the Commission of the Final Plans. Furthermore, within sixty (60) days after the construction of any phase of the Facilities is completed and approved, a completed set of "As-Built Drawings" (CD & hard copy) shall be submitted and approved by the Commission.

FOURTH: Developer shall maintain the Performance and Payment Bond or Letter of Credit provided in Exhibit **C**, without interruption for the period of construction of the Facilities, and for the period of the required warranty without interruption as set forth herein.

FIFTH: Developer shall make available the Property to duly authorized representatives of the Commission at all reasonable times for purposes of inspecting construction of the Facilities.

SIXTH: Developer shall pay the following fees and charges:

DUE/ **INSPECTION CHARGES: $0,000.00** based upon:

APPLICABLE 2.5% of Bond or 110% of Engineers Cost Estimate for Project Costs ≤ $385,000.00

- OR -

1.5% of Bond or 110% of Engineers Cost Estimate for Project Costs > $385,000.00

* *As verified by MetCom at the time of the Pre-Construction Meeting, which verification results in the payment of additional Inspection Charges under this Agreement.*

This charge reflects the currently approved inspection fees and is subject to change.

APPLICABLE **CONNECTION PERMIT FEES: $000.00** based upon the following fees per connection permit issued, as applicable, payable at the time each connection permit(s) is/are issued. Upon the Developer's election, this charge may be paid in advance at the time this Agreement is executed. This charge reflects the currently approved connection fee and is subject to change.

_____ $ 70.00 Sketch Plan Fee (diagram of building connection)
_____ $180.00 Water & Sewer Occupancy Inspection
_____ $120.00 Water (only) or Sewer (only) Occupancy Inspection
_____ $145.00 Grinder Pump Inspection (in addition to Occupancy Inspection)
_____ $276.00 Water Meter - 5/8" x 3/4" (Includes 20% storage/handling fee)

_____ $250.00 Residential Water Tap Fee
_____ $250.00 Residential Sewer Tap Fee

APPLICABLE **CAPITAL CONTRIBUTION CHARGE: $00,000.00** based upon the following fee per EDU, as applicable, payable at the time a property owner makes application or otherwise is required to connect to a water or sewer system, **in addition to the Connection Permit Fees specified herein above**. This charge reflects the currently approved fee and is subject to change.

WATER:
_____ $10,955.87/EDU Residential
_____ $13,147.04/EDU Commercial

SEWER:
_____ $6,941.21/EDU Residential
_____ $8,329.44/EDU Commercial

APPLICABLE **SYSTEM IMPROVEMENT CHARGE: $0.00,** based upon the following monthly fee per EDU allocated, payable at the time any EDU allocation is made. This charge reflects the currently approved fee and is subject to change.

WATER:
_____ $12.48/month/EDU Residential
_____ $14.98/month/EDU Commercial

SEWER:
_____ $15.39/month/EDU Residential
_____ $18.47/month/EDU Commercial

APPLICABLE **READY TO SERVE CHARGE FOR WATER: $9.87** per meter, per month based on a 5/8" water meter, beginning when service is utilized. The meter will be read on a monthly basis and a Usage Charge applied based on a graduating rate scale per thousand gallons of water used per month. The Ready to Serve Charge reflects the currently approved rate and is subject to change.

APPLICABLE **READY TO SERVE CHARGE FOR SEWER: $18.81** per meter, per month based on a 5/8" water meter, beginning when service is utilized. The meter will be read on a monthly basis and a Usage Charge applied based on **$5.11** per thousand gallons of water used per month up to 10,000 gallons per month for residential customers with 5/8" meters. The Ready to Serve and Usage Charges reflect the currently approved rates and are subject to change.

NOT APPLICABLE **USAGE CHARGE ONLY FOR IRRIGATION METER:** The irrigation meter will be read on a monthly basis and a Usage Charge will be applied based on a graduated rate scale, per thousand gallons of water used per month. Usage Charges are subject to change.

APPLICABLE **BAY RESTORATION FEE:** Per Senate Bill 320 (Bay Restoration Fund) the Commission is charged with collecting Bay Restoration fees from its customers beginning in January of 2005. This includes customers connected to the Public Wastewater System and customers connected to a Public Water System who have Onsite Septic Systems. A **$5.00** fee per month per EDU beginning when the service is utilized will be added to the Monthly Bill received by each residential customer that is served by the public wastewater system or by an onsite system; and the fee is **$5.00** for each 250 gallons per day (7,500 gallons per month) of water used up to a maximum of $10,000.00 per month for non-residential customers.

SEVENTH: No premises within the Project to be connected to the Facilities shall be occupied or used for any purpose whatsoever prior to the Facilities being accepted by the Commission without the express written prior approval of the Commission.

EIGHTH: Developer shall warrantee all mechanical, electrical and control Facilities for a period of twelve (12) months, and all earthwork and associated underground construction for a period of eighteen (18) months, after approval and acceptance by the Commission. The warranties shall cover the cost of labor, equipment and materials necessary to correct any problems with the Facilities.

NINTH: In addition to the occurrence of other circumstances which may constitute a default of this Agreement, the parties hereto expressly acknowledge that the following shall constitute events of Default of this Agreement:

1. Failure of Developer to construct the Facilities according to the schedule and in the phase or phases set forth herein.
2. Failure of Developer to construct the Facilities in accordance with the approved Final Plans approved by the Commission, as set forth herein.
3. Failure of Developer to provide a complete set of "As-Built Drawings" (CD & hard copy) pursuant to Paragraph Third above.
4. Failure of Developer to maintain the required bonding and/or letters of credit for the period of construction and warranty of the Facilities.
5. Failure of Developer to prosecute work according to the Commission's standard specifications.
6. Failure of Developer to respond to requests to honor warranties within a reasonable time schedule, such schedule to be established by the Commission.
7. Failure of Developer to perform any of the terms and conditions of this Agreement.

TENTH: The parties hereto acknowledge and agree that in an event of Default the Commission may avail itself of any and all available legal or equitable remedies, which may include, but which shall not be limited to, the following actions:

1. Notify Developer to Stop Work.
2. Demand that Developer vacate Commission Property, if applicable.
3. Notify Developer of intention to call bond or Irrevocable Letter of Credit.

The Commission may, in its sole discretion and for the benefit of the Project, give Developer a reasonable period to cure an event of Default. Failure of Developer to cure Default during such cure period shall constitute an event of continuing Default, with all remedies available to the Commission. Forbearance by the Commission shall not constitute a waiver of its rights to declare subsequent default.

ELEVENTH: Upon completion and acceptance by the Commission of the Facilities as set forth in Paragraph Second above, the Developer, when requested to do so by the Commission, agrees to convey all of the Facilities to the Commission for the nominal sum of One Dollar ($1.00).

TWELFTH: This Agreement shall be binding upon and inure to the benefit of the heirs, successors, personal representatives and assigns of the parties hereto.

WITNESS THE HANDS AND SEALS OF THE PARTIES HERETO:

ATTEST:

_____

ST. MARY'S COUNTY METROPOLITAN COMMISSION

By: _____
George A. Erichsen, Executive Director

_____
Date

ATTEST:

_____

DEVELOPER:

By: _____
_____(Name)
_____(Title)
_____(Company)

_____
Date

ATTEST:

_____

OWNER:

By: _____
_____(Name)
_____(Title)
_____(Company)

_____
Date

ATTEST:

_____

1st LIEN HOLDER:

By: _____
_____ (Name)
_____ (Title)
_____ (Company)

_____
Date

ATTEST:

_____

2nd LIEN HOLDER

By: _____
_____(Name)
_____(Title)
_____(Company)

_____
Date

ATTEST:

_____

ISSUER OF BOND / LETTER OF CREDIT

By: _____
_____(Name)
_____(Title)
_____(Company)

_____
Date

[NOTARY PROVISIONS ON FOLLOWING PAGES]

(COMMISSION)

STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared George A. Erichsen, Executive Director of the St. Mary's County Metropolitan Commission, and on behalf of said Commission did acknowledge the foregoing instrument to be the act and deed of the St. Mary's County Metropolitan Commission.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

(DEVELOPER)

STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared _____ _____, _____ of _____, and on behalf of said entity did acknowledge the foregoing instrument to be the act and deed of the said entity.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

(OWNER)

STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared _____ _____, _____ of _____, and on behalf of said entity did acknowledge the foregoing instrument to be the act and deed of the said entity.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

(1st LIEN HOLDER)

STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared _____ _____, _____ of _____, and on behalf of said entity did acknowledge the foregoing instrument to be the act and deed of the said entity.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

(2nd LIEN HOLDER)
STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared _____ _____, _____ of _____, and on behalf of said entity did acknowledge the foregoing instrument to be the act and deed of the said entity.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

(ISSUER OF BOND or LETTER OF CREDIT)
STATE OF MARYLAND, COUNTY OF ST. MARY'S to wit:

I HEREBY CERTIFY that on this _____ day of _____, 20___, before me, a Notary Public in and for the County of St. Mary's, aforesaid personally appeared _____ _____, _____ of _____, and on behalf of said entity did acknowledge the foregoing instrument to be the act and deed of the said entity.

WITNESS my hand and Notarial Seal.

_____
Notary Public
My Commission Expires: _____

EXHIBIT A

STATEMENT OF

PROPOSED WATER FACILITIES

AND PHASING

PROJECT NAME:

TOTAL # OF PHASES **1**

DEVELOPER

PHASE I:

Plat Ref: _____ # OF LOTS/EDUS TO BE SERVED _____
(Note: EDUs are subject to adjustment based on actual use.)

PROJECTED CONSTRUCTION START DATE: **Date of Execution of the P.W.A.**

PROJECTED CONSTRUCTION COMPLETION
DATE **Two years after the execution of the P.W.A.**

FACILITIES TO BE CONSTRUCTED*: Water distribution system with all appropriate appurtenances in accordance with the definition below and per the approved construction plans as signed by the Metropolitan Commission's Chief Engineer on: 00-00-00.

COMMISSION PARTICIPATION: **NONE**

*The facilities listed also include for WATER PUMPING STATION: Wells, pumps, controls, generators, chlorinators, compressors, meters, valves, interior and exterior piping and appurtenances, together with all sites on which they are situated and 20' access to the same. FOR WATER STORAGE TANKS: Elevated storage tanks, standpipes, fittings, blow offs, water house connections, water house service lines, curb stops, curb stop boxes, water meter settings and appurtenances, together with a 20' permanent easement over the same for maintenance and modifications of an connection to these facilities; along with any and all other facilities or appurtenances which in any way could be construed as part of the water system.

EXHIBIT B

STATEMENT OF

PROPOSED SEWER FACILITIES

AND PHASING

PROJECT NAME:

TOTAL # OF PHASES **1**

DEVELOPER

PHASE I:

Plat Ref: _____ # OF LOTS/EDUS TO BE SERVED _____
(Note: EDUs are subject to adjustment based on actual use.)

PROJECTED CONSTRUCTION START DATE: **Date of Execution of the P.W.A.**

PROJECTED CONSTRUCTION COMPLETION
DATE **Two years after the execution of the P.W.A.**

FACILITIES TO BE CONSTRUCTED*: Sewerage collection system with all appropriate appurtenances in accordance with the definition below and per the approved construction plans as signed by the Metropolitan Commission's Chief Engineer on: 00-00-00.

COMMISSION PARTICIPATION: **NONE**

*The facilities also include for WASTEWATER PUMPING STATIONS: pumps, wet, wells, generators, compressors, meters, valves, interior and exterior piping and appurtenances, together with all sites on which they are situated and 20' access to the same. FOR WASTEWATER TREATMENT PLANTS: Storage lagoons, physical plants influent and effluent lines, lift stations, generators, together with all sites on which they are situated and 20' access to the same; FOR COLLECTION SYSTEMS: Collector and lateral sewers, force mains, sewer house service lines, air release valves, together with 20' permanent easements over the same for maintenance and modifications of connection to these facilities, along with any an and all other facilities or appurtenances which in any way could be construed as part of the sewerage system.

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St. Mary's County Metropolitan Commission

23121 Camden Way California, MD 20619
Tel. No. (301) 737-7400 — Fax No. (301) 737-7458

Construction Permit – Notice to Proceed
Water Supply and/or Sewerage System Development

PART I: TO BE COMPLETED BY OWNER OR AGENT

1. Owner's Name _____ Telephone _____

2. Address _____

3. Development Name _____ 4. Type of Improvements: Residential / Commercial / Industrial

5. Tax Map # _____ 6. Block _____ 7. Parcel/Lot _____

8. Additional Property Information (optional) _____

I, _____ being the _____ of the property described
(Print Name) (owner, agent, etc.)
above, hereby request permission to provide water and/or sewerage service to the property described above. In consideration for the granting of this permit, I agree:

1. To furnish any additional information requested by MetCom relating to the proposed work, including but not limited to, Performance and Maintenance Bonds when necessary, and an As-Built survey.
2. To furnish MetCom with the name of its representative on the job and give at least 48 hrs notice prior to starting any work under this permit.
3. To notify Miss Utility (800-257-7777), 48 hours in advance of any excavation work under this permit.
4. To obey all provisions of all ordinances, regulations, specifications or direction set forth by MetCom.
5. To pay in advance review fees, inspection fees, etc., as assessed and requested by MetCom, as well as to pay the balance if the total inspection cost is more than the inspection fees initially collected.
6. To leave the water building service line and/or sewer building service line uncovered and to request an inspection by the County Plumbing Inspector forty-eight (48) hours before the line(s) are ready for connection to the Water or Sewerage system, and to maintain the water building service line and/or sewer building service line at no expense to MetCom.
7. To lay out and construct the system(s) to permit connection to the MetCom system as economically and conveniently as possible, and upon completion of the systems and approval and acceptance by MetCom, to deed the system, including all lines, structures and appurtenances with appropriate easements to MetCom.
8. To comply with all provisions as stated in the Public Works Agreement (if applicable).
9. See Page (3) relative security and bonding

Signed _____ Date _____

PART II: TO BE COMPLETED BY METROPOLITAN COMMISSION PERSONNEL

9. Sanitary Dist. _____ 10. No. EDUs; Date Granted _____

12. Application for Permit to:
    a. Single Residence Connection (No PWA) ☐
        i. Water Service Tap (Y/N) _____
        ii. Sewer Service Tap (Y/N) _____ Grinder Pump? (Y/N) _____
    b. Commercial/Industrial Site Plan (No PWA – Cost Estimate Required to determine Inspection Fee Amount) ☐
        i. Water (Y/N) _____
        ii. Sewer (Y/N) _____
    c. Water/Sewer Construction (PWA Required) ☐
        i. Water (Y/N) _____
        ii. Sewer (Y/N) _____

17. Contractor/ Builder of Water System Name _____ Address _____

Contractor / Builder of Sewer System Name _____ Address _____

PART III: CONSTRUCTION PERMIT APPROVAL / NOTICE TO PROCEED

The above application for Construction Permit is hereby approved and Notice to Proceed has been granted.

_____ Date: _____

MetCom Chief Engineer or Representative

Permit #: _____

This permit expires on*: _____

*Permit expiration coincides with the expiration of the approved construction plan or sketch plan

PART IV: COMPLIANCE, VIOLATION, PENALTIES AND EXCEPTIONS

A. Compliance

The Metropolitan Commission Standard Specifications are prepared, printed and distributed with every expectation and intention that they shall be complied with in all respects. The correctness of contract documents can be checked through the review process; however, materials and construction techniques can only be confirmed by observation and testing. This, therefore, requires that the Engineer, through his inspectors, observe the work as it progresses. In order to accomplish this, the Contractor is enjoined not to commence any work until he/she has given the Commission Engineering Department (phone number 301-373-4733) at least forty-eight (48) hours prior notice. At the time of this notice, the Contractor shall state the time and date he/she expects to start work. If this time or date should change, immediate notification of the Engineering Department must be made. Contractors are cautioned that contact must be made with Engineering Department personnel only, as relay of messages can be unreliable. Information concerning start of work will be recorded in a permanent ledger. If a particular job should stop for more than five (5) working days, the Developer/Contractor is required to re-contact the Commission concerning resumption of work. In the event of a conflict involving Federal, State, or local standards and/or specifications, the most stringent of those standards/specifications shall take precedence.

B. Violations

Past experience indicates that some Contractors have been remiss in areas as follows:

1. *Failure to insure that a Construction or Connection Permit has been issued by this Commission prior to start of excavation. It is advisable that the Contractor "cite" the appropriate permit prior to start of work. If in doubt, call the Commission Engineering Department.*
2. *Failure to notify the Engineer prior to start of work, or restart of work after five (5) day inactive period.*
3. *Connection of building lines (house connections) to a water meter, curb stop, water main or clean out/sewer main/manhole/grinder pump without a permit.*
4. *Covering project work without such work having been inspected by this Commission.*
5. *Failure to securely plug exposed ends of newly laid pipe overnight, during weekends and other work interruption periods. Upon work resumption, all water and soil eroded to the trench bottom must be removed from the trench prior to plug removal from the pipe. Under no circumstances shall any liquid or solid matter be allowed to enter any pipe or associated component during construction.*
6. *Opening of water valves by personnel other than licensed Commission water system operators is prohibited; except that Fire Department personnel may operate fire hydrant valves as required in performance of their duties.*
7. *Only materials approved in this document or approved on the Construction Project Plan will be allowed. Any other materials must be approved by the Engineer using shop drawings. An approved set of shop drawings shall be on-site at all times during construction.*

C. Penalties

As a general rule, citations will be issued for any and all violations with specific penalties as follows:

1. *Violation of B.1. above will result in issue of a "Stop Work Order" and uncovering of all pipe and structures already covered, this at the Contractor's expense. In addition, the Owner/Developer will be issued a citation, with a maximum fine of two hundred dollars ($200.00). Work shall not thereafter proceed until the appropriate permit is issued.*
2. *Violation of B.2. above will require uncovering of all work at Contractor's expense.*
3. *Violation of B.3. is considered to be a prima-facie evidence of intent to defraud. In such cases, both the property owner and the Contractor shall be held accountable. The Contractor can protect himself by "citing" the Connection Permit as issued by this Commission.*

4. *Violation of B.4. most commonly occurs when sewer or water service connection are tapped into existing water and sewer mains and manholes. If work is covered prior to inspection, it shall be uncovered at the Contractor's expense as scheduled by the Engineer. In addition, the Contractor will be issued a citation with the assessment of one hundred ($100.00) dollar fine.*
5. *Violation of B.5. above will result in a "Stop Work Order" until all affected pipes and components are thoroughly cleaned. In addition, the Contractor will be issued a citation with a maximum fine of five hundred ($500.00) dollars.*
6. *Violation of B.6. above will result in an official citation and a maximum fine of five hundred ($500.00) dollars. Additional charges shall be levied to cover the cost of lost water.*

D. Public Works Agreement (PWA)

All water and/or sewer infrastructure to be dedicated to public use must have a PWA and bonding. The PWA must be fully executed prior to the following:

1. *Approval of a subdivision of the property.*
2. *Notice to proceed for construction of the proposed infrastructure.*

E. Bonding

All water and/or sewer infrastructure to be dedicated to public use, including all connections within a SHA ROW (with or without a PWA), must be bonded as follows:

1. *Off-site water and/or sewer infrastructure shall be included in an Engineer's Cost Estimate and approved with the Site Plan or sketch plan by the MetCom Chief Engineer.*
2. *The amount of bonding and the infrastructure inspection fee are based on the approved Engineer's Cost Estimate.*
3. *A Performance and Maintenance Bond are required with a PWA. The Performance Bond shall be reduced to a Maintenance Bond for a period of 18-months upon acceptance of the water and/or sewer infrastructure. Acceptable forms of bonding are as follows:*
   a. *Surety bond shall not have an expiration date.*
   b. *Bank letter of credit to be good for two-years and automatically renewable.*
   c. *Cash bond will be deposited in a secure account.*
4. *A nominal bond is required when a PWA is not required for off-site water and/or sewer utility work. The bonding shall be returned/refunded to the applicant upon completion of construction and acceptance of the work by MetCom. Acceptable forms of bonding are as follows:*
   a. *Surety bond shall not have an expiration date.*
   b. *Bank letter of credit to be good for two-years and automatically renewable.*
   c. *Cash bond will be deposited in a secure account.*

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St. Mary's County Metropolitan Commission
23121 Camden Way, California, MD 20619

Serving our customers since 1964

www.metcom.org

Potable Water Distribution - Wastewater Collection / Treatment

Phone: 301-737-7400
FAX: 301-737-7459

STAFF ONLY
INITIALS: _____
DATE: _____

WATER AND SEWER CONSTRUCTION PLAN AS-BUILT REQUIREMENTS CHECKLIST

MINIMUM REQUIREMENTS

As-Built Drawings shall include all sheets approved by the Commission in the Construction Plan set showing if any locations were revised, in Red. Two submissions are required: the first submission shall include 2 sets of paper plans and a CD. Once approved, the final submission shall include one paper set and one final CD. The CD shall contain the drawings in AutoCAD .dwg format, with northing and easting data embedded, and clearly labeled. Drawings shall be registered to NAD 83 Maryland State Plane Feet and shall be stated as such on the drawings.

"AS-BUILT" in bold RED letters shall be shown above the Title block on the lower right-hand corner of the plan along with the date that the as-built modifications were completed.

Each sheet of as-built drawings shall be signed and sealed by a Maryland Licensed Professional Land Surveyor or Maryland Licensed Property Line Surveyor. The cover sheet shall be signed and sealed and contain the following statement:

> *"I hereby certify that the as-built location information of the water and sewer facilities are true and correct to the best of my knowledge and belief as surveyed under my direction."*

The cover sheet shall include the Surveyor's name and number, business name, address and telephone number.

The amount of information required on as-builts will entail the drawing author to organize its presentation for plan readability. It may be necessary to put water and sewer information on separate sheets and/or provide tables to show coordinate information where congested conditions affect the neatness and legibility of the plans.

One of the following marks shall be placed (as appropriate) on each line (METCOM reviewer shall verify each mark): ***N/A*** *- not applicable* ✓ *- provided*

PROJECT NAME: _____

DEVELOPER: _____

ENGINEERING FIRM: _____

ADDRESS: _____

PHONE: _____ **FAX**: _____

DEPT. OF LAND USE AND GROWTH MANAGEMENT (LUGM) NUMBER: _____

SUBMITTAL #_____ DATE: _____/_____/_____

A. General Requirements

_____ 1. Each page is signed, sealed and dated by a MD Registered Professional Land Surveyor or MD Licensed Property Line Surveyor.

_____ 2. Surveyor's certificate, name, address, phone number, signature and seal is provided and signed.

_____ 3. A minimum of two (paper) sets and a CD are enclosed for the first submission. Once approved, the final submission shall include one paper set, one Mylar set, and one final CD.

_____ 4. "AS-BUILT" in bold RED letters are shown above the Title block on the lower right-hand corner of the plan along with the date that the as-built modifications were completed.

_____ 5. The CD contains the drawings in AutoCAD .dwg format, and the northing and easting data is embedded and clearly labeled.

_____ 6. Drawings shall be registered to NAD 83, NAVD 88 horizontal and vertical datum and shall be stated as such on the drawings.

_____ 7. All watermains and services are shown in BLUE.

_____ 8. All sewermains and services are shown in GREEN.

_____ 9. All forcemains are shown in ORANGE.

_____ 10. A flow test has been completed for all new fire hydrants and the results of those tests have been included with this submittal.

B. Plan View

_____ 1. The locations of any easements used by the water and sewer facilities (both new and existing) are clearly shown.

_____ 2. The originally proposed locations of all manholes, fire hydrants, valves, etc. are lightened and all as-built locations are bolded and colorized.

_____ 3. All storm drain, mains, structures and appurtenances and all other utilities which come within ten (10) feet of the water and/or sanitary sewer are clearly shown.

_____ 4. A minimum of three (3) grid ticks with northing and easting indicated are provided.

_____ 5. Northing and easting data (in NAD 83 Maryland State Plane Feet) was acquired and is submitted for Commission maintained facilities, including:

   a. The center of each manhole, fitting, bends, valve, blow off, hydrant, water meter, sewer cleanout, lift station wet well, double detector check or other non pipe water or sewer facility.

   b. Locations of grinder pumps and service valves.

   c. Any other locations designated by the Commission.

C. Profile View

_____ 1. The length of gravity sewer piping and actual slope between manholes are indicated.

_____ 2. Elevations to the nearest tenth of a foot are shown for all:

a. Top of valve box

b. Top of operating nut for all valves.

_____ 3. Elevations to the nearest one hundredth of a foot are shown for all:

a. Manhole rims

b. Inverts of every gravity sewer pipe and force main connections to manholes.

D. Pump/Water Stations

_____ 1. The as-built locations for all interior piping, vaults, inverts, valves, pits/crocks, manholes/wet wells, and electrical information are clearly shown.

_____ 2. The as-built locations for all yard piping, vaults, inverts, wells, valves, pits/crocks, manholes/wet wells, electrical information are clearly shown.

_____ 3. The as-built locations of any buildings or structures (including any fencing) are clearly shown.

_____ 4. All grading/paving information is provided.

_____ 5. The locations of any easements are clearly shown.

Applicant's Certification

I, the undersigned, hereby certify that the attached Water and Sewer As-Built Construction Plans include all items required by the St. Mary's County Metropolitan Commission. I understand that if any of the items required are found to be missing from the submittal, the Water and Sewer As-Built Plan will not be acceptable for approval and will be returned as incomplete. I am aware of these criteria and will accept all responsibility for delays due to incomplete submittals. I am enclosing an explanation for each item which I feel is not required and, therefore, has not been included in this submittal package.

_____ _____

Professional Surveyor's Signature Date

_____

Professional Surveyor's Printed Name SEAL

MD LICENCED PROFESSIONAL SURVEYOR MUST SIGN AND SEAL THIS CHECKLIST

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ST. MARY'S COUNTY
METROPOLITAN COMMISSION

STANDARD PROCEDURES & POLICIES

SP Number:	Approval Date: *02/14/19* Revision Dates:	Effective Date: *02/14/19*
ENG-19-01	Approved by: M. Hollander	

SUBJECT: **PROCEDURE FOR UPDATING THE METCOM DESIGN MANUAL, STANDARD DETAILS, AND TECHNICAL SPECIFICATIONS**

Authority:

In accordance with Chapter 113-11 of the St. Mary's County Code, before any construction is done upon any area served by a public water or sewer system, the person doing the construction shall first obtain a permit from the St. Mary's County Metropolitan Commission (MetCom) and the work shall be done under and pursuant to the rules, regulations and requirements that MetCom formulates and subject to any inspections which it deems necessary. Any construction shall be done under conditions that MetCom authorizes.

Introduction:

Periodically, the MetCom Design Manual, Standard Details, and Technical Specifications (Design Manual) requires updated in order to address updated design requirements, industry standards, national regulations and local ordinances. This procedure for updating the Design Manual will help streamline the approval process.

Conditions:

The MetCom Design Manual may be updated for numerous reasons to include but not limited to:

1. Changes to industry standards; and
2. Changes that in MetCom policy and maintenance methods;
3. The addition of a new product, material, or manufacturer.

Procedure:

1. Design Manual

    A. All changes to the Design Manual will be evaluated internally by the Chief Engineer. The Chief Engineer may assemble an internal committee of select MetCom staff including the Director to write and review the proposed changes. The update may be posted on MetCom's website for a minimum of thirty (30) days in order to receive public comment. Any comments received will be reviewed by the Chief Engineer and any valid comments will be incorporated into the update. The Board will be presented with the final update for approval. Once concurrence is obtained from the Board, the revised Design Manuals shall be posted to the MetCom website.

2. Standard Construction Details

    A. Updates or changes to the Construction details may include but are not limited to dimensional changes, acceptable material changes, manufacturer changes, or changes to the construction method.

        i. Changes which are initiated by a change in the Design Manual shall be included with the Design Manual change process.

        ii. Changes to the Construction Details not associated with an update to the Design Manual as described in 2.A.i will be evaluated and approved by the Chief Engineer. The approved detail update will have a revision date, and signature of the Chief Engineer.

        iii. Changes to the Standard Details shall be posted to the MetCom website.

3. Technical Specifications

    A. Updates or changes to the Technical Specifications may include but are not limited to changes to the referenced code or standard. It is the intent of the Technical Specifications to be based on ISO and industry standards.

        i. If the ISO industry standards change or are revised, then these changes shall be incorporated by reference and be changed without action by the Chief Engineer.

        ii. Changes which are initiated by a change in the Design Manual shall be included with the Design Manual change process.

iii. Changes to the Technical Specifications not associated with an update described in 3.A.i and 3.A.ii will be evaluated and approved by the Chief Engineer.

iv. Changes to the Technical Specifications shall be posted to the MetCom website.

4. Appendix

A. All items in the Appendix of the Design Manual are included for informational purposes only and are considered independent of these standards. Additions or deletions to the Appendix will occur as needed. Changes will be registered by date and notice posted to the MetCom website. The modified items shall be posted to the MetCom Website.

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St. Mary's County Metropolitan Commission
23121 Camden Way, California, Maryland 20619
Serving St. Mary's County
Potable Water Distribution - Wastewater Collection / Treatment
www.metcom.org
Phone: 301-737-7400
FAX: 301-737-7458

Water and Sewer Construction Cost Estimate
Calendar Year 2019

Note: If phased please complete a separate estimate for each phase or section.

Project Name and Phase (if applicable): _____

Developer: _____

Engineering Firm: _____ Completed by: _____

LUGM Number: _____

Water EDUs: _____ Sewer EDUs: _____ Date: _____

Water				
Item / Description	**Unit**	**Quantity**	**Unit Price**	**Total**
1" Corp. Stops	EA.		$275.03	$0.00
1-1/2" Corp. Stops	EA.		$636.23	$0.00
2" Corp. Stops	EA.		$801.56	$0.00
1" Curb Stop w/box	EA.		$602.07	$0.00
1 1/2" Curb Stop w/box	EA.		$970.51	$0.00
2" Curb Stop w/box	EA.		$970.51	$0.00
1" Copper WHC	L.F.		$51.21	$0.00
1-1/4" Copper WHC	L.F.		$62.70	$0.00
1-1/2" Copper WHC	L.F.		$76.72	$0.00
2" Copper WHC	L.F.		$109.29	$0.00
4" Main, DIP CL - 52	L.F.		$100.93	$0.00
6" Main, DIP CL - 52	L.F.		$120.77	$0.00
8" Main, DIP CL - 52	L.F.		$137.75	$0.00
10" Main, DIP CL - 52	L.F.		$175.06	$0.00
12" Main, DIP CL - 52	L.F.		$206.52	$0.00
16" Main, DIP CL - 52	L.F.		$289.35	$0.00
20" Main, DIP CL - 52	L.F.		$406.00	$0.00
4" Main, C-900, SDR - 21 PVC	L.F.		$20.63	$0.00
6" Main, C-900, SDR - 21 PVC	L.F.		$31.37	$0.00
8" Main, C-900, SDR - 21 PVC	L.F.		$46.93	$0.00
10" Main, C-900, SDR - 21 PVC	L.F.		$65.61	$0.00
12" Main, C-900, SDR - 21 PVC	L.F.		$87.70	$0.00
4" Main, HDPE DR - 11	L.F.		$29.33	$0.00
6" Main, HDPE DR - 11	L.F.		$55.54	$0.00
8" Main, HDPE DR - 11	L.F.		$64.65	$0.00
10" Main, HDPE DR - 11	L.F.		$90.28	$0.00
12" Main, HDPE DR - 11	L.F.		$121.98	$0.00
4" Valve & Box	E.A.		$2,963.60	$0.00
6" Valve & Box	E.A.		$3,592.68	$0.00
8" Valve & Box	E.A.		$4,401.43	$0.00
			Water Subtotal (Sheet 1):	$0.00

Water Cont.				
Item / Description	**Unit**	**Quantity**	**Unit Price**	**Total**
12" Valve & Box	E.A.		$7,277.00	$0.00
16" Valve & Box	E.A.		$20,756.24	$0.00
8"x 4" Tapping Sleeve & Valve	E.A.		$5,846.54	$0.00
8" x 6" Tapping Sleeve & Valve	E.A.		$6,529.53	$0.00
8" x 8" Tapping Sleeve & Valve	E.A.		$7,733.67	$0.00
12" x 6" Tapping Sleeve & Valve	E.A.		$8,175.62	$0.00
12" x 8" Tapping Sleeve & Valve	E.A.		$9,433.68	$0.00
12" x 12" Tapping Sleeve & Valve	E.A.		$13,627.18	$0.00
6" Fire Hydrants, Assembly	E.A.		$9,104.23	$0.00
Post Indicator Valve	E.A.		$3,557.81	$0.00
4" Blowoff	E.A.		$2,963.60	$0.00
6" Blowoff	E.A.		$3,592.68	$0.00
8" Blowoff	E.A.		$4,401.43	$0.00
12" Blowoff	E.A.		$7,277.00	$0.00
4" Check Valve	E.A.		$5,389.91	$0.00
8" Check Valve	E.A.		$9,882.99	$0.00
Air Release Valve and Vault	E.A.		$23,713.48	$0.00
Bore & Jack (Up to 24" Casing w/Grout)	L.F.		$1,315.56	$0.00
Directional Drilling up to 12"	L.F.		$22.59	$0.00
Concrete Encasement	C.Y.		$382.74	$0.00
Borrow Backfill Material (Quantity = 10% of total linear feet of pipe)	L.F.		$96.00	$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00

Water Subtotal (Sheet 2):	$0.00
Water Subtotal (Sheet 1):	$0.00
Water Total:	**$0.00**

- Please include the estimated cost of water storage tanks as an additional line item in the cost estimate.

Sewer				
Item / Description	**Unit**	**Quantity**	**Unit Price**	**Total**
6" Clean-out Assembly	E.A.		$1,509.67	$0.00
4" Gravity PVC SDR - 35 / C900 DR 14[1]	L.F.		$50.67	$0.00
6" Gravity PVC SDR - 35 / C900 DR 14[1]	L.F.		$76.87	$0.00
8" Gravity PVC SDR - 35 / C900 DR 14[1]	L.F.		$115.00	$0.00
10" Gravity PVC SDR - 35 / C900 DR 14[1]	L.F.		$160.67	$0.00
12" Gravity PVC SDR - 35 / C900 DR 14[1]	L.F.		$214.91	$0.00
24" Gravity, RCP	L.F.		$472.65	$0.00
4" Force Sewer, HDPE / DR-11	L.F.		$29.33	$0.00
6" Force Sewer, HDPE / DR-11	L.F.		$55.54	$0.00
8" Force Sewer, HDPE / DR-11	L.F.		$64.65	$0.00
10" Force Sewer, HDPE / DR-11	L.F.		$90.28	$0.00
12" Force Sewer, HDPE / DR-11	L.F.		$121.98	$0.00
6" Gravity/Force Sewer, DIP Cl-52	L.F.		$120.77	$0.00
8" Gravity/Force Sewer, DIP Cl-52	L.F.		$137.75	$0.00
10" Gravity/Force Sewer. DIP Cl-52	L.F.		$175.06	$0.00
12" Gravity/Force Sewer, DIP Cl-52	L.F.		$206.52	$0.00
16" Gravity/Force Sewer, DIP Cl-52	L.F.		$289.35	$0.00
20" Gravity/Force Sewer DIP Cl-52	L.F.		$406.00	$0.00
1-1/2" Force Sewer, PVC SDR -21	L.F.		$4.16	$0.00
2" Force Sewer, PVC SDR -21	L.F.		$5.08	$0.00
2-1/2" Force Sewer, PVC SDR -22	L.F.		$7.20	$0.00
3" Force Sewer, PVC SDR - 21	L.F.		$12.90	$0.00
4" Force Sewer, PVC C900 / DR18	L.F.		$20.72	$0.00
6" Force Sewer, PVC C900 / DR18	L.F.		$31.37	$0.00
8" Force Sewer, PVC C900 / DR18	L.F.		$46.93	$0.00
10" Force Sewer, PVC C900 / DR18	L.F.		$65.57	$0.00
12" Force Sewer, PVC C900 / DR18	L.F.		$232.82	$0.00
1-1/2" Valve & Box	E.A.		$1,246.00	$0.00
2" Valve & Box	E.A.		$1,256.94	$0.00
2-1/2" Valve & Box	E.A.		$1,818.62	$0.00
3" Valve & Box	E.A.		$1,548.28	$0.00
4" Valve & Box	E.A.		$2,963.60	$0.00
6" Valve & Box	E.A.		$3,592.68	$0.00
MH-4' Dia., Precast	V.F.		$751.26	$0.00
MH-5' Dia., Precast	V.F.		$1,078.34	$0.00
Adjust 4' Dia MH Rings	V.F.		$751.26	$0.00
Adjust 5' Dia MH Rings	V.F.		$1,078.34	$0.00
Standard Frame & Cover	EA.		$1,457.55	$0.00
Water Tight Frame & Cover	EA.		$2,097.35	$0.00
Drop Connection (Inside or Out)	EA.		$3,207.56	$0.00
Inserta-Tee	EA.		$2,912.18	$0.00
Kor-n-Seal, Tie-in to Manhole	EA.		$3,207.56	$0.00
Air Release Valve and Vault	E.A.		$23,713.48	$0.00
Bore & Jack (Up to 24" Casing w/Grout)	L.F.		$1,315.56	$0.00
Directional Drilling up to 12"	L.F.		$22.59	$0.00
Flushing Connection	E.A.		$6,240.39	$0.00
Grinder Pump, Duplex	E.A.		$33,282.08	$0.00
Oil/Grease Interceptors	E.A.		$26,001.62	$0.00
Septic Tank	1000 Gal		$3,235.89	$0.00
Borrow Backfill Material (Quantity = 10% of total linear feet of pipe)	L.F.		$96.00	$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00
				$0.00

▪ Please include the estimated cost of simplex grinder pumps and pump stations as an additional line item in the cost estimate.

1. Unit prices revised 10/31/19

Totals	
Water Total:	$0.00
Sewer total:	$0.00
Subtotal:	$0.00
Contingencies (10% of subtotal):	$0.00
Total:	$0.00
Construction and Mobilization: (10% of Total Construction Cost, $500 min. $2500 max.)	$0.00
Construction Survey Including Field Engineering: (5% of Total Construction Cost, $1000 min. $50,000 max.)	$0.00
Engineer's Cost Estimate: (Total of Water, Sewer, Construction Mobilization., and Construction Survey, Rounded to the nearest $100)	$0.00
Bond/ Letter of Credit: (110% of Engineers Cost Estimate, Rounded to the nearest $100)	$0.00
Water and/or Sewer Infrastructure Inspection: (2.5% of Bond/LOC amount (if applicable), or 2.5% of 110% of the Engineer's Cost Estimate, rounded to the nearest $100 if no Bond/LOC is required, for projects ≤ $385k; or 1.5% of Bond/LOC amount (if applicable), or 1.5% of 110% of the Engineer's Cost Estimate, rounded to the nearest $100 if no Bond/LOC is required, for projects > $385k.	$0.00

* Note: The prices for the pipes include the cost for bends, tees, crosses, reducers, caps, and all other incidentals.
**Note: This estimate is for MetCom use only and should not be used for any other purpose.

FOR METCOM STAFF ONLY

St. Mary's County
Metropolitan Commission
Engineering Department

Reviewed for general conformance with design concept of the project and general compliance with requirements of the contract documents only. No contract requirements are waved.

☐ Approved ☐ Revise & Resubmit

☐ Approved as Noted ☐ Rejected

By: _____ Date: _____

Specification for Backup Power Supply: SCADA Transmitters

1. Overview

METCOM has identified a need to provide backup/emergency power to remote data collection transmitters (SCADA) located at various sites throughout the county. This equipment is generally powered from the standard utility power grid but can be powered by a 12 VDC source in the event of grid failure. SCADA equipment provides general alarm and monitoring information necessary to maintain continued safe operation of said equipment on 24x7 basis.

2. Requirement

Provide backup power per the following specs:

Output voltage:	12 VDC (10.5 VDC minimum – 14 VDC maximum)
Current draw:	~8 amps peak; 3-5 amps expected; 1-2 amps idle
Output time:	50 hours continuous operation
Voltage drop:	<1.5 VDC over 50 hours
Min Output voltage:	10.5 (after 50 hours operation)
Battery Type:	12 VDC AGM no maintenance
Recharge type:	Solar Panel(s)
Recharge Time:	20 hours (accumulated)

As previously outlined, SCADA equipment needs to be operational at all times and in all conditions in order to keep operators appraised of pump and well conditions and fluid levels. To meet this end, a standby power supply is required to provide uninterrupted operation of the equipment for a specified minimum of fifty (50) hours of continuous operation supplying 12 VDC (nominal) at a maximum peak, intermittent current draw of ~8 amps @ 12 VDC (approx 100 watts) The duty cycle is expected to be less than 50% giving a total of approx 2500 watt/hrs over 50m hours of operation.

Basic Calculations and Standards

1. Equipment power requirements

As with most complex electronic systems, power requirements vary. Therefore, we shall extrapolate an average power consumption requirement based on the worst case scenario or, in this case, the highest expected continuous current draw, eight (8) amps (transmitting) at 12 VDC. This gives us a continuous power consumption figure of one hundred (100) watts at peak consumption. Since our transmitter “on air” time approximates a 50% duty cycle, we can average the total power consumption to 50 watts for 50 hours or 2500 watt/hrs.

We can now figure the total battery capacity needed to meet the specs: 2500 watt hours or 150 amp hours battery capacity (50 watts per hour X 50 hour run time). Since most 12 volt storage batteries are rated in amp hours, we will use this capacity

measurement for the remainder of this document. (average 4 amp draw X 50 hours = 200 amp hours total)

Also, with the actual output of lead acid 12 volt storage batteries at approximately 13.8 volts, we will have some reserve capacity if we standardize on a 12 volt requirement. There for, figuring a 10% standard loss in the system (wiring, heat loss, connection loss, etc) we would require a battery bank capable of supplying 220 amp hours at 12 VDC.

Now that we know the capacity needed, we can figure the charge rate and solar panel size required.

Since we are only providing power for emergency backup, we only need a panel that is capable of replacing, during peak daylight hours, however much energy the system has pulled from the battery bank during operation. Let's use the worst case scenario again and assume the batteries are discharged (10.5 VDC). The only real variable here is how long do we want to allow for battery charging? Since this requirement has the ability to greatly influence the system cost, we shall settle on 20 hours of accumulated time to reach full charge after a total discharge event. This gives us a solar panel specification of 220 watts output in bright sunlight. Two 8 amp panels in parallel will easily provide the required voltage and amperage in combination with a 16 amp charge controller. The following assumptions are made:

The system will use energy from the battery bank continuously while on back up power but, we only have approximately 5 hours of high output per day from a fixed solar panel under the best of conditions.

Panel output is figured on a yearly average at a given latitude, southwest facing panel at 45 degrees, no obstructions, in bright sunlight.

Total battery bank discharge to 10.5 VDC should not occur in normal operation but is possible.

Recommended Equipment

1. Batteries

Requirement:	200 amp hour capacity, 12 VDC battery bank
Recommendation:	Three (3) Optima 12 volt, 75 amp hr, AGM Deep Cycle batteries connected in parallel. Optima Part# D31A

I recommend AGM (Absorbent Glass Mat) marine grade, deep cycle batteries since their power output is relatively flat over the life of the battery and they require no regular maintenance. Also, these batteries provide higher power output at extreme temperatures than other lead acid storage batteries.

Since a 12 volt lead acid battery regardless of electrolyte type is considered dead at ~10.5 volts we know that we can already meet the requirement of a maximum voltage drop of 1.5 volts over the life of the system's continuous output.

Specs may be reviewed at: http://www.1st-optima-batteries.com/

2. Solar Panels

Requirement: 100 watts (12 VDC@8 amps)
Recommendation: GE GEPV-110 or equivalent

Panels may use single or multi-crystal cells with the following specs:

Peak Power:	110 watts
Max Power Voltage (Vmp):	16.1
Open Circuit Voltage:	20.6
Short Circuit Current:	7.1 amps
Short Circuit Temperature Coefficient:	-0.08 V/°C

Aluminum frame with pre drilled holes preferred. Outdoor commercial/industrial rating required. Built in weatherproof junction box (on panel) preferred.

Specs may be reviewed at: http://shop.altenergystore.com

3. Charge Controller

Requirement: 16 amps @ up to 26 vdc input
UL listed and FM approved for hazardous locations
Recommendation: Specialty Concepts ASC-12/16AE

Charge controller should be rated for hazardous environments and include lightening protection and blocking diode (to prevent batteries from discharging through solar cells at night). The unit should be 100% solid state with input noise suppression.

Specs may be reviewed at: http://shop.altenergystore.com
FM Global: http://www.fmglobal.com/approvals/approved/categories/locations.asp

4. Miscellaneous

All switches, circuit breakers, connection boxes, wire and miscellaneous parts needed to complete the system and meet all applicable safety requirements. This may vary according to existing conditions at each installation site. A basic specification should be included.

5. Conclusion

While certain parts/systems have been recommended here, the basic need to build a cost effective system that meets the specifications as outlined in “Section 2: Requirement” is the prime focus of this document. Keep in mind that these systems will be operating in a less than friendly environment, year round, without more that basic maintenance and sometimes without any maintenance. When considering parts and ultimate design, this should be kept foremost in mind.

Prepared by: Robert J. Fehn Sr.

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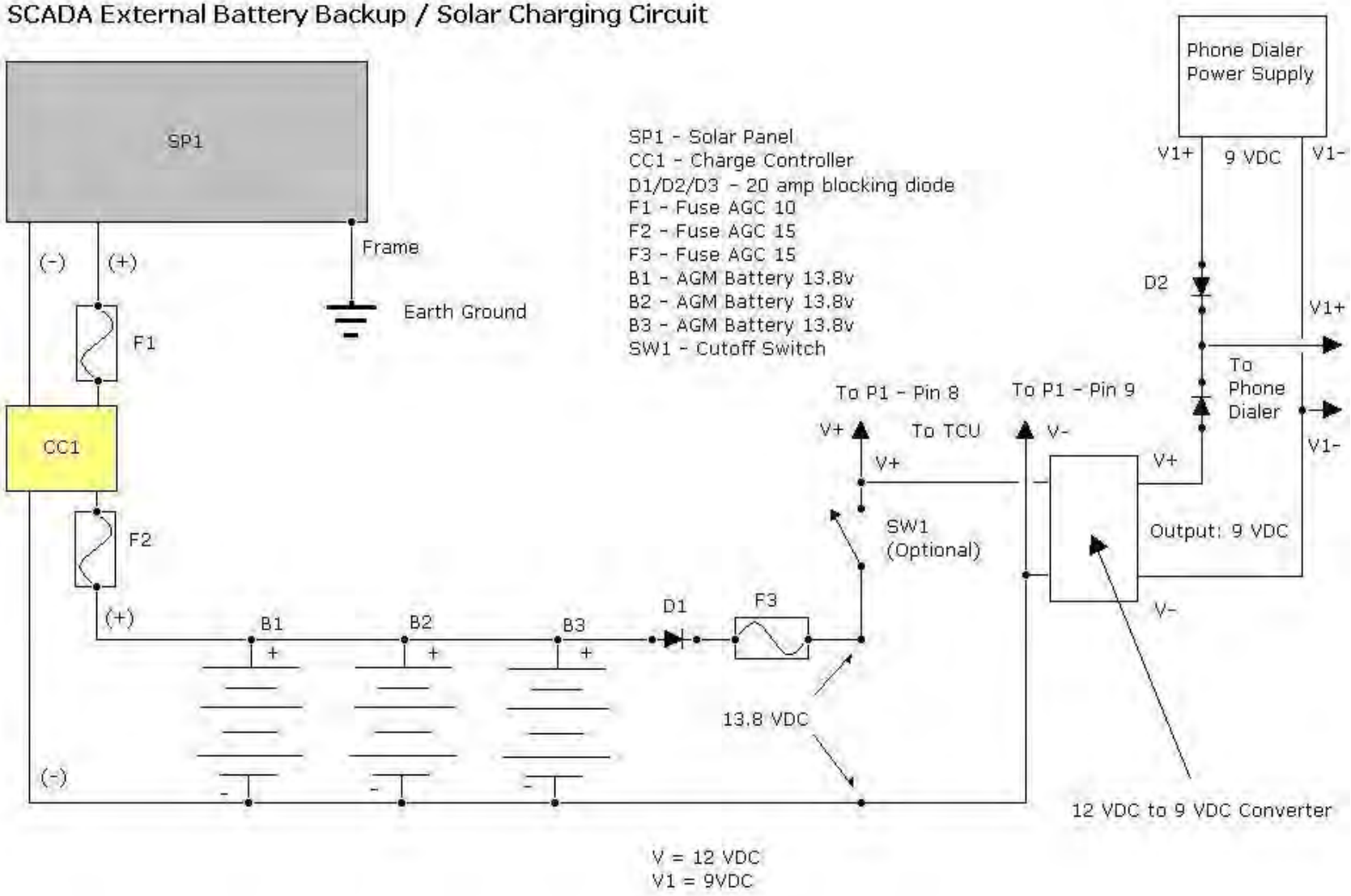
SCADA External Battery Backup / Solar Charging Circuit



V = 12 VDC
V1 = 9VDC

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ST MARY'S COUNTY METROPOLITAN COMMISSION

LIST OF APPROVED MATERIALS & MANUFACTURERS FOR WATER & SEWER CONSTRUCTION

The Commission shall maintain an approved materials and manufacturers list. The amendment of the list shall be the result of an evaluation and recommendation of a committee of operations, maintenance and engineering staff periodically designated by the Chief Engineer. The list shall be utilized by contractors, suppliers, designers, and staff when identifying materials which have been approved for use in the water and sewer systems. This list shall be utilized in construction or maintenance when the project specifications do not contain enough detail to identify every item. This list is to be used or referenced in designs unless a material not contained in the list is otherwise approved for use in a specification package.

The Manufacturer of a material not on the list may request inclusion of a product by pursuing the following evaluation procedures:

1. Materials must be presented with a request for inclusion in the approved materials list. The request may initially be for an individual or limited number of projects.

2. Five (5) copies of fact sheets, specifications, laboratory test results, drawings and significant information on applicability of use of the product must be presented before a request will be considered.

3. Documentation of approval for use for the proposed application by other local, state or federal water and sewer operations and construction agencies must be presented.

4. Depending on the nature of the product, factory visits and on-site visits to locations where the material or product is being utilized in construction and/or operation may be required as part of the evaluation process.

5. If evaluation of the aforementioned information is acceptable, the product may be approved for use on a trial basis in a developer-funded or Capital Improvement project. NOTE: Large quantities or extensive use in the trial installation will normally not be allowed.

6. The Commission reserves the right to have the product tested by an independent agency to assure that it meets the minimum requirements established in the Standard Specifications. In the event that the product does not meet the minimum requirements, the manufacturer will be responsible for all associated cost including, but not limited to, the test performed and any additional testing by the Commission.

7. If the trial installation produces satisfactory results then after an appropriate time for observation, the material or product may be utilized on a limited basis.

8. Pending continued satisfactory performance and evaluation during the trial installation and limited use periods, the material or product may be added to the List of Approved Materials and Manufacturers.

List of Approved Materials Manufacturers
General

	Spec. Sec.	**Standard**	**Approved / Manufacturer**
Metallic Warning Tape (water / gravity, & FM sewer)	Sec. 02551, 02553, 02561, 02563, 02566		All Manufacturers
Tracer Wire (12 ga. solid)	Sec. 02553		All Manufacturers
Tracer Wire: (#8 AWG)	Sec. 02310		All Manufacturers
Standard Valve Box (screw type)	Sec. 02553	W-1, W-2	Sigma, Bingham & Taylor, Capitol Foundry, Tyler Union
	Sec. 02566	P-1, P-2, P-3	Sigma, Bingham & Taylor, Capitol Foundry, Tyler Union
Curb Valve Box (screw type) with Water Lid	Sec. 02552	W-9	Sigma, Bingham & Taylor, Capitol Foundry, Tyler Union

List of Approved Materials Manufacturers
Water Main Construction

	Spec. Sec.	Standard	Approved / Manufacturer
(DIP) CL-52 / Slip Joint / Restrained Joint (cement Lined)	Sec. 02551		US Pipe, Griffin, American, Atlantic States, Clow
(PVC) C-900 DR-18 CLASS 150	Sec. 02551		JM, National, Diamond, North American
(PVC) SDR-21 B&S (bell gasket) 200 psi	Sec. 02551		JM, National, Diamond, North American
(HDPE) High Density Polyethylene DR-11	Chap 2 Design		Pressure Rated to Match System Piping
Mechanical Joint Fittings (cement Lined)	Sec. 02551		Tyler, Union, Sigma, Star Pipe
Ductile Iron (sleeves, bends, tees, reducers, end cap, plugs)			
MJ Accessory Kits	Sec. 02551		EBAA, Sigma, US Pipe, Star Pipe
HDPE Fittings (fusion type)			Pressure Rated to Match System Piping
Resilient Seat Wedge (Gate) Valves / (MJ)	Sec. 02552	W-1, W-2	US Pipe, Mueller, Kennedy, M&H, Clow
Fire Hydrants (5-1/4" main valve x MJ)	Sec. 02554	W-1	Mueller, US Pipe, Clow, Kennedy, American, M&H
MJ x Swivel Tee (Req. for hydrant service valve)	Sec. 02551	W-1	Griffin, Tyler, Clow, Union, Sigma
2.0" Hydrant Blow Off (connected with 2" brass pipe)		W-3	Kupferle, Mainguard
2.0" Brass Hardware			Merit Brass or approved equal
2.0" Air Release Valve (stainless body)	Sec. 02552		Crispin, ARI
Air/Vacuum Release Valve	Sec. 02552		Crispin, Apco, ARI or approved equal
Double Strap Brass Service Saddles	Sec. 02553	W-4A,W-4B, W-5, W-9	Ford. Mueller, McDonald
Corporation Stop / Bronze Curb Stop (assembly)	Sec. 02553	W-9	Ford, Mueller, McDonald
K Copper Tubing (soft / rolled) 1" dia. and greater	Sec. 02553	W-5	Mueller, Reading, Cambridge-Lee Industries
Copper Setter Flared (with dual cartridge check valve)	Sec. 02553		Ford, Mueller, McDonald
(Single or Shared Domestic / Sprinkler Connection)		W-4A, W-4B	Ford, Mueller, McDonald
Meter Vault (plastic pit setter)	Sec. 02553	W-4A, W-4B, W-5	DFW Plastics, Mid States
Blow Off Vault		W-3	DFW Plastics, Mid States
Frame & Cover (cast iron with locking mechanism)		W-8, W-10	Capitol Foundry, Ford, AY McDonald, Sigma
Lid Labeled (water meter designed for ECR sensor)	Sec. 02553	W-8, W-10	Capitol Foundry, Ford
Fireman Post Indicator & Valve	Sec. 02553	W-15	Kennedy, Mueller
Water Meters	Sec. 02553	W-6, W-8, W-10, W-11	Neptune Automatic Meter Read (AMR) Meter
Joint Restraint for PVC Pipe			EBAA Iron Series 1600 and 2000PV
Joint Restraint for Ductile Iron Pipe			EBAA Iron Series 1100 Megalug
Leak Joint Clamps (reduced clearance)	Special Exceptions		Style 516 by Romac Industries, Inc. JCM 143 Bell Joint Leak Clamp by JCM Industries Smith-Blair 274 by Smith-

List of Approved Materials Manufacturers
Gravity Sewer Construction

	Spec. Sec.	Standard	Approved / Manufacturer
Sewer Pipe (Mains / Services)			
(PVC) SDR-35 / C-900 - DR 14	Sec. 02561		JM, National, Diamond, North American
(DIP) Cl-52 Fiberglass or Ceramic Epoxy lined	Sec. 02561		US Pipe, Griffin, American, Atlantic States, Clow **(approved applicators)**
(RCP) Reinforced Concrete Pipe	Sec. 02561		Hydro Conduit, Concrete Pipes & Products
(HDPE) High Density Polyethylene	Sec. 02561		Pressure Rated to Match System Piping
Service Connections / Fittings (Wyes / Bends)			
(DIP) Fiberglass, Ceramic Epoxy, Dbl. Cement Lined	Sec. 02561		Griffin, American, Atlantic States, Clow **(approved applicators)**
(PVC) SDR-35 / C-900	Sec. 02561	S-3, S-4, S-10, S-11, S-12	Harco, Multi Fittings, GPK, Plastic Trends
Pipe Strap Saddle (tee or wye gasketed)	Sec. 02561	S-13, S-14	Geneco, Romac or approved equal
Core Drilled and Inserted Main Tap	Sec. 02561	S-15, S-16	Insert-A-Tee
Cored Manhole Gasket	Sec. 02561		Kor-N-Seal
Pinella Cover	Sec. 02561	S-17	Jumbo, Pinella Industries
Lamphole Cover (with expansion plug)	Sec. 02561	S-18	Capitol Foundry
3" and 4" Collar	Sec. 02561		Rectorseal
6" Collar	Sec. 02561		Rectorseal
Backwater Valve	Sec. 02561		Rectorseal Clean Check
Flapper	Sec. 02561		Rectorseal
Riser Assembly	Sec. 02561		Rectorseal
3", 4", and 6" Valve Body	Sec. 02561		Rectorseal
Precast Concrete Structures			
Sewer Manholes	Sec 02562	S-1, S-2	Frederick, Superior, Terre Hill, Americast, Hanson
Drop Connections	Sec 02562	S-3, S-4	Precast or Cast in Place
Manhole Built over Existing (doghouse)	Sec 02562	S-5	Frederick, Superior, Terre Hill, Americast, Hanson
Cast in Place Channels	Sec 02562	S-6	Submit manufacturers shop drawings

List of Approved Materials Manufacturers
Gravity Sewer Construction

	Spec. Sec.	Standard	Approved / Manufacturer
Brick Masonry	Sec 04200	S-6	Type SM / ASTM C32
Manhole Frames and Covers			
Standard Heavy Traffic	Sec 02562	S-7	Capitol Foundry, East Jordan, Chesapeake Foundry, US Foundry
Watertight	Sec 02562	S-8	Capitol Foundry, East Jordan, Chesapeake Foundry, US Foundry
Insert with Strap	Sec 02562		Flow in Flow, East Jordan
Miscellaneous			
Epoxy Lining			Protecto 401 Ceramic Epoxy Lining

List of Approved Materials Manufacturers
Low Pressure Forced Main Sewer Construction

	Spec. Sec.	Standard	Approved / Manufacturer
Mains and Services			
(PVC) SDR-21 B&S (bell gasket) 200 psi	Sec. 02563		JM, National, Diamond, North American
(PVC) C-900 DR-18 Class 150 B&S (bell gasket)	Sec. 02563		JM, National, Diamond, North American
(PVC) Schedule-80 pipe (plain end) Solvent Weld Joints	Sec. 02566	P-1	
(DIP) CL-52 (glass or epoxy lined) B&S (flex joint)	Sec. 02563		US Pipe, Griffin, American, Atlantic States, Clow **(approved applicators)**
(HDPE) / DR-11 (fused joints)	Sec. 02563		Pressure Rated to Match System Piping
Pressure Rated Fittings			
Service Tee (PVC, DIP) Threaded Outlet	Sec. 02566	P-1	Harco or approved equal
Horizontal / Vertical bends (PVC, DIP)	Sec. 02566		Harco, Multi Fittings, GPK, Plastic Trends
PVC Schedule-80 (solvent weld joints)	Sec. 02566	P-1, P-2, P-3, P-4, P-5, P-6	National, Charlotte, Crestline, Lasco
HDPE (fusion type)	Sec. 02566		Central Plastics or approved equal
Valves			
Resilient Seat Wedge (MJ) Gate Valve (flanged interior use)	Sec. 02552		US Pipe, Mueller, Kennedy, M&H, Clow
Plug Valve (MJ or Flanged)	Sec. 02566		Dezurik or approved equal
Bronze Ball Valve (fipt x fipt w' 2" sq. oper. nut)	Sec. 02566	P-1, P-2, P-3, P-4, P-5, P-6	Ford, Mueller, McDonald
Bronze Check Valve (fipt x fipt)	Sec. 02566	P-9	Ford, Mueller, McDonald
Grinder and Chopper Pumps			Barnes SGV Series, Myers WGL 20 Series (Grinder), Myers VR2 Series (Chopper), HOMA GRP19/1FSISMC
Miscellaneous			
Brass (nipples, tees, bushings, plug)	Sec. 02566	P-3, P-4, P-5, P-6	Merit or approved equal
Couplings, Saddles (@ trans. connection to gravity sewer)	Sec. 02566	P-10, P-11	Geneco, Romac, Harco

List of Approved Materials Manufacturers
Low Pressure Forced Main Sewer Construction

Comb. Air Release / Air / Vacuum Valve (stainless body)	Sec. 02563	P-8	ARI, Crispin, Apco or approved equal
Sewage Grinder Pumping Unit (simplex / duplex units)	Sec. 11307	P-9, P-9A	Myers or Barnes

List of Approved Materials Manufacturers
Wastewater Pump Station

	Spec. Sec.	Standard	Approved / Manufacturer
Components			
Flowmeter			(ABB) Process Master for submergence in water l P68 with start up
Transducer (submersible)			KPSI Series 750 (Non-Fouling), Mercoid PBLT2
Solar Controller for Solar Backup (WWPS with a Godwin pump)			Morning Star Pro Star 30
Circular Chart Recorder			Honeywell DR4300
Magnetic Contactors and Starters			Square D Class 8536
Automatic Transfer Switch			ASCO 300, Zenith ZTG
Generator Sets			Katolight, Kohler, Tognum MTU, Detroit Diesel
Macerator			Franklin Miller Taskmaster 8500, JWC Environmental Muffin Monster
Odor Control System			Calgon Carbon Ventsorb, ESD Purafil Drum Scrubber, ESD Purafil Vent Scrubber
Pumps			Barnes, Flygt, Homa, Myers
SCADA			
Tower			Rohn 45AG
Telemetry Control Unit			DFS TCU800 Pump Controller
Yagi Antenna			Kathrein Scala Division CA5-300
Input/Output Device			RIO032, RIO128
TCU Enclosure			Stahlin Enclosures RJ1816HPL

List of Approved Materials Manufacturers
Water Pump Station

	Spec. Sec.	**Standard**	**Approved / Manufacturer**
Chlorine Injection Pump			Stenner (parastolic)
Chlorine Analyzer			Hach CL-17
Chart Recorder			Honeywell DR 4300
Eyewash			Pedestal Mounted with Potable Water

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St. Mary's County Metropolitan Commission

www.metcom.org

Standard Construction Details

Effective July 11, 2019

23121 Camden Way, California, MD 20619
Telephone: 301-737-7400
Website: www.metcom.org

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Standard Details
Table of Contents

General

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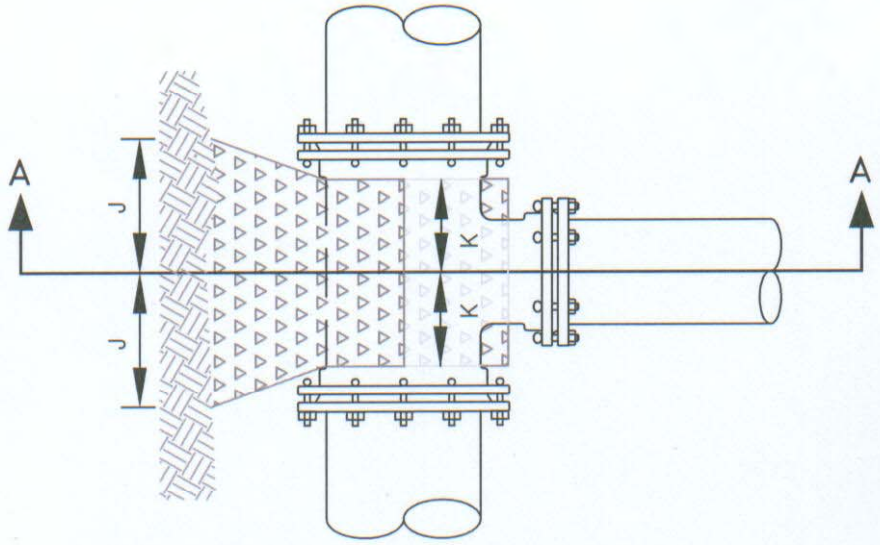

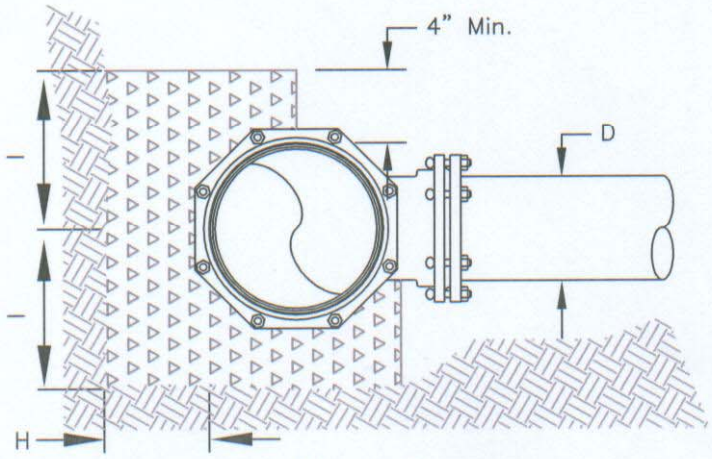

SECTION "A–A"

BUTTRESS FOR TEES					
SIZE OF BRANCH					
D	6"	8"	10"	12"	16"
H	8"	9"	10"	12"	14"
I	9"	10"	12"	15"	20"
J	7"	9"	12"	14"	18"
K	6"	6"	8"	9"	10"

NOTES:

1. All concrete shall be MDOT SHA mix #1 (2500 p.s.i.) or as directed by the Engineer.

2. Buttress dimensions shown are minimum. dimensions are based upon a soil bearing pressure of 3000 p.s.f. and static water pressure of 150 p.s.i. where soil bearing pressure is less than 3000 p.s.f. or water pressure exceeds 150 p.s.i., special buttress design shall be required.

3. Buttress shall extend to undisturbed soil.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			BUTTRESSES FOR TEES
			STANDARD NO. G-1

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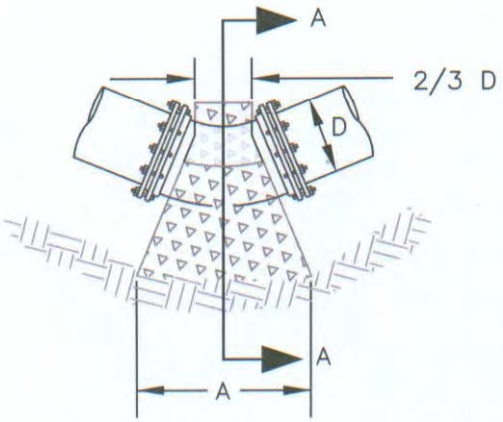
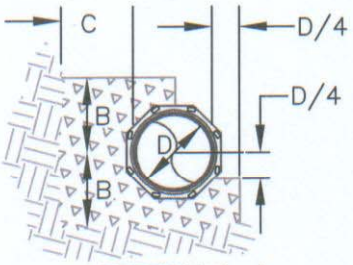
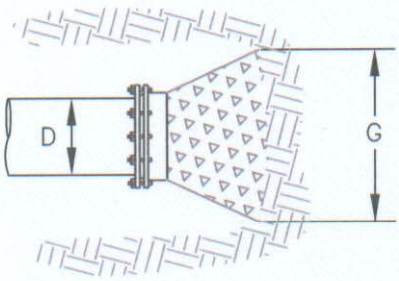


PLAN



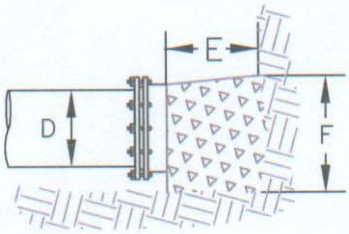
SECTION A–A

BUTTRESS FOR HORIZONTAL BENDS						
D		6"	8"	10"	12"	16"
1/32	A	6"	8"	10"	1'–0"	1'–4"
	B	7"	8"	9"	10"	1'–0"
	C	7"	7"	8"	8"	9"
1/16	A	9"	1'–0"	1'–6"	1'–9"	2'–3"
	B	7"	8"	9"	10"	1'–0"
	C	8"	9"	10"	11"	1'–2"
1/8	A	1'–3"	1'–8"	2'–1"	2'–6"	3'–4"
	B	7"	8"	9"	11"	1'–3"
	C	8"	9"	10"	11"	1'–2"
1/4	A	2'–0"	2'–6"	3'–0"	3'–6"	5'–0"
	B	6"	8"	1'–0"	1'–3"	1'–6"
	C	1'–10"	9"	1'–8"	1'–7"	1'–5"



PLAN

BUTTRESS FOR CAPS						
D	6"	8"	10"	12"	16"	20"
E	6"	8"	8"	10"	1'–0"	1'–4"
F	1'–0"	1'–4"	1'–8"	2'–0"	2'–8"	3'–3"
G	1'–5"	1'–11"	2'–5"	2–10"	3'–9"	4'–9"



SECTION

Notes:

1. All concrete to be MDOT SHA mix #1.(2500 p.s.i.)
2. Buttress dimensions shown are minimum. Dimensions are based upon soil bearing pressure of 3000 p.s.f. and static water pressure of 150 p.s.i. Where pressure exceeds 150 p.s.i. or where soil bearing pressure is less than 3000 p.s.f. special buttress design is required.
3. Concrete shall extend to undisturbed soil.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			BUTRESSES FOR CAPS AND HORIZONTAL BENDS
			STANDARD NO. G-2

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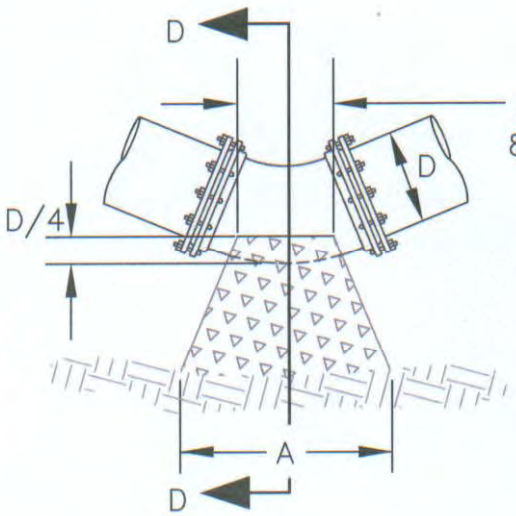
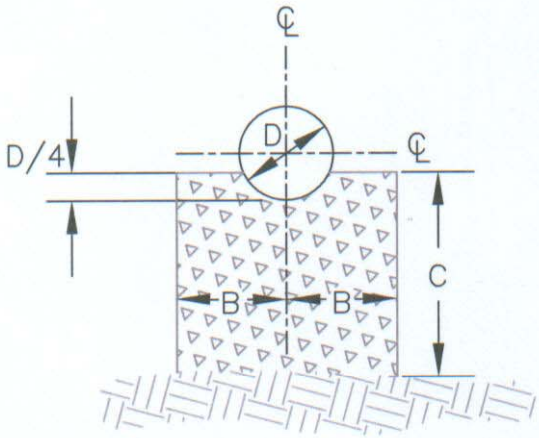


Buttresses For Vertical Bends						
D		Size				
		6"	8"	10"	12"	16"
1/32	A	1'–6"	1'–6"	1'–5"	3'–0"	3'–6"
	B	1'–3"	1'–9"	1'–3"	2'–0"	2'–0"
	C	2'–0"	2'–6"	2'–9"	3'–0"	4'–0"
1/16	A	2'–0"	3'–4"	3'–8"	4'–0"	4'–4"
	B	1'–9"	2'–3"	2'–6"	2'–6"	2'–6"
	C	2'–6"	2'–8"	3'–10"	4'–0"	5'–6"
1/8	A	2'–6"	3'–0"	4'–0"	4'–6"	5'–2"
	B	2'–6"	2'–9"	3'–0"	3'–6"	4'–0"
	C	3'–0"	4'–0"	4'–6"	4'–9"	6'–6"



Section D–D

Notes:

1. All concrete shall be MDOT SHA mix #1, (2500 p.s.i) or as directed by the Engineer.
2. Buttress dimensions shown are minimum. dimensions are based upon a soil bearing pressure of 3000 p.s.f. and static water pressure of 150 p.s.i. where soil bearing pressure is less than 3000 p.s.f. or water pressure exceeds 150 p.s.i., special buttress design shall be required.
3. Buttress shall extend to undisturbed soil.

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** BUTTRESSES FOR VERTICAL BENDS **STANDARD NO. G-3**

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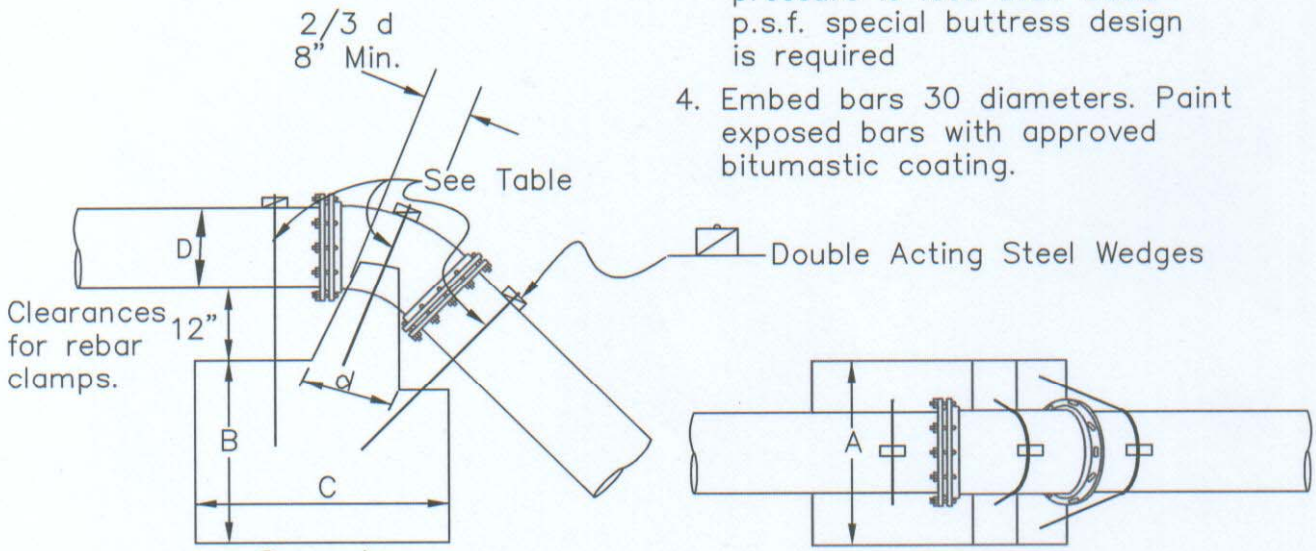
Anchorages For Vertical Bends						
D		Size				
		6"	8"	10"	12"	16"
1/32	A	6"	8"	10"	1'–0"	1'–4"
	B	7"	8"	9"	10"	1'–0'
	C	7"	7"	8"	8"	9"
1/16	A	9"	1'–0"	1'–6"	1'–9"	2'–3"
	B	7"	7"	8"	10"	1'–0"
	C	7"	7"	8"	8"	9"
1/8	A	1'–3"	1'–8"	2'–1"	2'–6"	3'–4"
	B	7"	8"	9"	11"	1'–3"
	C	7"	8"	10"	11"	1'–3"

Size	Reinforcing Bars			
		1/32	1/16	1/8
6"		3@6"	3@6"	3@6"
8"		3@6"	3@6"	3@6"
10"		3@6"	3@6"	3@6"
12"		3@6"	3@6"	3@6"
16"		3@6"	3@6"	3@6"

Notes:

1. All concrete to be MDOT SHA mix #1. (2500 psi)
2. Buttress dimensions shown are minimum and are based upon soil bearing pressure of 3000 p.s.f. and static water pressure of 150 p.s.i.
3. Where pressure exceeds 150 p.s.i. or where soil bearing pressure is less than 3000 p.s.f. special buttress design is required
4. Embed bars 30 diameters. Paint exposed bars with approved bitumastic coating.



APPROVED	REVISIONS		ST. MARY'S COUNTY METROPOLITAN COMMISSION
	DATE	INITIALS	STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES
C. I. FREDERICK JR., P.E. CHIEF ENGINEER	6/18/09	J.E.C.	ANCHORAGES FOR VERTICAL BENDS
DATE: 7/1/09			STANDARD NO. G-4

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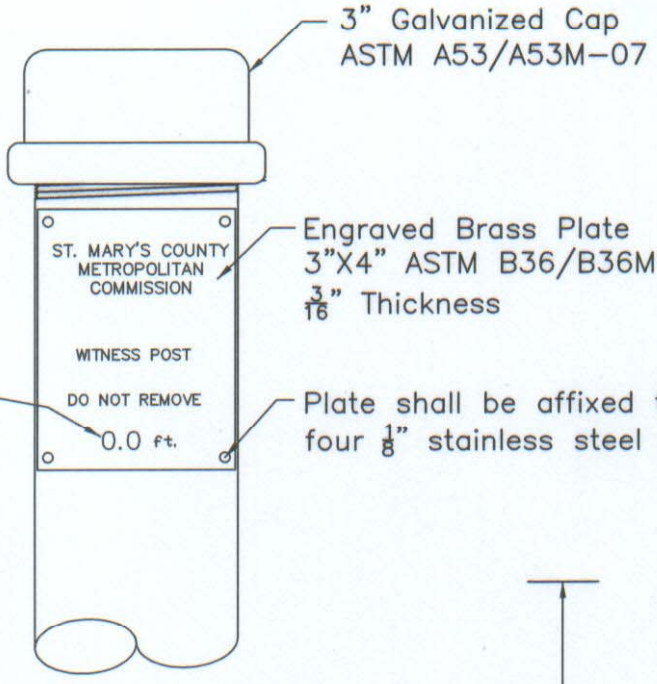

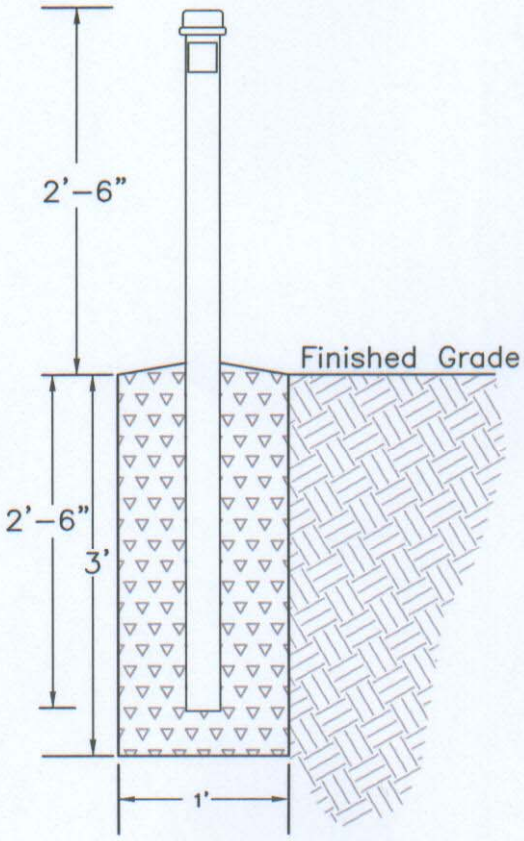

NOTES:

Witness post piping shall be 3" Galvanized Pipe meeting ASTM A53/A53M–07

Pipe shall be painted with a corrosion resistant primer and safety green topcoat or as directed by the Engineer.

Height of witness post may be increased due to topography or environmental concerns at the discretion of the Engineer.

Location of the witness post shall be as shown on the plan unless approved by the Engineer.

Concrete shall be MDOT SHA MIX #1 2500 psi.

Data plate shall face the item referenced.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** WITNESS POST (TYPICAL) **STANDARD NO. G-5**

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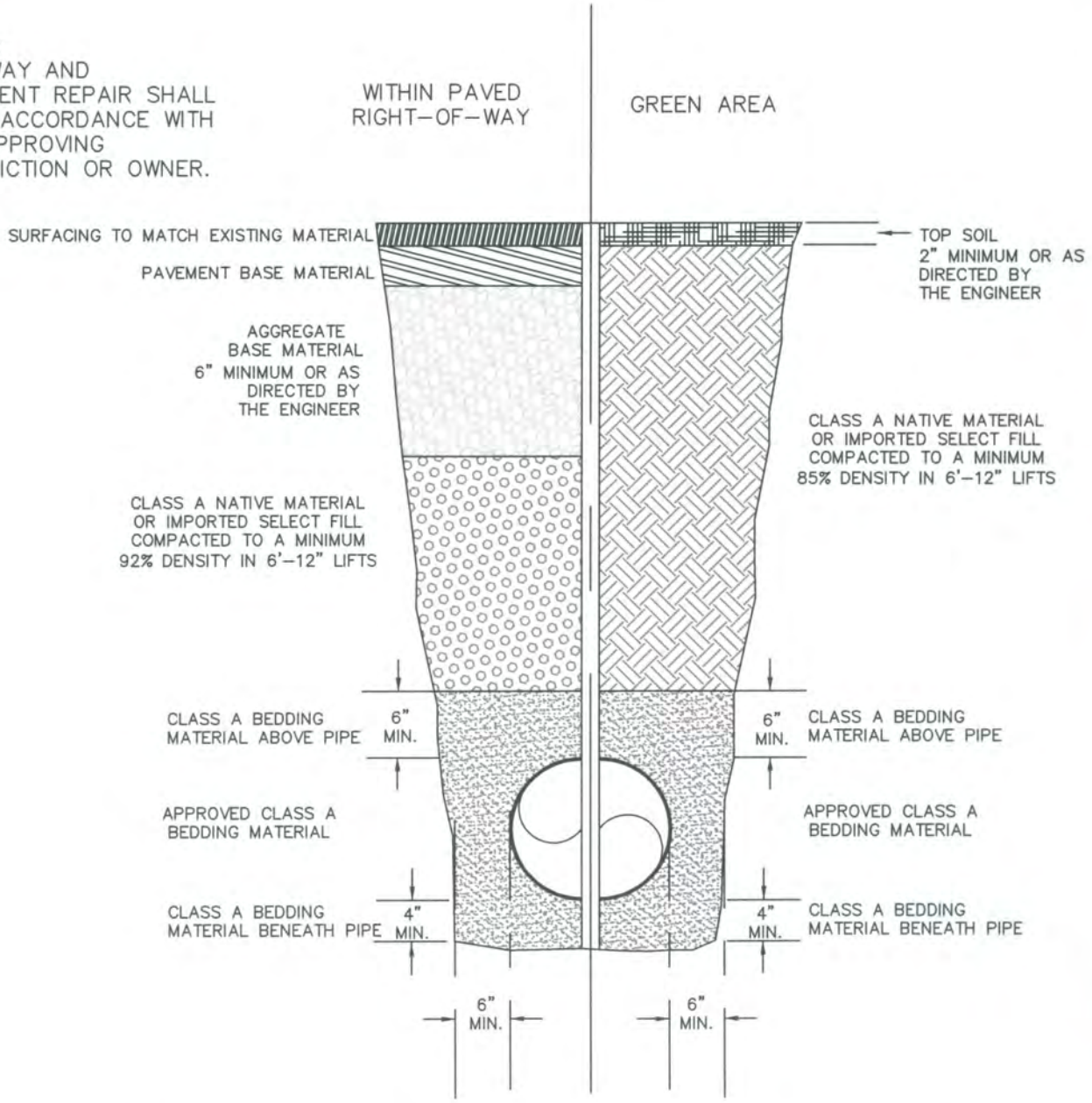
NOTES:
ROADWAY AND PAVEMENT REPAIR SHALL BE IN ACCORDANCE WITH THE APPROVING JURISDICTION OR OWNER.



*ALL LOOSE MATERIAL SHALLL BE REMOVED FROM THE TRENCH BOTTOM PRIOR TO BEDDING PIPE.

AGGREGATE MATERIAL SHALL BE PLACED AGAINST UNDISTURBED SOIL.

TRENCH FOUNDATION WHEN REQUIRED SHALL BE SPECIFIED BY THE ENGINEER.

St. Mary's County Metropolitan Commission Since 1967 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	TYPICAL BEDDING AND BACKFILL FOR PIPE AND APPURTENANCES
		7/26/10	J.E.C.	
				STANDARD NO. G-6

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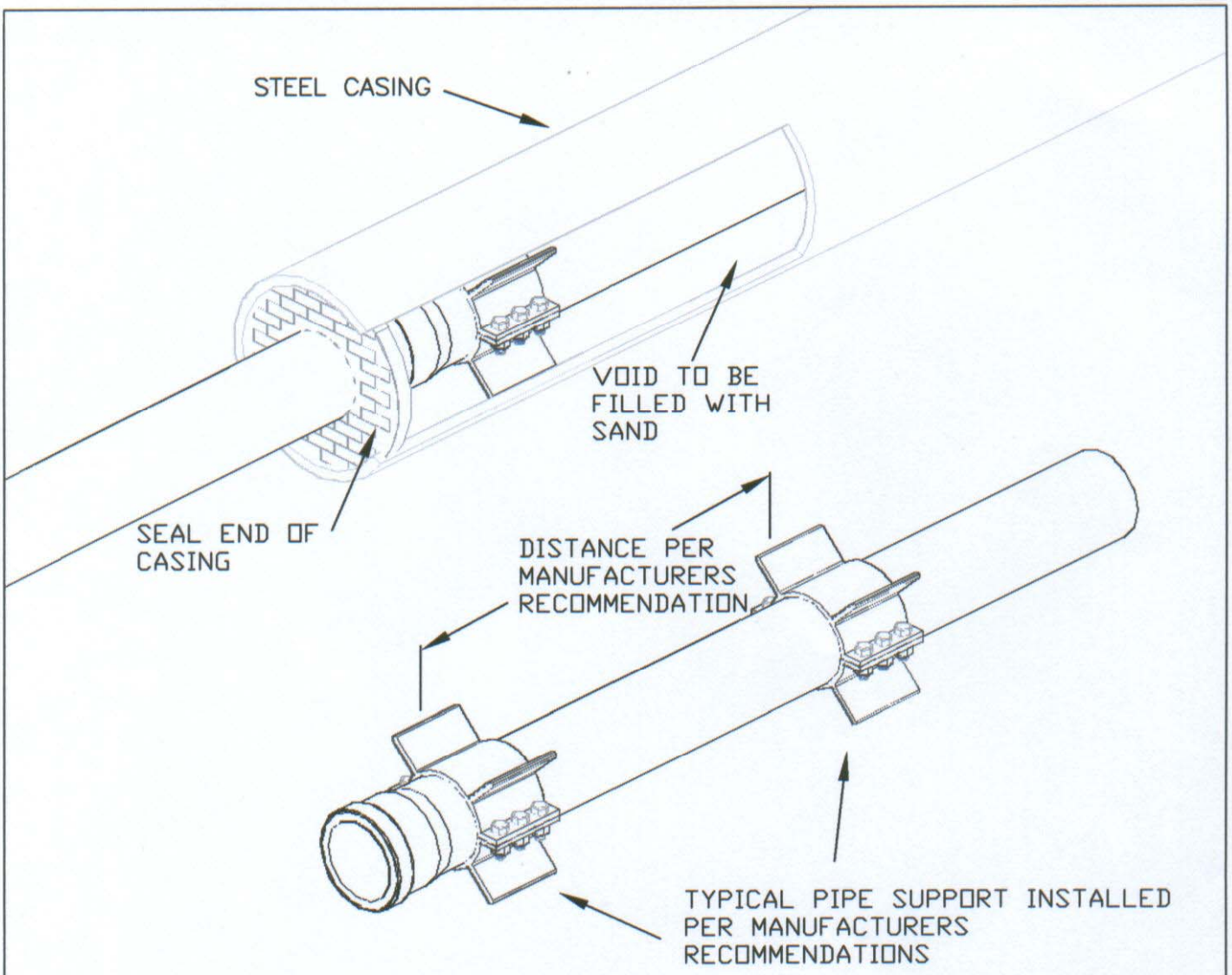

DIAMETER OF CASING SHALL BE DETERMINED BY THE ENGINEER.

PIPE SUPPORTS SHALL BE THE PROPER SIZE TO CENTER THE PIPE IN THE CASING.

CASING SHALL BE INSTALLED LEVEL UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

WELDS ON CASING SECTIONS SHALL BE AROUND THE ENTIRE CIRCUMFERENCE OF THE CASING PIPE.

St. Mary's County Metropolitan Commission Since 1984 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	CASING ASSEMBLY USING PREFABRICATED PIPE SUPPORTS (TYPICAL)
				STANDARD NO. G-7

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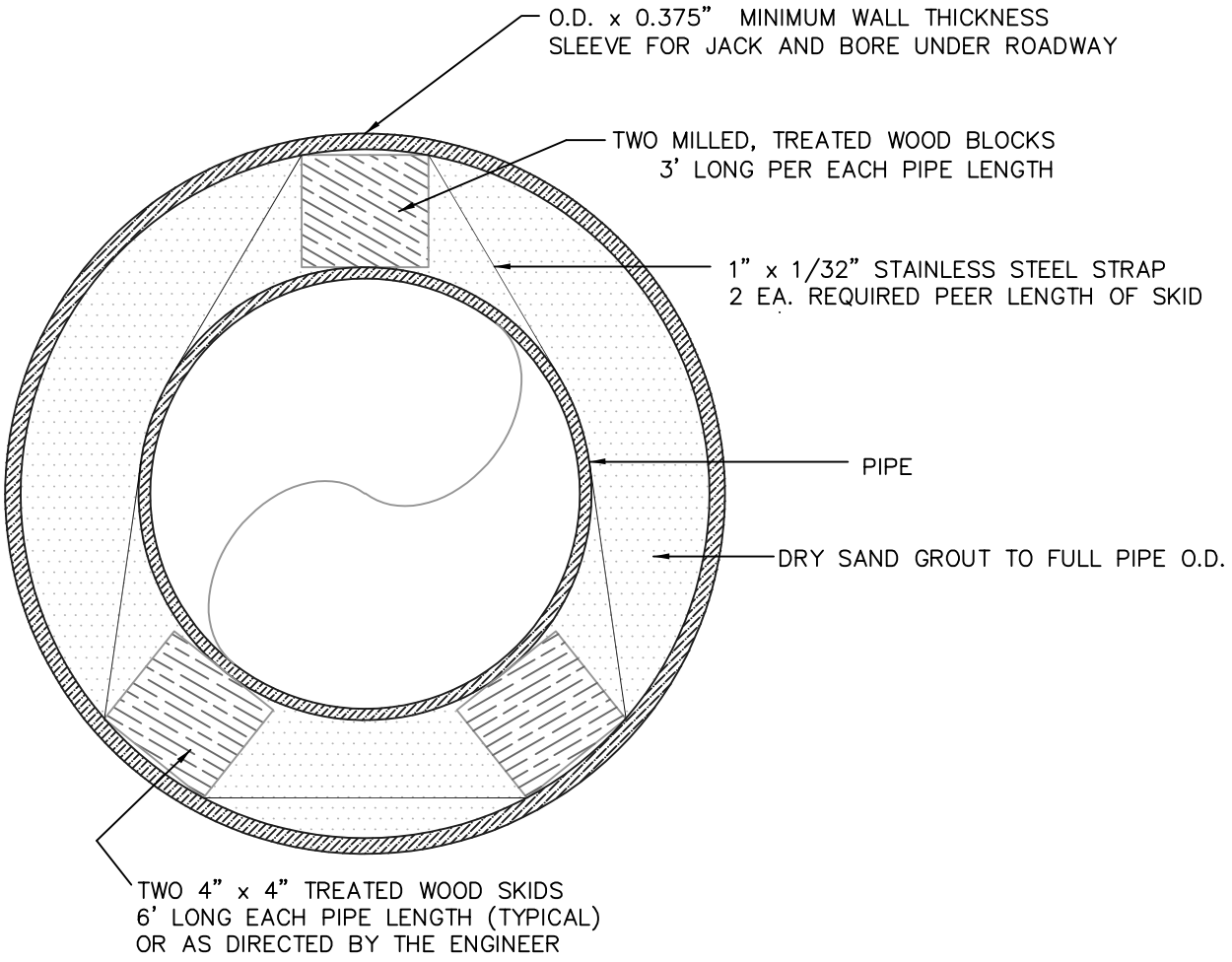
NOTES:

1. WOOD SHALL BE PRESSURE TREATED.
2. PROVIDE A JOINT 12" BEYOND THE END OF THE CASING PIPE.
3. CASING SIZE SHALL BE DETERMINED BY THE ENGINEER.
4. PIPE SPIDERS SHALL BE USED TO SUPPORT PIPING WHEN AVAILABLE.
5. SIZE OF WOOD SKIDS SHALL LARGE ENOUGH TO ENSURE THE PIPE JOINTS DO NOT MAKE CONTACT WITH THE CASING.
6. TOP BLOCKING SHALL BE SIZED TO ALLOW THE PIPE TO BE SHOVED THROUGH THE CASING HORIZONTALLY BUT RESTRICT ANY VERTICAL MOVEMENT.
7. ANY CASING SLEEVE 12" IN DIAMETER OR GREATER SHALL HAVE A GROUND PENETRATING RADAR TEST COMPLETED TO LOCATE ANY VOIDS.



*USE OF FIELD MANUFACTURED SUPPORTS SHALL REQUIRE THE WRITTEN APPROVAL OF THE ENGINEER

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	STEEL SLEEVE UNDER ROADWAY FIELD MANUFACTURED SUPPORTS (TYPICAL)
		7/26/10	J.E.C.	
		1/9/19	J.E.C.	**STANDARD NO. G-8**

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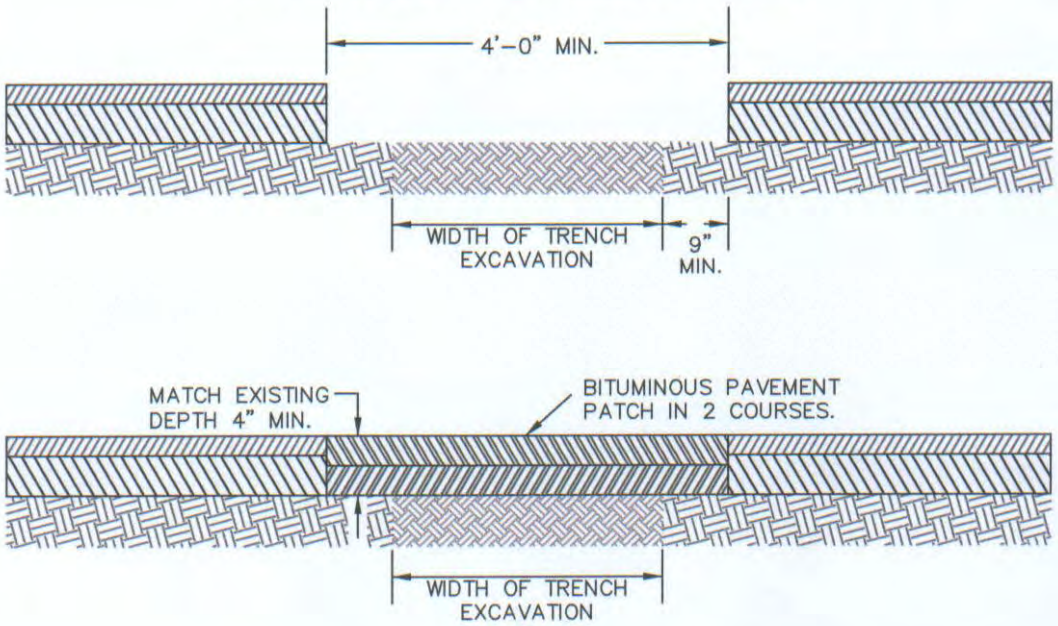
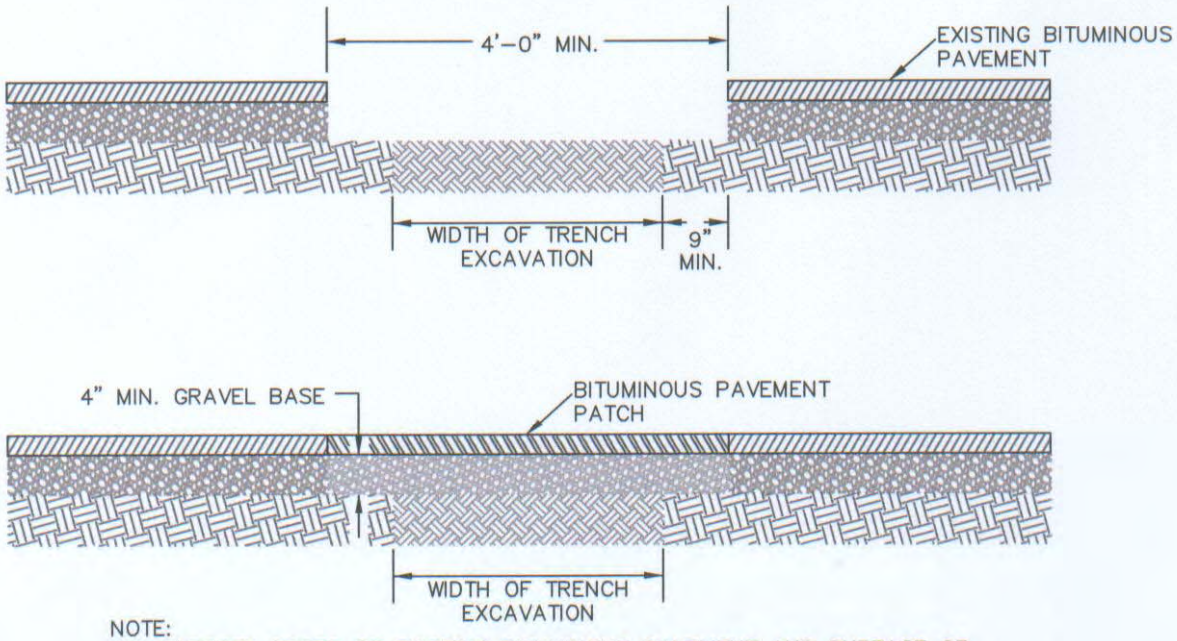
BITUMINOUS DRIVEWAY FULL DEPTH



BITUMINOUS DRIVEWAY OVER GRAVEL



NOTE:
ALL EXPOSED EDGES OF EXISTING BITUMINOUS PAVEMENT AND SURFACE OF GRAVEL BASE SHALL BE PRIMED BEFORE THE BITUMINOUS MIXTURE IS PLACED.

PRIOR TO PLACING BITUMINOUS PAVEMENT, ALL UTILITY STRUCTURES SHALL BE BROUGHT TO GRADE. BACKFILL AROUND UTILITY STRUCTURES WITH STRUCTURAL FILL.

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** METHOD OF CUTTING AND REPAIRING BITUMINOUS DRIVEWAYS **STANDARD NO. G-9**

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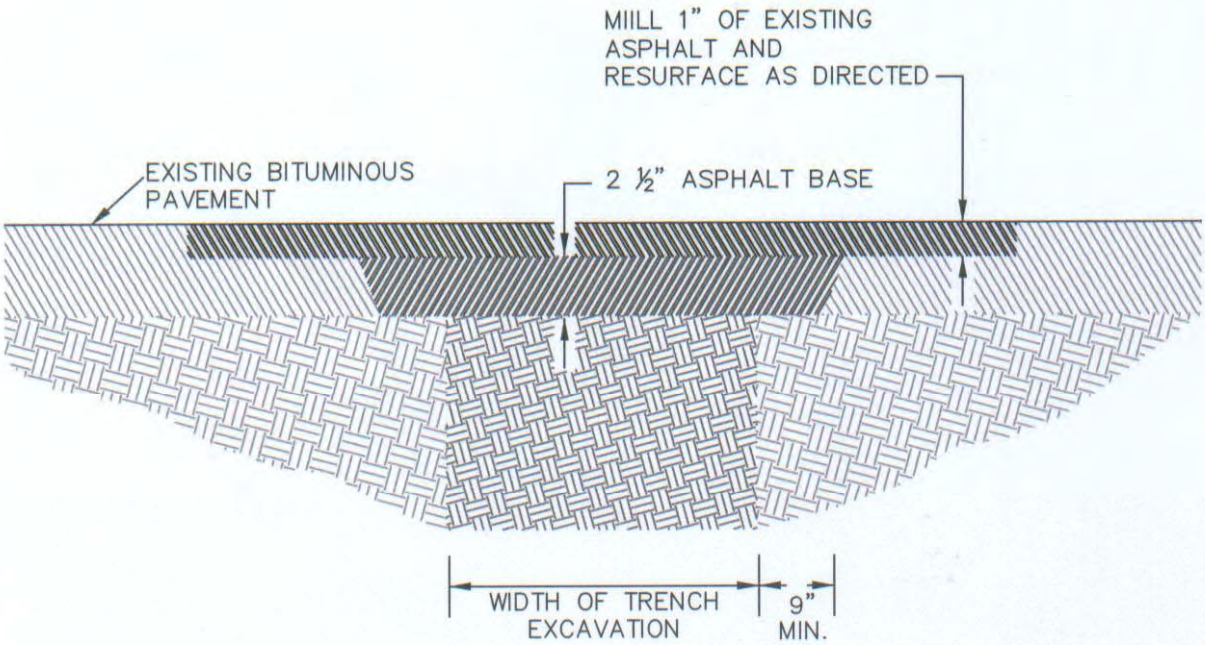

NOTE:
TRENCH SHALL BE COMPACTED TO A MINIMUM 95% OF DENSITY.

ALL EXPOSED EDGES OF EXISTING BITUMINOUS PAVEMENT AND SURFACE OF GRAVEL BASE SHALL BE PRIMED BEFORE THE BITUMINOUS MIXTURE IS PLACED.

PRIOR TO PLACING BITUMINOUS PAVEMENT, ALL UTILITY STRUCTURES SHALL BE BROUGHT TO GRADE. BACKFILL AROUND UTILITY STRUCTURES WITH STRUCTURAL FILL.

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	TYPICAL REPAIR OF BITUMINOUS SURFACES
				STANDARD NO. G-9A

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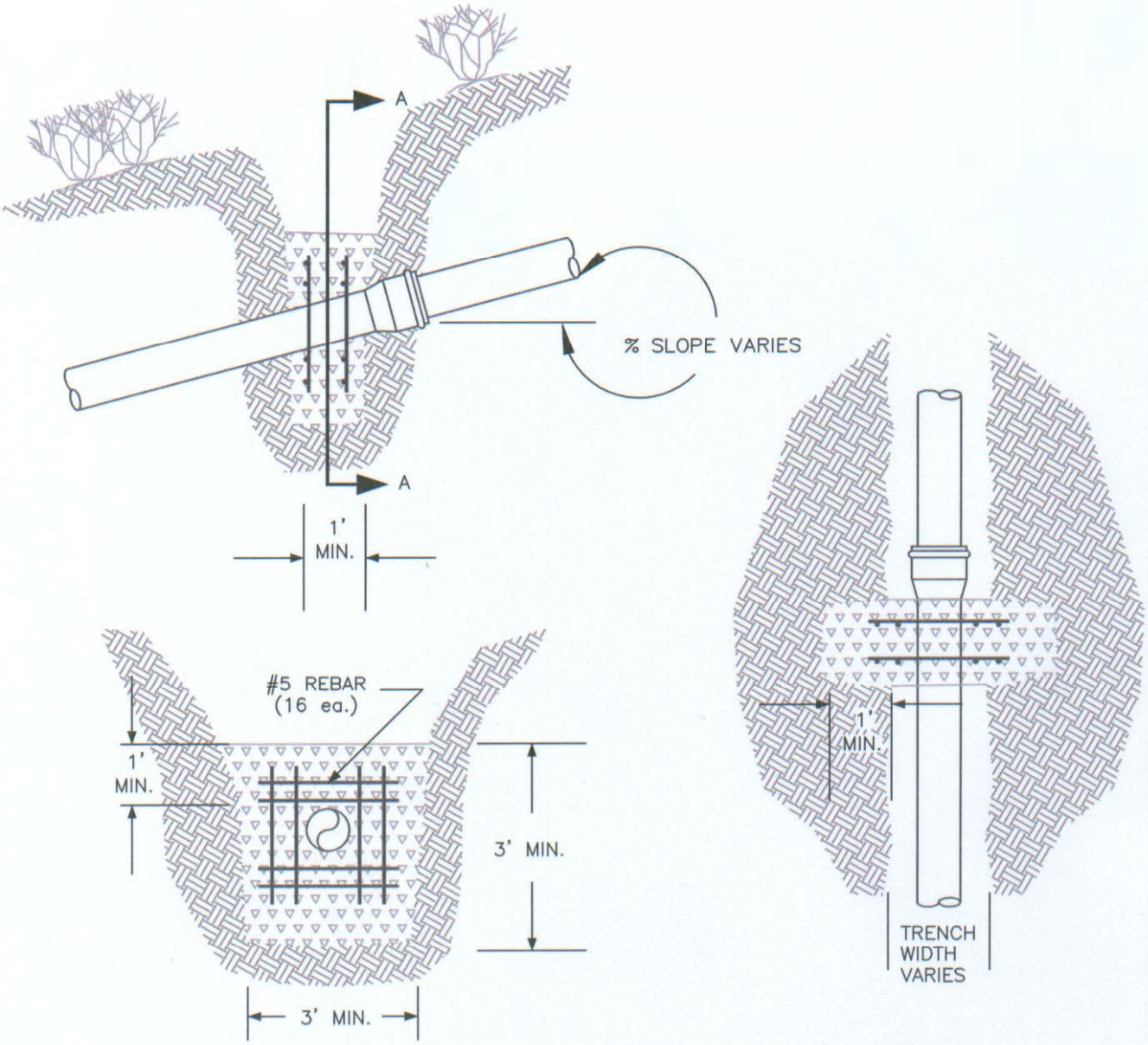

SECTION A–A

PLAN

CONCRETE SHALL BE MDOT SHA MIX #2, 3000 PSI IN 28 DAYS.
CONCRETE SHALL BE PLACED AGAINST UNDISTURBED SOIL.
CONCRETE ANCHOR SHALL BE PLACED ON DOWNGRADE SIDE OF BELL.
ROOFING FELT SHALL BE PLACED BETWEEN THE PIPE AND CONCRETE.
ACTUAL DIMENSIONS OF THE ANCHOR MAY BE ADJUSTED AT THE DIRECTION OF THE ENGINEER.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** TYPICAL CONCRETE PIPE ANCHOR PIPES 6" THRU 12" **STANDARD NO. G-10**

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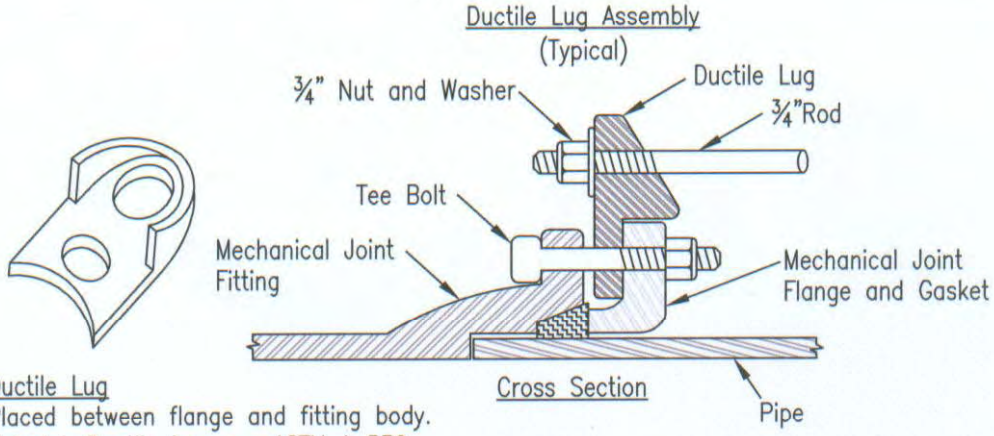
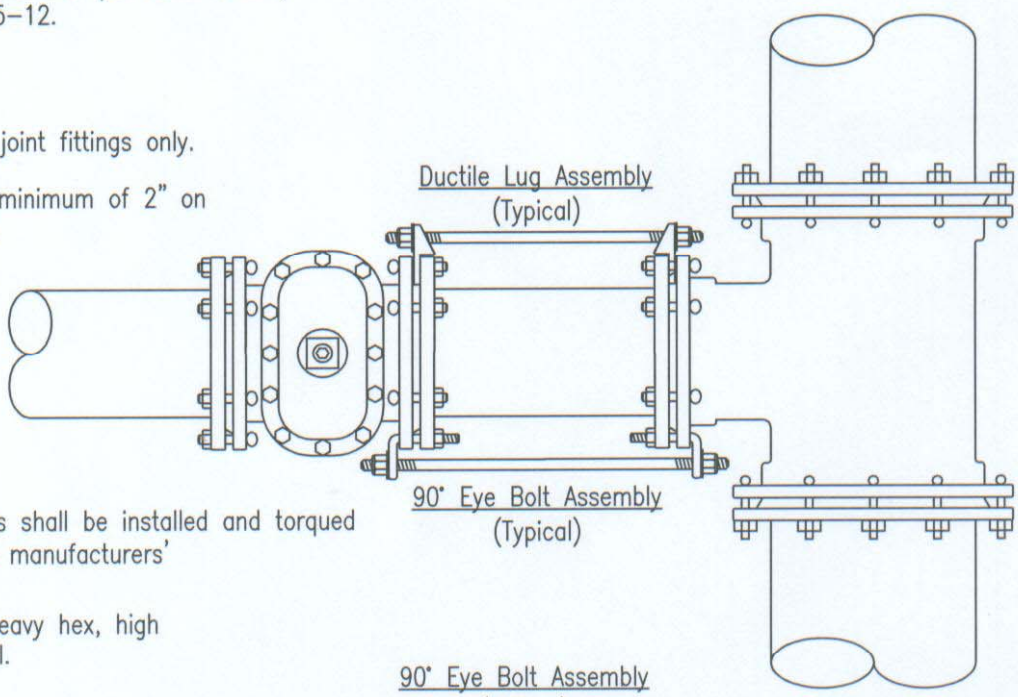


Ductile Lug
Placed between flange and fitting body.
Material: Ductile iron per ASTM A 536, Grade 65–45–12.

For use on mechanical joint fittings only.

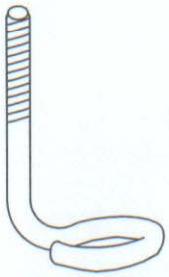
¾"Dia. bar threaded a minimum of 2" on each end or All–thread.

Bars to be coated with bituminous compound.

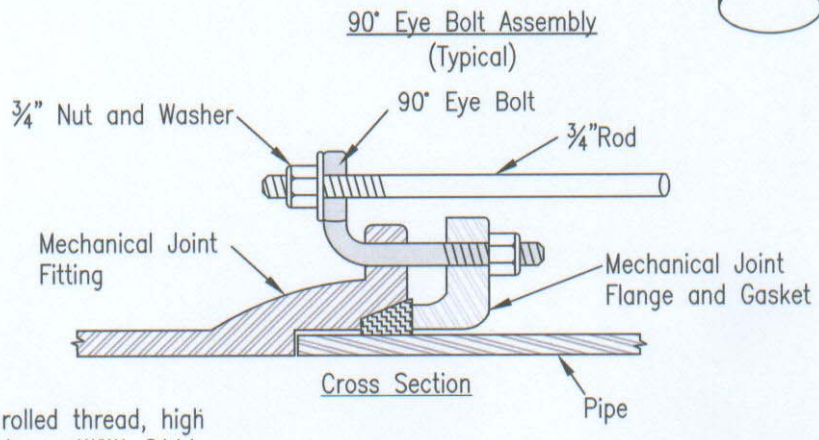


All bolts, rods and nuts shall be installed and torqued in accordance with the manufacturers' recommendations.

Nut and Washer: ¾" heavy hex, high strength low alloy steel.



90° Eye Bolt
Replaces tee bolt.
Material: ¾" Dia. UNC rolled thread, high strength, low alloy steel per AWWA C111.



	APPROVED	**REVISIONS**	ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		6/18/09 J.E.C.	TYPICAL METHOD FOR STRAPPING VALVE OR APPURTENANCE TO MAIN
	C. I. FREDERICK JR., P.E. CHIEF ENGINEER		
	DATE: 7/1/09		**STANDARD NO. G-11**

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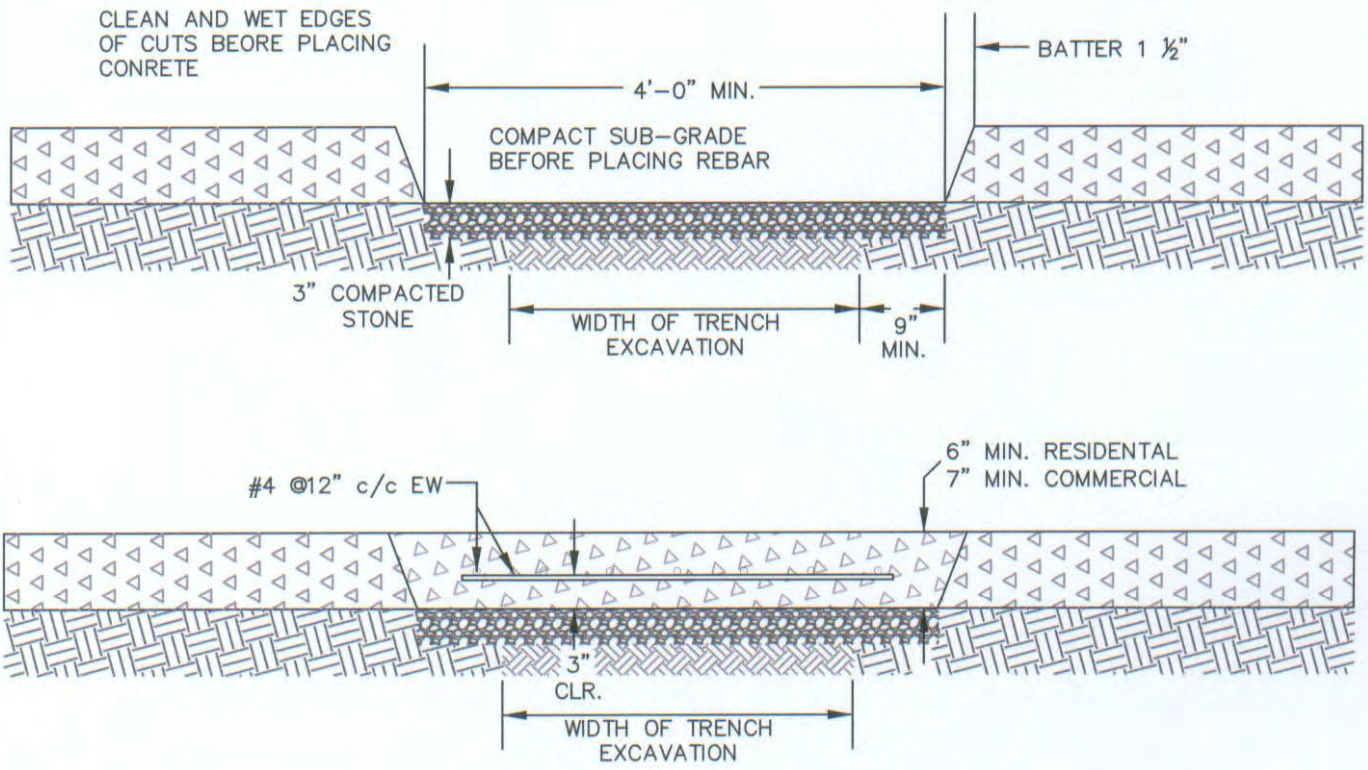
CONCRETE DRIVEWAY



NOTE:
ALL CONCRETE SHALL BE MDOT SHA MIX #2, 3000 psi@28 DAYS.

PRIOR TO PLACING CONCRETE , ALL UTILITY STRUCTURES SHALL BE BROUGHT TO GRADE. BACKFILL AROUND UTILITY STRUCTURES WITH APPROVED MATERIAL.

REMOVE EXISTING CONCRETE DRIVEWAY TO THE NEAREST JOINT WHEN SO DIRECTED BY THE ENGINEER.

St. Mary's County Metropolitan Commission — Since 1984 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	METHOD OF CUTTING AND REPAIRING CONCRETE DRIVEWAYS
				STANDARD NO. G-12

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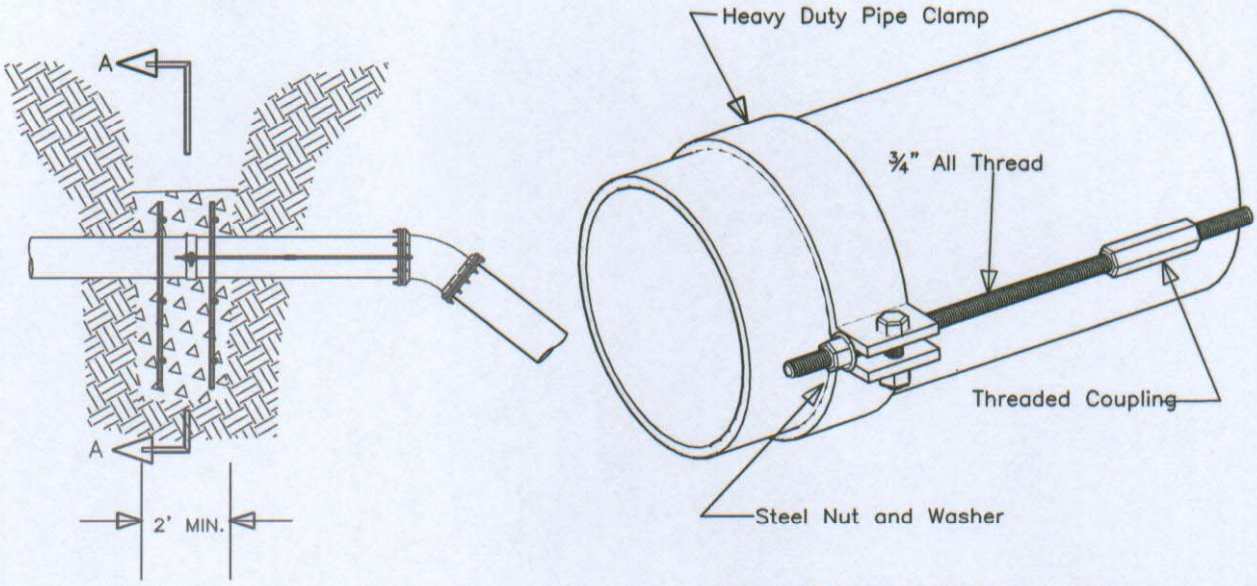

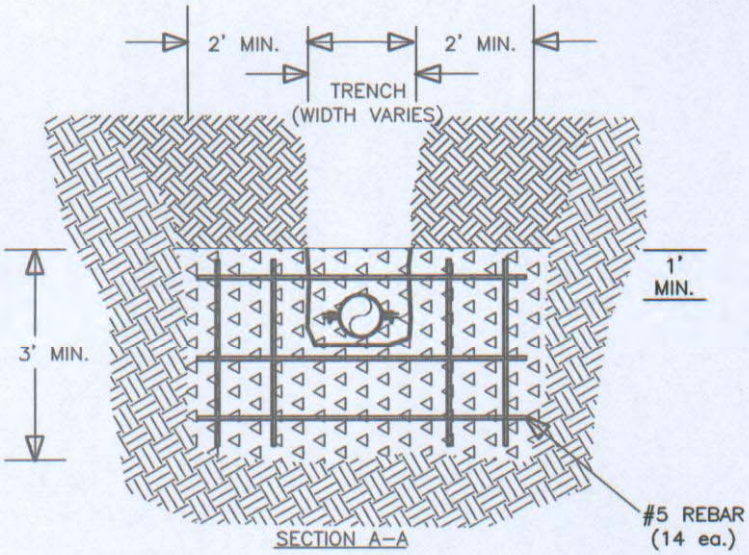

CONCRETE SHALL BE MDOT SHA MIX #2, 3000 PSI IN 28 DAYS.

CONCRETE ANCHOR SHALL BE PLACED A MINIMUM OF 5 FEET FROM FITTING.

CONCRETE SHALL BE PLACED AGAINST UNDISTURBED SOIL.

ROOFING FELT SHALL BE PLACED BETWEEN THE PIPE AND CONCRETE.

ACTUAL DIMENSIONS OF THE ANCHOR MAY BE ADJUSTED AT THE DIRECTION OF THE ENGINEER.

PIPE CLAMP SHALL CONFORM TO FEDERAL SPECIFICATION WW–H–171E, TYPE 4 AND MANUFACTURERS STANDARDIZATION SOCIETY SP–69, TYPE 4.

ALL–THREAD CONNECTING FITTING SHALL BE INSTALLED IN ACCORDANCE WITH STANDARD DETAIL G–11.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09	INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** FITTING ANCHOR (TYPICAL) **STANDARD NO. G-13**

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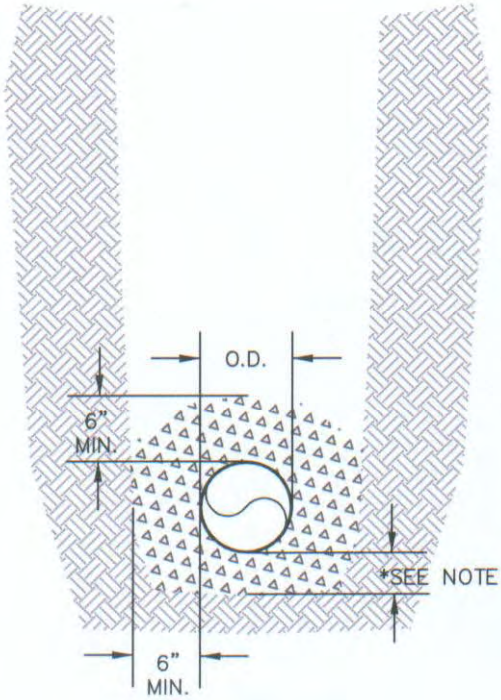
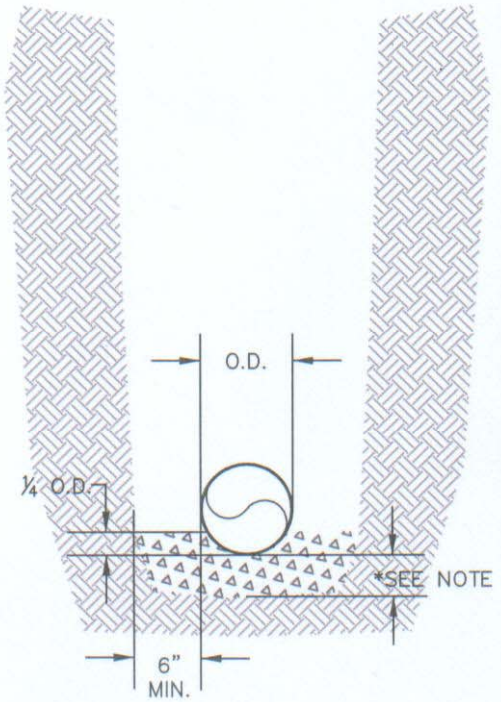


CONCRETE ENCASEMENT

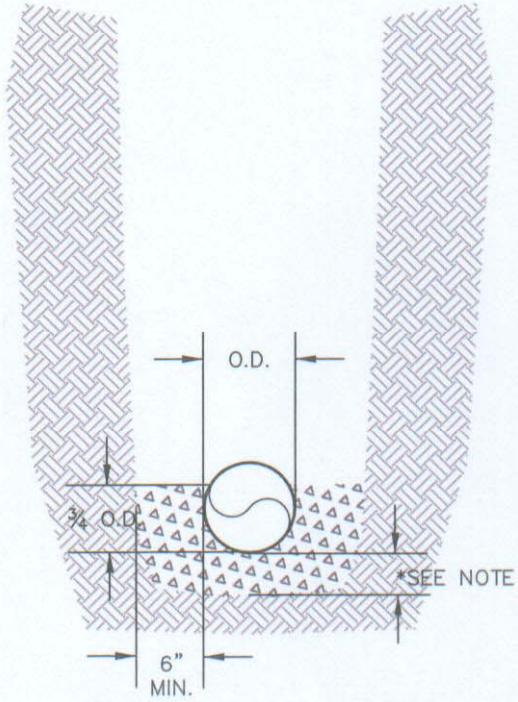
POUR CONCRETE AGAINST UNDISTURBED EARTH. REMOVE SHEETING BEFORE POURING CONCRETE OR LEAVE LOWER PORTION OF SHEETING IN PLACE.

ALL CONCRETE SHALL BE MDOT SHA MIX #1, 2500 PSI @ 28 DAYS.

*NOTE:
3" MINIMUM FOR PIPES 24" AND SMALLER IN DIAMETER.
4" MINIMUM FOR PIPES LARGER THAN 24" IN DIAMETER.



LOW CRADLE



HIGH CRADLE

	APPROVED	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION*
		DATE	INITIALS	***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	C. I. FREDERICK JR., P.E. CHIEF ENGINEER	6/18/09	J.E.C.	TYPICAL CONCRETE ENCASEMENT CONCRETE CRADLE
	DATE: 7/1/09			**STANDARD NO. G-17**

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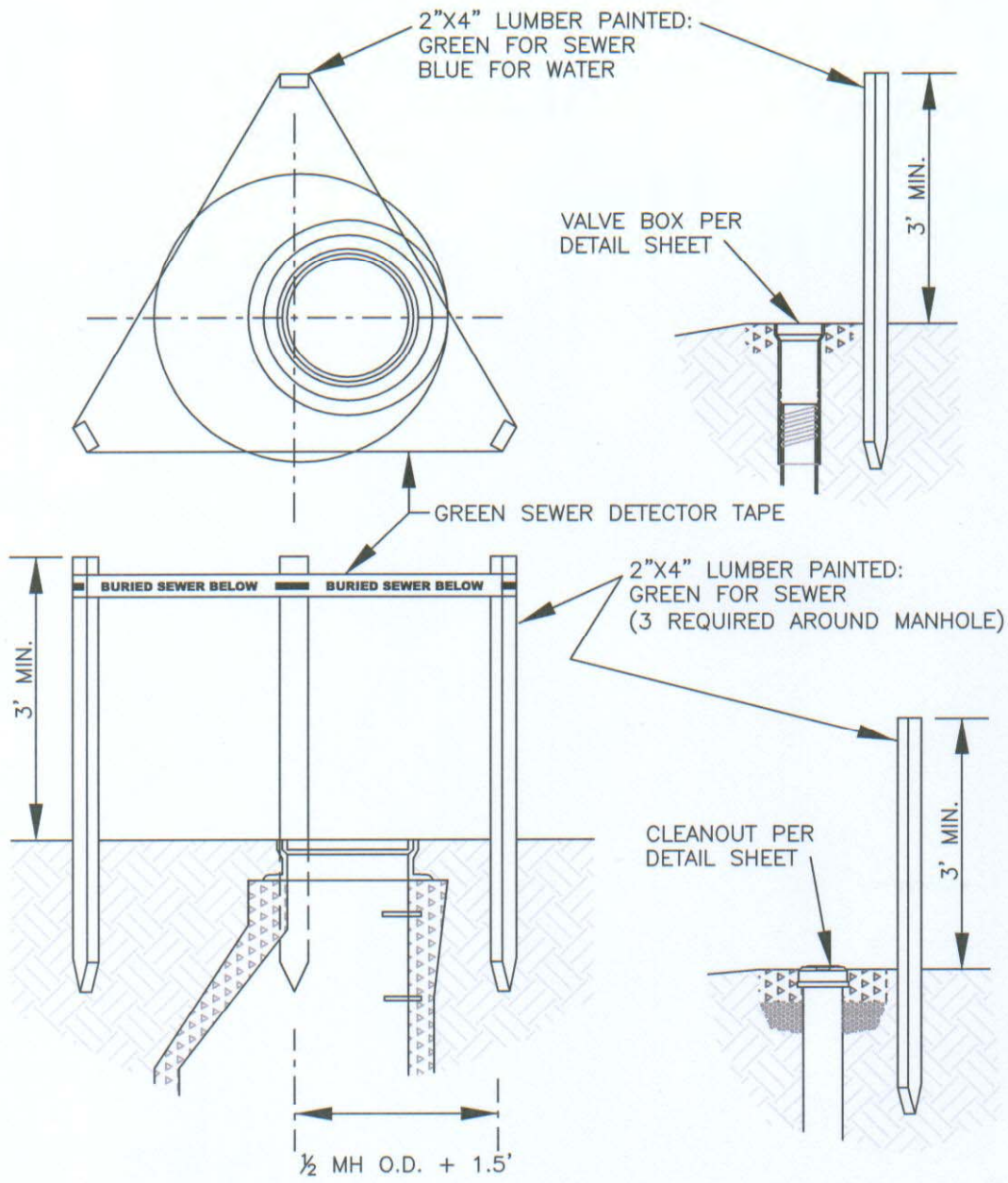

STAKES FOR VALVE BOXES AND CLEANOUTS SHALL BE PLACED AS CLOSE AS PRACTICAL.

ONE STAKE SHALL BE REQUIRED FOR EACH VALVE BOX REGARDLESS OF DISTANCE WHEN THE VALVE BOXES ARE GROUPED IN CLOSE PROXIMITY.

THIS STANDARD IS APPLICABLE FOR THE MARKING OF ALL WATER AND SEWER APPURTENANCES.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	MARKER STAKES FOR MANHOLES, VALVE BOXES, CLEANOUTS AND OTHER APPURTENANCES
				STANDARD NO. G-18

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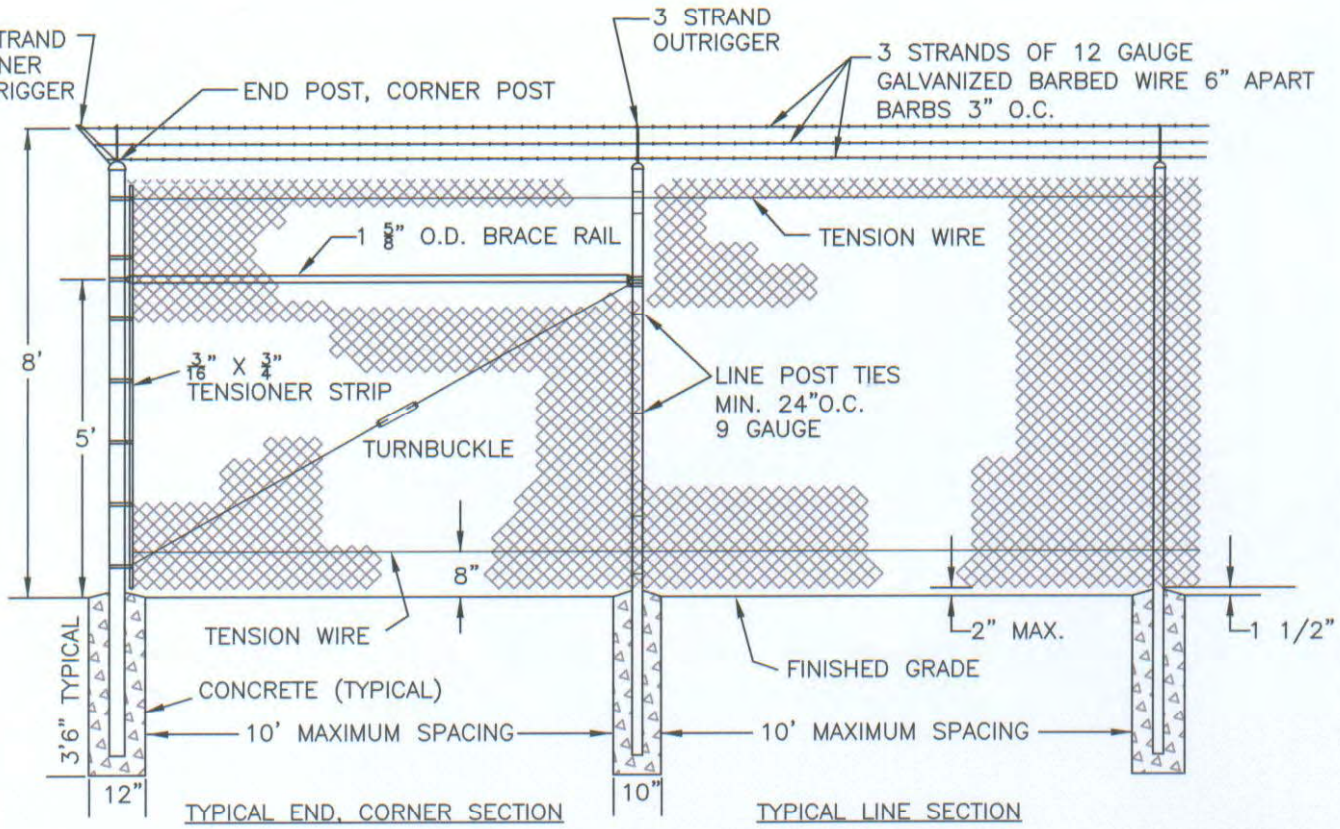

1. CHAIN LINK FABRIC SHALL BE #9 GAUGE, 2" MESH.
2. CHAIN LINK FABRIC SHALL BE GALVANIZED STEEL WITH A BLACK VINYL COATING. FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.
3. CHAIN LINK FABRIC SHALL BE TWISTED AND BARBED TOP AND BOTTOM.
4. END, CORNER POST SHALL BE 3 1/2" N.P.S. IN DIAMETER.
5. LINE POST SHALL BE 2 1/2" N.P.S. IN DIAMETER.
6. ALL POSTS AND RAILS SHALL BE ROLL FORMED HOT-DIPPED GALVANIZED STANDARD WEIGHT PIPE.
7. ALL POSTS SHALL SET IN CONCRETE, MDOT SHA MIX #1, 2500 p.s.i.
8. BRACES, EXTENSION ARMS AND ALL FITTINGS SHALL BE HOT-DIPPED GALVANIZED. EACH EXTENSION ARM CARRIES THREE BARBED WIRES. SECURELY FASTENED TOPMOST BARBED WIRE 12" ABOVE THE FABRIC AND 12" OUT FROM THE FENCE LINE AND AT AN ANGLE OF 45°.
9. 1 5/8" O.D. BRACE RAIL SHALL BE ATTACHED TO CORNER, END OR GATE POST AND TO ADJACENT LINE POST
10. TRUSS ROD SHALL BE A MINIMUM OF 3/8", ROUND ROD WITH AN ADJUSTABLE TURNBUCKLE.
11. UPPER AND LOWER TENSION WIRES SHALL BE #7 GAUGE, GALVANIZED.
12. FENCE SHALL FOLLOW THE CONTOUR OF THE GROUND.
13. FENCE WITHOUT THE THREE STRANDS OF BARBED WIRE MAY BE SUBSTITUTED WITH FABRIC 8' IN HEIGHT WITH THE APPROVAL OF THE ENGINEER.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	TYPICAL CHAIN LINK FENCE 8 FT. HEIGHT
				STANDARD NO. G-19

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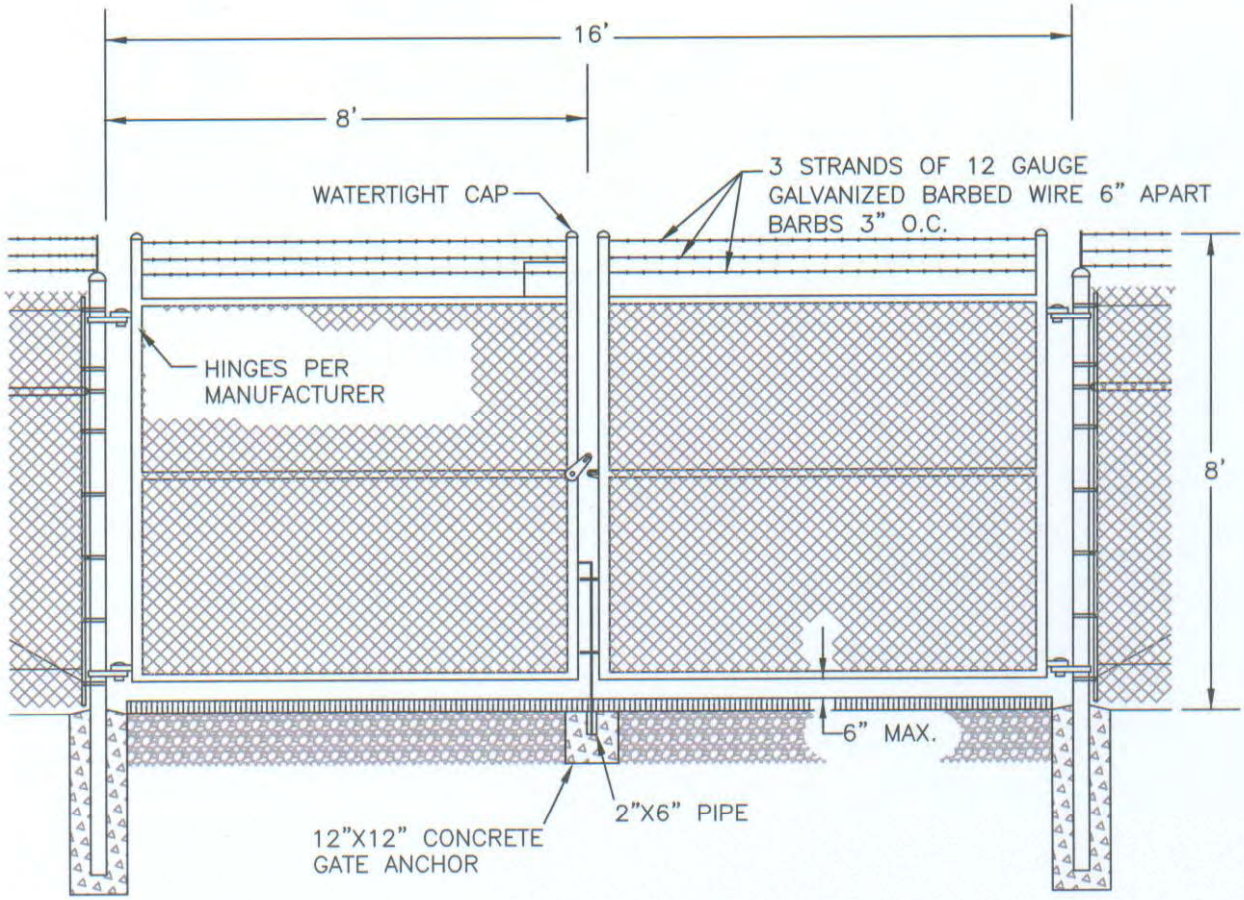

1. CHAIN LINK FABRIC SHALL BE #9 GAUGE, 2" MESH.
2. CHAIN LINK FABRIC SHALL BE GALVANIZED WITH A BLACK VINYL COATING. FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.
3. GATE SHALL BE 2" GALVANIZED PIPE AND SHALL BE OF WELDED CONSTRUCTION.
4. GATE POST SHALL BE 3 $\frac{1}{2}$" N.P.S. IN DIAMETER.
5. GATE SHALL BE CONSTRUCTED WITH LATCH ASSEMBLY AND GATE ANCHOR ROD.
6. ALL POSTS AND RAILS SHALL BE ROLL FORMED HOT–DIPPED GALVANIZED STANDARD WEIGHT PIPE.
7. ALL FITTINGS SHALL BE HOT–DIPPED GALVANIZED.
8. GATES SHALL BE HUNG TO SWING AWAY FROM THE SECURE AREA.
9. HINGES SHALL BE DESIGNED IN A MANNER THAT DOES NOT ALLOW THE GATES TO BE LIFTED OFF.
10. GATE WITHOUT THREE STRANDS OF BARBED WIRE MAY BE SUBSTITUTED WITH GATE FRAME AND FABRIC 8' IN HEIGHT WITH THE APPROVAL OF THE ENGINEER.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			TYPICAL CHAIN LINK GATE 8 FT. HEIGHT
			STANDARD NO. G-20

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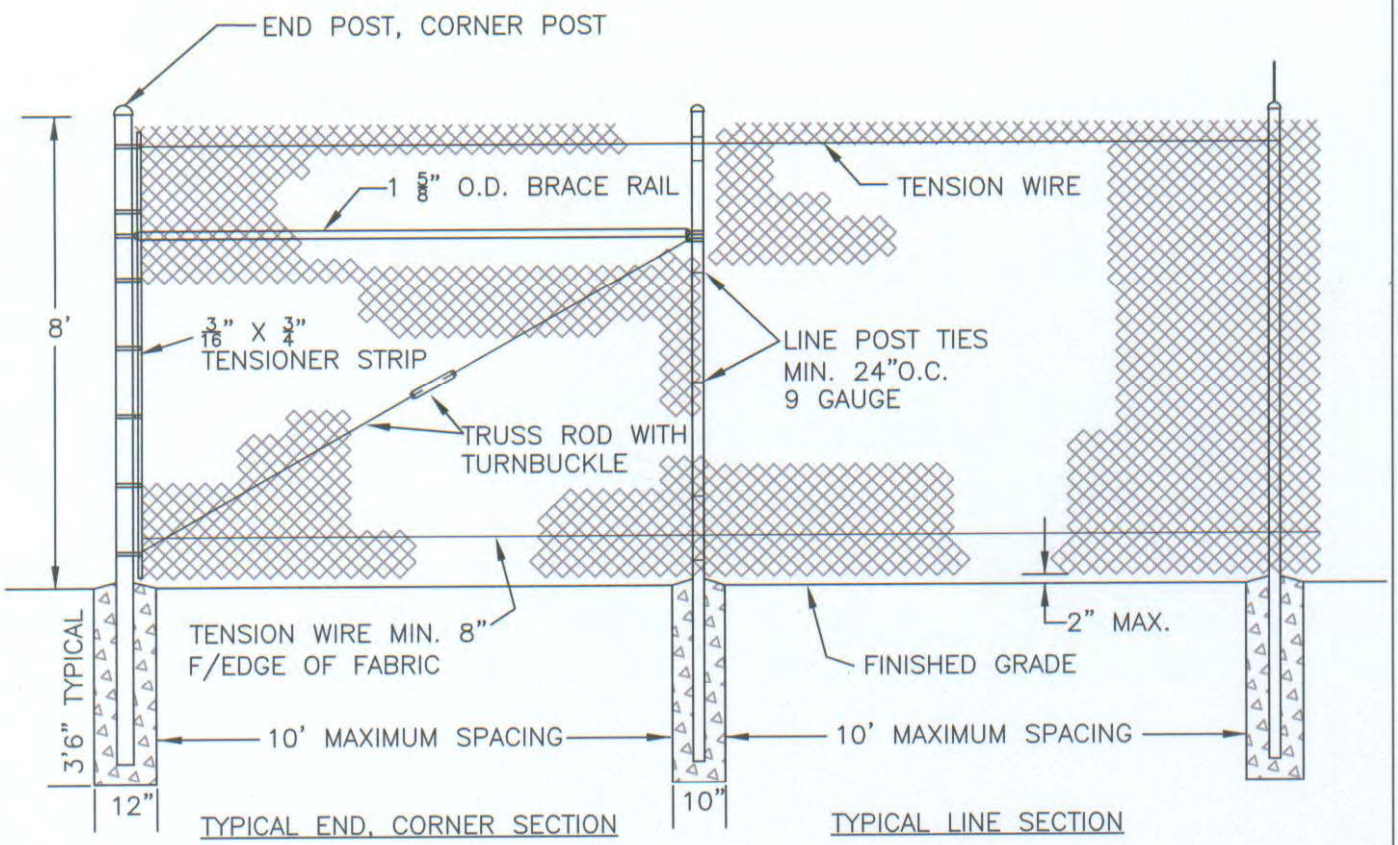

1. CHAIN LINK FABRIC SHALL BE #9 GAUGE, 2" MESH.
2. CHAIN LINK FABRIC SHALL BE GALVANIZED WITH A BLACK VINYL COATING. FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.
3. CHAIN LINK FABRIC SHALL BE TWISTED AND BARBED TOP AND BOTTOM.
4. END, CORNER POST SHALL BE 3 1/2" IN DIAMETER.
5. LINE POST SHALL BE 2 1/2" IN DIAMETER.
6. ALL POSTS AND RAILS SHALL BE ROLL FORMED HOT-DIPPED GALVANIZED STANDARD WEIGHT PIPE.
7. ALL FITTINGS SHALL BE HOT-DIPPED GALVANIZED.
8. 1 5/8" O.D. BRACE RAIL SHALL BE ATTACHED TO CORNER, END OR GATE POST AND TO ADJACENT LINE POST
9. TRUSS ROD SHALL BE A MINIMUM OF 3/8", ROUND ROD WITH AN ADJUSTABLE TURNBUCKLE.
10. TENSION WIRE SHALL BE #7 GAUGE, GALVANIZED.
11. FENCE SHALL FOLLOW THE CONTOUR OF THE GROUND.
12. GATE SHALL BE INSTALLED IN ACCORDANCE WITH STANDARD DETAIL G-22.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** TYPICAL CHAIN LINK FENCE 8 FT. HEIGHT **STANDARD NO. G-21**

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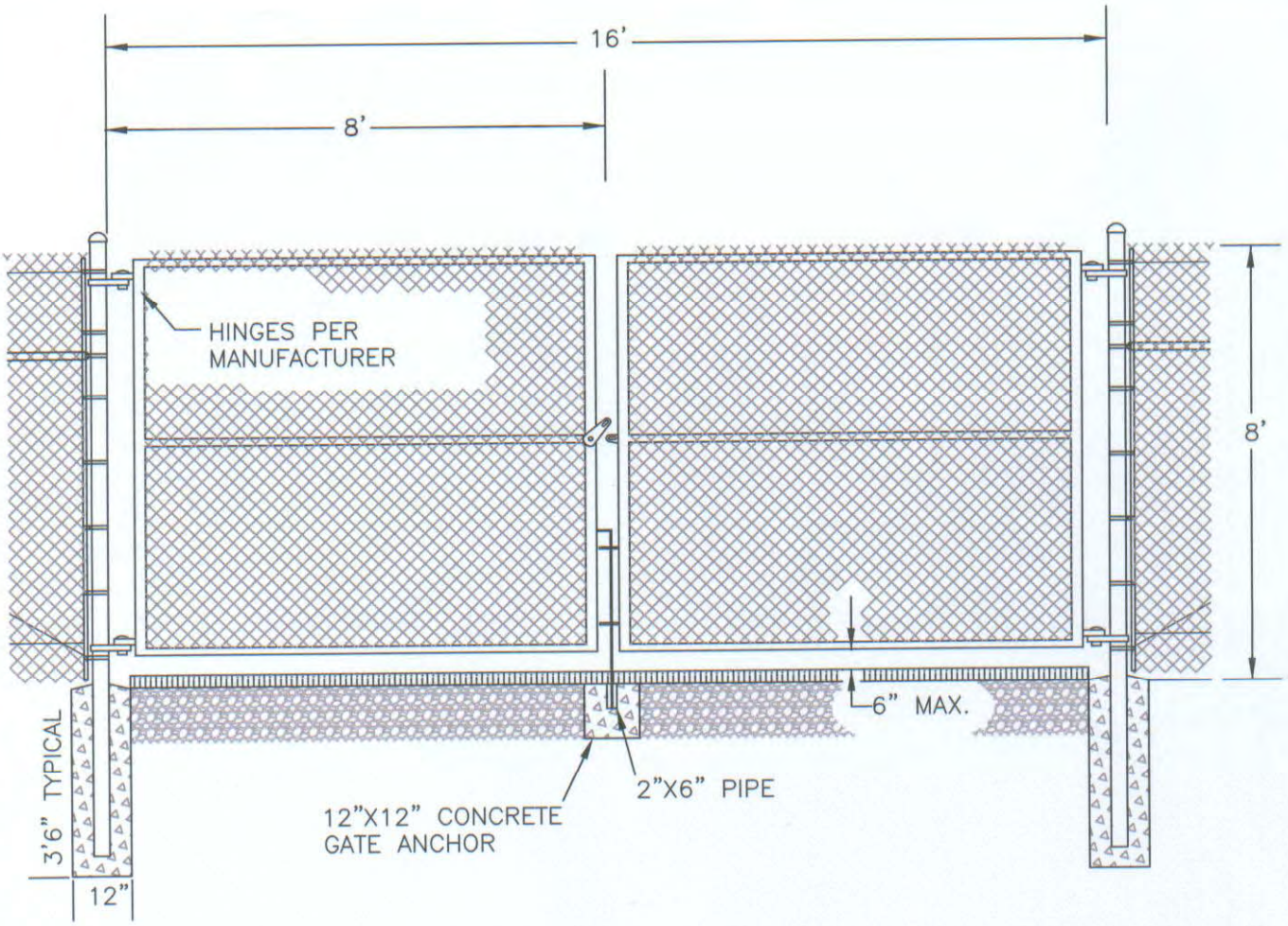

1. CHAIN LINK FABRIC SHALL BE #9 GAUGE, 2" MESH.
2. CHAIN LINK FABRIC SHALL BE GALVANIZED WITH A BLACK VINYL COATING. FABRIC SHALL BE PLACED ON THE OPPOSITE SIDE OF THE SECURE AREA.
3. GATE SHALL BE 2" GALVANIZED PIPE AND SHALL BE OF WELDED CONSTRUCTION.
4. GATE POST SHALL BE 3 $\frac{1}{2}$" N.P.S. IN DIAMETER.
5. GATE SHALL BE CONSTRUCTED WITH LATCH ASSEMBLY AND GATE ANCHOR ROD.
6. ALL POSTS AND RAILS SHALL BE ROLL FORMED HOT–DIPPED GALVANIZED STANDARD WEIGHT PIPE.
7. ALL FITTINGS SHALL BE HOT–DIPPED GALVANIZED.
8. GATES SHALL BE HUNG TO SWING AWAY FROM THE SECURE AREA.
9. HINGES SHALL BE DESIGNED IN A MANNER THAT DOES NOT ALLOW THE GATES TO BE LIFTED OFF.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment

APPROVED

C. I. FREDERICK JR., P.E.
CHIEF ENGINEER

DATE: 7/1/09

REVISIONS

DATE	INITIALS
6/18/09	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

TYPICAL CHAIN LINK GATE
8 FT. HEIGHT

STANDARD NO. G-22

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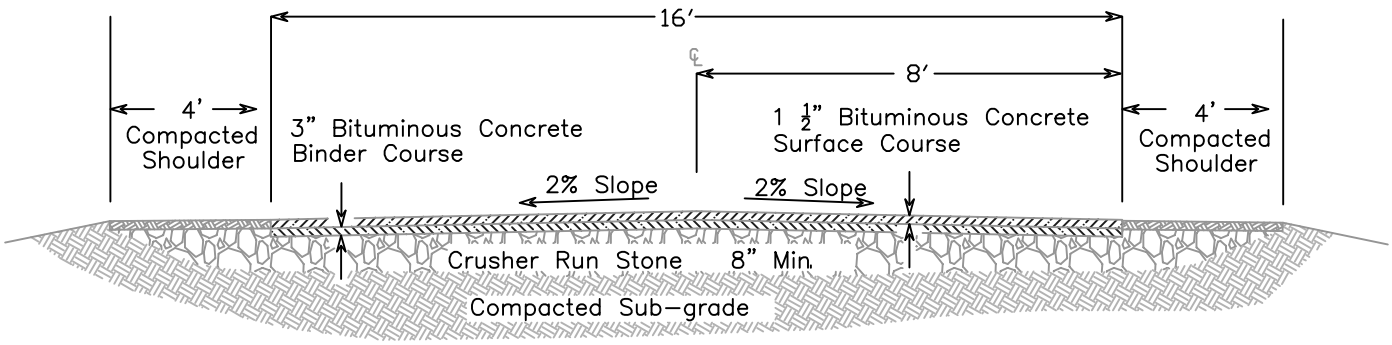
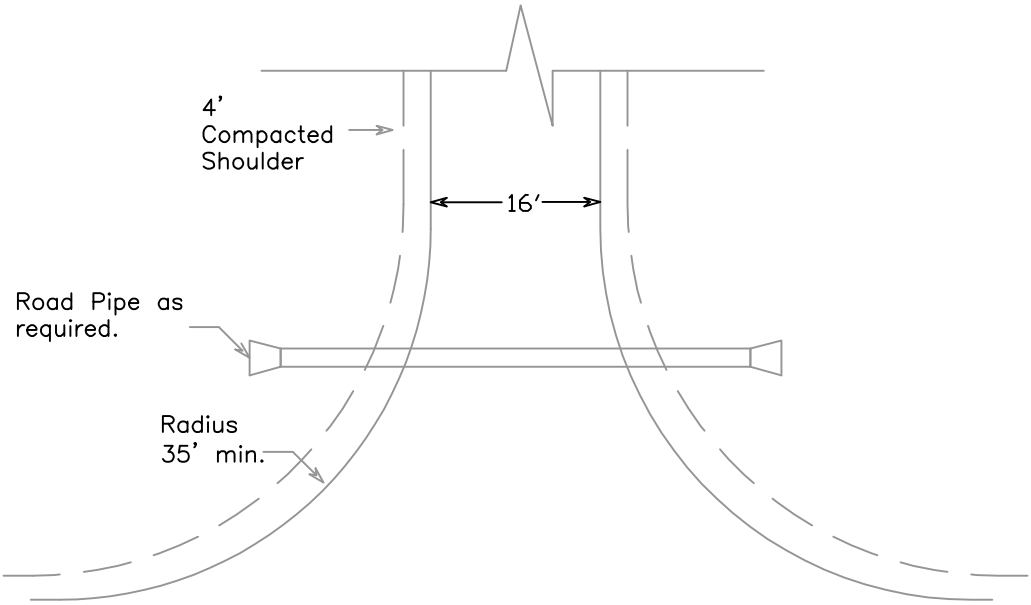


Paved parking areas shall be sloped to drain away from the facility.

Water from adjacent properties shall not be permitted to sheet across driveway.

Driveways longer than 100' off the roadway shall shall have a turn-around adjacent to the facility served.

There shall be no turns in the roadway or facility entrance with a radius less than 35'.



Final design of the entrance shall be in accordance with the appropriate approving authority.

	APPROVED Marc C. Hollander M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/16/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** TYPICAL SERVICE ENTRANCE AND PARKING **STANDARD NO. G-23**

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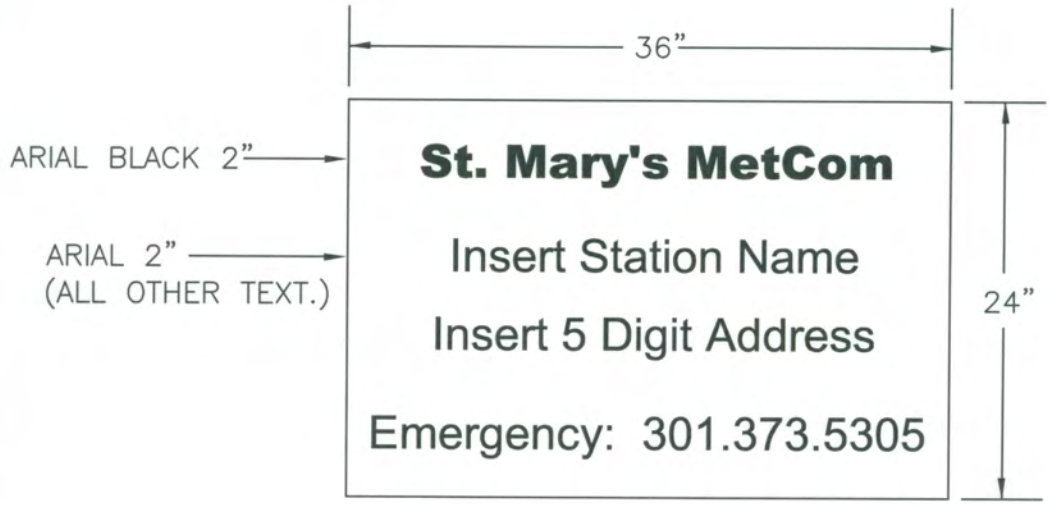

SIGN MATERIAL SHALL BE 8 GAUGE METAL WITH A WHITE, BAKED ALUMINUM BACKGROUND.

TEXT SHALL BE PLACED AND CENTERED TO PROVIDE MAXIMUM VISIBILITY.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		7/26/09	J.E.C.	
				STATION ADDRESS SIGN (TYPICAL)
				STANDARD NO. G-24

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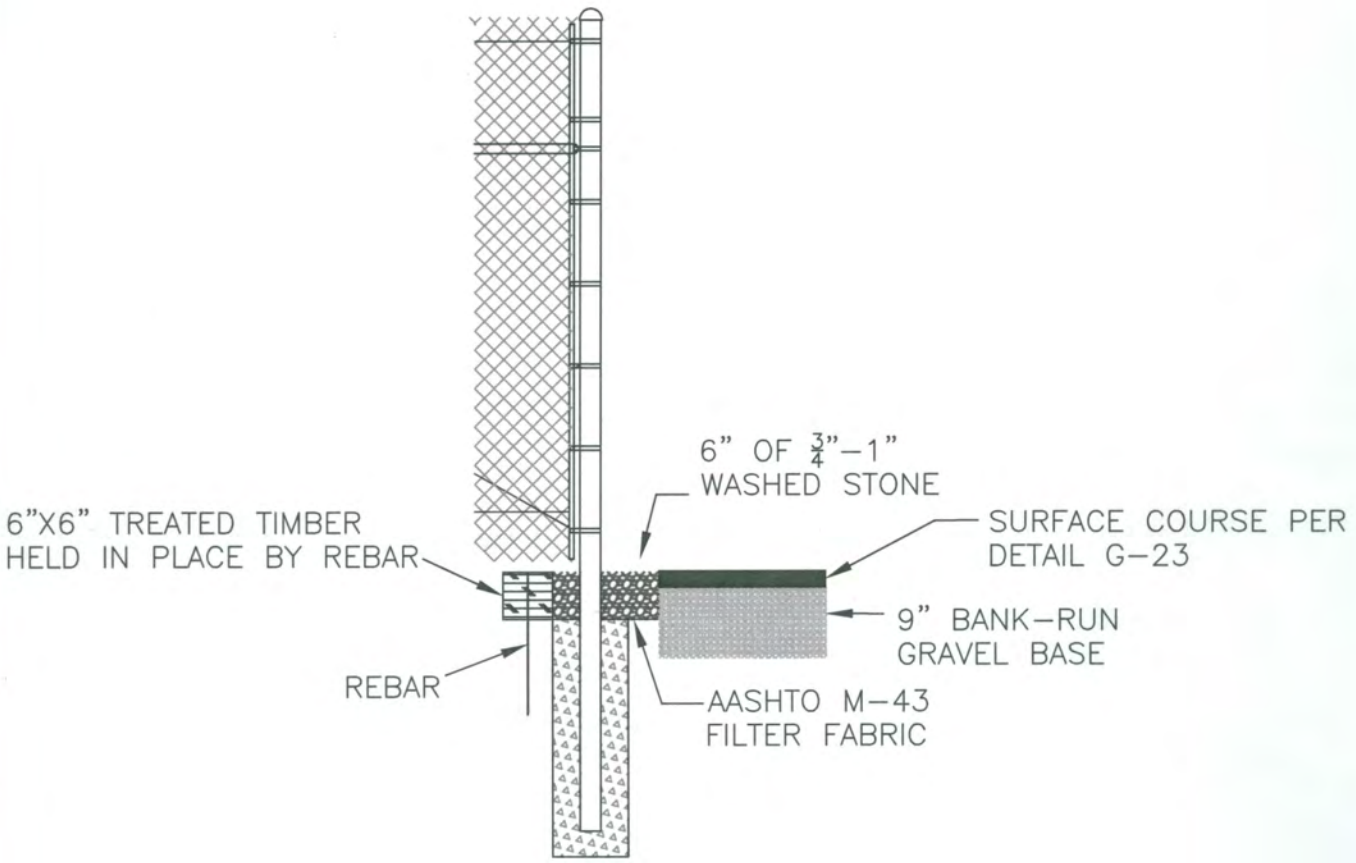

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		7/26/10	J.E.C.	FENCE ABUTTING DRIVEWAY (TYPICAL)
				STANDARD NO. G-25

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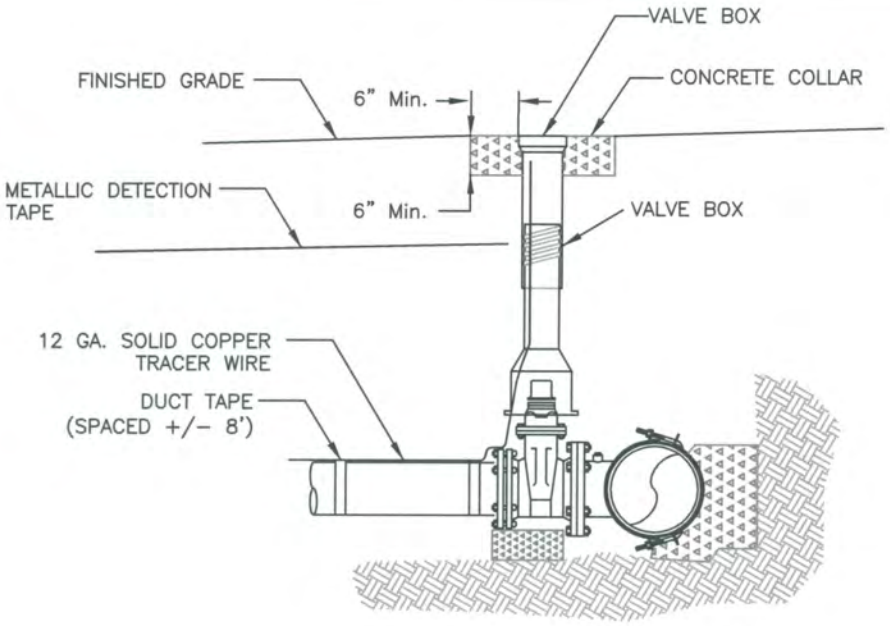

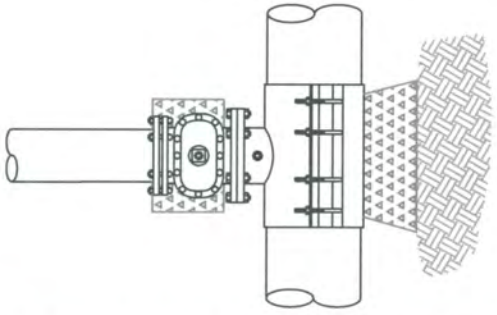

NOTES:

TAPPING SLEEVE SHALL BE GRADE 18-8, 304 STAINLESS STEEL, FLANGED OUTLET, FORD FAST TAPPING OR APPROVED EQUAL.

TAPPING SLEEVE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE PIPE.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

ALL BLOCKING SHALL BE AGAINST UNDISTURBED EARTH.

BACKFILL AND COMPACTION SHALL BE IN ACCORDANCE WITH STANDARD G-6 OR AS DIRECTED BY THE ENGINEER.

VALVE BOX SHALL BE SCREW TYPE ADJUSTABLE ONLY.

VALVE SHALL BE FLANGED BY MECHANICAL JOINT AND OPEN COUNTER CLOCKWISE.

St. Mary's County Metropolitan Commission Since 1961 Potable Water Distribution Wastewater Treatment	***APPROVED*** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	***REVISIONS***		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	*INITIALS*	
		7/24/10	J.E.C.	TAPPING SLEEVE AND VALVE (TYPICAL)
				STANDARD NO. G-26

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Standard Details
Table of Contents

Water

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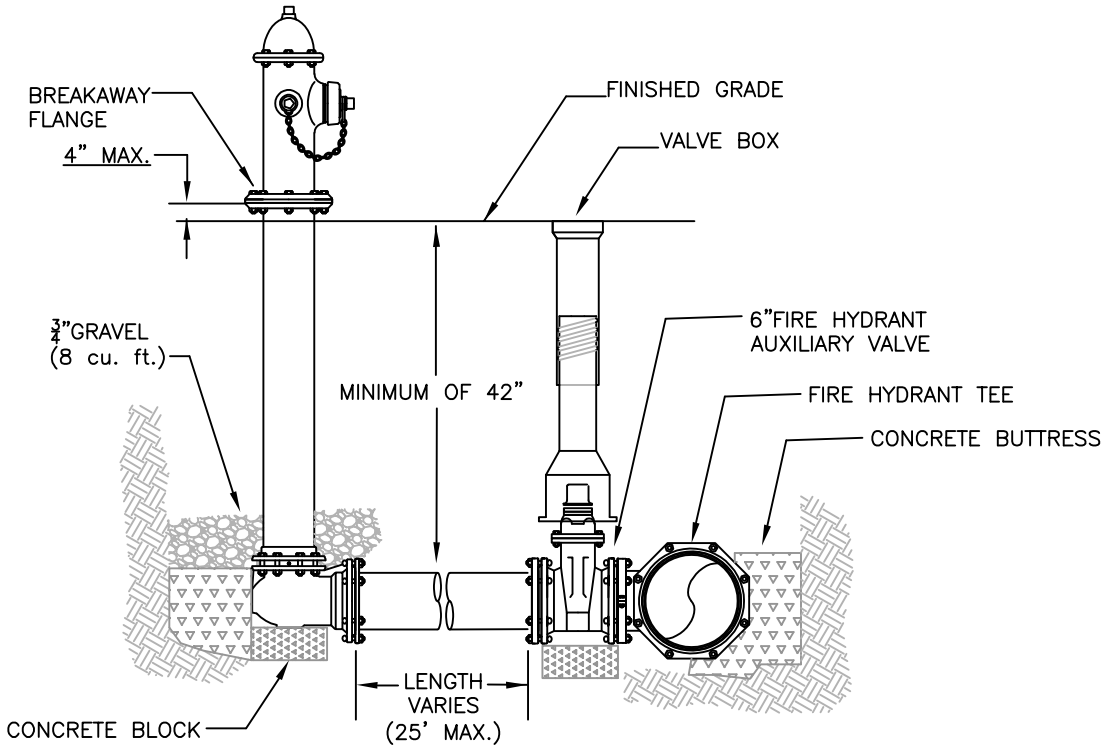

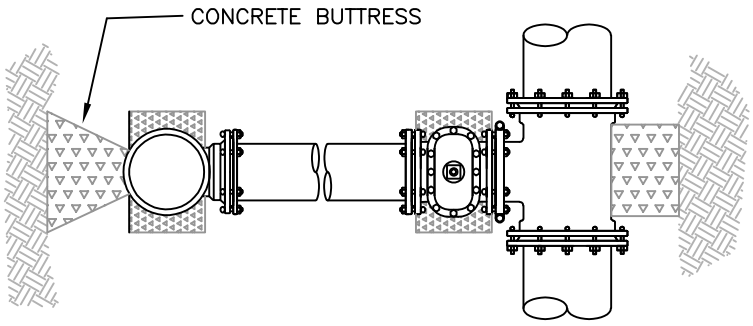

HYDRANT LEAD SHALL BE 6" D.I. PIPE ONLY.

HYDRANT LEAD SHALL NOT EXCEED 25 FEET IN LENGTH.

HYDRANT AUXILIARY VALVE SHALL BE BOLTED DIRECTLY TO THE TEE.

ALL FITTINGS, HARDWARE, ASSOCIATED CONCRETE AND AGGREGATES SHALL BE IN ACCORDANCE WITH THE APPROPRIATE MATERIAL SPECIFICATIONS, SECTION.

HYDRANT SHALL BE ROTATED AS DIRECTED BY ENGINEER.

HYDRANT SHALL BE 4' TO 6' BURY DEPTH.

USE OF MECHANICAL JOINT RETAINER GLANDS MAY BE USED INSTEAD OF THRUST BLOCKING WITH THE APPROVAL OF THE ENGINEER.

Since 1964	***APPROVED*** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	***REVISIONS*** DATE / INITIALS 6/18/09 J.E.C. 2/5/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** FIRE HYDRANT SETTING (TYPICAL) **STANDARD NO. W-1**

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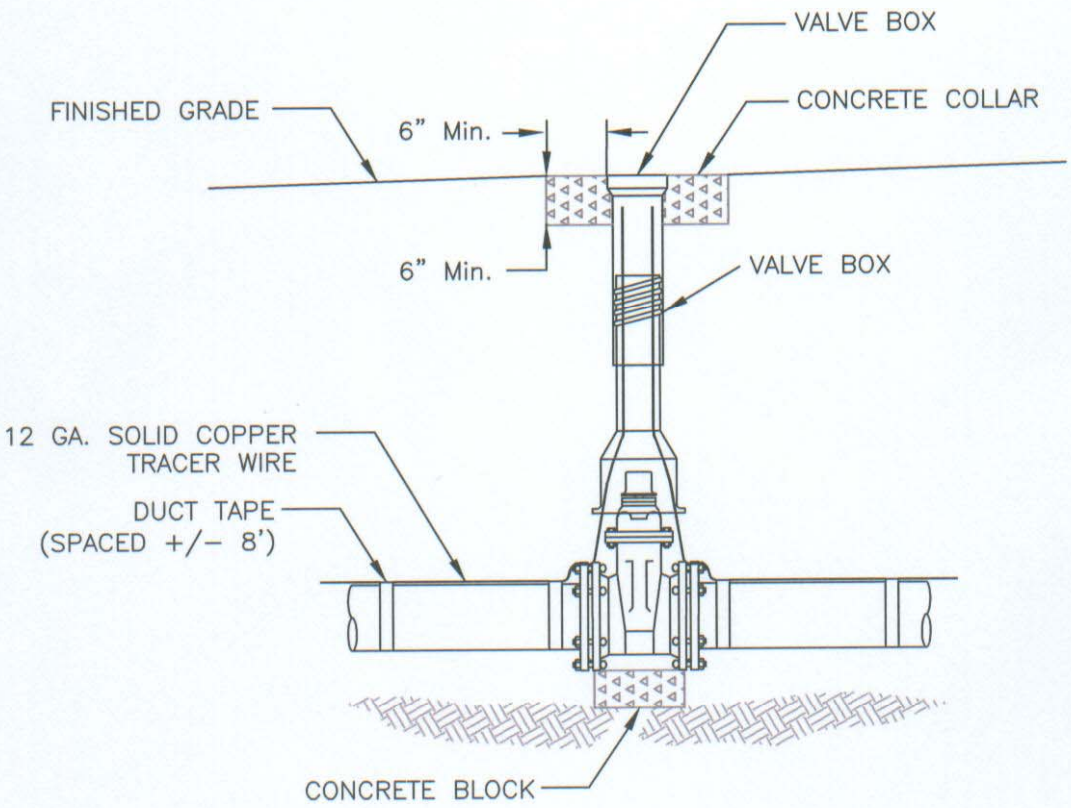

NOTES:

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE PIPE.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

ALL BLOCKING SHALL BE AGAINST UNDISTURBED EARTH.

BACKFILL AND COMPACTION SHALL BE IN ACCORDANCE WITH STANDARD G-6 OR AS DIRECTED BY THE ENGINEER.

VALVE BOX SHALL BE SCREW TYPE ADJUSTABLE ONLY.

VALVE SHALL HAVE MECHANICAL JOINTS AND OPEN COUNTER CLOCKWISE.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE	INITIALS	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		6/18/09	J.E.C.	IN-LINE WATER VALVE SETTING
				STANDARD NO. W-2

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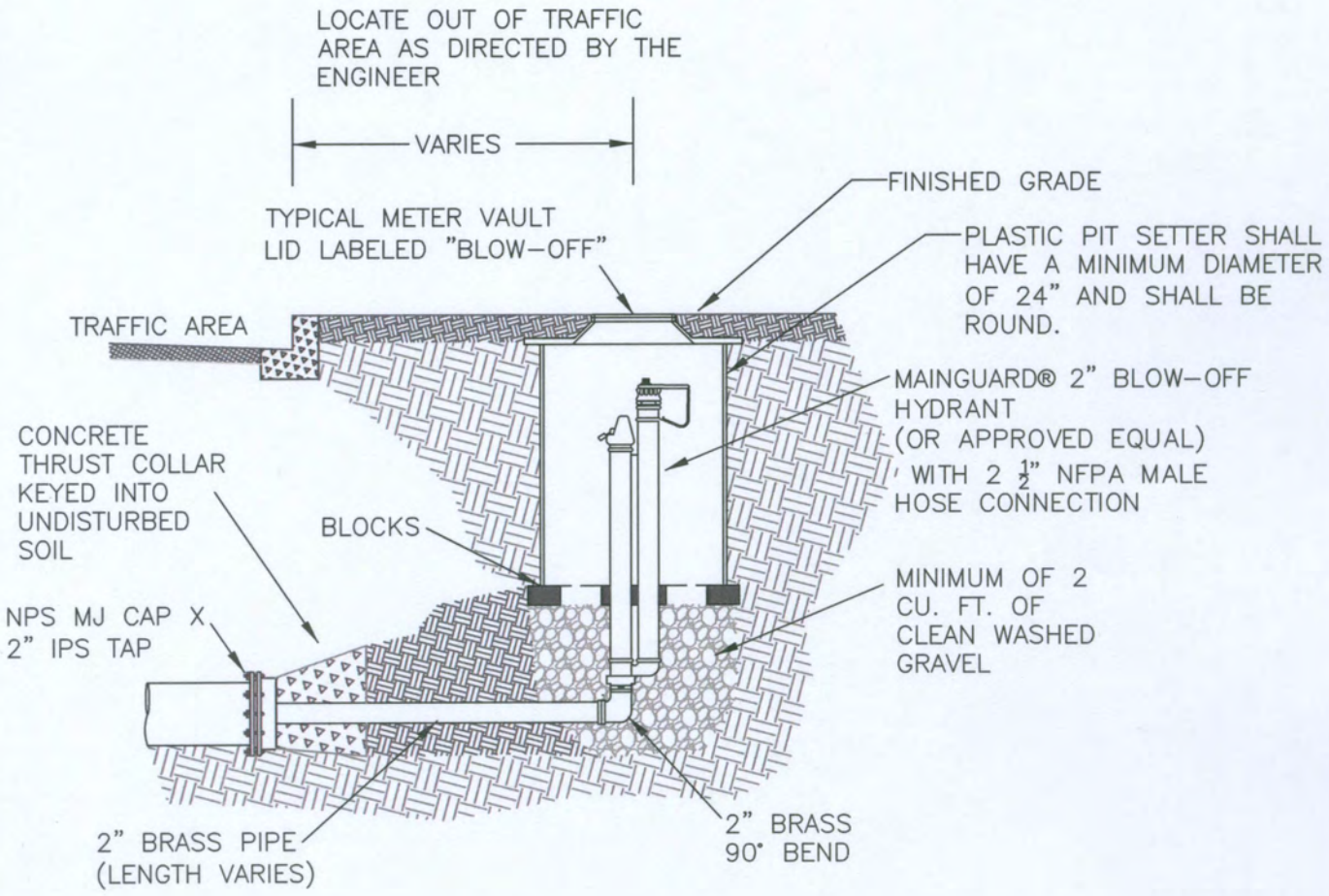

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS** DATE: 6/18/09; 7/23/10 INITIALS: J.E.C.; J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***	MAINGUARD® BLOW-OFF HYDRANT **STANDARD NO. W-3**

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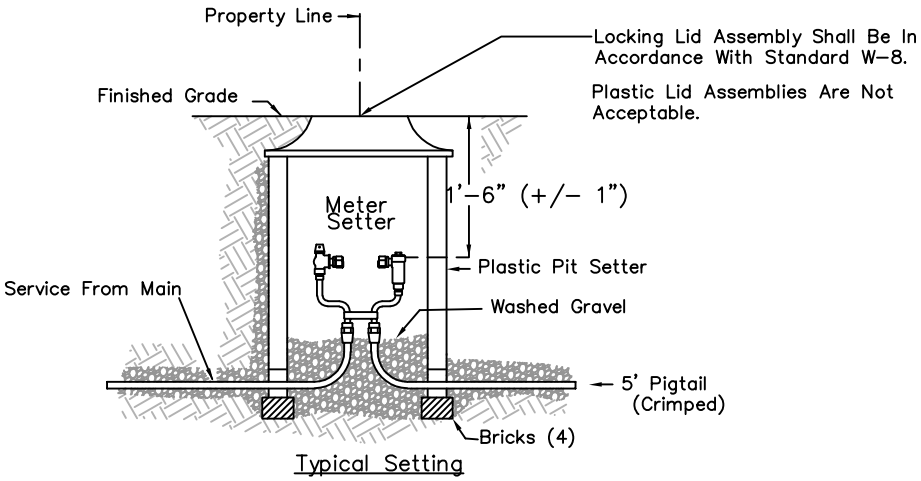
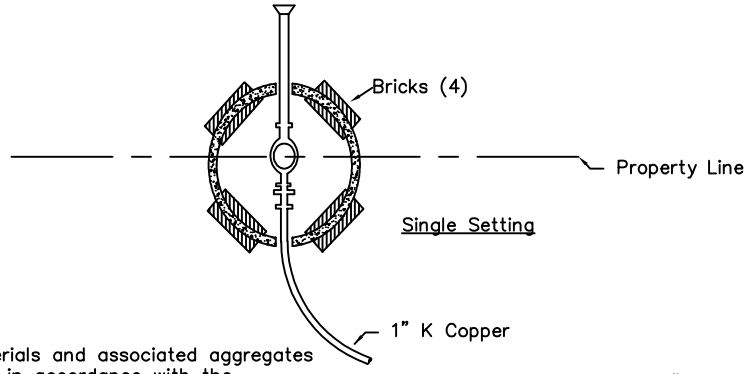
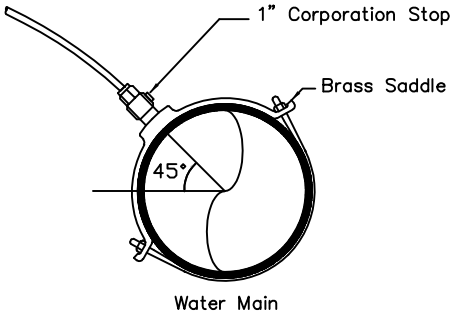


Typical Setting



Single Setting



All materials and associated aggregates shall be in accordance with the Material Specifications Section as most recently revised.

All copper connections shall be flared.

Meter setter shall be appropriately sized and shall include the lockable angle valve on the inlet side of the meter and the dual cartridge check valve on the discharge side of the meter.

Plastic pit setter shall have a minimum diameter of 18" and shall be round.

Plastic pit setter shall have a minimum height of 30" without the meter lid frame installed.

Plastic pit setter shall not be placed in an area subject to vehicular traffic.

Meter placed in an area subject to vehicular traffic will require the approval of the Engineer.

Corporation stop may be tapped directly into a ductile iron main with the approval of the Engineer.

Meter located within 3 feet of a driveway shall have the lid assembly encased and supported with concrete.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 2/5/19	**REVISIONS** DATE: 6/18/09, 2/5/19 INITIALS: J.E.C., J.E.C.	ST. MARY'S COUNTY METROPOLITAN COMMISSION **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** TYPICAL INSTALLATION OF SINGLE METER SETTING FOR DOMESTIC USE **STANDARD NO. W-4A**

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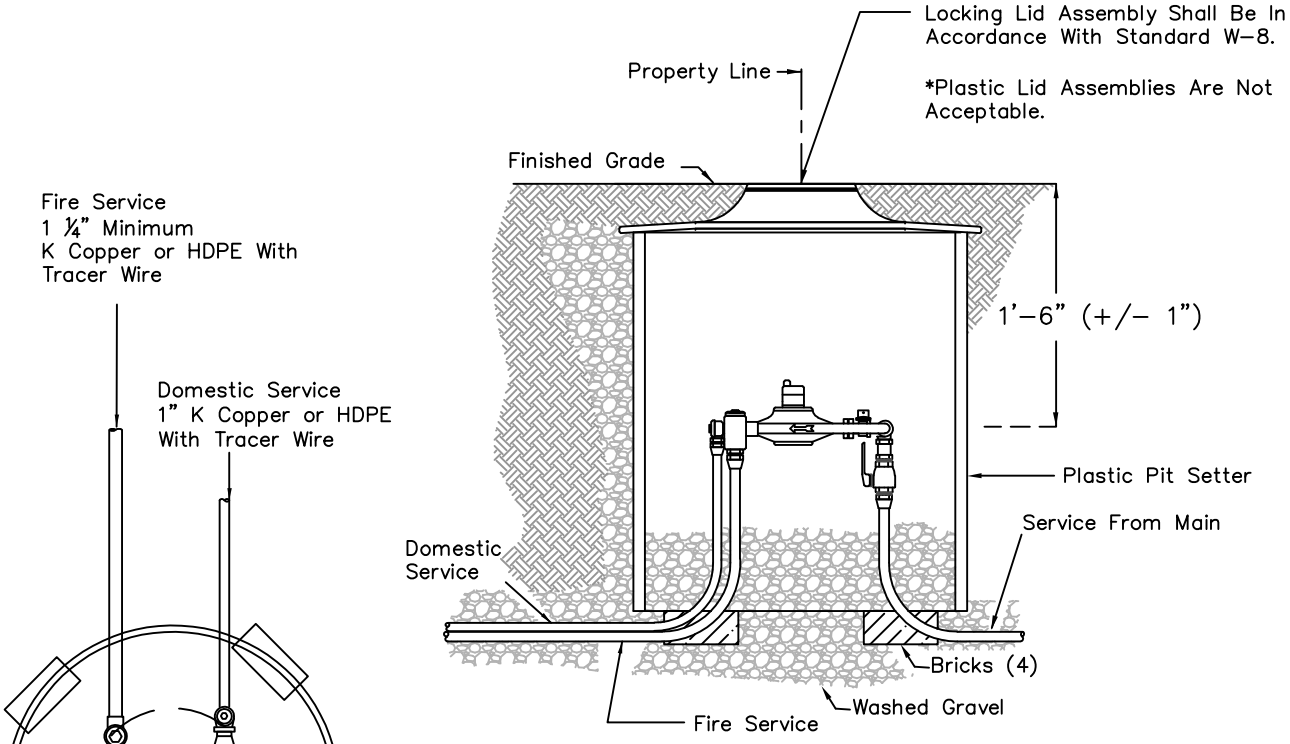


Plastic pit setter shall have a minimum diameter of 24" and shall be round.

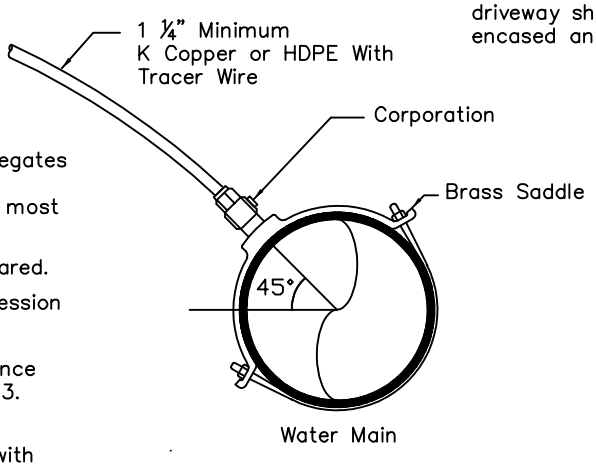
Plastic pit setter shall have a minimum height of 30" without the meter lid frame installed.

Plastic pit setter shall not be placed in an area subject to vehicular traffic.

Meter placed in an area subject to vehicular traffic will require the approval of the Engineer.

Meter located within 3 feet of a driveway shall have the lid assembly encased and supported with concrete.

Single Setting



All materials and associated aggregates shall be in accordance with the Material Specifications Section as most recently revised.

All copper connections shall be flared.

HDPE connections shall be compression type with stainless steel insert

Copper setter shall be in accordance with MetCom Standard Detail W–13.

Corporation stop may be tapped directly into a ductile iron main with the approval of the Engineer.

	APPROVED	**REVISIONS**		ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE	INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
	M. C. HOLLANDER, P.E. CHIEF ENGINEER	6/18/09	J.E.C.	TYPICAL INSTALLATION OF SINGLE METER SETTING FOR DOMESTIC USE WITH DOMESTIC SPRINKLER SYSTEM
	DATE: 7/11/19	7/23/10	J.E.C.	
		2/5/19	J.E.C.	**STANDARD NO. W-4B**

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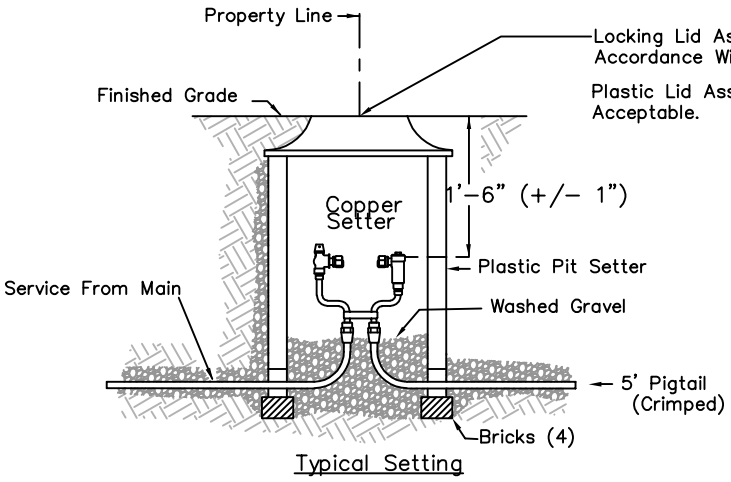
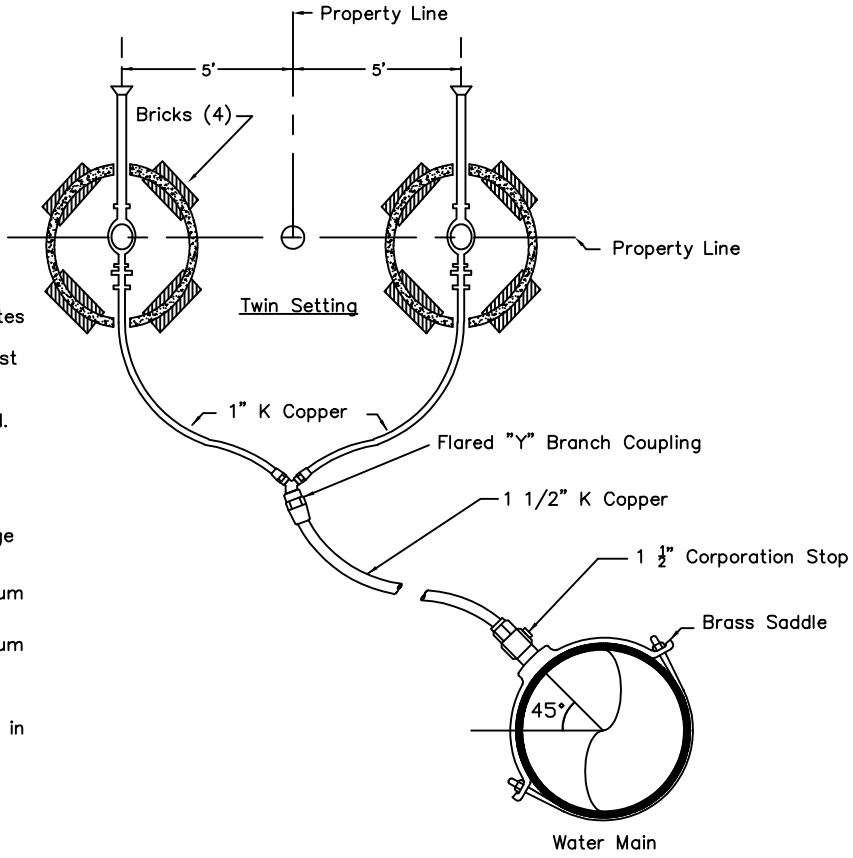


Typical Setting



All materials and associated aggregates shall be in accordance with the Material Specifications Section as most recently revised.

All copper connections shall be flared.

Copper meter setter shall be appropriately sized and shall include the lockable angle valve on the inlet side of the meter and the dual cartridge check valve on the discharge side of the meter.

Plastic pit setter shall have a minimum diameter of 18" and shall be round.

Plastic pit setter shall have a minimum height of 30" without the meter lid frame installed.

Plastic pit setter shall not be placed in an area subject to vehicular traffic.

Meter placed in an area subject to vehicular traffic will require the approval of the Engineer.

Corporation stop may be tapped directly into a ductile iron main with the approval of the Engineer.

Meter located within 3 feet of a driveway shall have the lid assembly encased and supported with concrete.

Note:
Twin connections shall not be used for new construction. Use of twin connections shall require the approval of the Engineer.

	APPROVED M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		ST. MARY'S COUNTY METROPOLITAN COMMISSION **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	TYPICAL INSTALLATION OF TWIN METER SETTING FOR DOMESTIC USE
		2/5/19	J.E.C.	
				STANDARD NO. W-5

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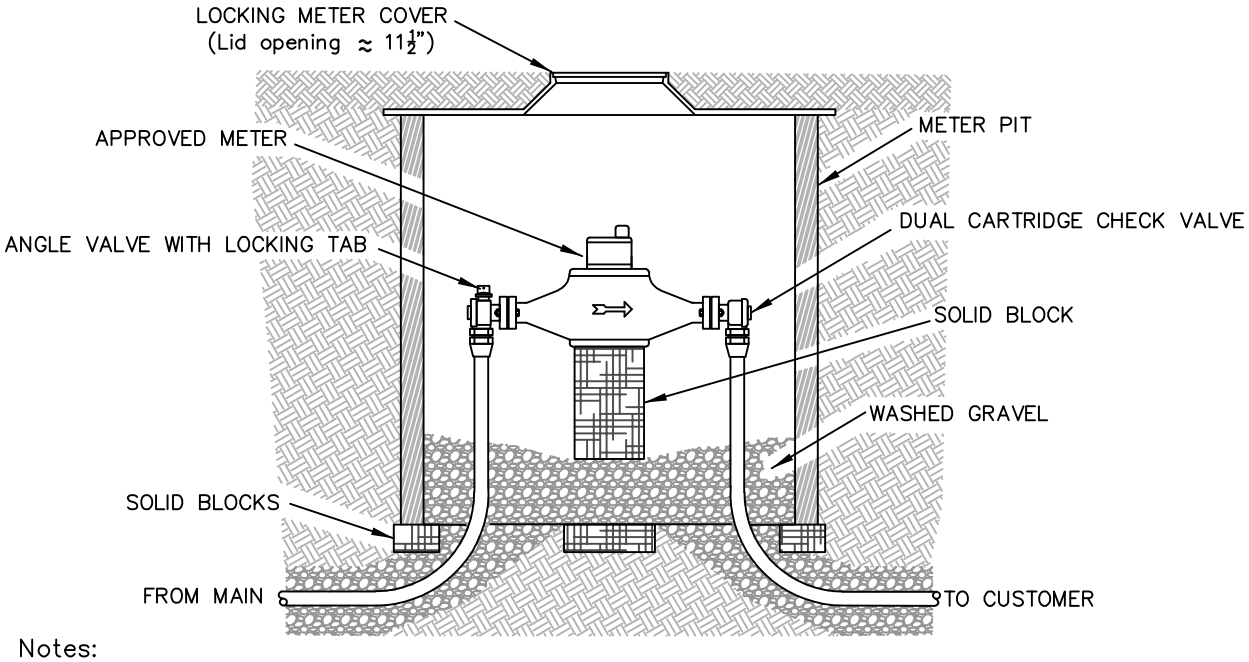

Notes:

1. Meter shall be from an approved manufacturer.
2. Meter connections shall be flanged.
3. Meter pit shall be sized to accomodate the meter with adequate room for maintenance.
4. Plastic meter box covers shall not be permissible.
5. All copper lines shall be type "K" (Federal Spec. WW–T–799).
6. Meter pit shall be constructed of concrete, ABS plastic or an approved equal.
7. Larger frame and lid meter box cover may be used with the approval of the Engineer.
8. Meter shall be placed as close as possible to the property line.
9. Meter shall be not be placed in areas subject to vehicular traffic without the approval of the Engineer.
10. Meter located within 3 feet of a driveway shall have the lid assembly encased and supported with concrete.

Since 1964	**APPROVED** Marc C. Hollander M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 8/31/10 J.E.C. 2/5/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** TYPICAL SETTING METERS 1 ½" and 2" **STANDARD NO. W-6**

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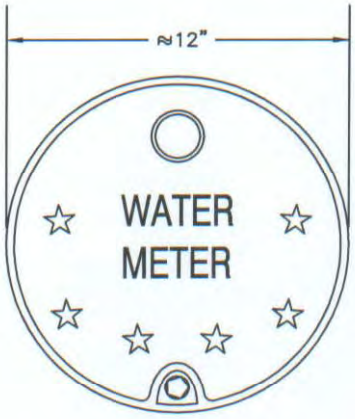
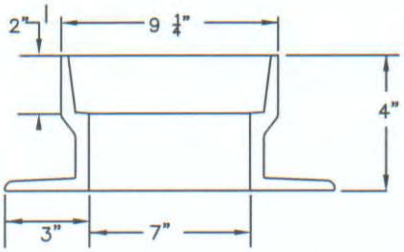
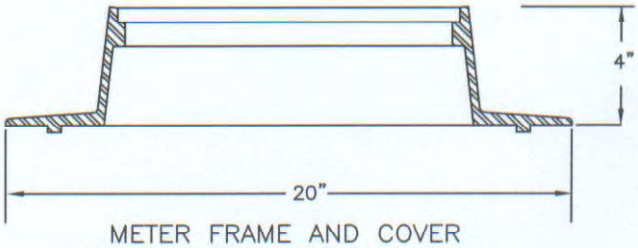
*NOTE: MEASUREMENTS MAY VARY SLIGHTLY BY MANUFACTURER.

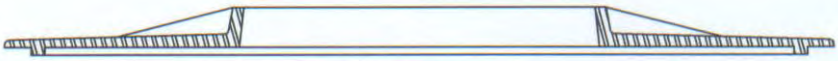




TYPICAL 7" FRAME AND COVER
FOR USE WITH VALVE VAULTS



METER FRAME AND COVER
FOR USE WITH 18" METER BOX.



EXTENSION RING
ALLOWS INSTALLATION OF STANDARD FRAME AND
COVER ON 24" THRU 36" METER PIT

METER LID SHALL HAVE A PRECAST HOLE FOR THE INSTALLATION OF THE ELECTRONIC METER READING MODULE.

METER LID SHALL BE EQUIPPED WITH A BRASS PENTAGON LOCKING BOLT.

LOCKING BOLT SHALL BE THE STANDARD WATERWORKS PENTAGON $\frac{27}{32}$" BOLT.

METER FRAME AND COVER MAY BE DESIGNED TO ALLOW THE LID TO EITHER SIT WITHIN THE FRAME OR OVERLAP THE FRAME.

FRAME AND COVER SHALL BE CONSTRUCTED OF CAST IRON AND SHALL CONFORM TO ASTM A 48, CLASS 30.

USE OF PLASTIC METER COVERS SHALL BE PERMISSIBLE UPON THE APPROVAL OF THE CHIEF ENGINEER.

www.metcom.org

APPROVED

DAVID J. ELBERTI, P.E.
CHIEF ENGINEER

DATE: 5/11/11

REVISIONS	
DATE	INITIALS
6/18/09	J.E.C.
5/5/11	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

STANDARD FRAMES AND COVERS FOR WATER METERS AND VALVE VAULTS

STANDARD NO. W-8

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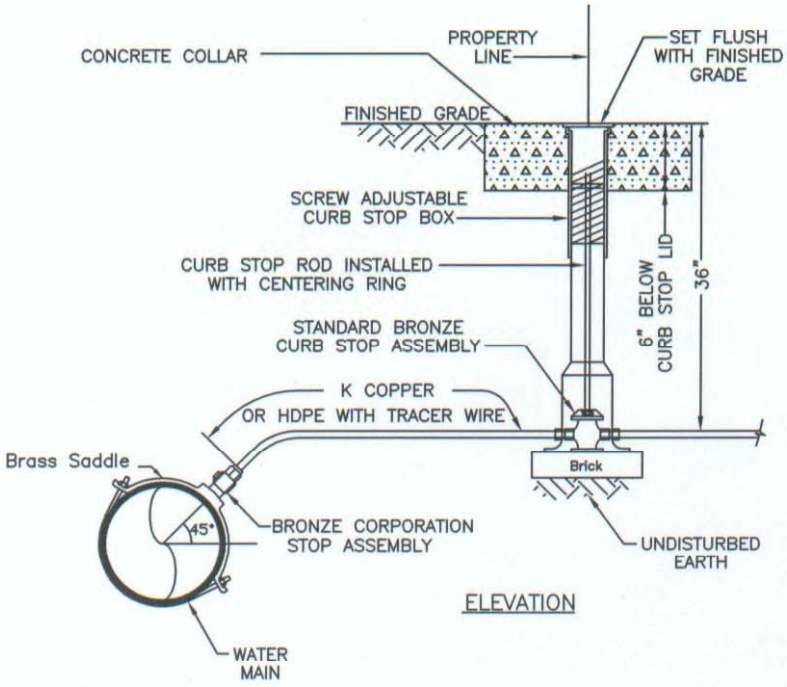

ELEVATION

All materials and associated aggregates shall be in accordance with the Material Specifications Section as most recently revised.

All copper connections shall be flared.

All HDPE connections shall be fusion.

Service line shall be one piece with no joints.

Tracer wire shall be installed along the entire length of the HDPE service line and into the meter pit.

Connection of adapters, bends or fittings in HDPE service line shall be fusion.

Valve box shall be screw–type adjustable.

Valve box shall be installed plumb and set to finished grade

Valve box shall be iron. Plastic shall not be permitted.

Curb stop in an area subject to vehicular traffic will require the the installation of a concrete collar.

Curb stop in an area subject to vehicular traffic will require the approval of the Chief Engineer.

www.metcom.org

APPROVED

DAVID J.ELBERTI, P.E.
CHIEF ENGINEER

DATE: 5/11/11

REVISIONS

DATE	INITIALS
6/18/09	J.E.C.
5/5/11	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

WATER SERVICE CONNECTION
1 ¼", 1 ½", 2" SETTING

STANDARD NO. W-9

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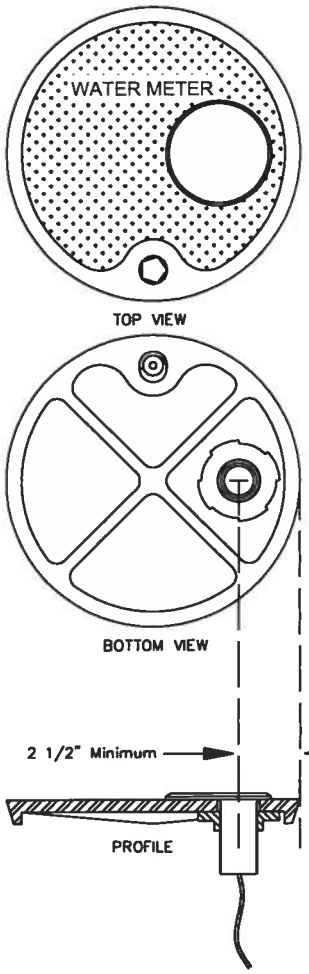


Antenna Installation

1. Insert antenna housing "A" through pit lid hole (from above) and secure in place with plastic nut "B". Plastic nut shall be installed with the solid face against the lid. Antenna shall be flush with the exterior of lid and completely supported.

2. Excess wire "C" should be coiled loosely in meter pit allowing for removal of pit lid.

For MIU conversions only:

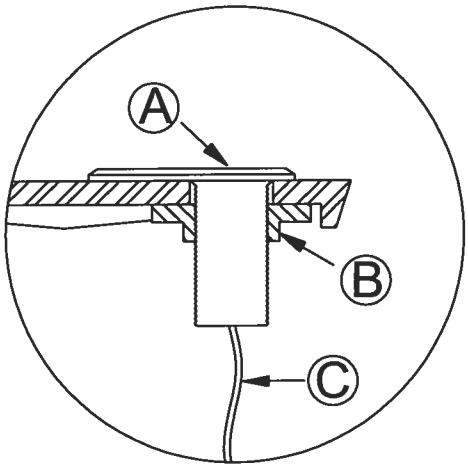
1. Hang MIU by lacing an electrical cable tie through the hole in the MIU and Antenna stem. The cable tie should be pulled small enough to limit depth but not restrict the MIU from hanging vertically. The coaxial cable should not have any tension on it from the MIU. Connect the MIU wire lead to the Sensus register terminals as shown on W-11. Do not shorten the MIU three wire cable lead, coil and other wise control the access by using of a non-conducting cable tie. Rubber bands are not acceptable.

2. The coaxial and MIU Lead connections to either the Meter or MIU shall be made per manufacture instructions. Extra care shall be taken for connections that have the potential for submersion. MIU Lead splice connections shall be a direct burial water submersion industrial quality connection. Use of Electrical tape is not acceptable .

General Notes

Radio-Read unit shall be installed in accordance with the manufacturers installation guide.

All material used in construction shall conform to the Standards and Specifications for Water and Sewer Installation as most recently revised.



Meter pit lids shall have either a pre-drilled hole or knock-out for the installation of the radio read pit-lid antenna.
FIELD ALTERING OR DRILLING OF LIDS SHALL NOT BE ACCEPTABLE FOR NEW CONSTRUCTION.

Field drilled 1 3/4" diameter hole shall be placed clear of the support ribs of the cover. FIELD DRILLED HOLES SHALL ONLY BE USED WHEN RETROFITTING EXISTING METER ASSEMBLIES.

Pit and meter assembly shall be installed in accordance with Std. Detail W4, W5 or W6 as applicable.

	APPROVED DAVID J. ELBERTI, P.E. CHIEF ENGINEER DATE: 7/20/11	**REVISIONS** DATE: 7/18/11 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			TYPICAL INSTALLATION OF RADIO READ METER MIU AND ANTENNA
			STANDARD NO. W-10

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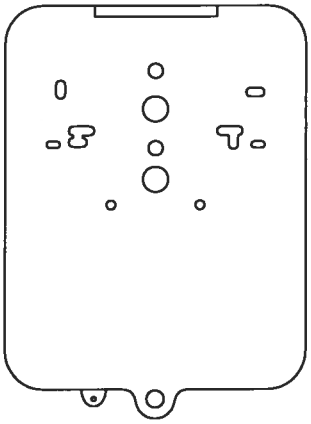


WALL MIU BRACKET

General

1. This standard is for radio read conversions only.
2. See Neptune Technology Group R900 MIU Installation manual for additional information.
3. For vault installations also see Standard W-4A/4B,W-5, W-6 or W-17 as applicable.
4. Neptune Wall Mount R900 is the MIU device for converting Sensus Touch Pad meters that are interior meter locations. The Wall Mount R900 replaces the exterior mounted touch pad device. Access to the Sensus meter register is required.

Radio Read MIU Location

1. The MIU shall be located in direct replacement of the Sensus Touch Pad when ever possible. The MIU should be elevated above any metal obstructions or fencing that is in the line of sight to the street
2. For vault or pit installations see W-17.
3. MUI shall be located in close proximity and at the same height as the electric meter base, but not more than three feet from the meter base.
4. Touch pad shall be located a minimum of three but not more than five and one half feet above the finished grade elevation.
5. The MIU shall be securely fastened to the structure with appropriate fasteners.
6. Weather-tight seals shall be provided for all penetrations existing, created or abandoned.

Wiring, General

1. Cabling between the Sensus ECR register and the Neptune MIU shall be as a minimum solid conductor, three wire 22 awg vinyl jacketed. The Metcom Engineer shall approve conductor size for cable lengths exceeding 200 feet. Conductor colors to be Red, Green and Black.
2. Cable shall be continuous with no splices except at the MIU lead.
3. The MIU lead shall not be cut shorter then 18 inches.
4. The MIU lead to cable splice shall be accomplished only with "direct burial water submersion" industrial quality connection and shall maintain the conductor color.
5. Route cable to and from the electronic communication register (ECR) by following the current cable. After terminations are complete a minimum of 18 inches of cable for future needs shall be available at both the MIU and the Register. Excess cable shall be neatly coiled, secured and other wise controlled to provide a neat and professional installation.
6. Stripping of cable jacket shall not harm the underlining conductor or it's insulation in any way. Exposed conductor insulation shall not exceed 1/2 inch.
7. Terminal connections shall be made by bending appropriate sized loops that provide sufficient mechanical and electrical contact. The conductor shall loop the terminal screw a minimum of 270 degrees. Exposed conductor shall not exceed 1/8 inch beyond the terminal screw.
8. The register terminal cap shall be removed and re-installed such that it provides the manufacture's level of protection and security.

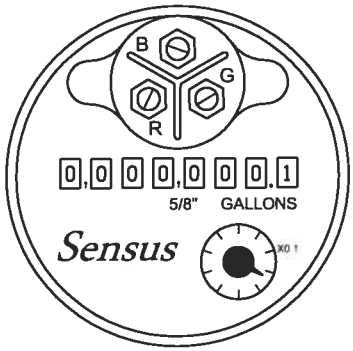
The MIU to ECR Register Wiring

1. When the MIU lead wires are to be terminated on Sensus register terminals, use the following color code.

MUI Conductor Color	Sensus Terminal
Black	R
Green	B
Red	G

2. When the MIU lead wires are to be spliced to the Sensus touch pad wiring harness,use the following color code.

MUI Conductor Color	Sensus Touch Pad Conductor Colors
Black	Red
Green	Black
Red	Green



TOP VIEW

ELECTRONIC COMMUNICATION REGISTER

	APPROVED DAVID J. ELBERTI, P.E. CHIEF ENGINEER DATE: 7/20/11	**REVISIONS** DATE / INITIALS 7/19/11 JEC	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** TYPICAL INSTALLATION AND WIRING OF MIU TO ECR REGISTER **STANDARD NO. W-11**

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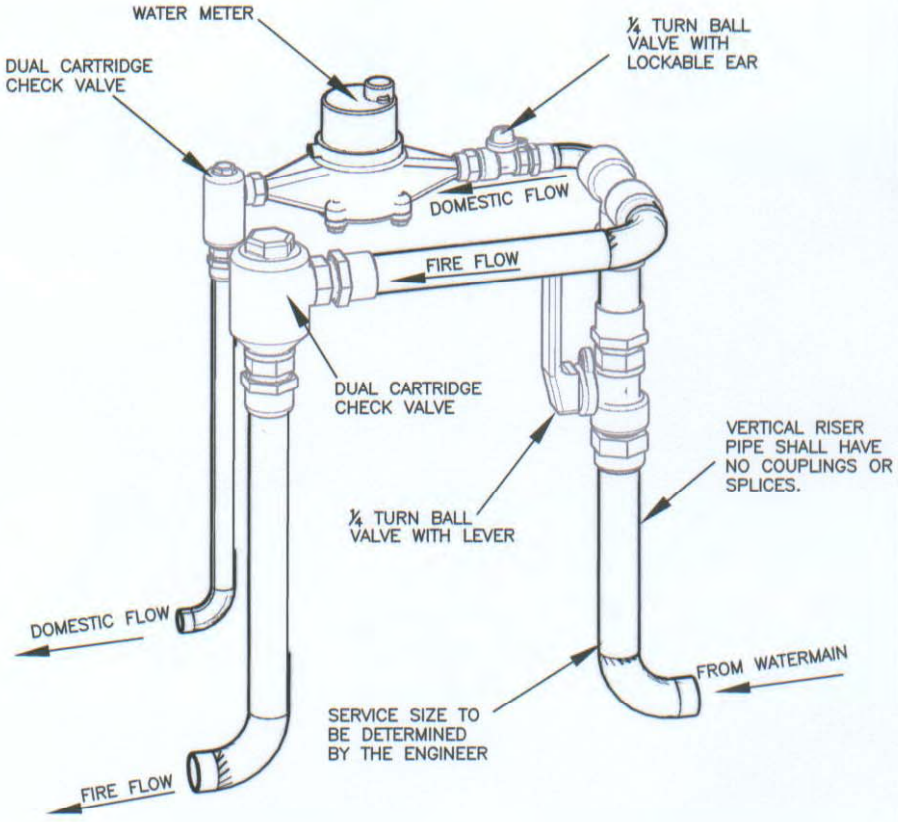

Coppersetter shall be commercially manufactured.

All materials shall be in accordance with the Material Specifications Section as most recently revised.

Piping sizes shall be determined by the Engineer for required flows.

Meter setter shall include the lockable angle valve on the inlet side prior to the tee and dual cartridge check valves on the discharge side of the meter and fire line.

Installation shall be in accordance with Standard W–4B.

Meter pit shall be installed in accordance with Standard W–4B, W–5 and W–6.

www.metcom.org

APPROVED

DAVID J. ELBERTI, P.E.
CHIEF ENGINEER

DATE: 5/11/11

REVISIONS	
DATE	INITIALS
6/18/09	J.E.C.
5/5/11	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

SHARED DOMESTIC SUPPLY AND SPRINKLER CONNECTION (TYPICAL)

STANDARD NO. W-13

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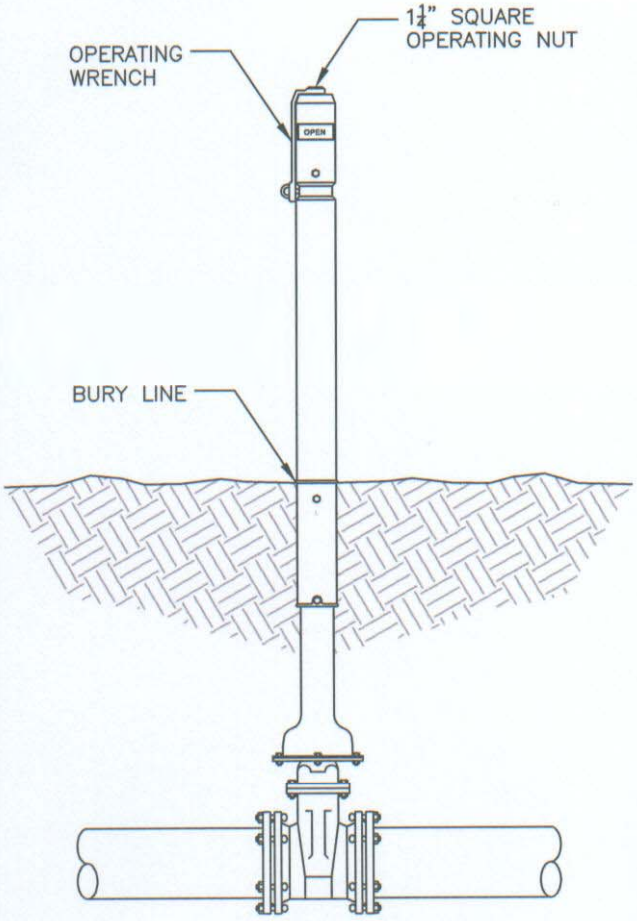

POST INDICATOR VALVE (P.I.V.) SHALL BE PLACED ON ALL FIRE SERVICE LINES.

VALVE SHALL BE INSTALLED IN ACCORDANCE WITH METCOM STANDARD W–2.

VALVE SHALL BE PROVIDED WITH P.I.V. RISER MOUNTING PLATE AFFIXED TO VALVE BONNET.

P.I.V. SHALL BE PLACED AT THE PROPERTY LINE OR AS CLOSE TO THE MAIN AS PRACTICAL AND OUTSIDE OF THE FALL LINE OF THE STRUCTURE SERVED.

P.I.V. SHALL OPERATE COUNTER CLOCKWISE TO SHUT.

OPERATING NUT SHALL BE 1¼" SQUARE.

P.I.V. OPERATING WRENCH SHALL BE PROVIDED AND AFFIXED TO THE VALVE BODY IN A MANNER THAT SHALL ENSURE THE VALVE IS LOCKED OPEN UNTIL NECESSARY TO CLOSE.

MODIFICATION OF P.I.V. FOR HEIGHT ADJUSTMENT SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.

P.I.V. SHALL BE A MINIMUM OF 36" FROM THE BURY LINE TO THE TOP OF THE OPERATING NUT.

MAXIMUM HEIGHT SHALL NOT EXCEED 48" .

P.I.V. SHALL BE FACTORY PAINTED RED.

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	POST INDICATOR VALVE (TYPICAL)
				STANDARD NO. W-15

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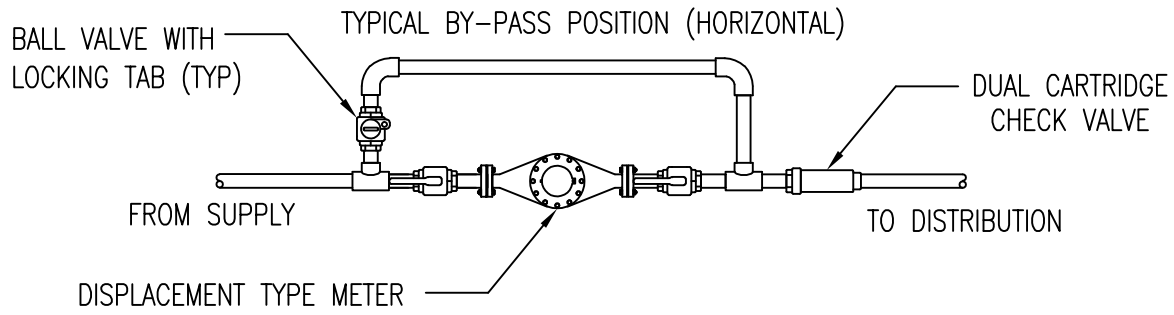

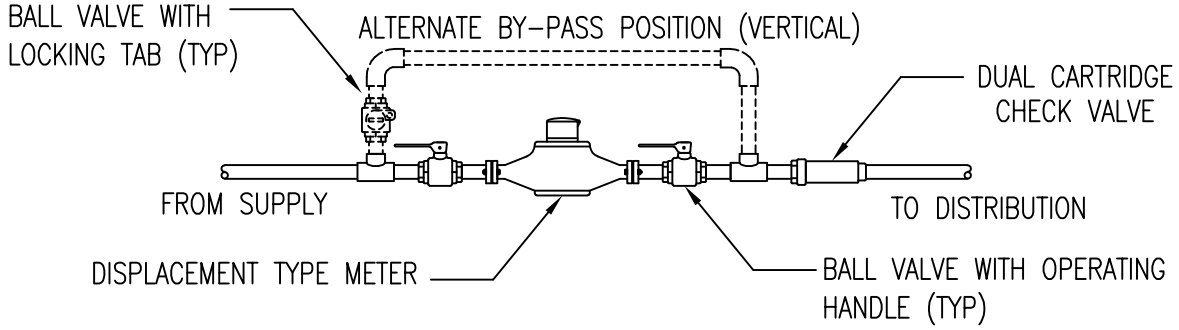

1. METER SHALL BE THE DISPLACEMENT TYPE OR AS DIRECTED BY THE ENGINEER.
2. METER SHALL BE INSTALLED 18" TO 36" ABOVE FINISHED FLOOR AND AT LEAST 2' FROM AN EXTERIOR WALL AND IN A HEATED AREA.
3. METER SHALL BE INSTALLED HORIZONTALLY.
4. METER CONNECTIONS AND ALL FITTINGS SHALL BE FLANGED.
5. VALVES SHALL BE SHALL BE FULL PORT THREADED BALL VALVES
6. ON A DUAL FIRE/DOMESTIIC SERVICE, METER CONNECTION SHALL BE WITHIN FIVE FEET OF THE SERVICE SPLIT.
7. BACK FLOW PREVENTION SHALL BE INSTALLED WITHIN FIVE FEET OF THE METER.
8. A BYPASS WHEN APPROVED SHALL BE THE SAME DIAMETER AS THE METER SIZE.
9. PLASTIC PIPING OR FITTINGS SHALL NOT BE PERMITTED.
10. PIPE SUPPORTS SHALL BE PROVIDED AS REQUIRED.
11. BACK FLOW DEVICES SHALL COMPLY WITH THE NATIONAL STANDARD PLUMBING CODE AND THE ST. MARY'S COUNTY METROPOLITAN COMMISSION CROSS CONNECTION CONTROL PROGRAM. THE BACK FLOW DEVICE SHALL COMPLY WITH THE USE'S HEALTH HAZARD LEVEL AS SPECIFIED IN THE NATIONAL STANDARD PLUMBING CODE.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		2/5/2019	J.E.C	TYPICAL INTERIOR METER INSTALLATION 3" AND SMALLER
				STANDARD NO. W-18

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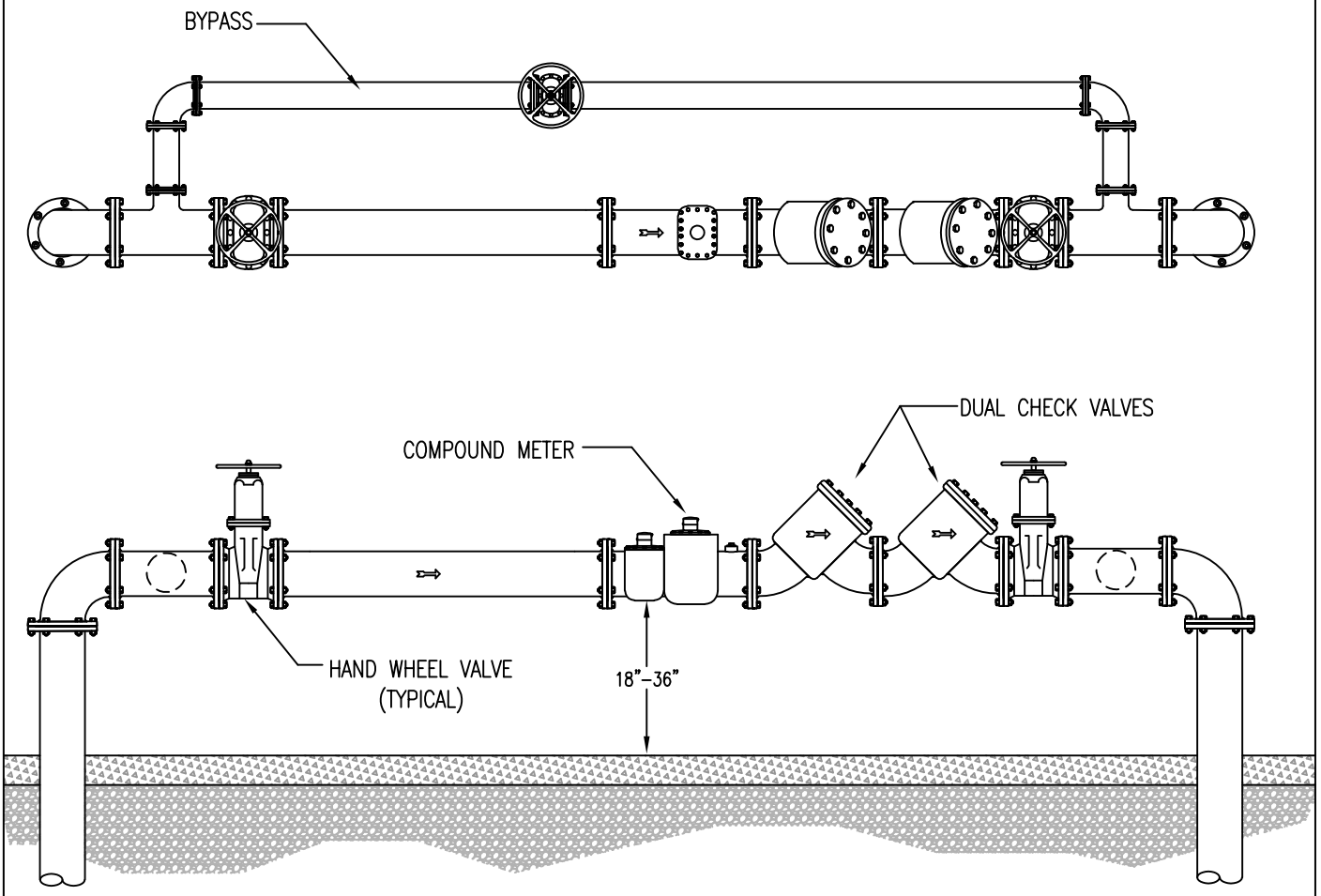

1. METER SHALL BE THE COMPOUND TYPE.
2. METER SHALL BE INSTALLED 18" TO 36" ABOVE FINISHED FLOOR AND AT LEAST 2' FROM AN EXTERIOR WALL AND IN A HEATED AREA.
3. METER SHALL BE INSTALLED HORIZONTALLY.
4. METER CONNECTIONS AND ALL FITTINGS SHALL BE FLANGED.
5. PROVIDE FIVE PIPE DIAMETERS OF STRAIGHT, UNOBSTRUCTED FLOW PRIOR TO METER. (MAY BE REDUCED WITH THE INSTALLATION OF A STRAINER)
6. ON A DUAL FIRE/DOMESTIIC SERVICE, METER CONNECTION SHALL BE WITHIN FIVE FEET OF THE SERVICE SPLIT.
7. BACK FLOW PREVENTION SHALL BE INSTALLED WITHIN FIVE FEET OF THE METER.
8. A BYPASS WHEN APPROVED SHALL BE A MINIMUM OF ONE HALF THE DIAMETER OF THE METER.
9. PLASTIC PIPING OR FITTINGS SHALL NOT BE PERMITTED.
10. PIPE SUPPORTS SHALL BE PROVIDED AS REQUIRED.
11. BACK FLOW DEVICES SHALL COMPLY WITH THE NATIONAL STANDARD PLUMBING CODE AND THE ST. MARY'S COUNTY METROPOLITAN COMMISSION CROSS CONNECTION CONTROL PROGRAM. THE BACK FLOW DEVICE SHALL COMPLY WITH THE USE'S HEALTH HAZARD LEVEL AS SPECIFIED IN THE NATIONAL STANDARD PLUMBING CODE.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		2/5/2019	J.E.C	TYPICAL INTERIOR METER INSTALLATION 3" AND LARGER
				STANDARD NO. W-19

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Standard Details
Table of Contents

Typical Potable Water Pumping Station

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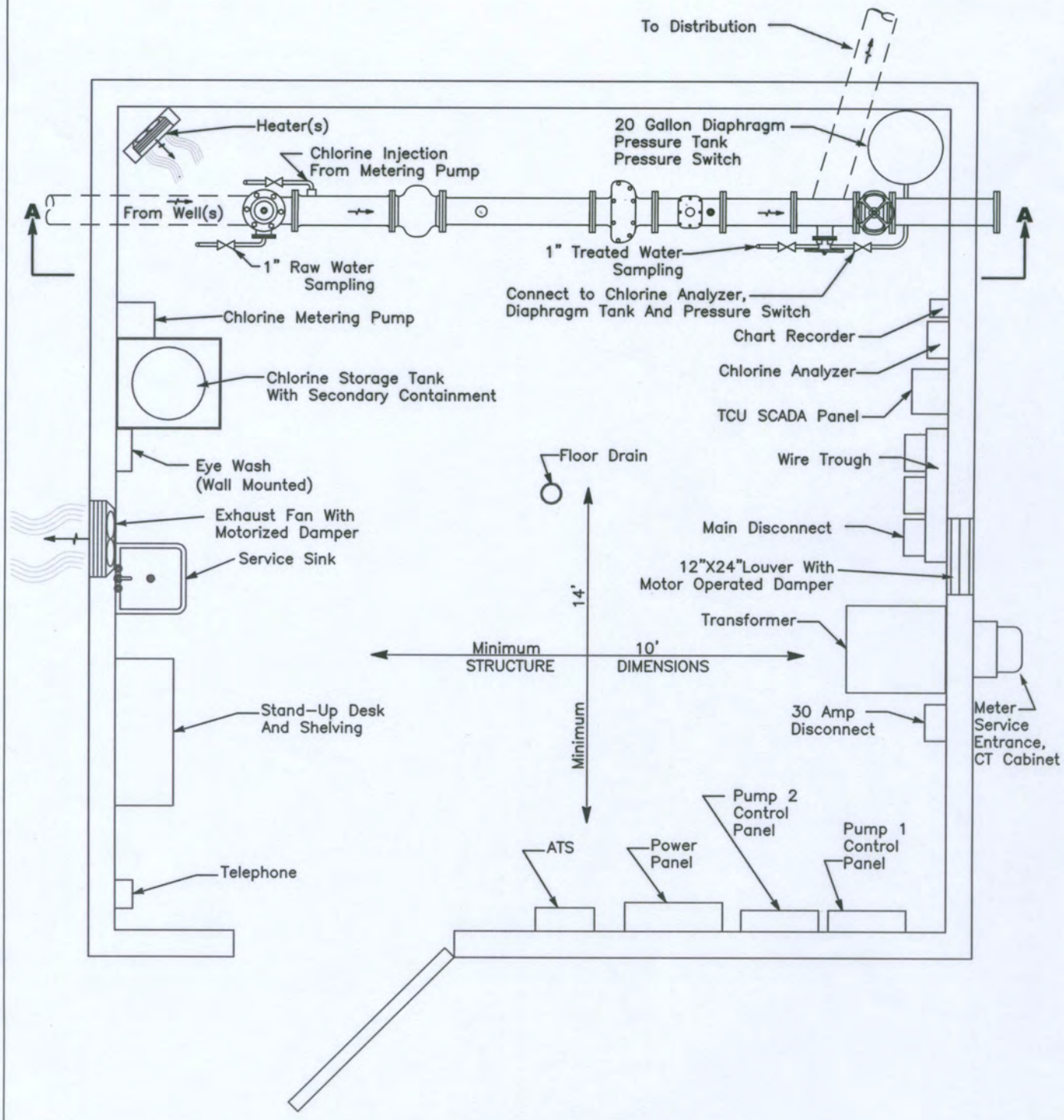

*Drawing is not to scale. Plan is one of several possible layouts and is for illustrative purposes only.

Provide drains for eye wash, sink and chlorine analyzer.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS** DATE: 6/18/09; 7/26/10 INITIALS: J.E.C.; J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Typical Water Pumping Station Pumping to System Or Tower **STANDARD NO. WP-1**

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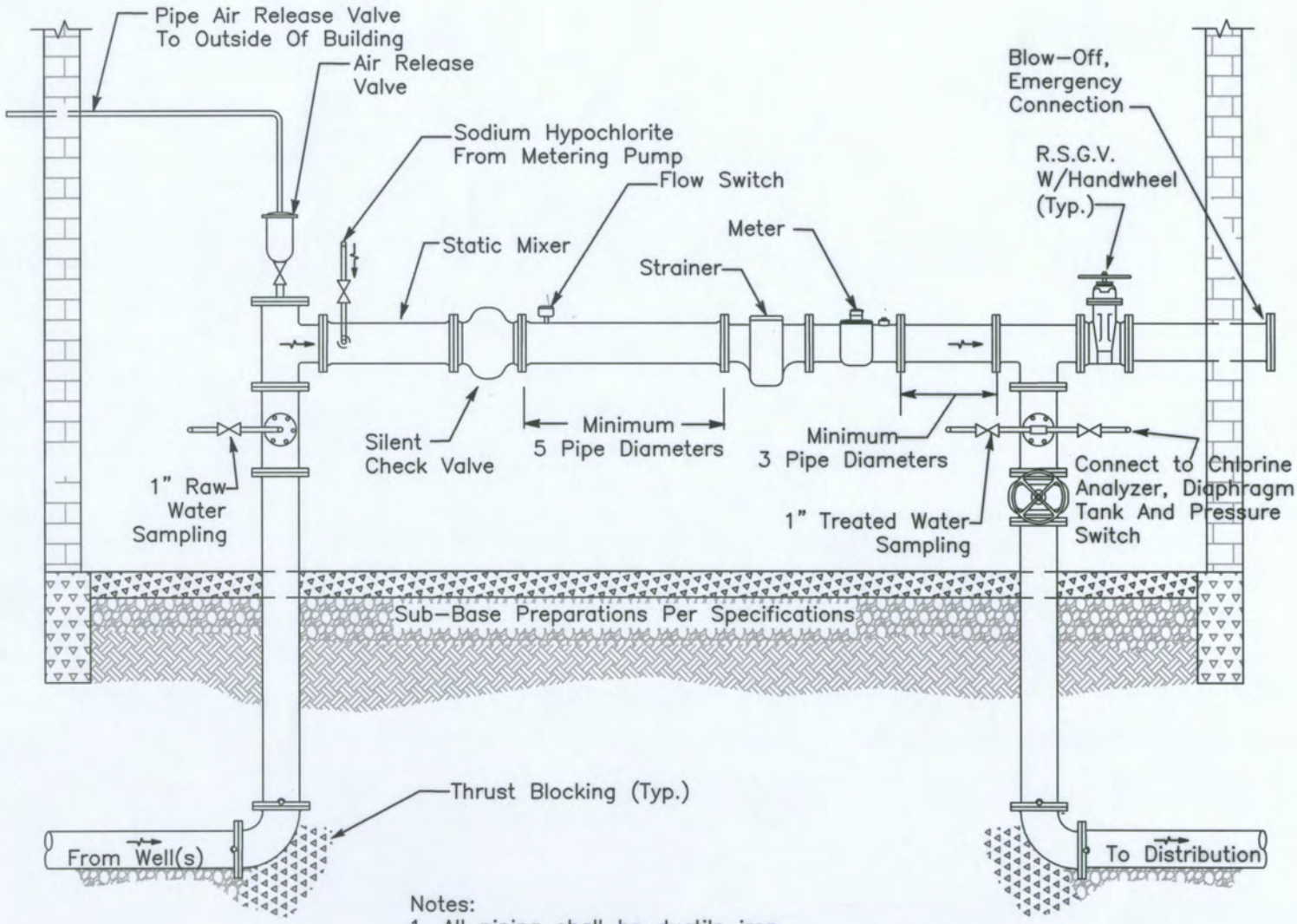
*Drawing is not to scale. Plan is one of several possible layouts and is for illustrative purposes only.



Notes:
1. All piping shall be ductile iron.
2. Mechanical joints beneath floor shall be restrained.
3. Interior piping shall be flanged.
4. All building penetrations shall be sealed with hydraulic grout.
5. Provide pipe supports as required.

APPROVED

C. I. FREDERICK JR., P.E.
CHIEF ENGINEER

DATE: 7/26/10

REVISIONS

DATE	INITIALS
6/18/09	JEC
7/26/10	JEC

ST. MARY'S COUNTY
METROPOLITAN COMMISSION
STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

Typical Water Pumping Station
Pumping to System Or Tower
Section A-A

STANDARD NO. WP-2

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Standard Details
Table of Contents

Gravity Sewer

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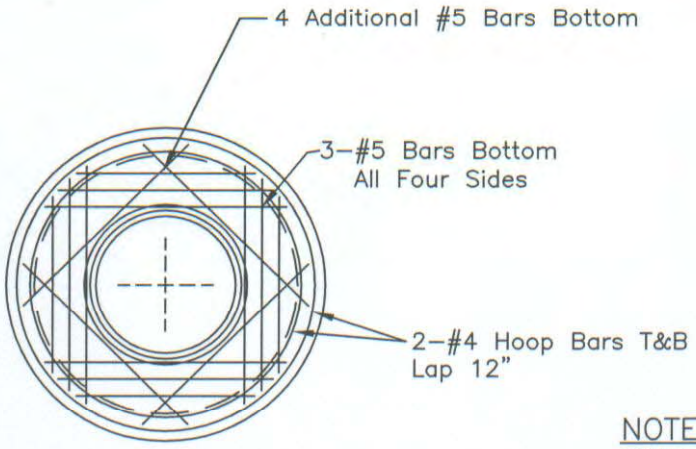
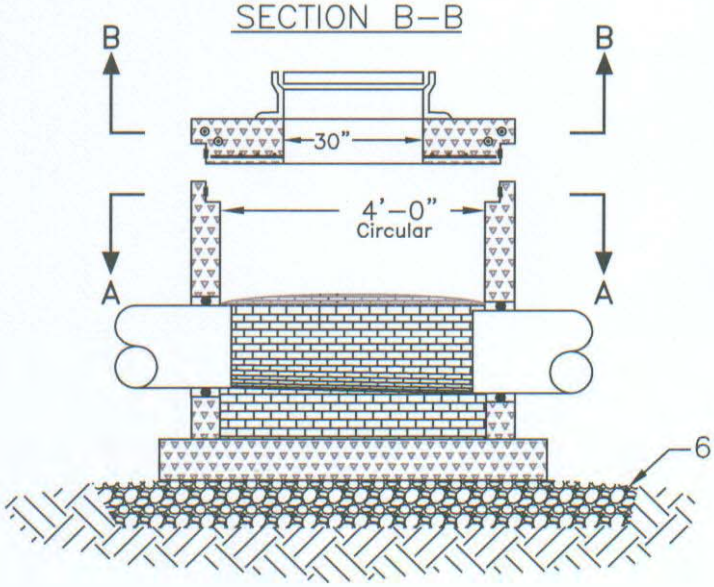


SECTION B–B

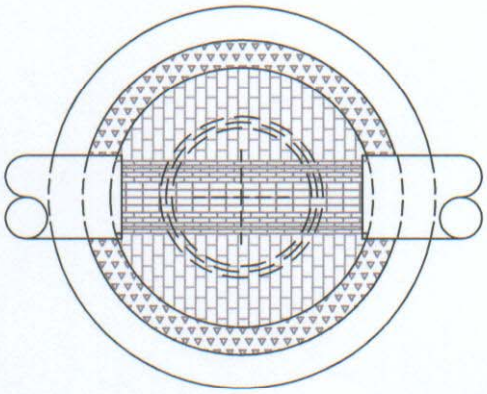


NOTES:

SHALLOW MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S–2*

*EXCEPTIONS:

FLAT TOP AND 30" ACCESS WAY, 30" FRAME AND COVER



SECTION A–A

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** SHALLOW MANHOLE **STANDARD NO. S-1**

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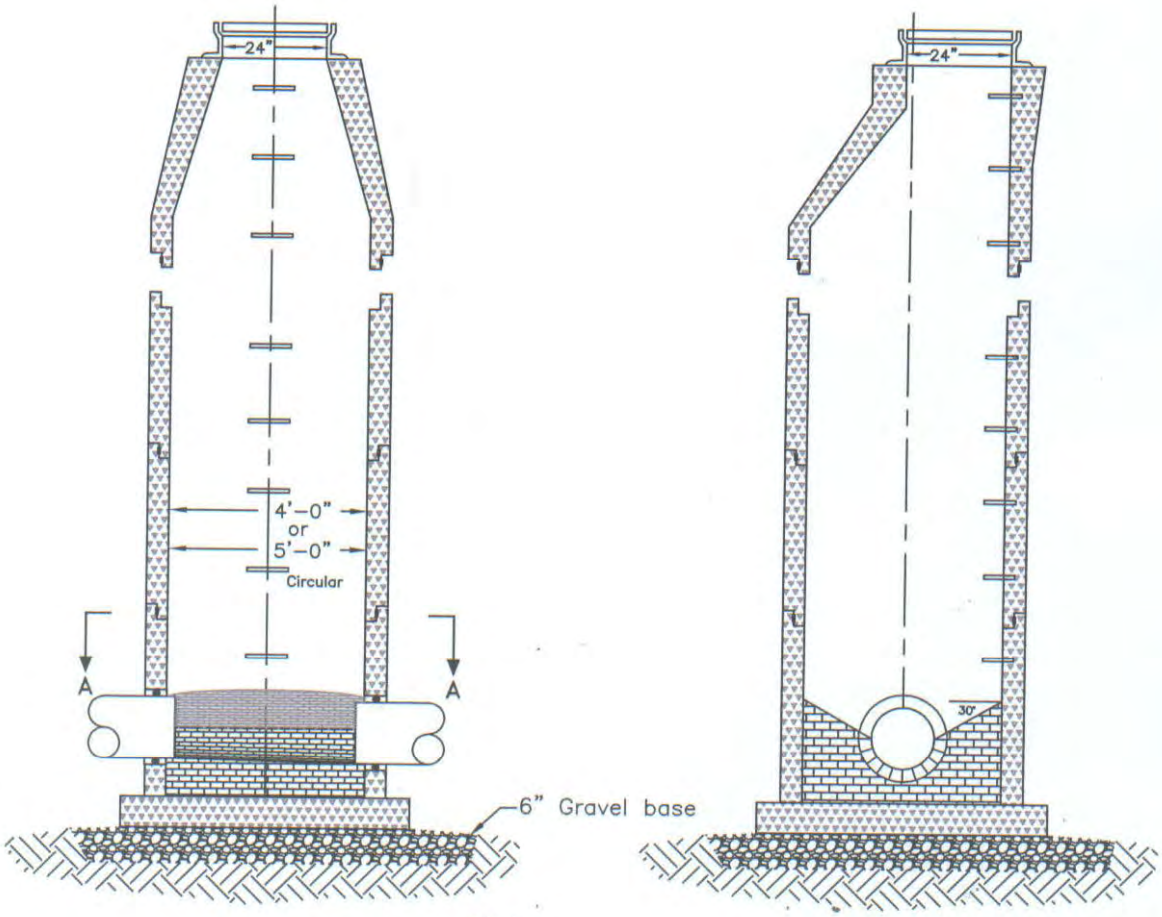

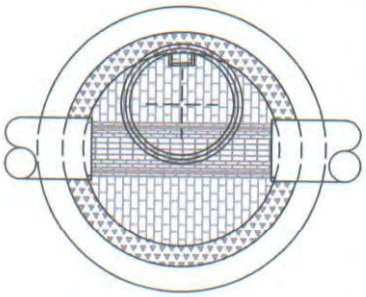

SECTION A–A

Notes:

1. Precast manhole and appurtenances shall conform to all applicable standards and details as most recently revised.
2. Where cover over pipe is less than 3.5', a shallow manhole shall be used.
3. Minimum fall across the manhole shall be 0.2' unless approved by the Engineer.
4. Exterior of structure shall be coated with bituminous sealant.
5. All brick shall be solid sewer manhole brick. Brick in channel invert shall be laid on edge.
6. Max. four courses of brick between manhole and manhole frame.
7. Channel shall be constructed in accordance with MetCom Standard Detail S–6.
8. 60" manhole shall be required for pipes larger than 24", for sewers greater than 15' in depth or as directed by the Engineer.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	STANDARD PRECAST LINE MANHOLE
				STANDARD NO. S-2

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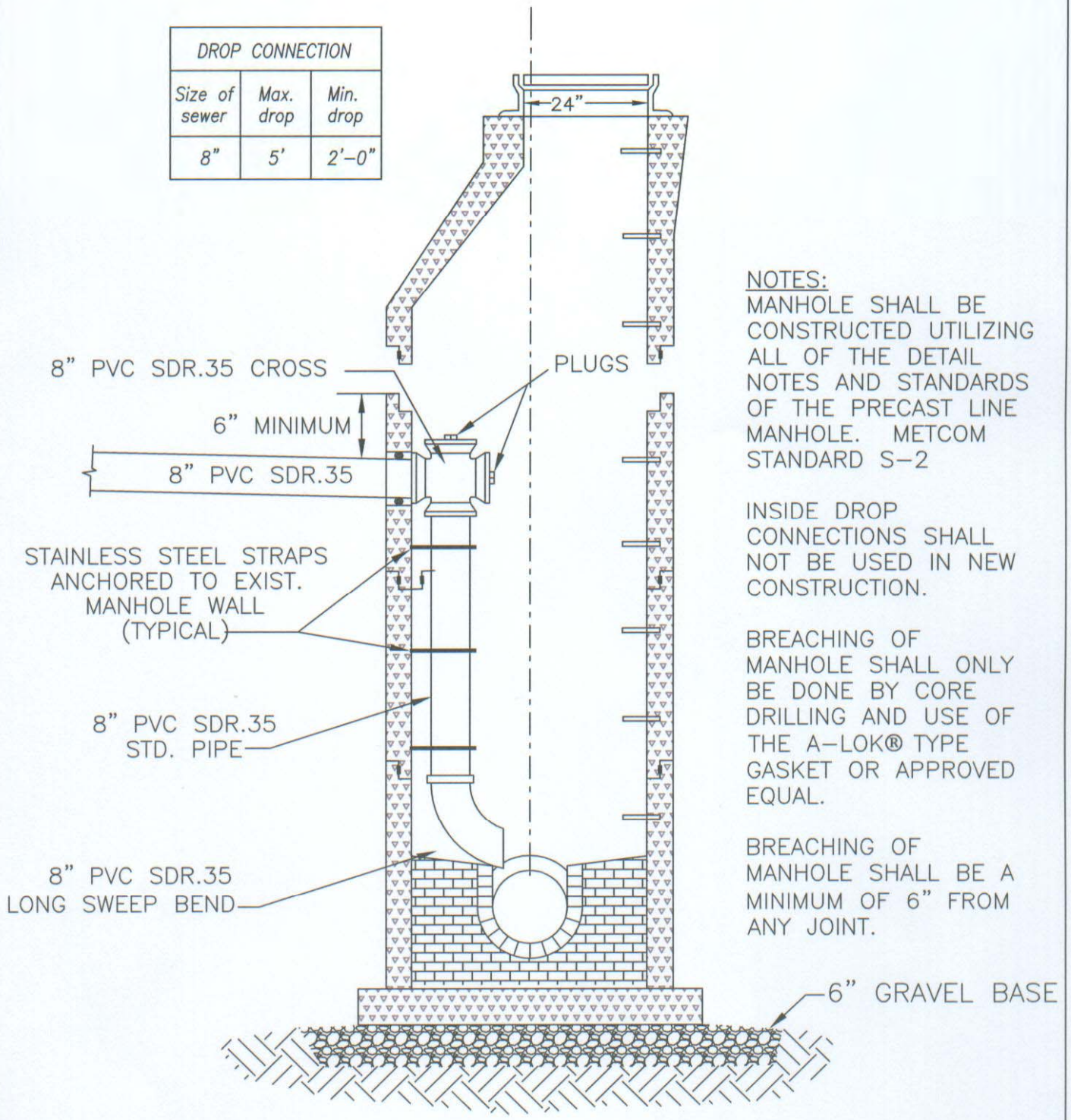
DROP CONNECTION		
Size of sewer	Max. drop	Min. drop
8"	5'	2'–0"



NOTES:

MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S–2

INSIDE DROP CONNECTIONS SHALL NOT BE USED IN NEW CONSTRUCTION.

BREACHING OF MANHOLE SHALL ONLY BE DONE BY CORE DRILLING AND USE OF THE A–LOK® TYPE GASKET OR APPROVED EQUAL.

BREACHING OF MANHOLE SHALL BE A MINIMUM OF 6" FROM ANY JOINT.

APPROVED	REVISIONS		ST. MARY'S COUNTY METROPOLITAN COMMISSION STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES
	DATE	INITIALS	
C. I. FREDERICK JR., P.E. CHIEF ENGINEER	6/18/09	J.E.C.	INSIDE DROP FOR EXISTING MANHOLE
DATE: 7/1/09			STANDARD NO. S-3

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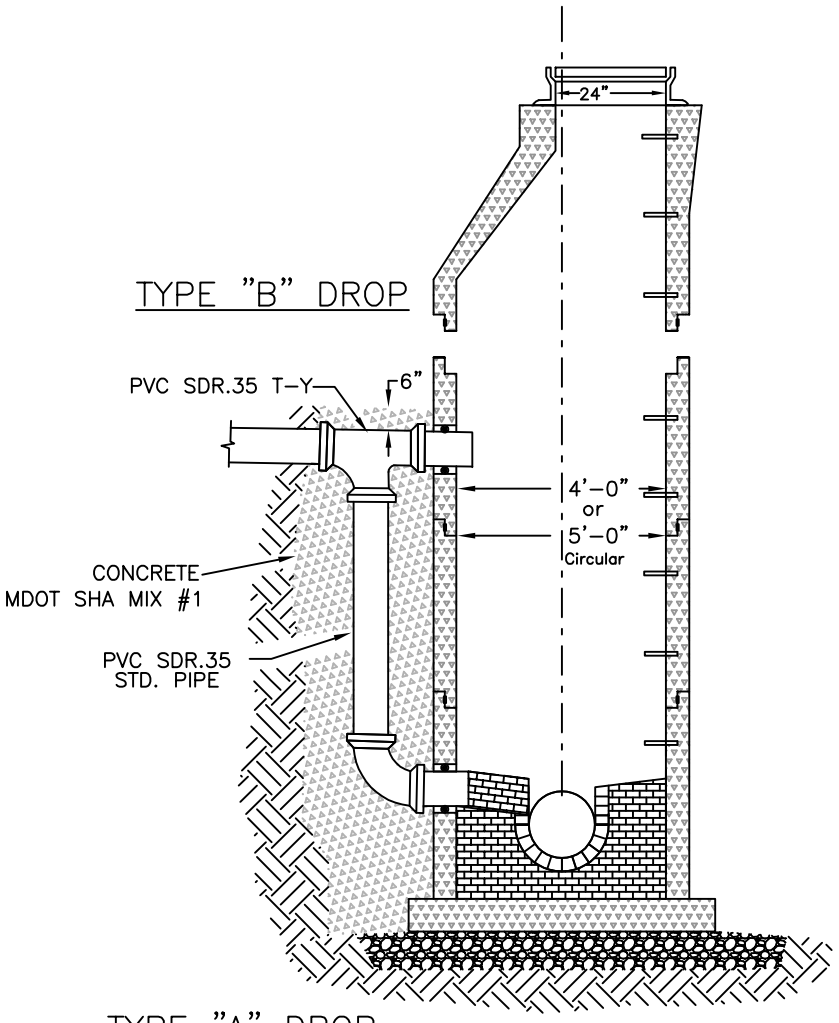
DROP CONNECTIONS			
Size of sewer	Type"A"		Type"B"
	max. drop	min. drop	min. drop
8"	3'–9"	2'–0"	3'–9"
10"	4'–0"	2'–0"	4'–0"
12"	6'–0"	2'–6"	6'–0"
15"	6'–0"	2'–6"	6'–0"

NOTES:
MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE, METCOM STANDARD S–2

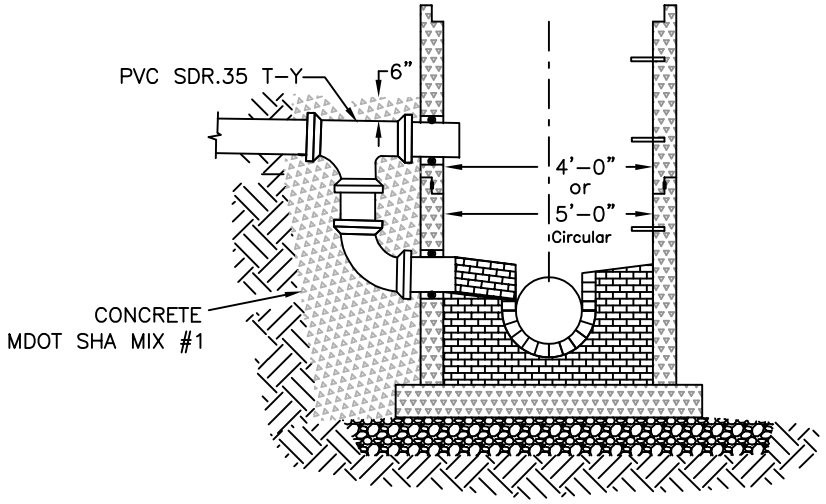
PRECAST STRUCTURE BASES WITH MONOLITHICALLY CAST 90° ELBOWS AND PRECAST CONCRETE COLLARS ON EXTERIOR PIPING SHALL BE ACCEPTABLE IN LIEU OF POURED CONCRETE.

A 5'0" DIAMETER MANHOLE IS REQUIRED IF MORE THAN ONE DROP IS PROPOSED.

TYPE "B" DROP



TYPE "A" DROP



APPROVED

M. C. HOLLANDER, P.E.
CHIEF ENGINEER

DATE: 7/11/19

REVISIONS	
DATE	INITIALS
6/18/09	J.E.C.
1/8/19	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

DROP MANHOLE FOR NEW CONSTRUCTION

STANDARD NO. S-4

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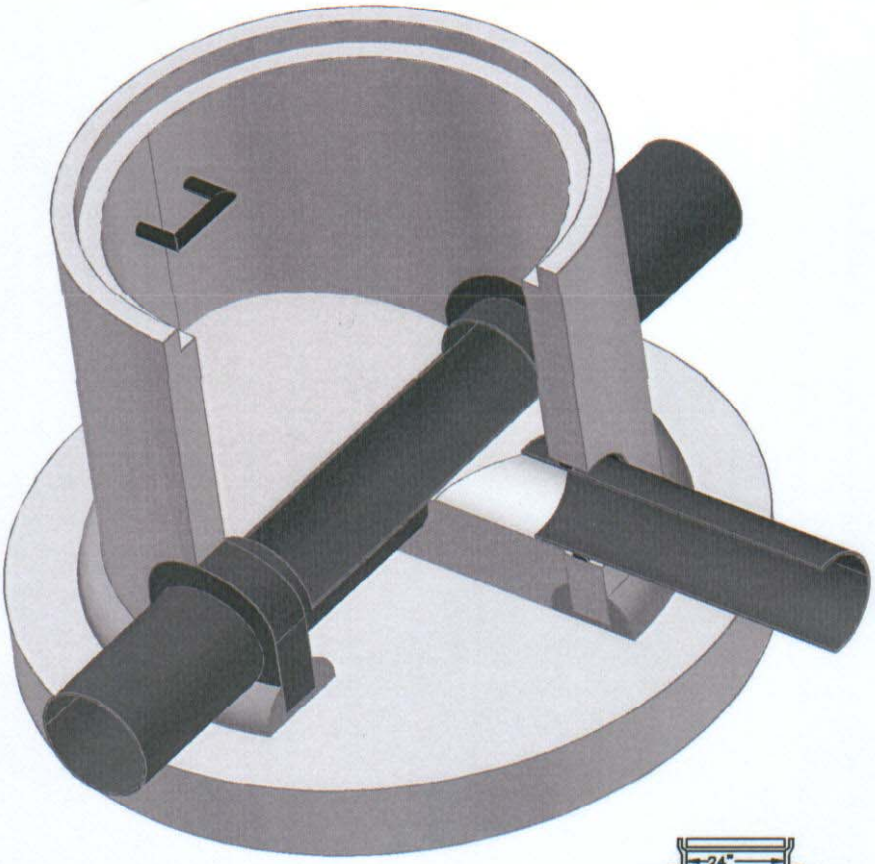


NOTES:

PRECAST DOGHOUSE MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE, METCOM STANDARD S-2 OR SHALLOW MANHOLE, METCOM STANDARD S-1.

INSIDE DROP CONNECTIONS SHALL NOT BE USED.

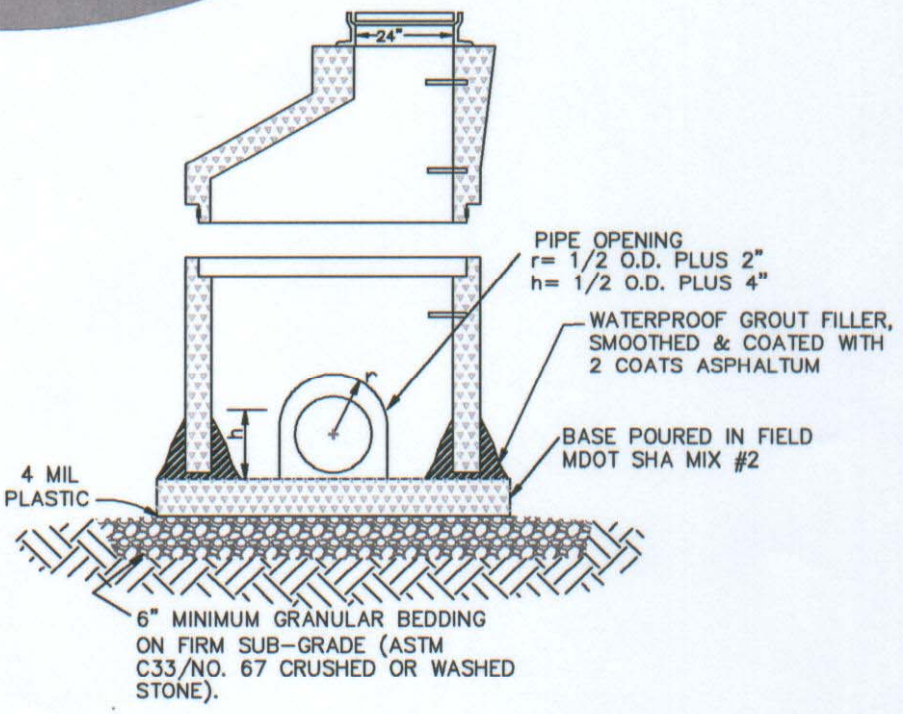
CHANNEL AND BENCH SHALL BE CONSTRUCTED IN ACCORDANCE WITH STANDARD DETAIL S-6.

CONNECTION BETWEEN MANHOLE WALL AND EXISTING SEWER PIPE SHALL BE SOLID BRICK, WATERPROOF CEMENT AND 2 COATS OF ASPHALTUM.

MANHOLE SHALL BE 5' IN DIAMETER UNLESS OTHERWISE SPECIFIED BY THE ENGINEER.

PRECAST BASE SECTION SHALL BE PERMISSABLE.

MANHOLE SHALL NOT BE INSTALLED OVER A BELL OR JOINT.



St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** MANHOLE BUILT OVER EXISTING SEWER MAIN (12" OR SMALLER) **STANDARD NO. S-5**

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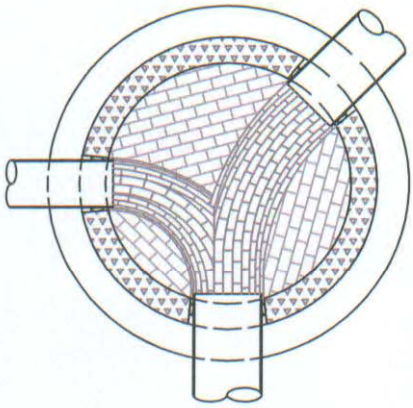
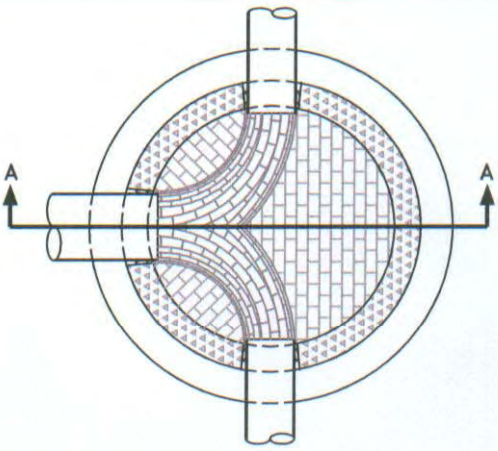
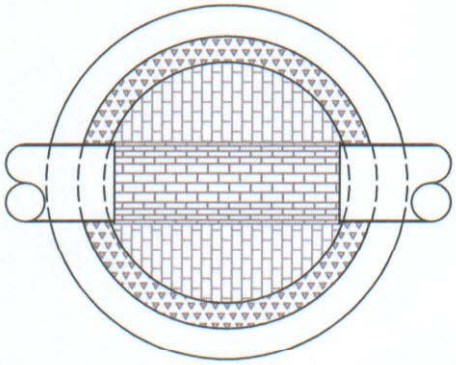
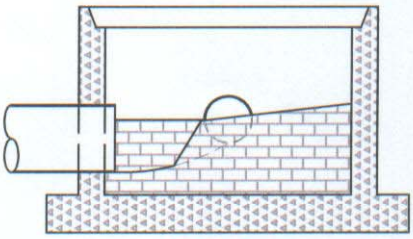
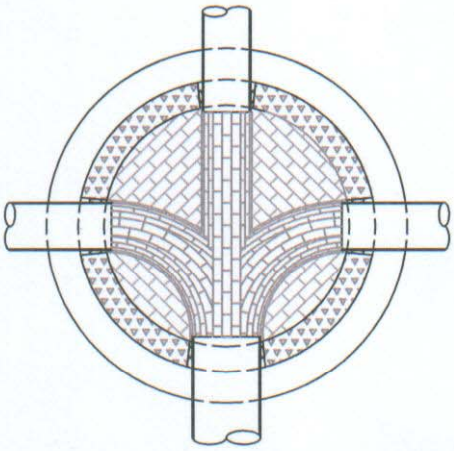


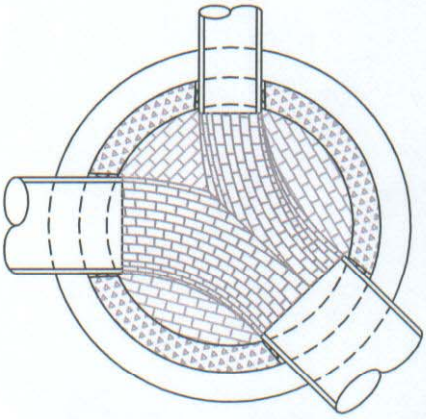






SECTION "A–A"





Notes:

1. Minimum fall across the manhole shall be 0.2' unless approved by the Engineer.
2. Angle between inlet and outlet pipe shall not be less than 90 degrees.
3. All brick shall be solid sewer manhole brick.
4. Brick in channel invert shall be laid on edge.
5. Concrete channels may be substituted for brick with the approval of the Engineer.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** MANHOLE CHANNELS (TYPICAL) **STANDARD NO. S-6**

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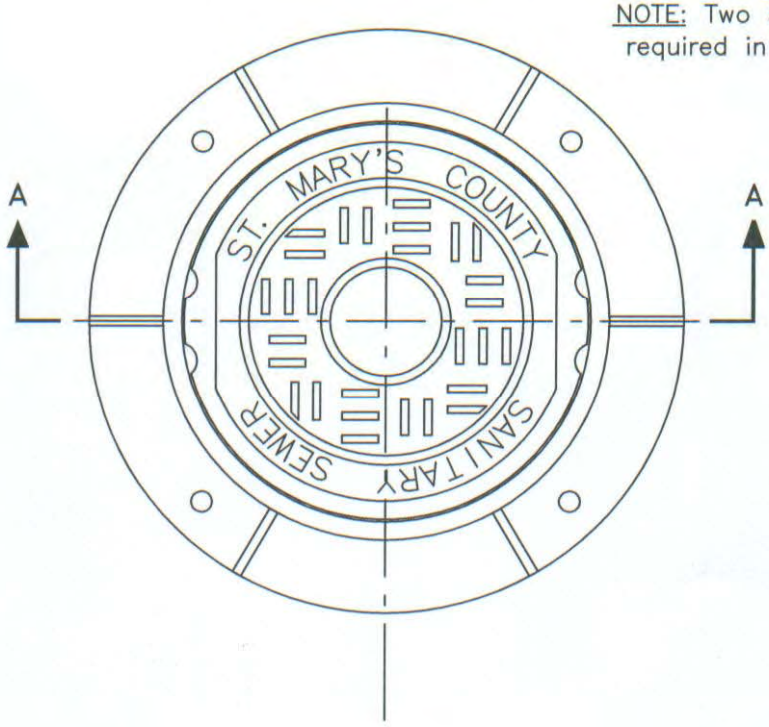
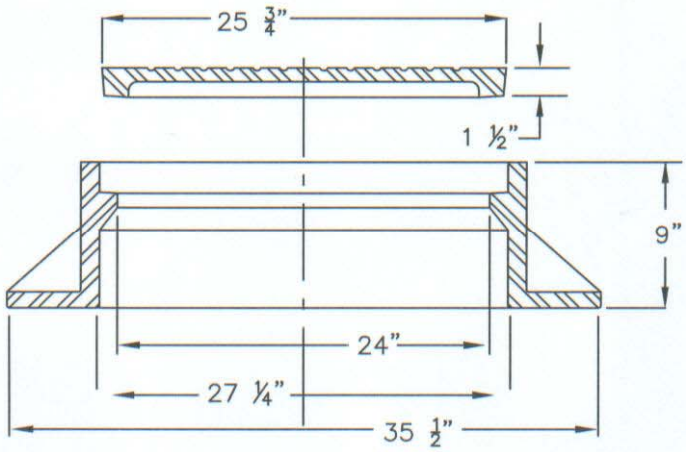
NOTE: Two 5/8" vent holes required in manhole cover.



SECTION A–A



NOTE:

1. Material used will be similar to ASTM Spec. A–48, Class 30 cast iron.
2. Pattern to be made of core type, provide rapping plates on pattern.
3. Average total weight – 505 lbs.

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** STANDARD HEAVY TRAFFIC MANHOLE FRAME AND COVER **STANDARD NO. S-7**

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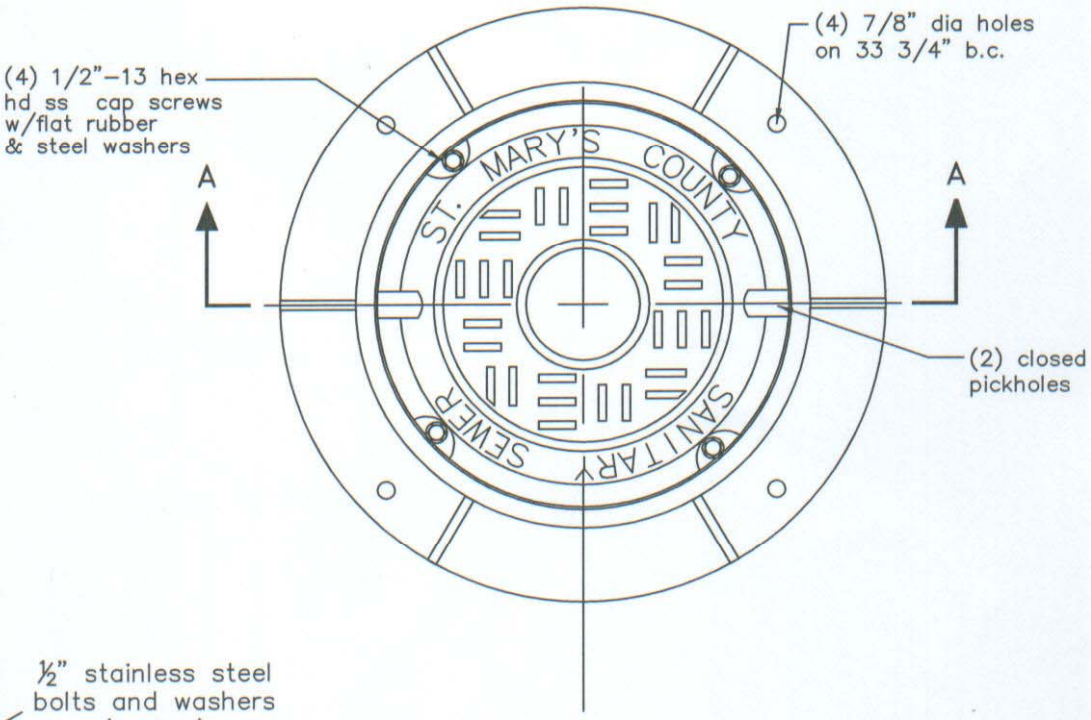
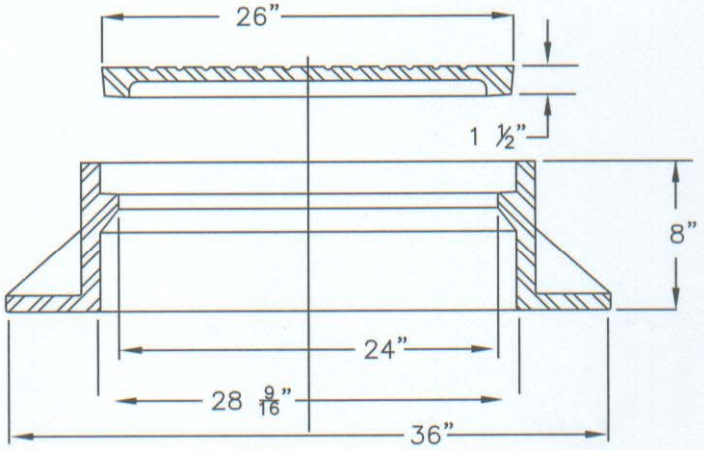
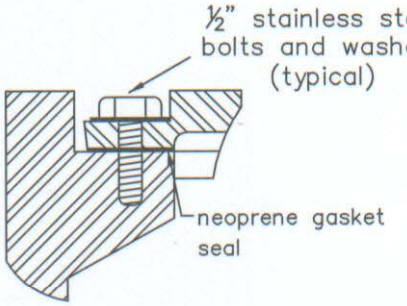


SECTION A–A





BOLTING DETAIL

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** WATERTIGHT MANHOLE FRAME AND COVER **STANDARD NO. S-8**

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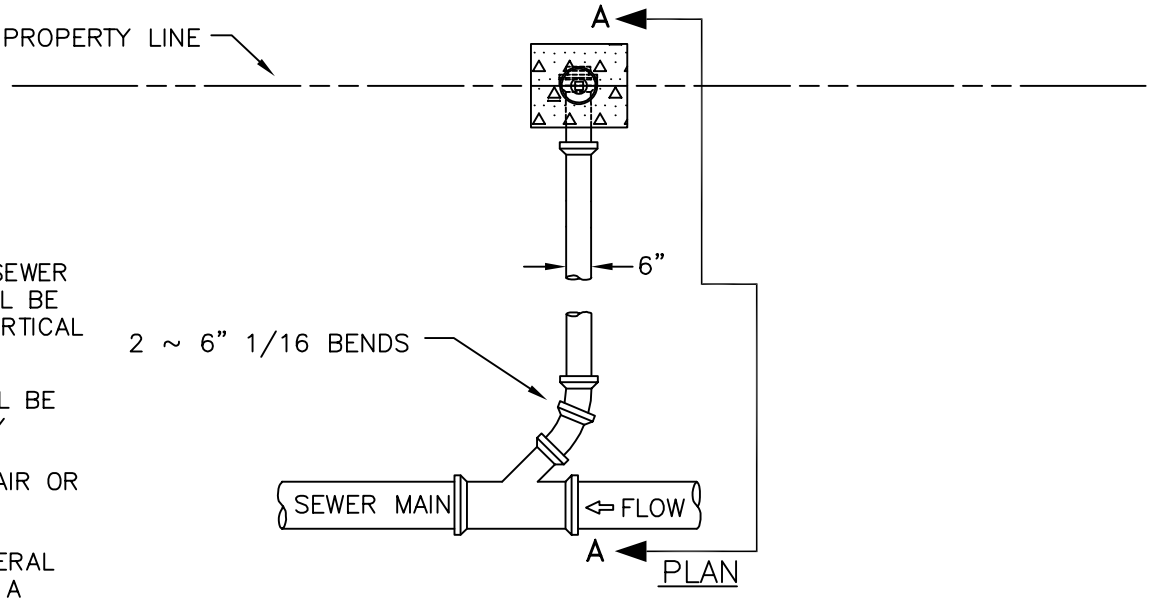


NOTES:

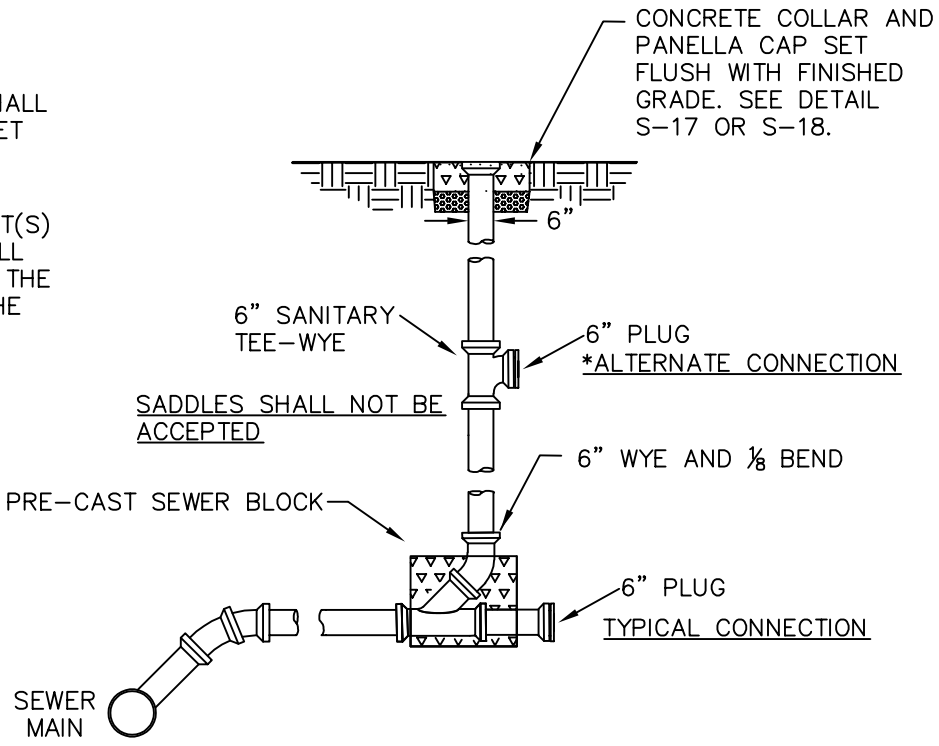
PRE-CAST SEWER BLOCK SHALL BE USED ON VERTICAL WYE

PLUGS SHALL BE SUFFICIENTLY BLOCKED TO WITHSTAND AIR OR WATER TEST

SERVICE LATERAL SHALL HAVE A MINIMUM SLOPE OF NO LESS THAN 2%

SERVICE LATERAL SHALL NOT EXCEED 100 FEET IN LENGTH BETWEEN CLEANOUTS

ADDITIONAL CLEANOUT(S) WHEN REQUIRED SHALL BE CONSTRUCTED IN THE SAME MANNER AS THE SERVICE CONNECTION SETTING.



SECTION A-A
PROFILE

SECTION A-A
MATERIAL SAME AS MAIN

*ALTERNATE CONNECTION REQUIRES THE PRIOR APPROVAL OF THE ENGINEER.

	APPROVED	**REVISIONS**	ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
	M. C. HOLLANDER, P.E. CHIEF ENGINEER	6/18/09 J.E.C.	SEWER SERVICE CONNECTION SINGLE SETTING
	DATE: 7/11/19	1/8/19 J.E.C.	**STANDARD NO. S-10**

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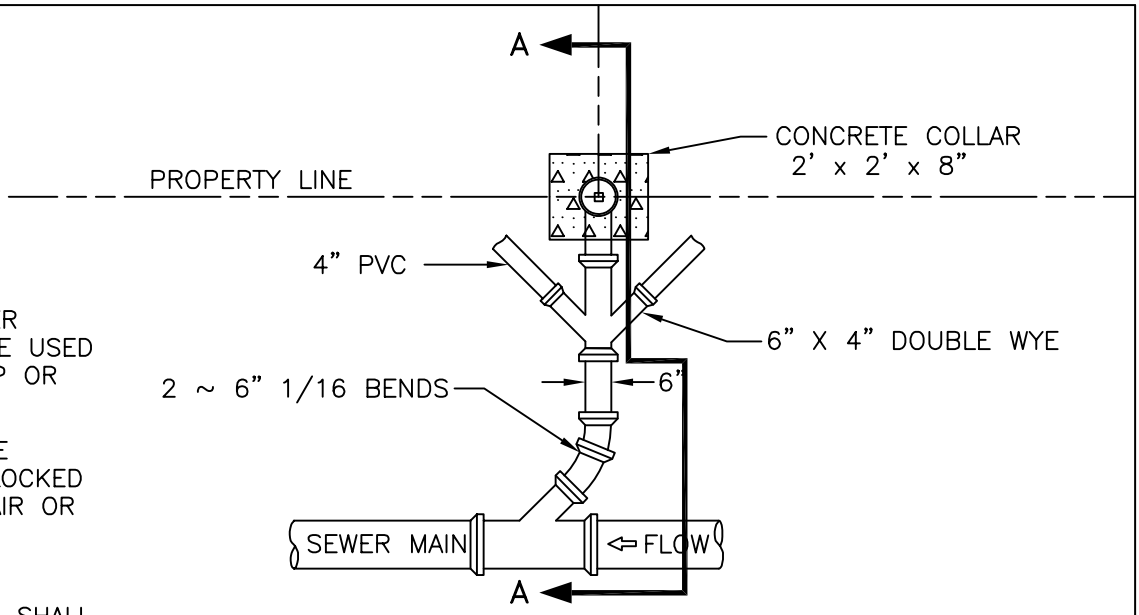


PLAN

NOTES:

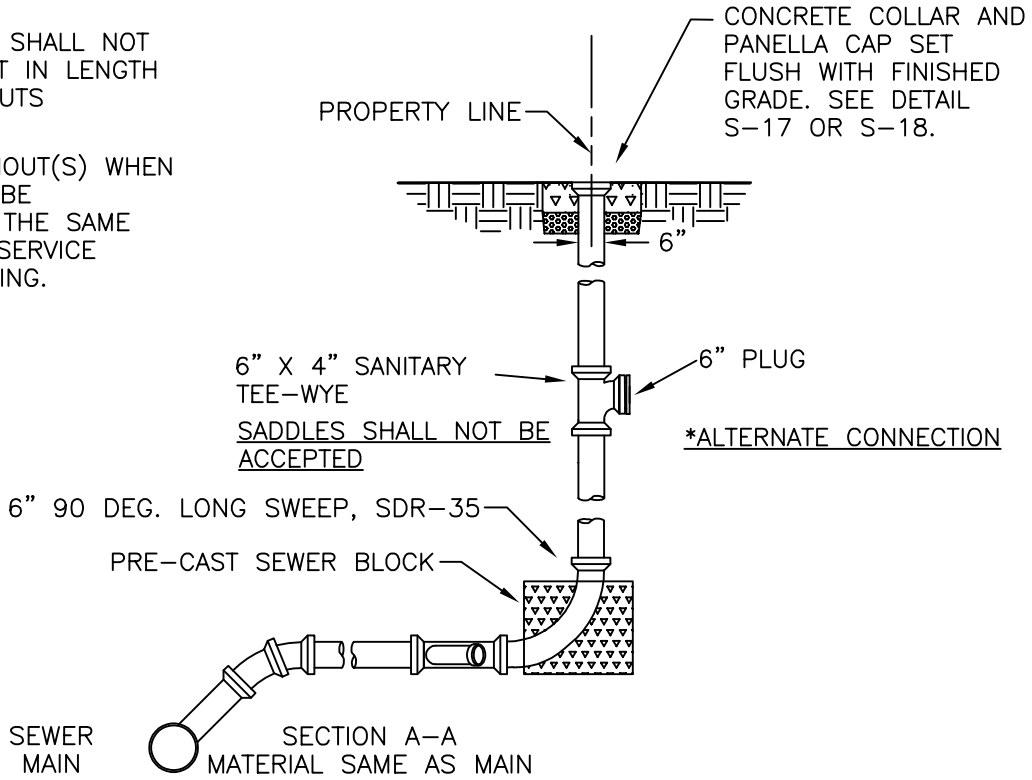
PRE-CAST SEWER BLOCK SHALL BE USED ON LONG SWEEP OR VERTICAL WYE

PLUGS SHALL BE SUFFICIENTLY BLOCKED TO WITHSTAND AIR OR WATER TEST

SERVICE LATERAL SHALL HAVE A MINIMUM SLOPE OF NO LESS THAN 2%

SERVICE LATERAL SHALL NOT EXCEED 100 FEET IN LENGTH BETWEEN CLEANOUTS

ADDITIONAL CLEANOUT(S) WHEN REQUIRED SHALL BE CONSTRUCTED IN THE SAME MANNER AS THE SERVICE CONNECTION SETTING.



SECTION A-A
PROFILE

*ALTERNATE CONNECTION REQUIRES THE PRIOR APPROVAL OF THE ENGINEER

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		5/2/08	J.E.C.	SEWER SERVICE CONNECTION TWIN SETTING (RETROFIT ONLY)
		1/8/19	J.E.C.	
				STANDARD NO. S-11

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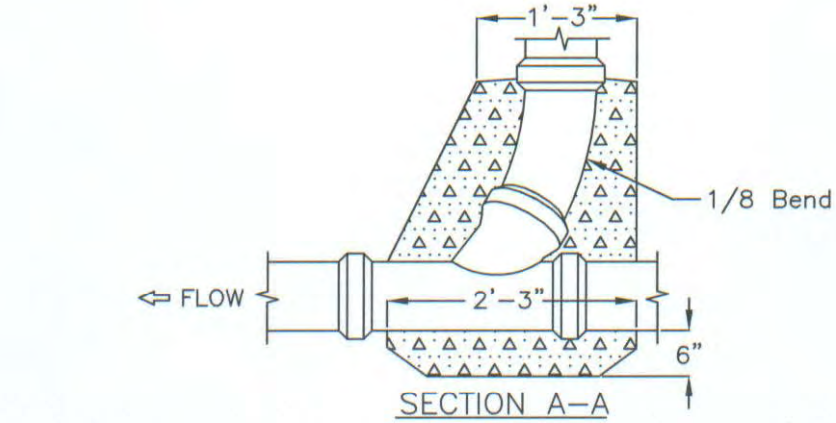
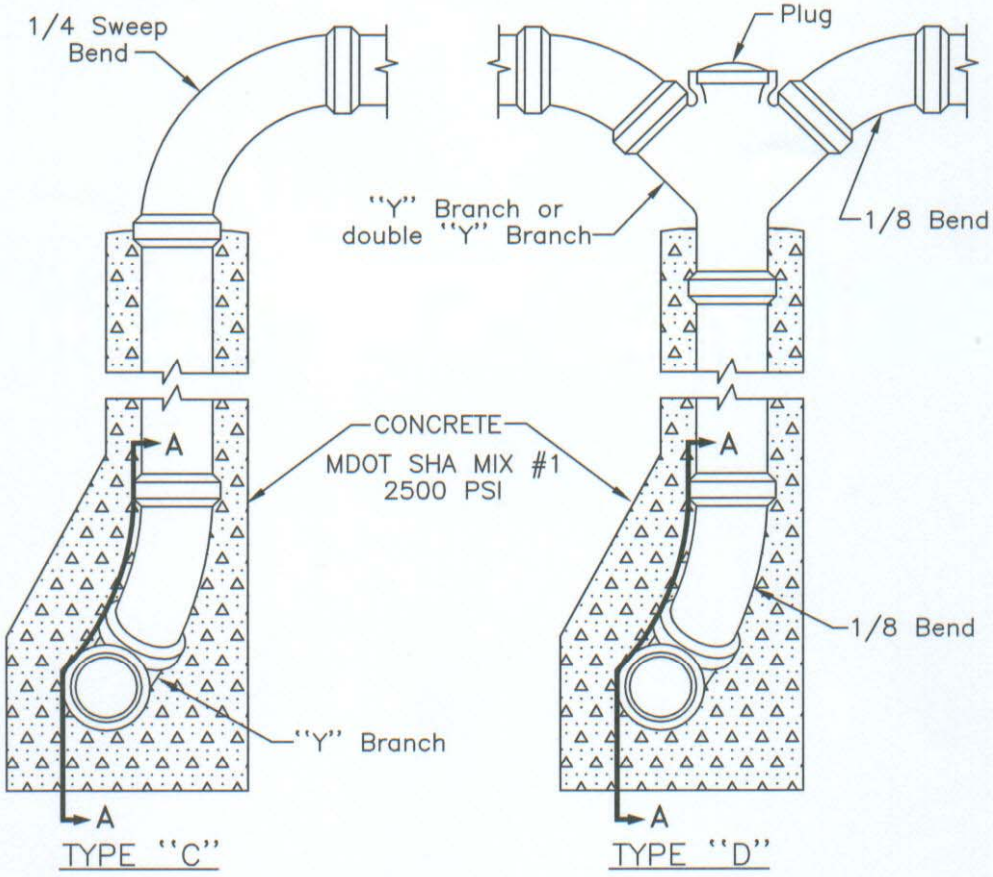


SECTION A–A



TYPE "C" TYPE "D"

NOTE:
1. GLASS LINED D.I.P. OR APPROVED EQUAL SHALL BE USED WHEN THE DEPTH OF MAIN IS 18' OR GREATER
2. TYPE "D" CONNECTION SHALL NOT BE USED FOR NEW CONSTRUCTION. (RETROFIT ONLY)

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			DEEP SEWER SERVICE CONNECTIONS
			STANDARD NO. S-12

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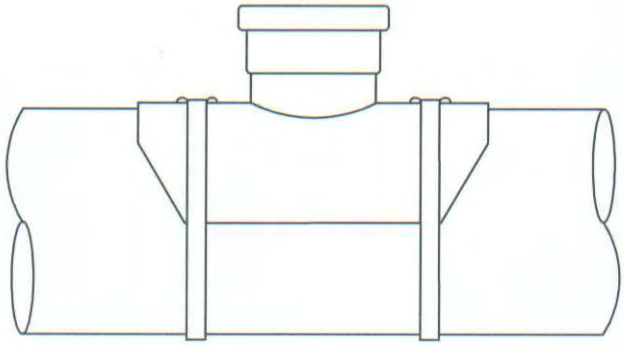
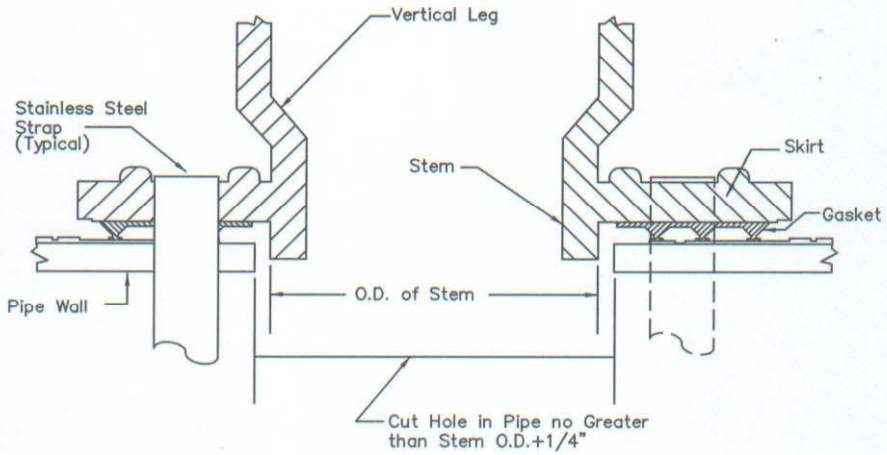
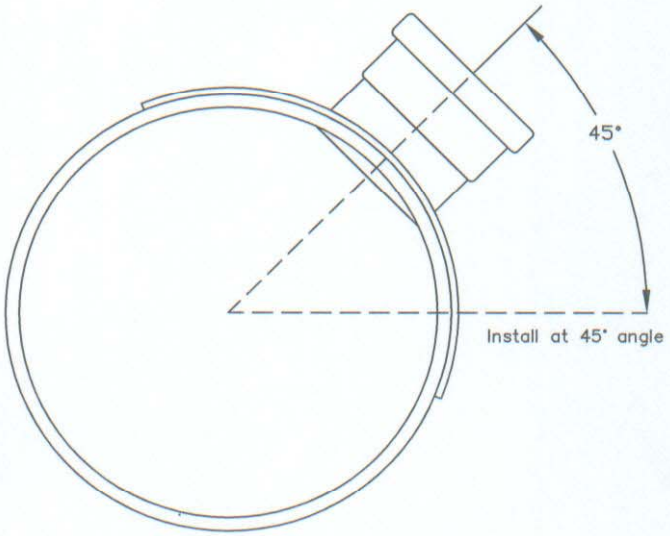


Smooth PVC pipe saddle (tee)





St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** SMOOTH PVC GASKETED TEE PIPE SADDLE FOR SEWER MAINS UP TO 12" **STANDARD NO. S-13**	

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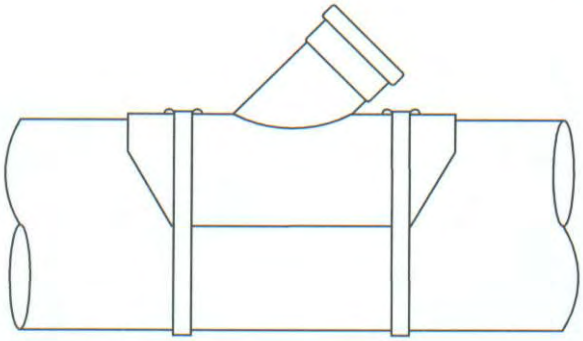
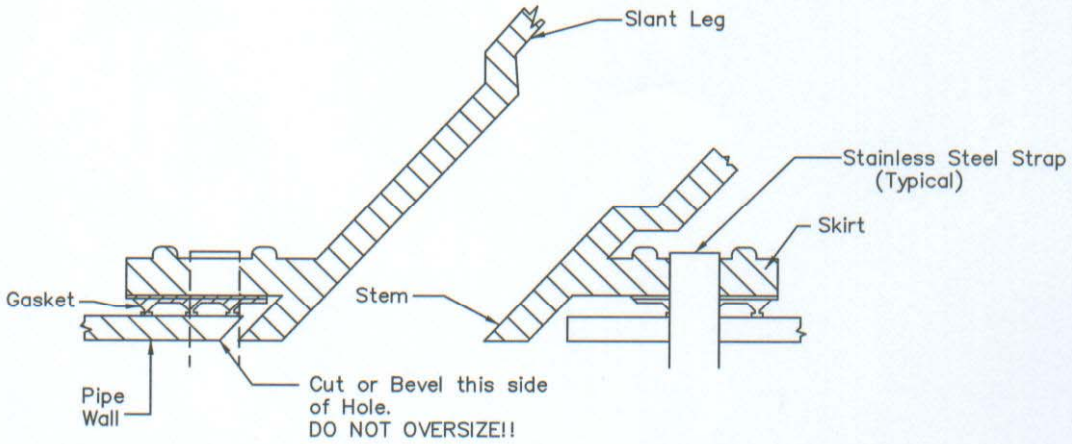
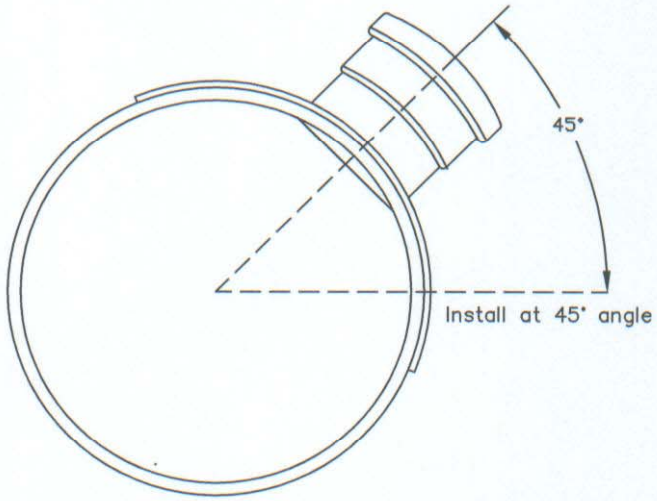


SMOOTH PVC PIPE SADDLE (WYE)





St. Mary's County Metropolitan Commission Since 1964 Portable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** SMOOTH PVC GASKETED WYE PIPE SADDLE FOR SEWER MAINS UP TO 12" **STANDARD NO. S-14**

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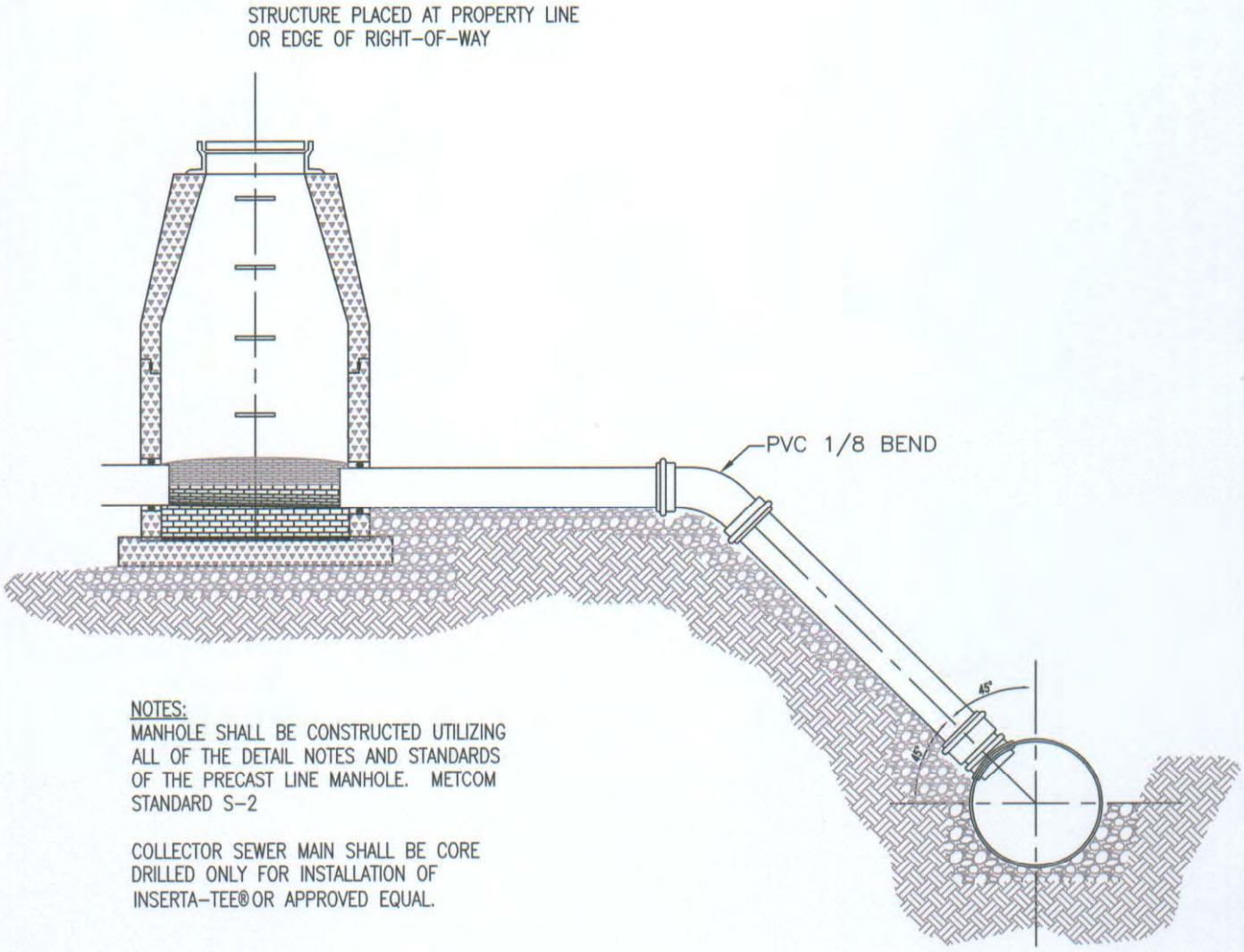

NOTES:
MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S-2

COLLECTOR SEWER MAIN SHALL BE CORE DRILLED ONLY FOR INSTALLATION OF INSERTA-TEE® OR APPROVED EQUAL.

	APPROVED	**REVISIONS**	*ST. MARY'S COUNTY METROPOLITAN COMMISSION*
		DATE / INITIALS	***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		6/18/09 J.E.C.	CONNECTION TO LARGE DIAMETER SEWER >12"
	C. I. FREDERICK JR., P.E. CHIEF ENGINEER		
	DATE: 7/1/09		**STANDARD NO. S-15**

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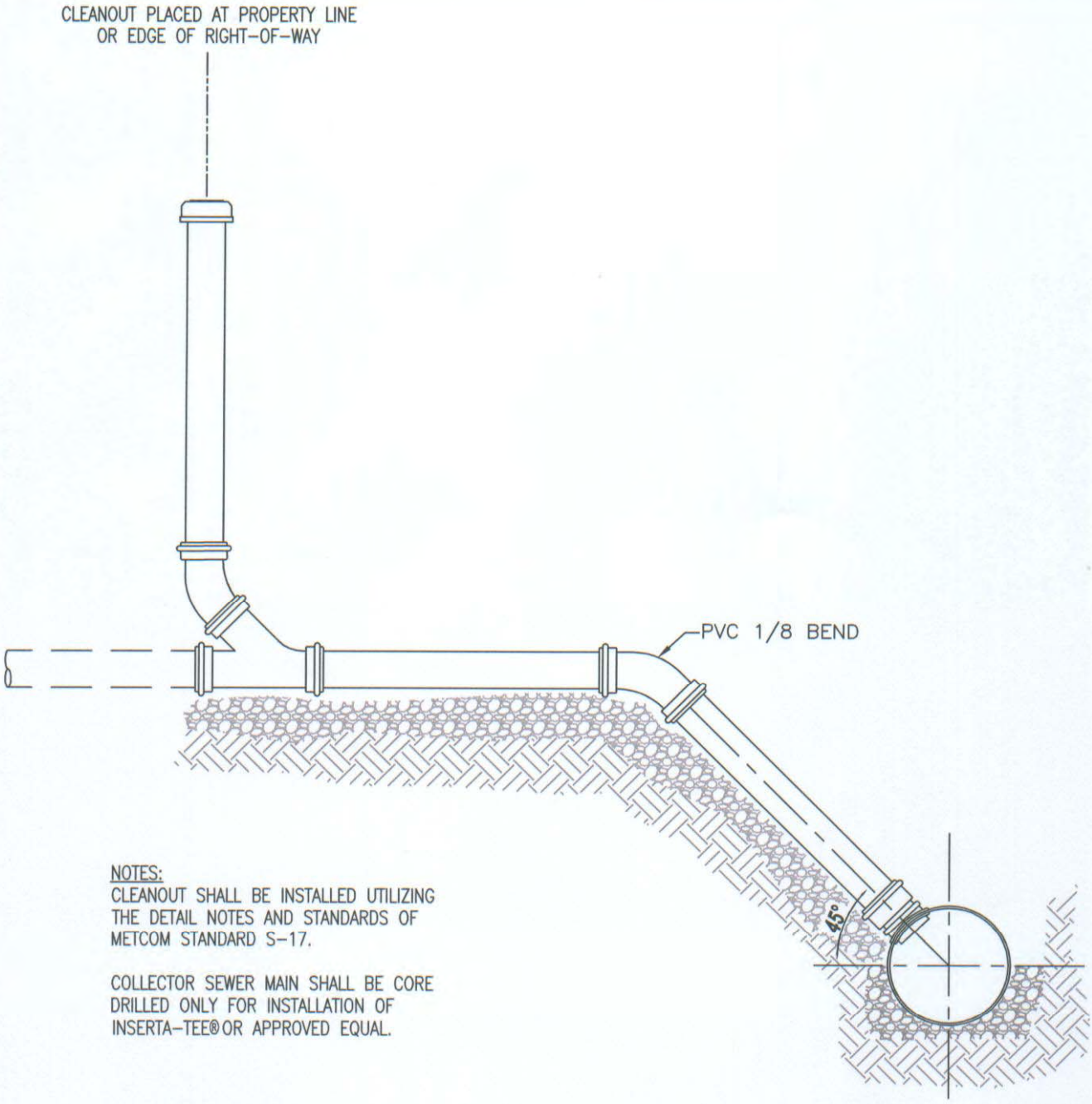

NOTES:
CLEANOUT SHALL BE INSTALLED UTILIZING THE DETAIL NOTES AND STANDARDS OF METCOM STANDARD S-17.

COLLECTOR SEWER MAIN SHALL BE CORE DRILLED ONLY FOR INSTALLATION OF INSERTA-TEE® OR APPROVED EQUAL.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			SINGLE SERVICE CONNECTION TO EXISTING LARGE DIAMETER SEWER >12"
			STANDARD NO. S-16

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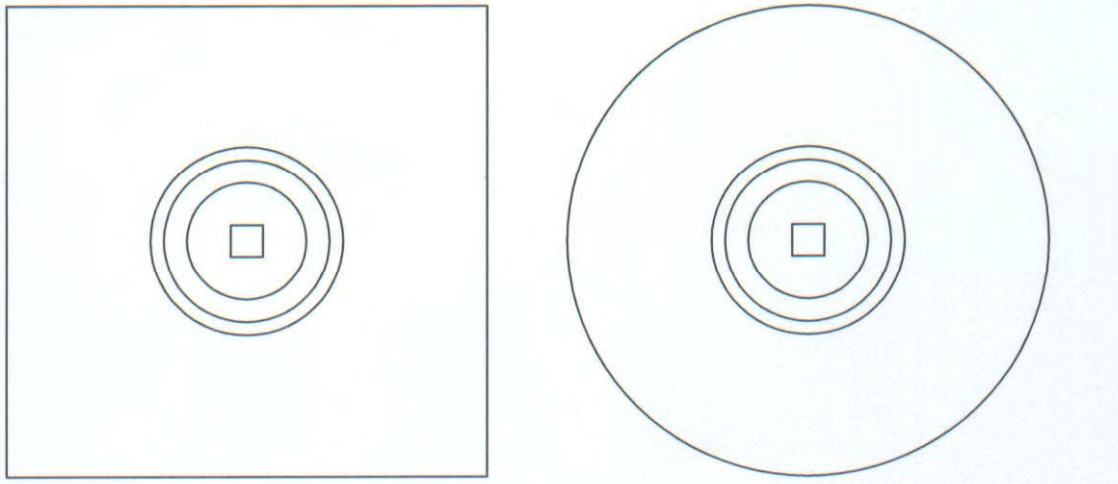
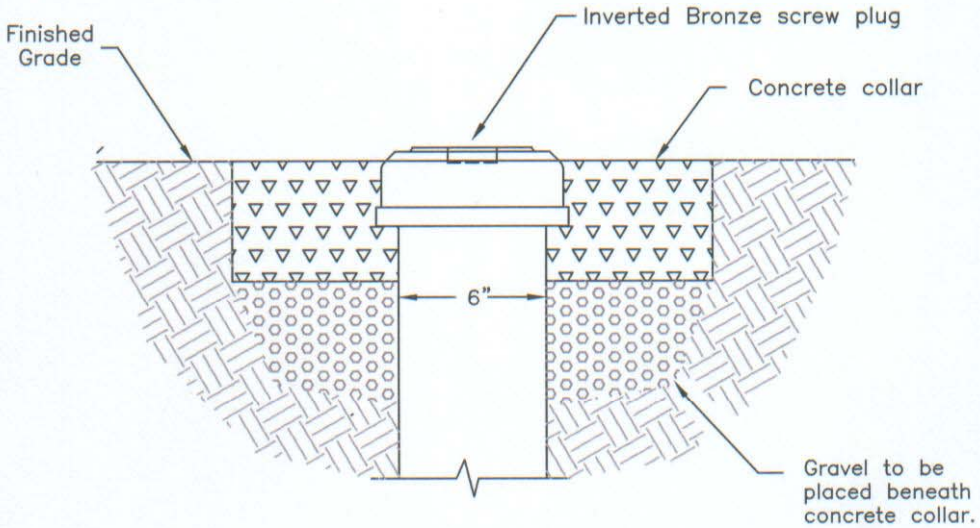


PLAN



ELEVATION

Notes:

Panella style cap shall be made of cast or ductile iron with a bronze screw plug and have an integral watertight gasket to seal against the outer wall of the pipe.

Concrete shall be MDOT SHA Mix #1

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** CLEANOUT CAP **STANDARD NO. S-17**

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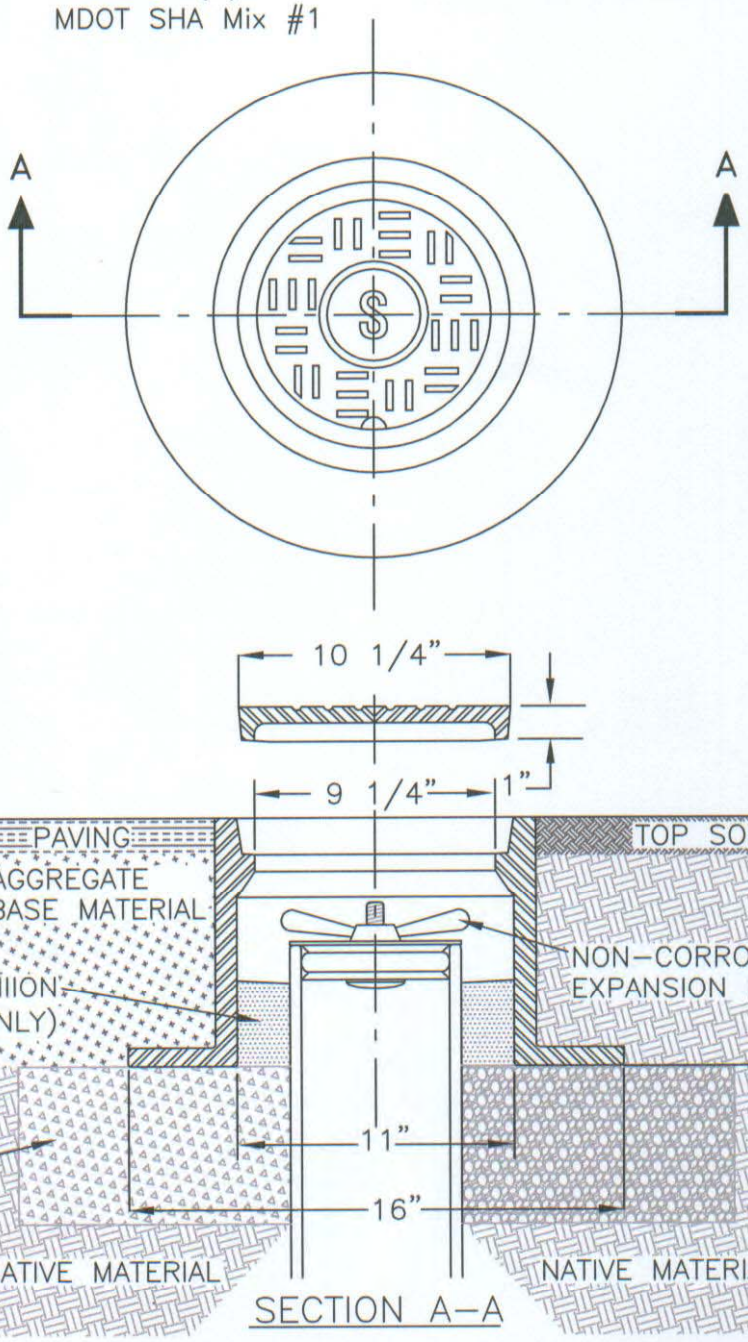
NOTES:

1. MATERIALS USED SHALL BE SIMILAR TO ASTM SPEC. A–48 CLASS 30 CAST IRON.

2. IN VEHICULAR TRAFFIC AREAS NOT PAVED, PROVIDE A 2'X2'X8" (H) SQUARE CONCRETE ENCASEMENT MDOT SHA Mix #1



SECTION A–A

	APPROVED	**REVISIONS**	*ST. MARY'S COUNTY METROPOLITAN COMMISSION*
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		6/18/09 J.E.C.	
	C. I. FREDERICK JR., P.E. CHIEF ENGINEER		STANDARD CLEANOUT COVER
	DATE: 7/1/09		**STANDARD NO. S-18**

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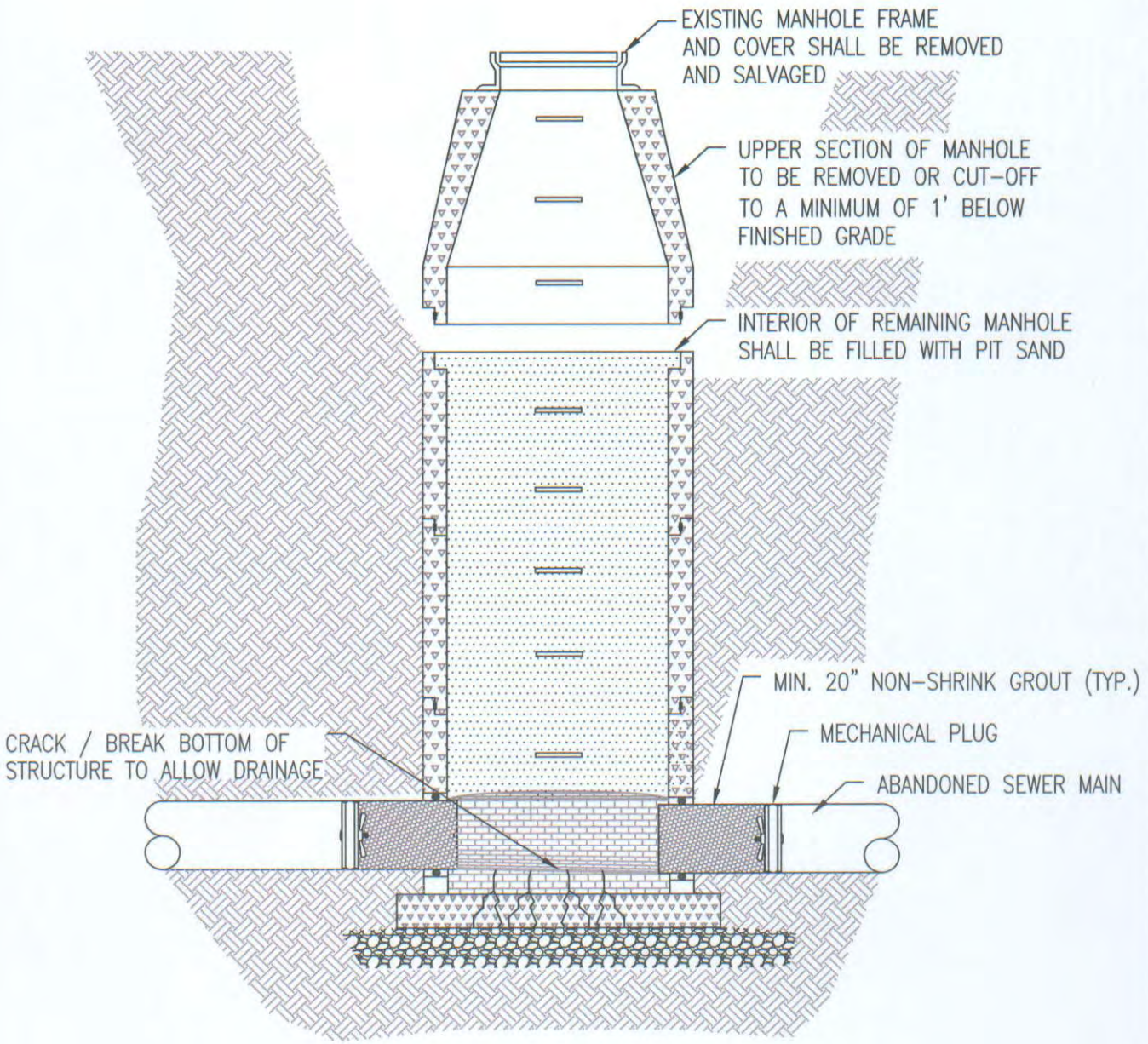

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** SEWER MANHOLE ABANDONMENT (TYPICAL) **STANDARD NO. S-19**
		DATE	INITIALS	
		6/18/09	J.E.C.	

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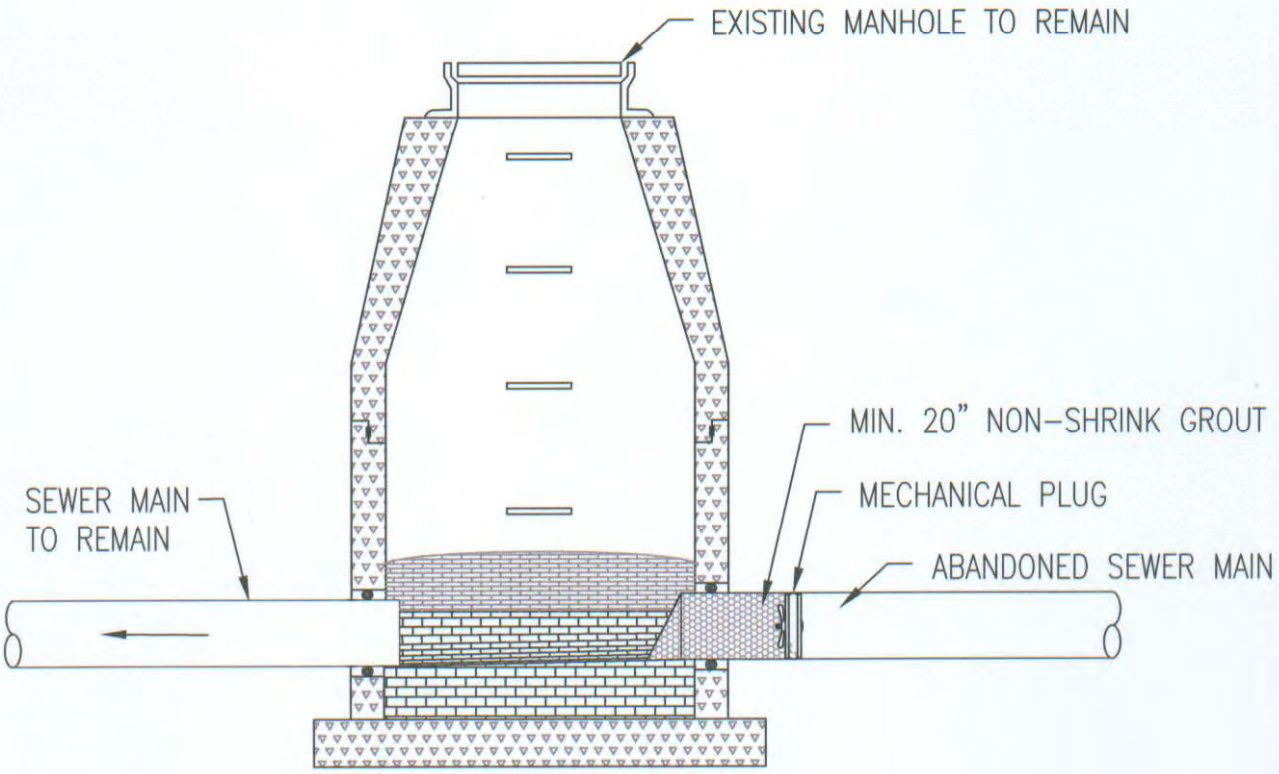

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** SEWER MAIN ABANDONMENT AT MANHOLE **STANDARD NO. S-20**

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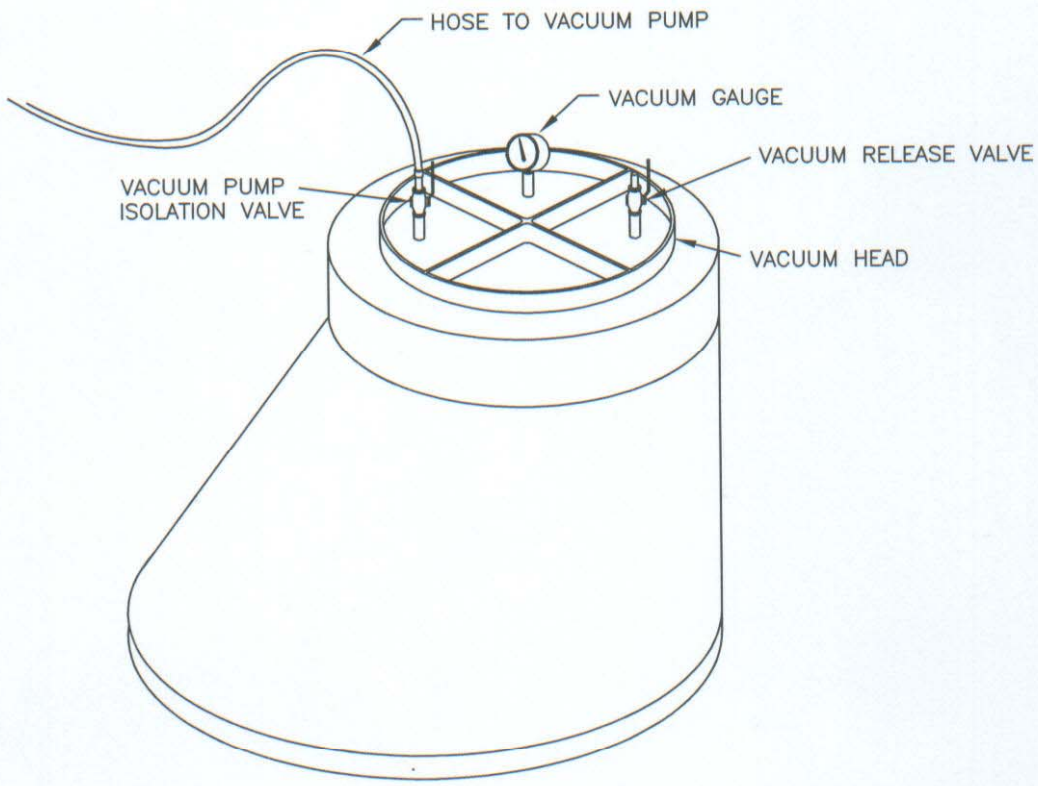
1. PLUG ALL CHANNEL INLETS AND OUTLETS IN THE MANHOLE BASE AND BRACE EACH PLUG.
2. PLACE THE VACUUM TEST HEAD ON THE TOP OF THE SURFACE OF THE MANHOLE. (CONE OR CAST IRON CASTING. USE APPROPRIATE TEST HEAD FOR APPLICATION.)
3. START THE VACUUM PUMP.
4. OPEN THE BALL VALVE INITIATING THE VACUUM IN THE MANHOLE. THE HIGH VOLUME VACUUM PUMP WILL SEAL THE TEST HEAD TO THE MANHOLE UNDER TEST.
5. WHEN THE VACUUM REACHES 10" Hg, SHUT OFF THE VACUUM BALL THUS ISOLATING THE VACUUM INSIDE THE MANHOLE. A PRESSURE RELIEF VALVE SHOULD BE PRESENT ON THE EQUIPMENT WHICH WILL ALLOW THE VACUUM PUMP TO IDLE DURING THE TEST WITHOUT CAUSING ANY DAMAGE.
6. MEASURE THE TIME WHICH THE VACUUM IN THE MANHOLE UNDER TEST FALLS TO 9" Hg.
7. RECORD THE TIME
8. RELEASE THE VACUUM IN THE MANHOLE BY OPENING THE VACUUM RELEASE VALVE ON THE TEST HEAD.
9. REFER TO SPECIFICATIONS FOR SPECIFIC TESTING CRITERIA.



St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** MANHOLE VACUUM TESTING **STANDARD NO. S-21**

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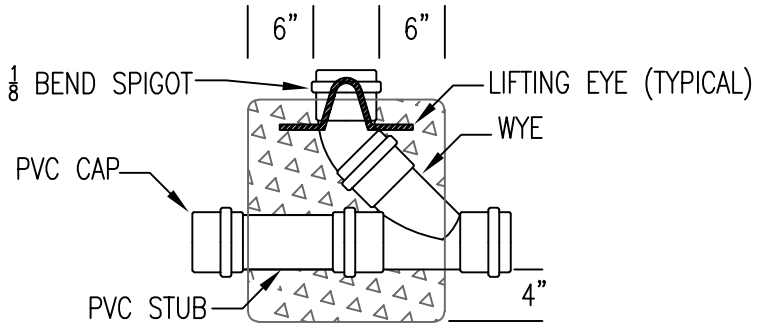

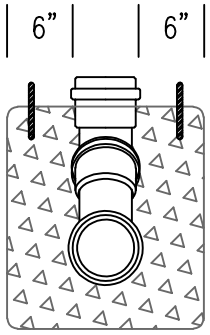

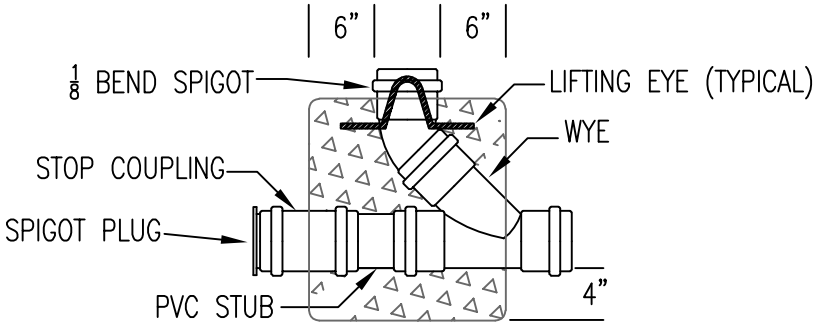

ALTERNATE SERVICE CONNECTION

NOTES:

1. ALL PIPE AND FITTINGS SHALL BE PVC SDR 35 AND THE SAME SIZE AS THE SHC LATERAL
2. CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 3000 PSI AT 23 DAYS
3. CONCRETE AST ON SITE SHALL BE CURED 7 DAYS PRIOR TO INSTALLATION
4. APPROVED MANUFACTURER'S PRECAST SHALL AT LEAST 80% OF REQUIRED STRENGTH BEFORE DELIVERY
5. 2 LIFTING EYES SHALL BE PROVIDED AS SHOWN
6. UPON INSTALLATION CAP OR PLUG MUST BE ADEQUATELY BRACED TO WITHSTAND AIR TESTING
7. DIMENSIONS AS SHOWN ARE THE MINIMUM ACCEPTABLE

Since 1964	**APPROVED** Marc C. Hollander M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		1/17/19	J.E.C.	CAST GRAVITY SEWER SERVICE CLEAN-OUT BLOCK
				STANDARD NO. S-22

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Standard Details
Table of Contents

Low Pressure Sewer

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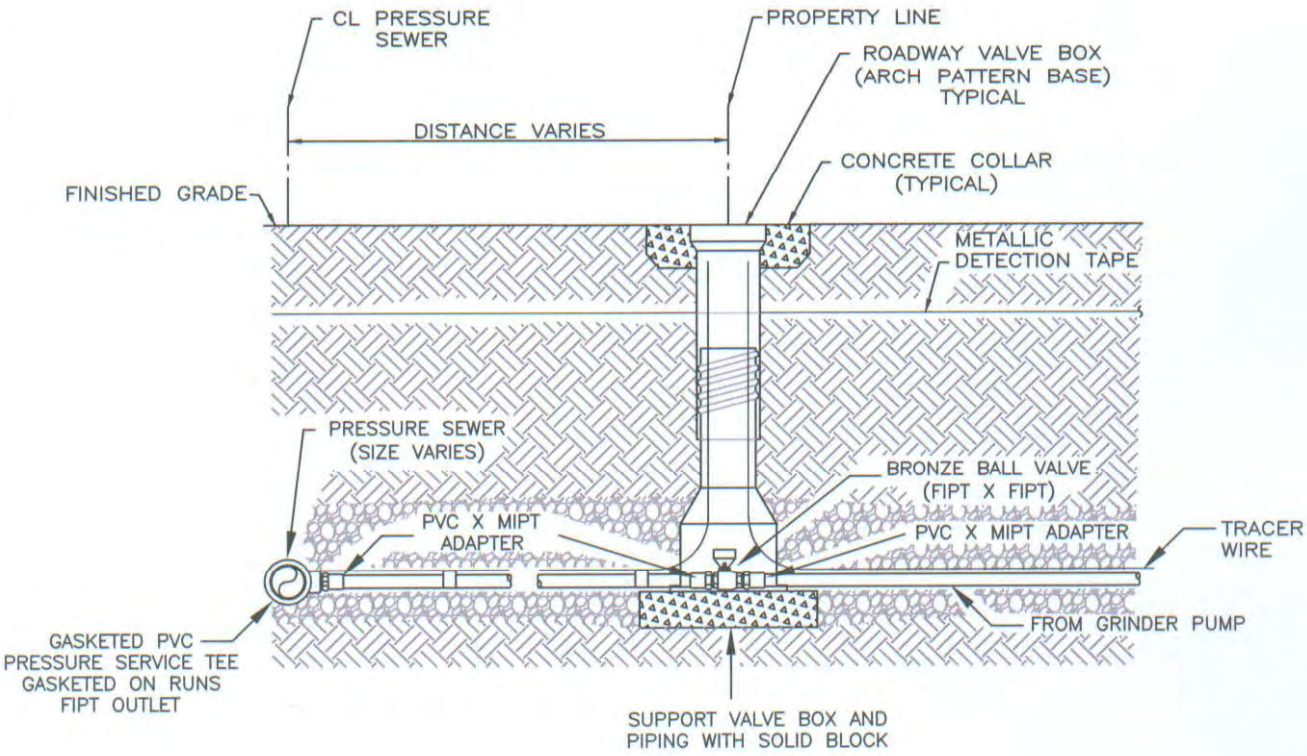

NOTES:

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

BRASS FITTINGS SHALL MEET MEET ASTM B176–95 STANDARD SPECIFICATION FOR COPPER–ALLOY DIE CASTINGS.

BRONZE BALL VALVES SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE SEWER PIPE.

ARCH OPENINGS IN VALVE BOX SHALL BE COVERED WITH ROOFING FELT TO PREVENT THE ENTRANCE OF BACKFILL MATERIAL.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

ALL PVC FITTINGS SHALL BE SCH 80.

HDPE PIPING SHALL BE FUSED JOINTS.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	
		6/18/09	J.E.C.	LOW PRESSURE SEWER SERVICE CONNECTION ASSEMBLY
				STANDARD NO. P-1

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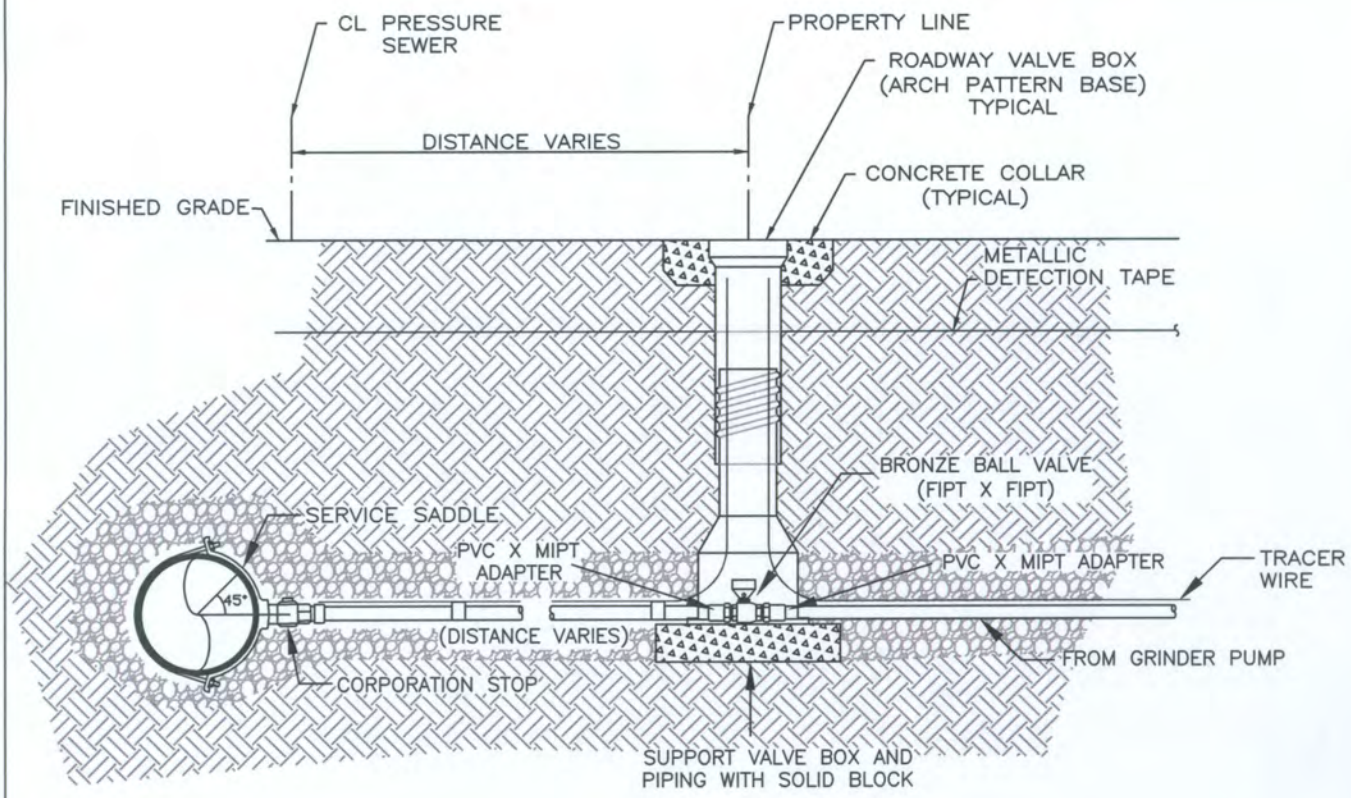

NOTES:

SADDLE AND CORPORATION STOP MAY BE ANGLED FROM HORIZONTAL TO NO MORE THAN 45°.

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

BRONZE BALL VALVES SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE SEWER PIPE.

ARCH OPENINGS IN VALVE BOX SHALL BE COVERED WITH ROOFING FELT TO PREVENT THE ENTRANCE OF BACKFILL MATERIAL.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

ALL PVC FITTINGS SHALL BE SCH 80.

HDPE PIPING SHALL BE FUSED JOINTS.

SADDLE SHALL BE MADE OF PVC AND DESIGNED TO WITHSTAND A MINIMUM OF 200 PSI AT 72° F.

CONNECTION TO THE TAPPING SADDLE SHALL BE MADE IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS

TAPPING OF MAINS LARGER THAN 2" SHALL REQUIRE THE APPROVAL OF THE ENGINEER

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/26/10	**REVISIONS** DATE / INITIALS: 6/18/09 J.E.C.; 7/23/10 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			LOW PRESSURE SEWER SERVICE CONNECTION ASSEMBLY WET TAP
			STANDARD NO. P-2

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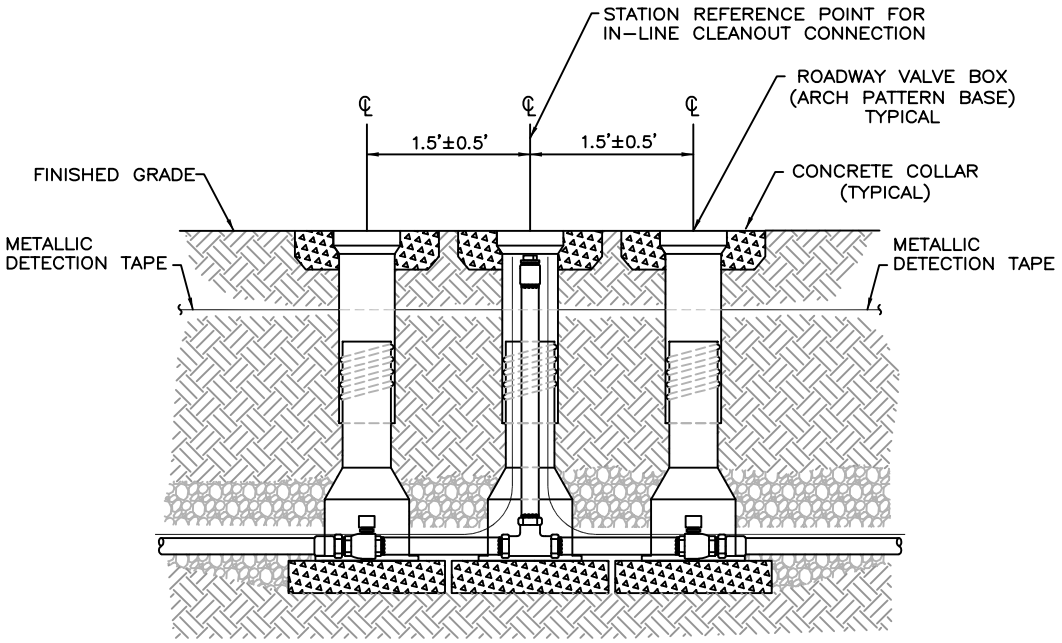

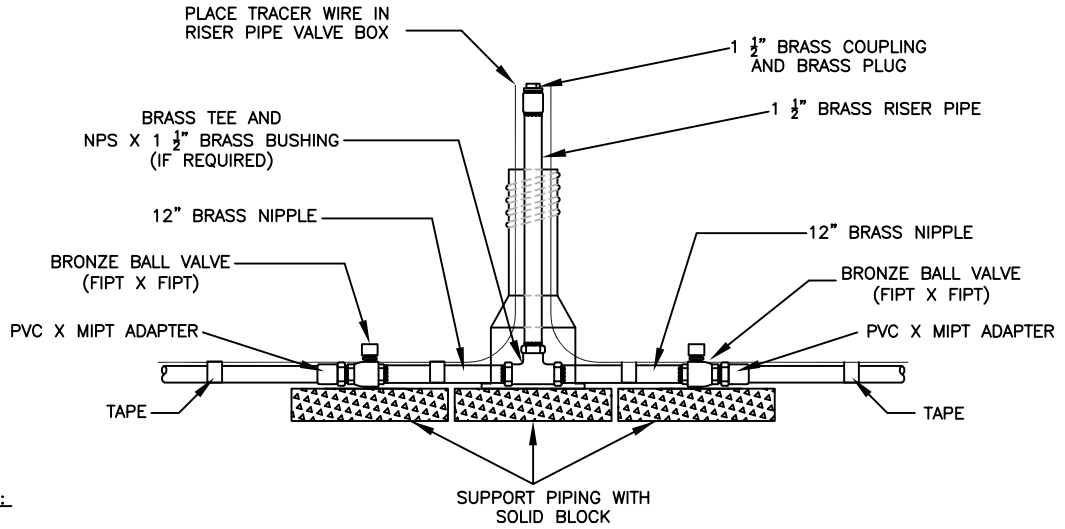

NOTES:

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

BRASS PIPING SHALL MEET MEET ASTM B43–98(2004) STANDARD SPECIFICATION FOR SEAMLESS RED BRASS PIPE, STANDARD SIZES.

BRASS FITTINGS SHALL MEET MEET ASTM B176–95 STANDARD SPECIFICATION FOR COPPER–ALLOY DIE CASTINGS.

BRONZE BALL VALVES SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE SEWER PIPE.

ARCH OPENINGS IN VALVE BOX SHALL BE COVERED WITH ROOFING FELT TO PREVENT THE ENTRANCE OF BACKFILL MATERIAL.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

BOND RISER PIPE TO TEE AND COUPLING USING SWEAT SOLDERING METHOD TO PREVENT ROTATION WHEN PLUG IS REMOVED.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/8/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** LOW PRESSURE SEWER DETAIL IN-LINE CLEANOUT FLUSHING CONNECTION **STANDARD NO. P-3**

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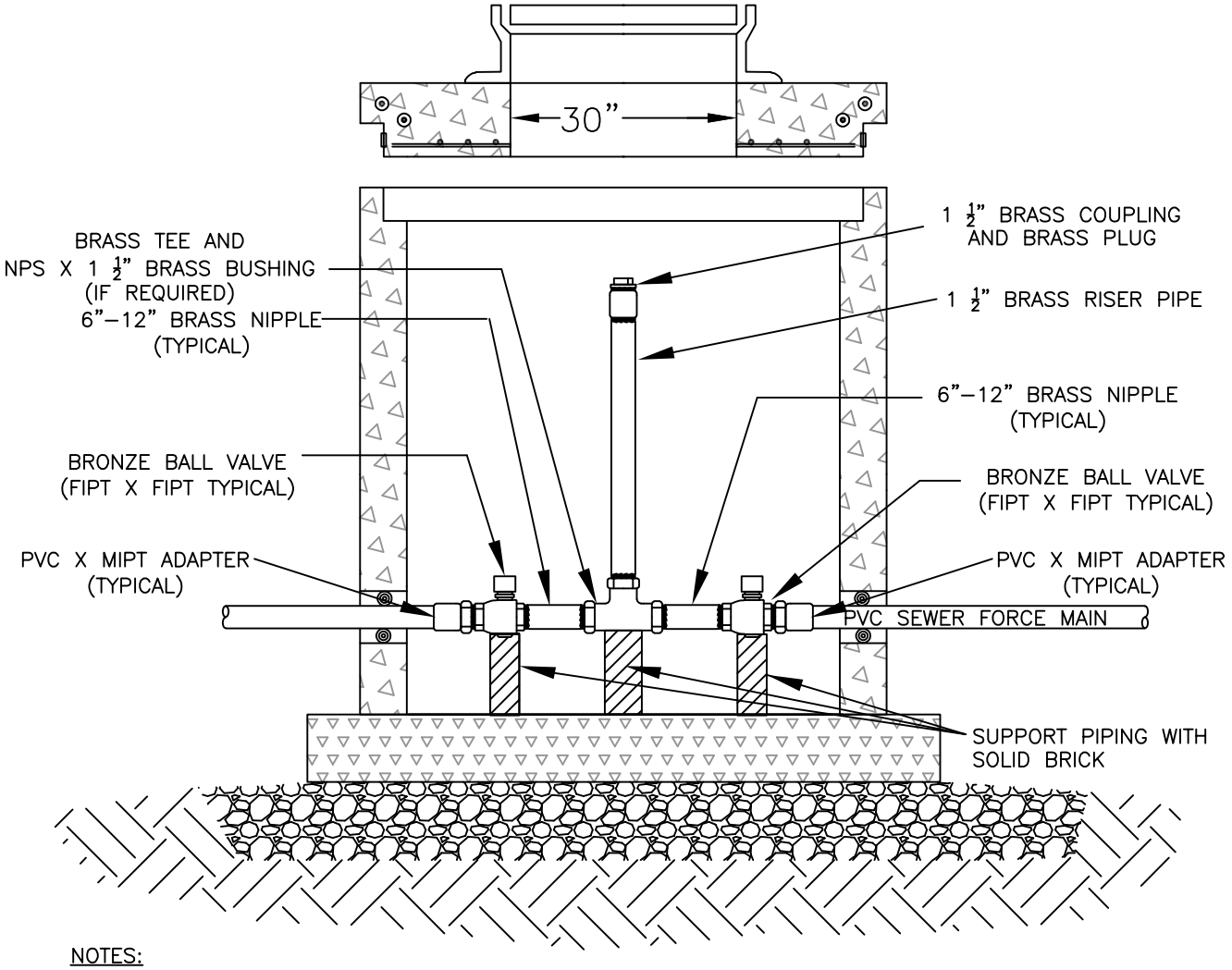

NOTES:

SHALLOW MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S–1

MANHOLE SHALL BE 48" IN DIAMETER

ACCESSWAY SHALL BE 30" IN DIAMETER

BLOCKING SHALL BE BRICK OR CONCRETE

BRASS PIPING SHALL MEET MEET ASTM B43–98(2004) STANDARD SPECIFICATION FOR SEAMLESS RED BRASS PIPE, STANDARD SIZES.

BRASS FITTINGS SHALL MEET MEET ASTM B176–95 STANDARD SPECIFICATION FOR COPPER–ALLOY DIE CASTINGS.

BRONZE BALL VALVE SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

BOND RISER PIPE TO TEE AND COUPLING USING SWEAT SOLDERING METHOD TO PREVENT ROTATION WHEN PLUG IS REMOVED.

VALVE SHALL BE ACCESSIBLE AND OPERATIONAL WITH A VALVE KEY THROUGH ACCESS WAY.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/8/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** LOW PRESSURE DETAIL IN-LINE FLUSHING CONNECTION IN TRAFFIC AREAS-SEWER LESS THAN 4" **STANDARD NO. P-4**

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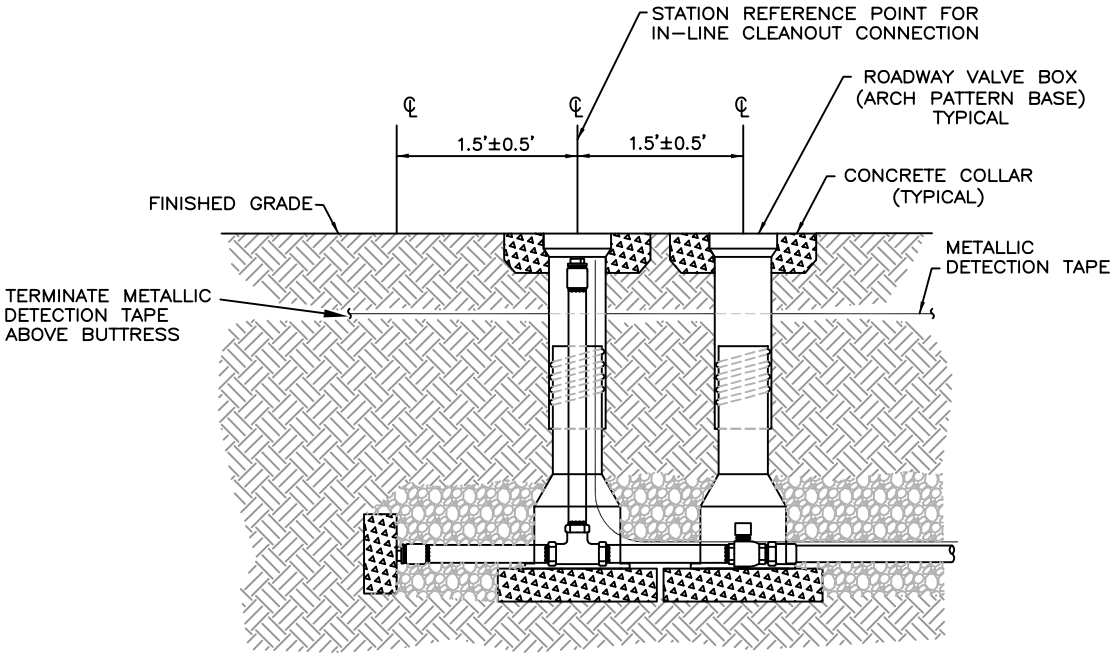

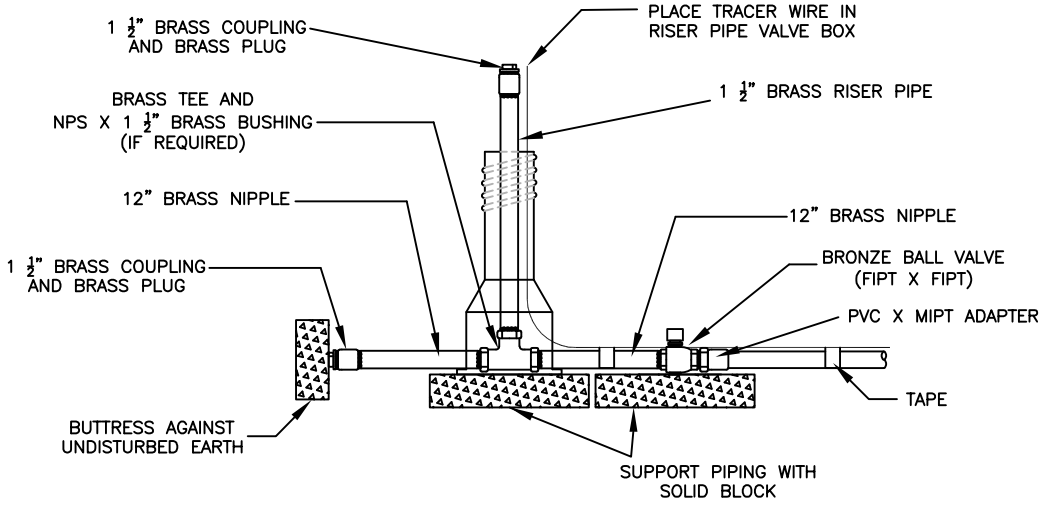

NOTES:

BLOCKING SHALL BE SOLID BLOCK OR CONCRETE.

BRASS PIPING SHALL MEET MEET ASTM B43-98(2004) STANDARD SPECIFICATION FOR SEAMLESS RED BRASS PIPE, STANDARD SIZES.

BRASS FITTINGS SHALL MEET MEET ASTM B176-95 STANDARD SPECIFICATION FOR COPPER-ALLOY DIE CASTINGS.

BRONZE BALL VALVES SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

TRACER WIRE SHALL BE 12 GAGE, SOLID COPPER WITH A MINIMUM OF 2 FEET EXTENDED THROUGH TOP OF RISER PIPE VALVE BOX.

TRACER WIRE SHALL BE TAPED TO THE TOP OF THE SEWER PIPE.

ARCH OPENINGS IN VALVE BOX SHALL BE COVERED WITH ROOFING FELT TO PREVENT THE ENTRANCE OF BACKFILL MATERIAL.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

BOND RISER PIPE TO TEE AND COUPLING USING SWEAT SOLDERING METHOD TO PREVENT ROTATION WHEN PLUG IS REMOVED.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/8/19 J.E.C.	ST. MARY'S COUNTY METROPOLITAN COMMISSION **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** LOW PRESSURE SEWER DETAIL TERMINAL CLEANOUT FLUSHING CONNECTION **STANDARD NO. P-5**

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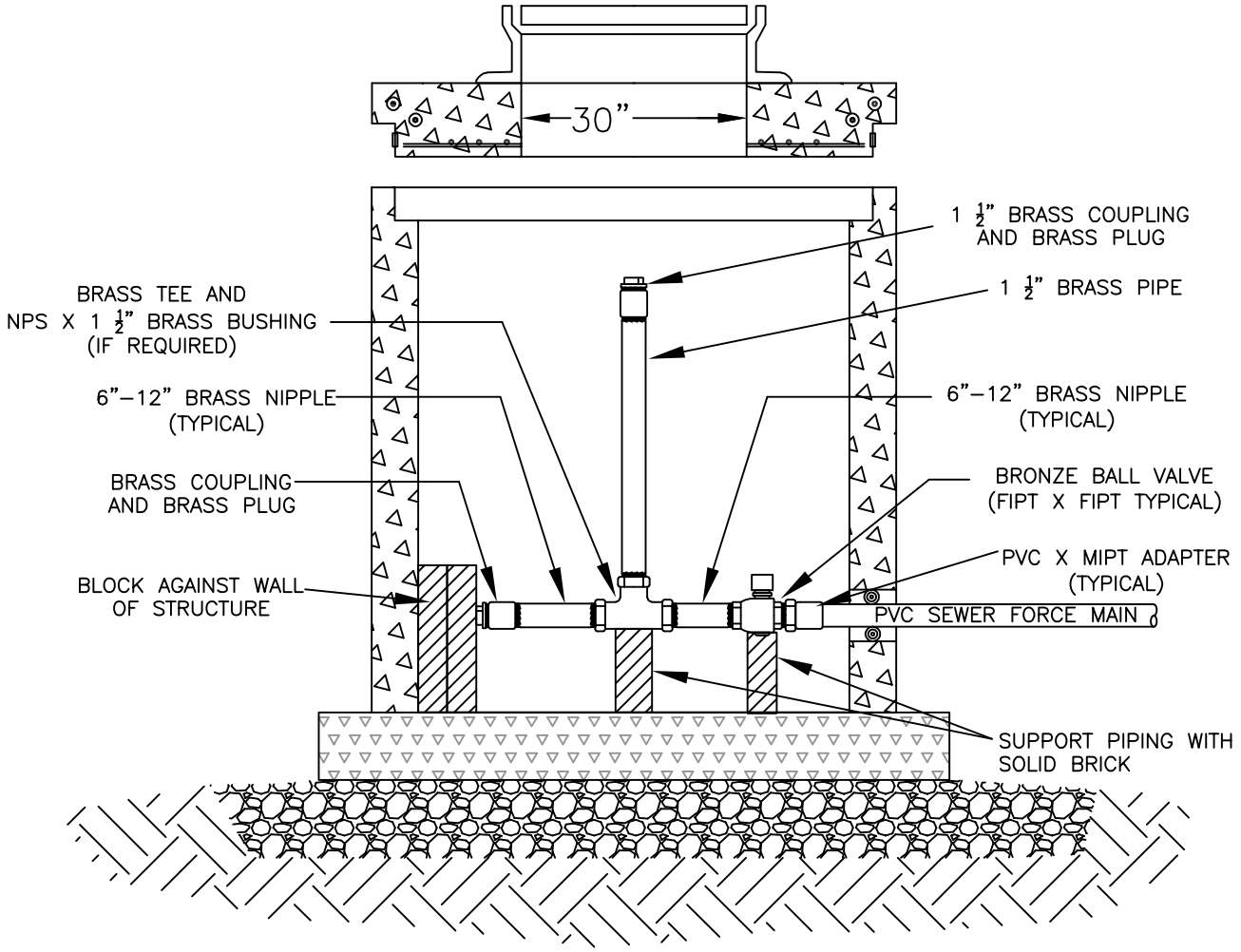

NOTES:

SHALLOW MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S–1

MANHOLE SHALL BE 48" IN DIAMETER

ACCESSWAY SHALL BE 30" IN DIAMETER

BLOCKING SHALL BE BRICK OR CONCRETE

BRASS PIPING SHALL MEET MEET ASTM B43–98(2004) STANDARD SPECIFICATION FOR SEAMLESS RED BRASS PIPE, STANDARD SIZES.

BRASS FITTINGS SHALL MEET MEET ASTM B176–95 STANDARD SPECIFICATION FOR COPPER–ALLOY DIE CASTINGS.

BRONZE BALL VALVE SHALL BE FITTED WITH A 2"X2" OPERATING NUT.

BOND RISER PIPE TO TEE AND COUPLING USING SWEAT SOLDERING METHOD TO PREVENT ROTATION WHEN PLUG IS REMOVED.

VALVE SHALL BE ACCESSIBLE AND OPERATIONAL WITH A VALVE KEY THROUGH ACCESS WAY.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/8/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***	LOW PRESSURE DETAIL TERMINAL FLUSHING CONNECTION IN TRAFFIC AREAS-SEWER LESS THAN 4" **STANDARD NO. P-6**

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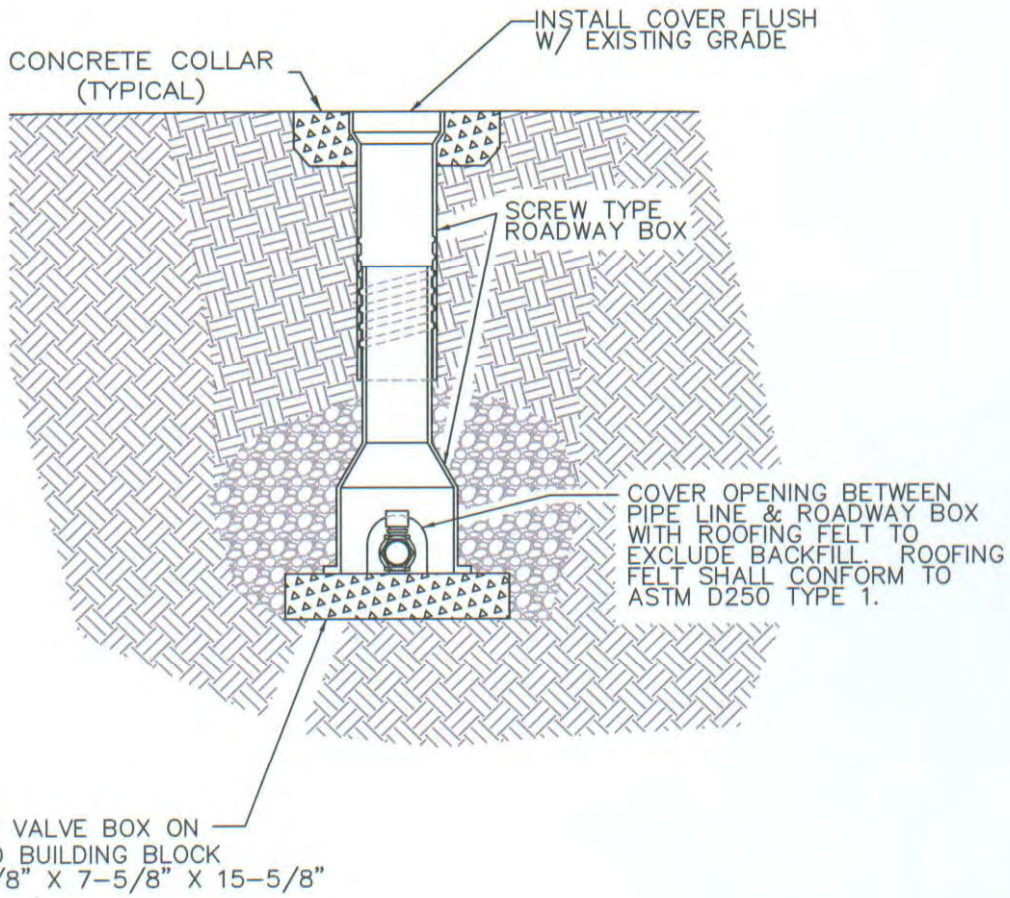

NOTES:

VALVE BOX SHALL BE SCREW ADJUSTABLE WITH AN ARCH PATTERN BASE

VALVE BOX SHALL BE GRAY CAST IRON WITH A $4\frac{1}{4}$" SHAFT AND COATED WITH COAL TAR EPOXY.

VALVE BOX SHALL HAVE THE WORD "SEWER" CAST IN THE COVER.

ARCH PATTERN VALVE BOX SHALL NOT BE USED FOR VALVES OVER 3".

BLOCKING SHALL BE SOLID BUILDING BLOCKS OR CONCRETE.

ARCH OPENINGS IN VALVE BOX SHALL BE COVERED WITH ROOFING FELT TO PREVENT THE ENTRANCE OF BACKFILL MATERIAL.

CONCRETE COLLARS, 18"X6" SHALL BE PROVIDED FOR ALL VALVE BOXES.

St. Mary's County Metropolitan Commission Since 1961 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE	INITIALS	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		6/18/09	J.E.C.	LOW PRESSURE SEWER DETAIL VALVE BOX SETTING 3" AND SMALLER
				STANDARD NO. P-7

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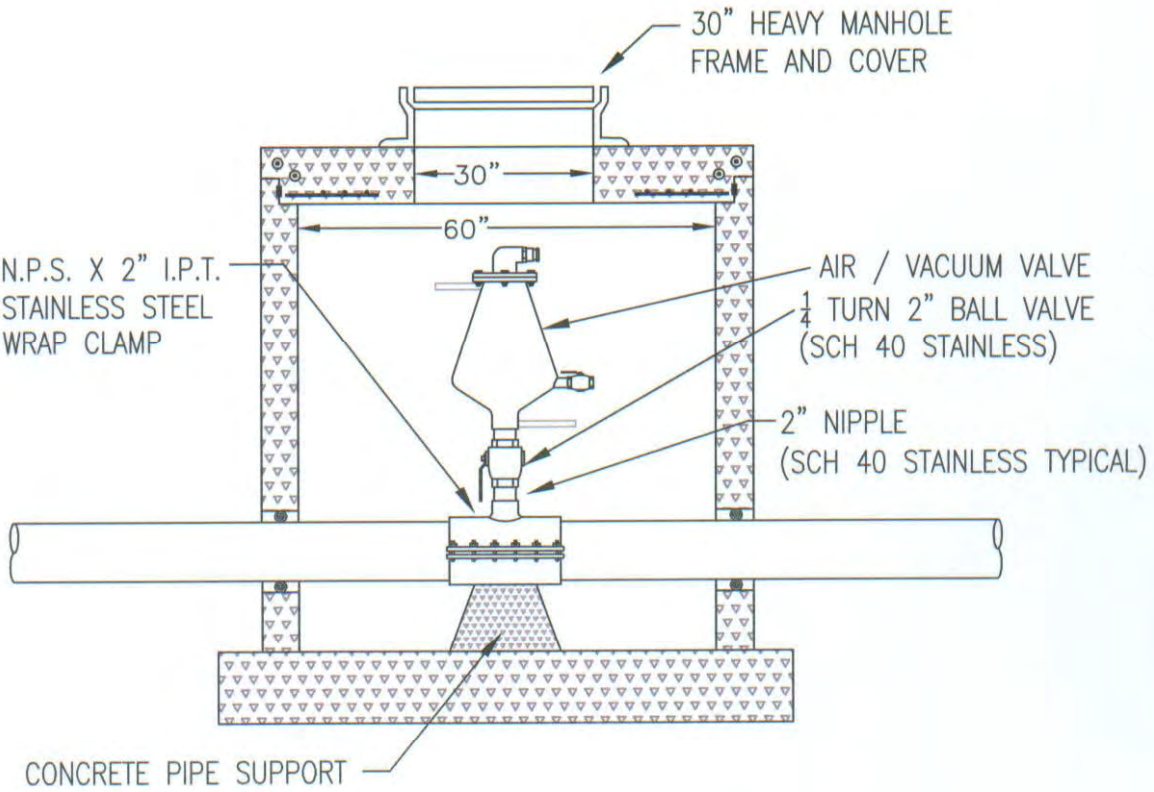

NOTES:

SHALLOW MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S-1

MANHOLE SHALL BE 60" IN DIAMETER

ACCESS WAY SHALL BE 30" IN DIAMETER

FORCE MAIN SHALL PASS THROUGH THE CENTER OF THE MANHOLE.

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
			LOW PRESSURE SEWER DETAIL AIR RELIEF / VACUUM VALVE SETTING
			STANDARD NO. P-8

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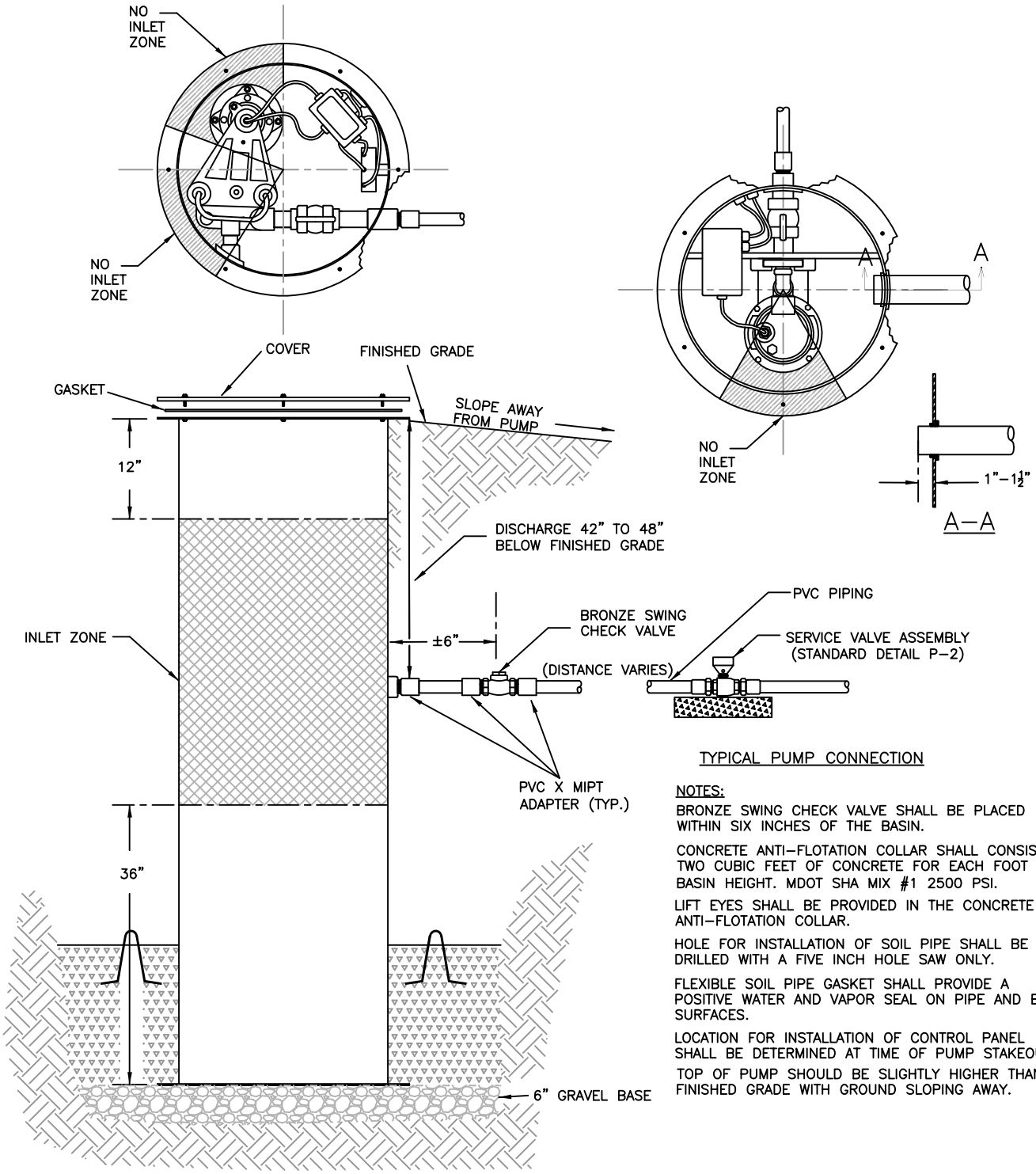

TYPICAL PUMP CONNECTION

NOTES:

BRONZE SWING CHECK VALVE SHALL BE PLACED WITHIN SIX INCHES OF THE BASIN.

CONCRETE ANTI–FLOTATION COLLAR SHALL CONSIST OF TWO CUBIC FEET OF CONCRETE FOR EACH FOOT OF BASIN HEIGHT. MDOT SHA MIX #1 2500 PSI.

LIFT EYES SHALL BE PROVIDED IN THE CONCRETE ANTI–FLOTATION COLLAR.

HOLE FOR INSTALLATION OF SOIL PIPE SHALL BE DRILLED WITH A FIVE INCH HOLE SAW ONLY.

FLEXIBLE SOIL PIPE GASKET SHALL PROVIDE A POSITIVE WATER AND VAPOR SEAL ON PIPE AND BASIN SURFACES.

LOCATION FOR INSTALLATION OF CONTROL PANEL SHALL BE DETERMINED AT TIME OF PUMP STAKEOUT

TOP OF PUMP SHOULD BE SLIGHTLY HIGHER THAN FINISHED GRADE WITH GROUND SLOPING AWAY.

Since 1964

APPROVED

M. C. HOLLANDER, P.E.
CHIEF ENGINEER

DATE: 7/11/19

REVISIONS

DATE	INITIALS
7/23/10	J.E.C.
7/24/14	J.E.C.
2/5/19	J.E.C.

ST. MARY'S COUNTY METROPOLITAN COMMISSION

STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

LOW PRESSURE SEWER DETAIL
GRINDER PUMP
TYPICAL INSTALLATION

STANDARD NO. P-9

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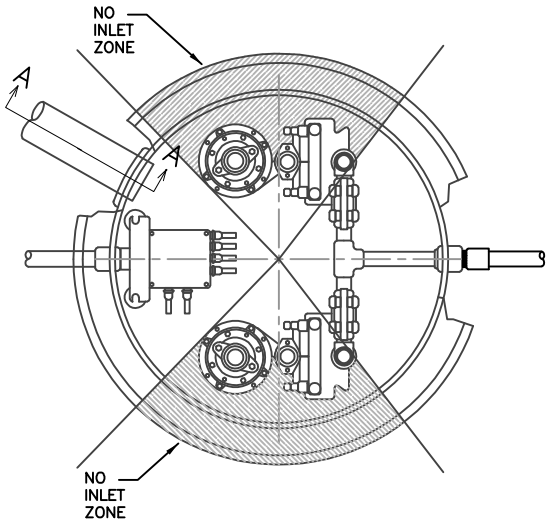


NOTES:

BRONZE SWING CHECK VALVE SHALL BE PLACED WITHIN SIX INCHES OF THE BASIN.

CONCRETE ANTI-FLOTATION COLLAR SHALL CONSIST OF THREE CUBIC FEET OF CONCRETE FOR EACH FOOT OF BASIN HEIGHT. MDOT SHA MIX #1 2500 PSI.

LIFT EYES SHALL BE PROVIDED IN THE CONCRETE ANTI-FLOTATION COLLAR.

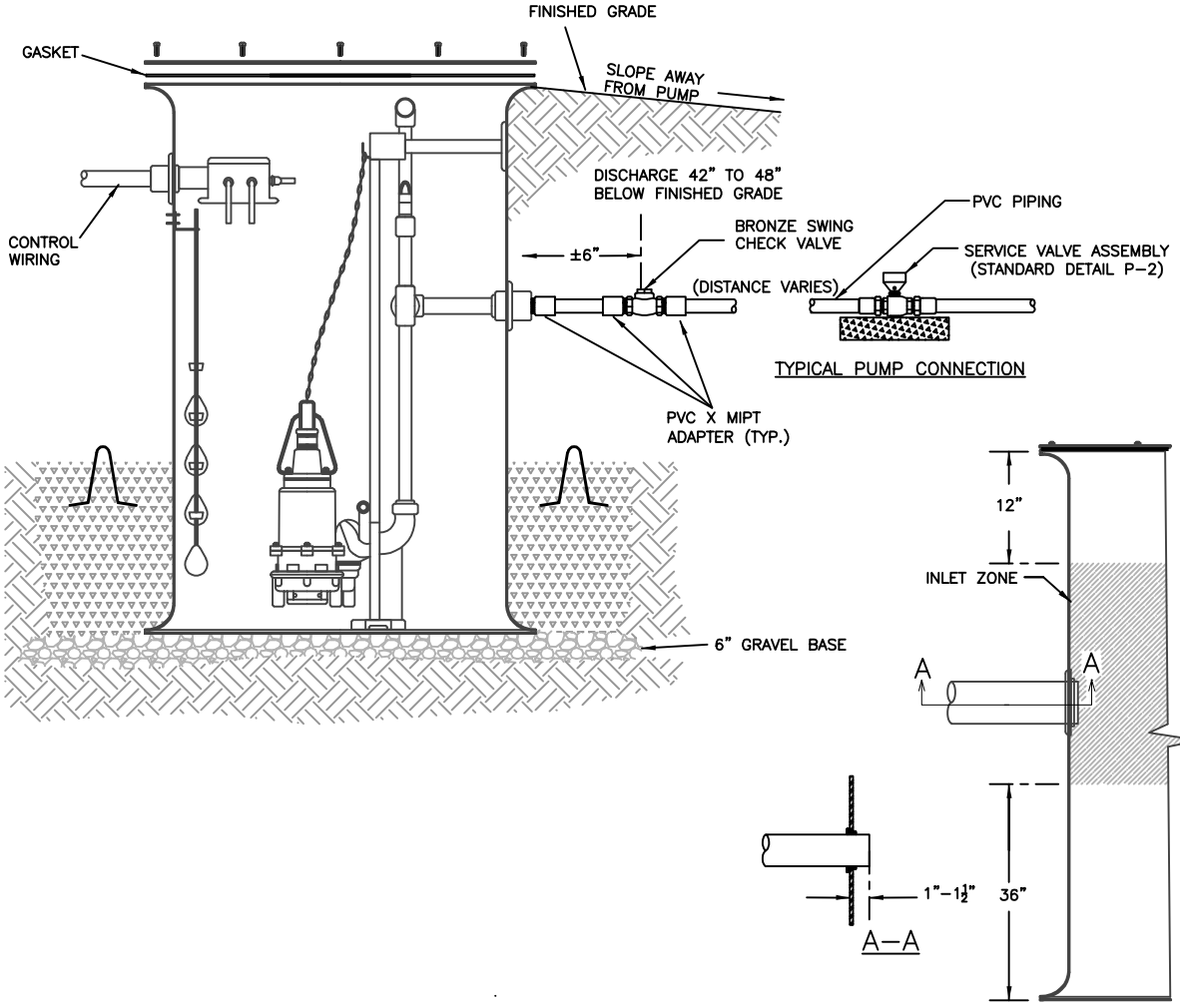
HOLE FOR INSTALLATION OF SOIL PIPE SHALL BE DRILLED WITH A FIVE INCH HOLE SAW ONLY.

FLEXIBLE SOIL PIPE GASKET SHALL PROVIDE A POSITIVE WATER AND VAPOR SEAL ON PIPE AND BASIN SURFACES.

LOCATION FOR INSTALLATION OF CONTROL PANEL SHALL BE DETERMINED AT TIME OF PUMP STAKEOUT

TOP OF PUMP SHOULD BE SLIGHTLY HIGHER THAN FINISHED GRADE WITH GROUND SLOPING AWAY.

BASIN HEIGHT SHALL BE DETERMINED BY THE ENGINEER.



Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		DATE	INITIALS	LOW PRESSURE SEWER DETAIL DUPLEX GRINDER PUMP TYPICAL INSTALLATION
		6/18/09	J.E.C.	
		7/23/10	J.E.C.	
		2/5/19	J.E.C.	**STANDARD NO. P-9A**

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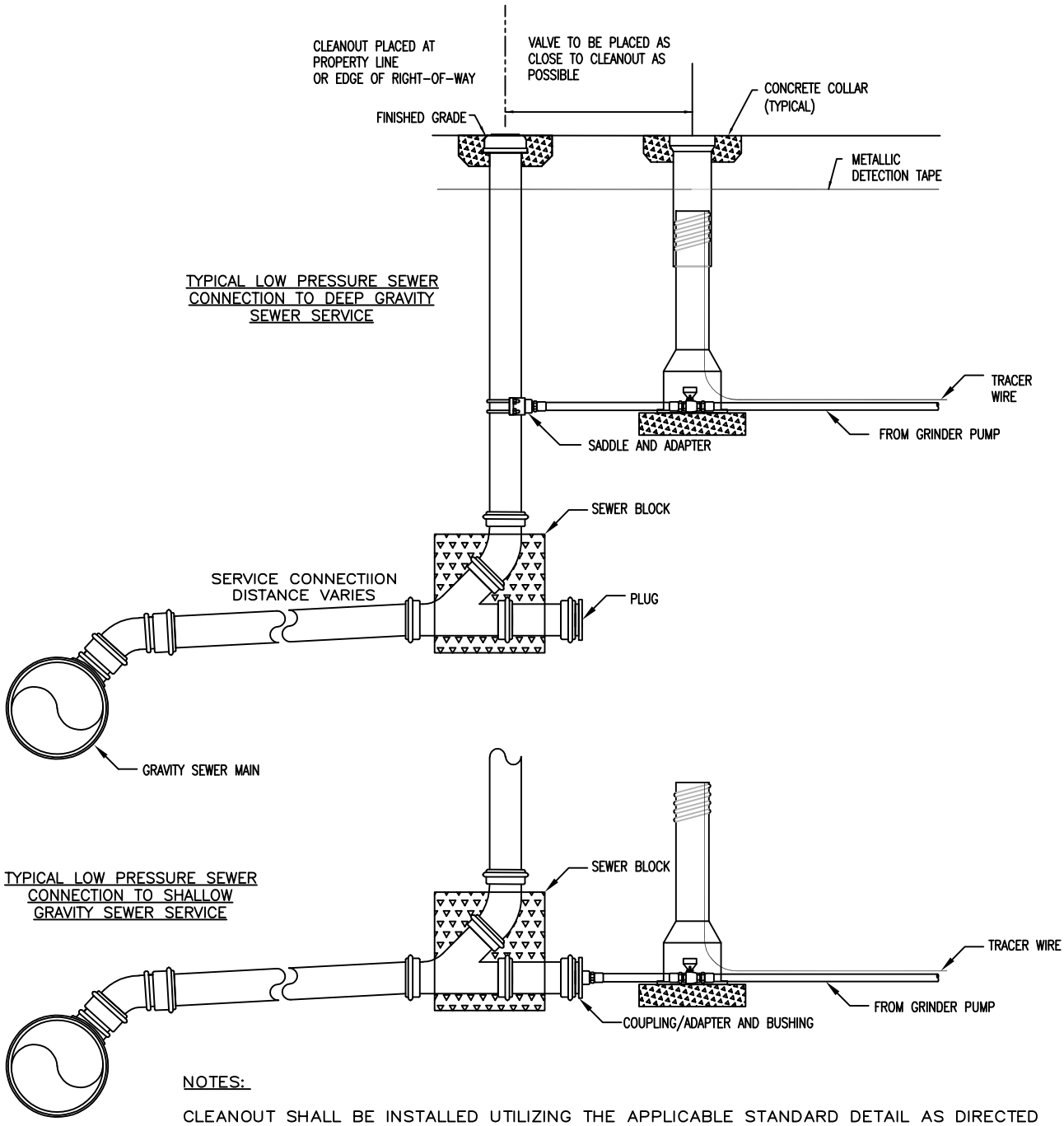

NOTES:

CLEANOUT SHALL BE INSTALLED UTILIZING THE APPLICABLE STANDARD DETAIL AS DIRECTED BY THE ENGINEER.

SERVICE VALVE ASSEMBLY SHALL BE INSTALLED IN ACCORDANCE WITH METCOM STANDARD P–1.

DEPTH OF PRESSURE SEWER SHALL NOT EXCEED 5'6".

PRECAST SEWER BLOCK SHALL BE USED ON VERTICAL WYE.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/8/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** LOW PRESSURE SEWER CONNECTION TO NEW OR EXISTING GRAVITY SEWER SERVICE **STANDARD NO. P-10**

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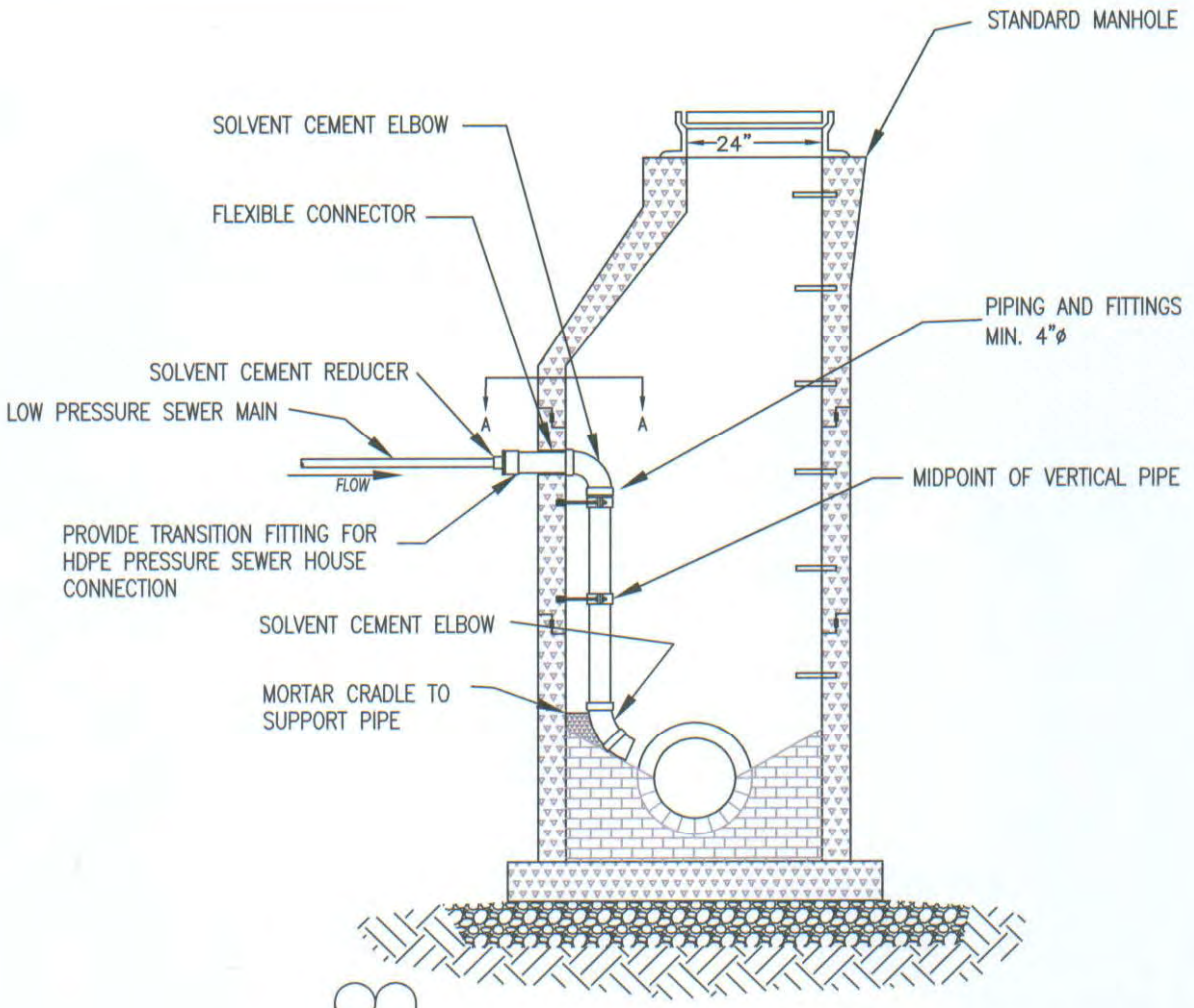

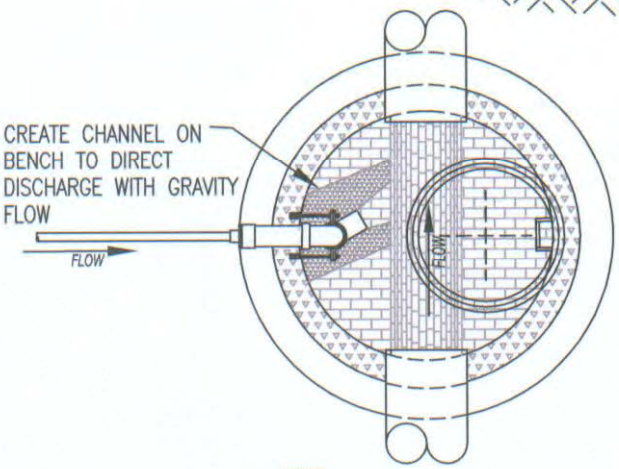

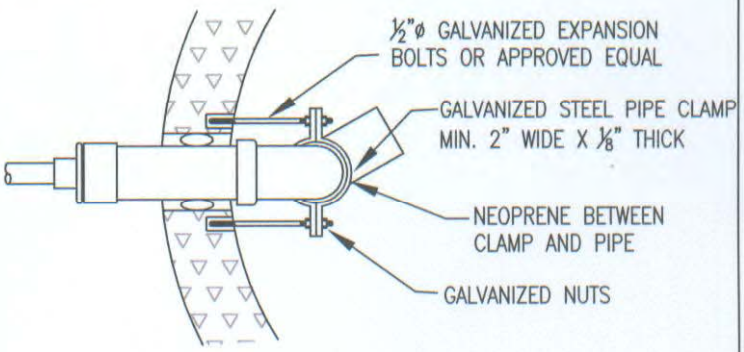

SECTION A–A

NOTE:
COAT ALL EXPOSED GALVANIZED STEEL WITH ASPHALTUM.

PIPING ENTERING MANHOLE SHALL MAINTAIN A MINIMUM OF 1' CLEARANCE FROM INTERIOR STEPS

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES** LOW PRESSURE SEWER CONNECTION TO EXISTING GRAVITY MANHOLE **STANDARD NO. P-11**

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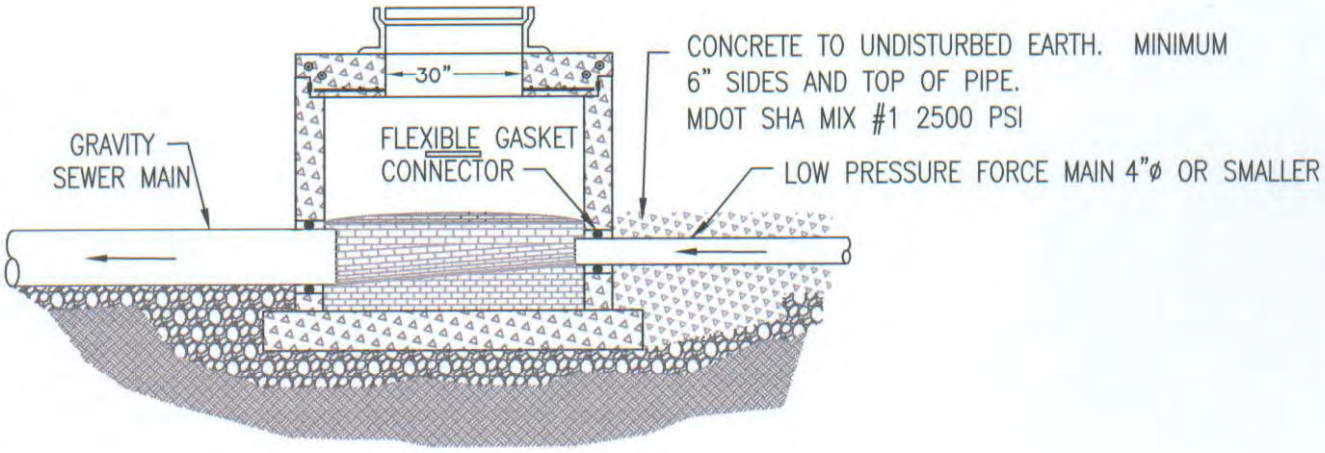

NOTES:

MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S-1 OR S-2 AS APPLICABLE.

BREACHING OF MANHOLE SHALL ONLY BE DONE BY CORE DRILLING AND USE OF THE A-LOK® TYPE GASKET OR APPROVED EQUAL.

PROVIDE SMOOTH DOWNWARD SLOPING CHANNEL FROM FORCE MAIN TO GRAVITY SEWER.

CHANNEL SHALL BE CONSTRUCTED IN ACCORDANCE WITH METCOM STANDARD S-7.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	TYPE "A" TRANSITION MANHOLE FORCE MAIN TO GRAVITY SEWER
				STANDARD NO. P-12

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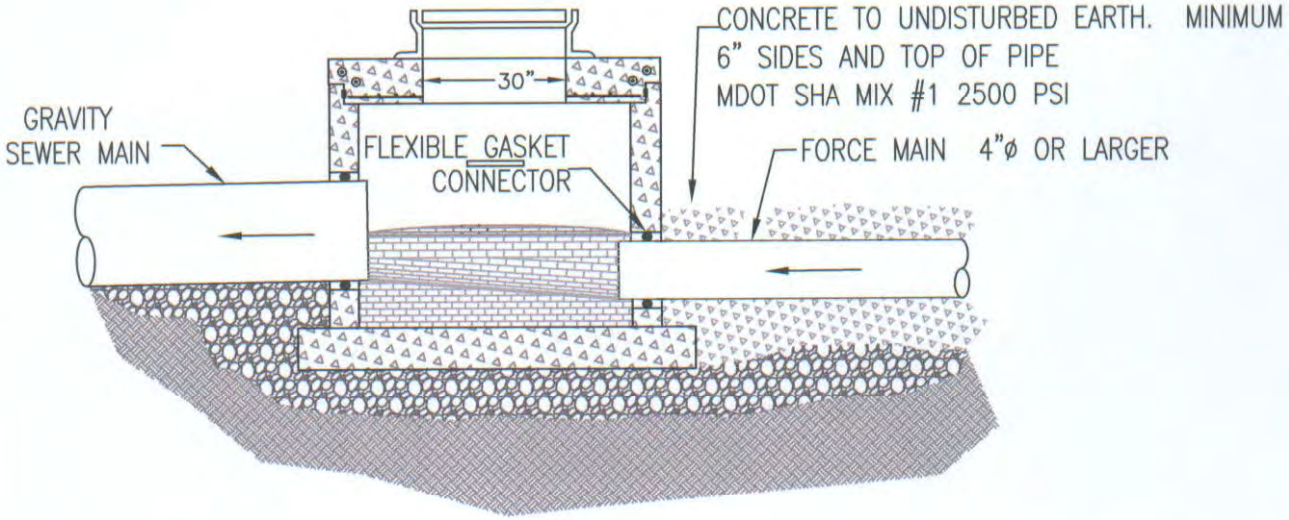

NOTES:

MANHOLE SHALL BE CONSTRUCTED UTILIZING ALL OF THE DETAIL NOTES AND STANDARDS OF THE PRECAST LINE MANHOLE. METCOM STANDARD S-1 OR S-2 AS APPLICABLE.

BREACHING OF MANHOLE SHALL ONLY BE DONE BY CORE DRILLING AND USE OF THE A-LOK® TYPE GASKET OR APPROVED EQUAL.

PROVIDE SMOOTH UPWARD SLOPING CHANNEL FROM FORCE MAIN TO GRAVITY SEWER.

CHANNEL SHALL BE CONSTRUCTED IN ACCORDANCE WITH METCOM STANDARD S-7.

CHANNEL SHALL HAVE A REVERSE SLOPE ACROSS THE MANHOLE OF ONE HALF THE DIAMETER OF THE FORCE MAIN OR AS DIRECTED BY THE ENGINEER.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	
				TYPE "B" TRANSITION MANHOLE FORCE MAIN TO GRAVITY SEWER
				STANDARD NO. P-13

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Standard Details
Table of Contents

Typical Wastewater Pumping Station

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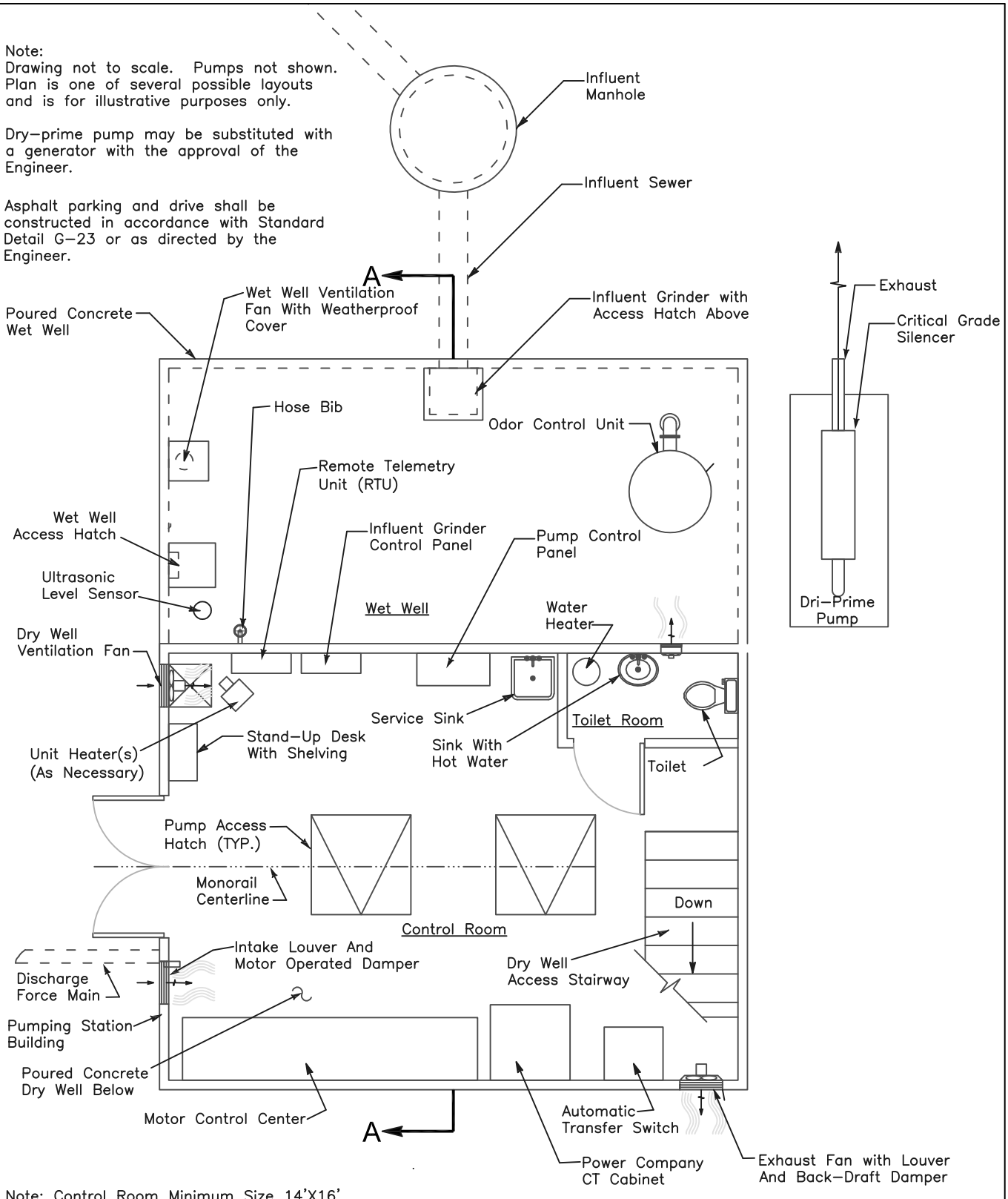
Note:
Drawing not to scale. Pumps not shown. Plan is one of several possible layouts and is for illustrative purposes only.

Dry–prime pump may be substituted with a generator with the approval of the Engineer.

Asphalt parking and drive shall be constructed in accordance with Standard Detail G–23 or as directed by the Engineer.



Note: Control Room Minimum Size 14'X16'

	APPROVED	**REVISIONS**	ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
	M. C. HOLLANDER, P.E. CHIEF ENGINEER	6/18/09 J.E.C.	Typical Plan For Wastewater Pumping Station
	DATE: 7/11/19	1/16/19 J.E.C.	**STANDARD NO. PS-1**

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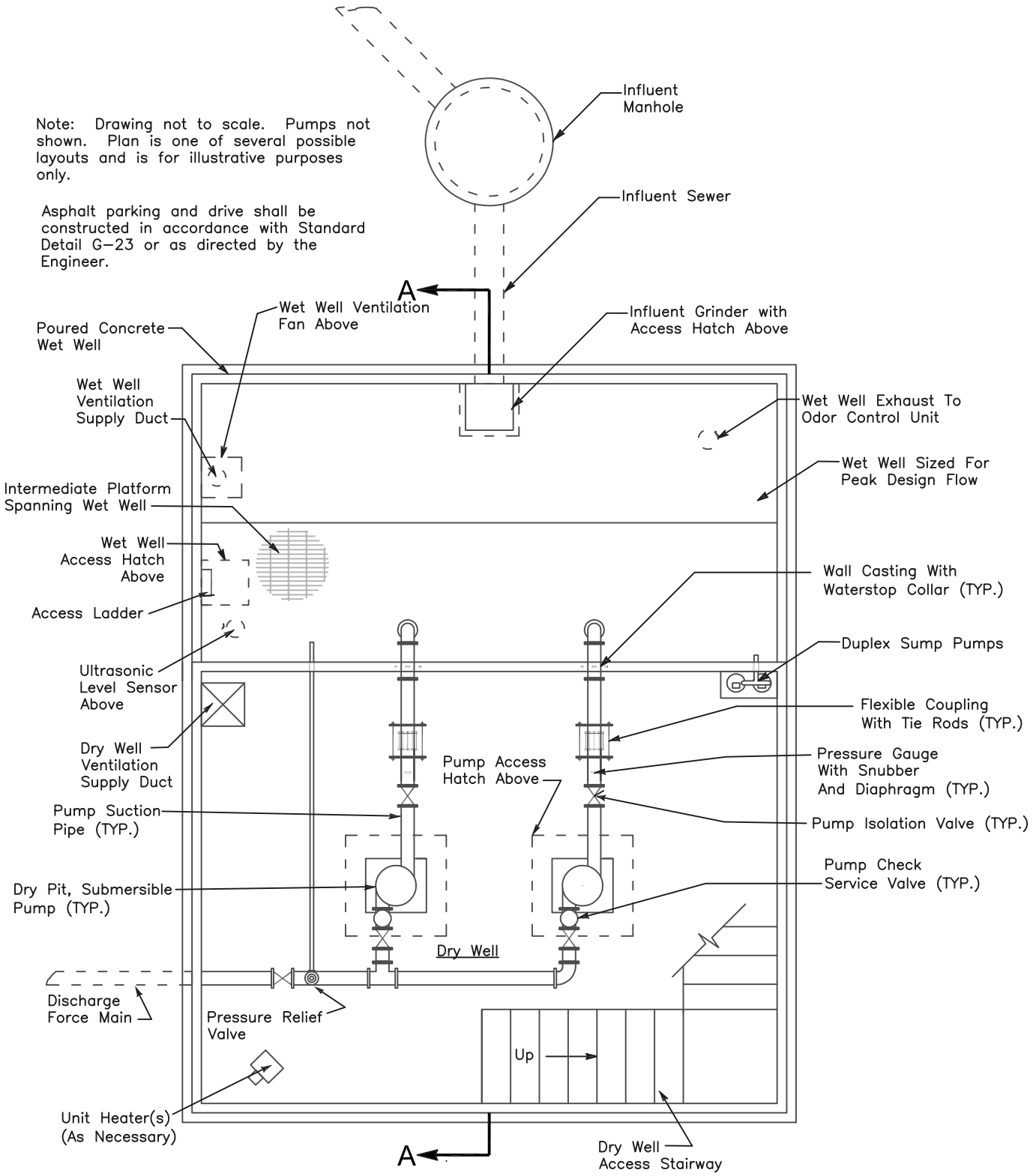

Note: Dry Well Minimum Size 14'X16'

	APPROVED	**REVISIONS**	ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
Since 1964	M. C. HOLLANDER, P.E. CHIEF ENGINEER	6/18/09 J.E.C.	Wastewater Pumping Station Wet Well and Dry Well Plan
	DATE: 7/11/19	1/16/19 J.E.C.	**STANDARD NO. PS-2**

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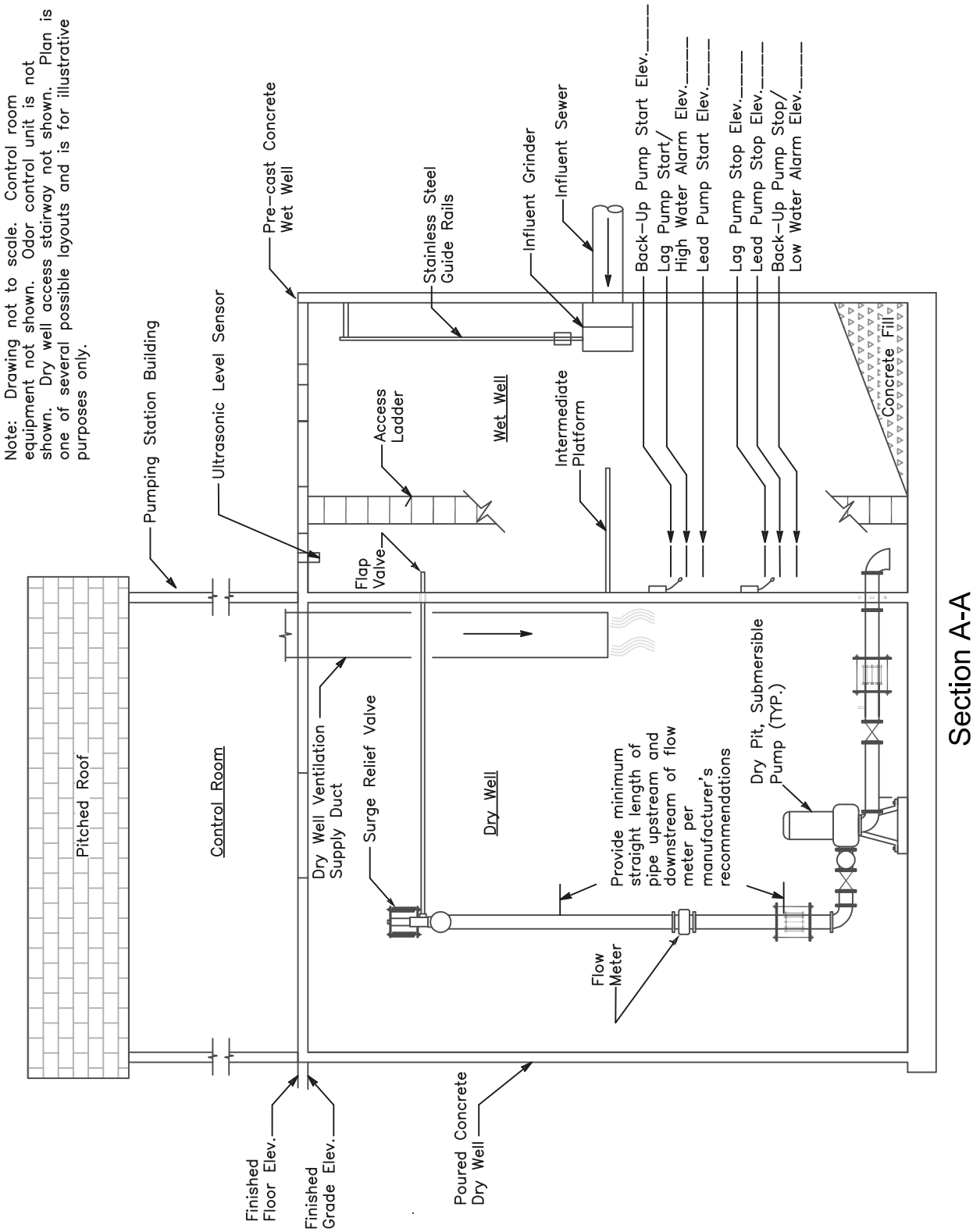

	APPROVED M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE: 6/18/09, 1/16/19 INITIALS: J.E.C., J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Wastewater Pumping Station Wet Well and Dry Well Plan Section A-A **STANDARD NO. PS-3**

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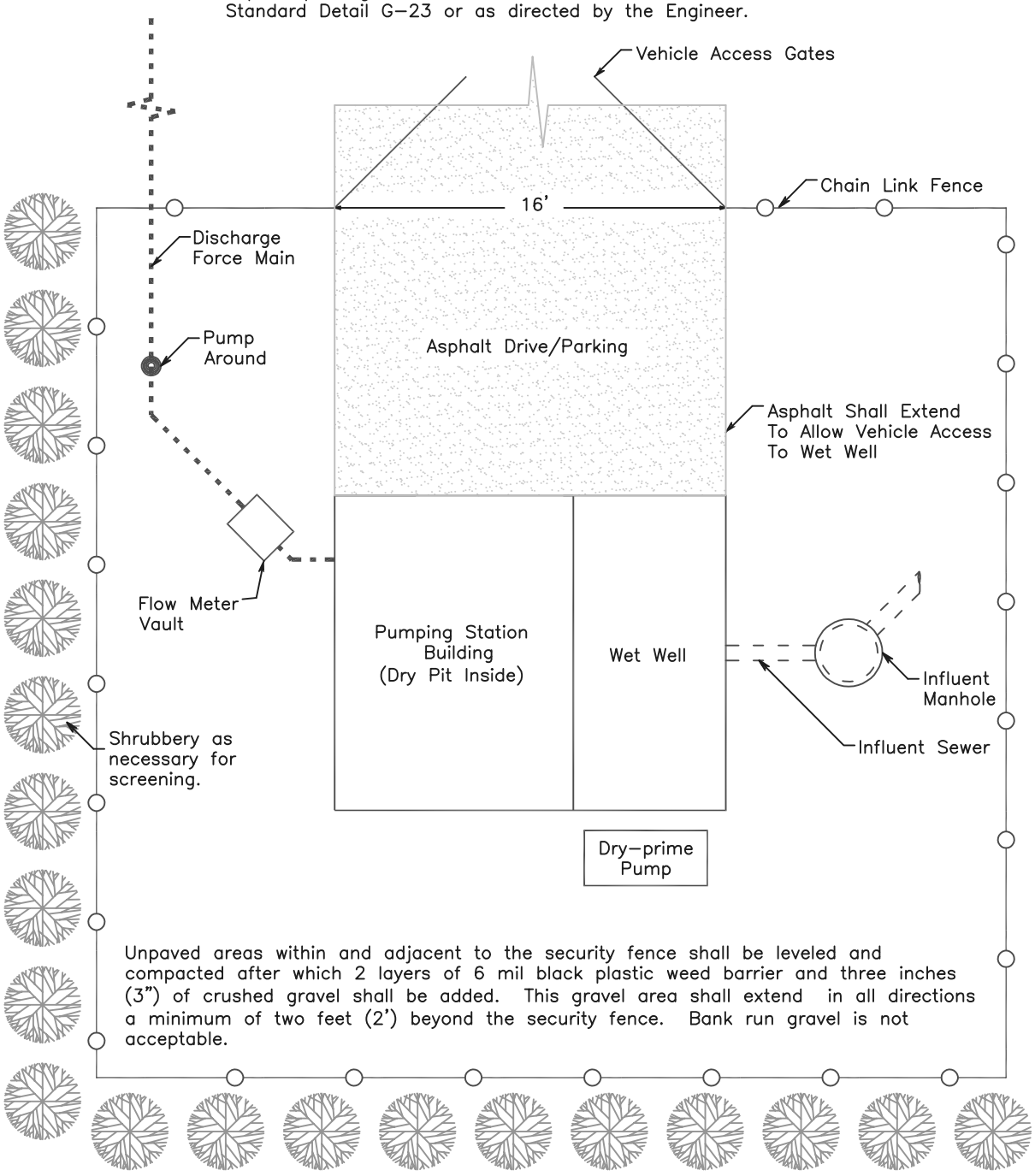
Asphalt parking and drive shall be constructed in accordance with Standard Detail G–23 or as directed by the Engineer.



Unpaved areas within and adjacent to the security fence shall be leveled and compacted after which 2 layers of 6 mil black plastic weed barrier and three inches (3") of crushed gravel shall be added. This gravel area shall extend in all directions a minimum of two feet (2') beyond the security fence. Bank run gravel is not acceptable.

Note:
Drawing not to scale. Site Layout is one of several possible layouts and is for illustrative purposes only.

Dry–prime pump may be substituted with a generator with the approval of the Engineer.

Since 1964	**APPROVED** M. C. HOLLANDER, P.E. CHIEF ENGINEER DATE: 7/11/19	**REVISIONS** DATE / INITIALS 6/18/09 J.E.C. 1/16/19 J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Wastewater Pumping Station Site Plan **STANDARD NO. PS-4**

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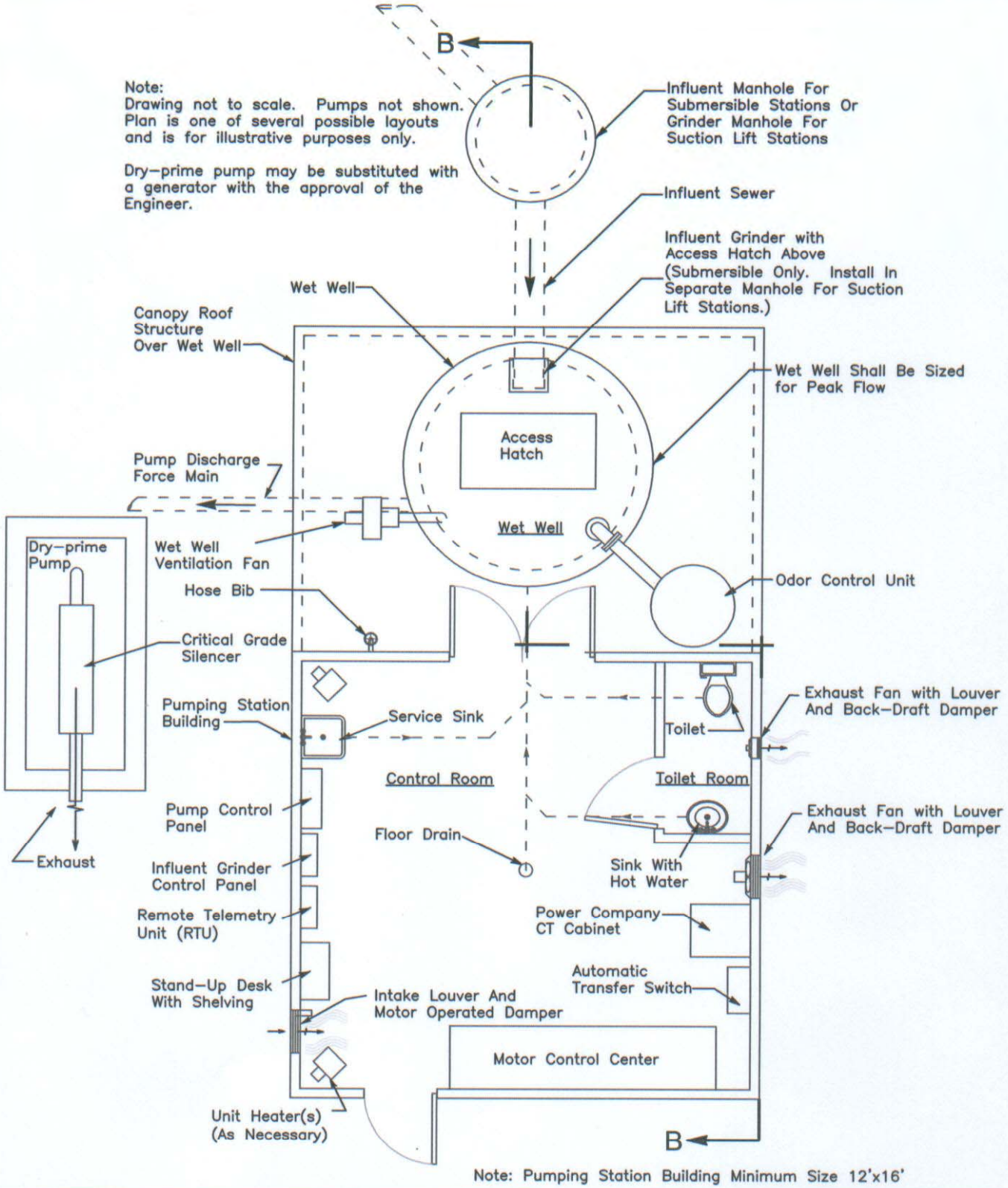

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Typical Plan For Suction Lift & Submersible Wastewater Pumping Stations **STANDARD NO. PS-5**

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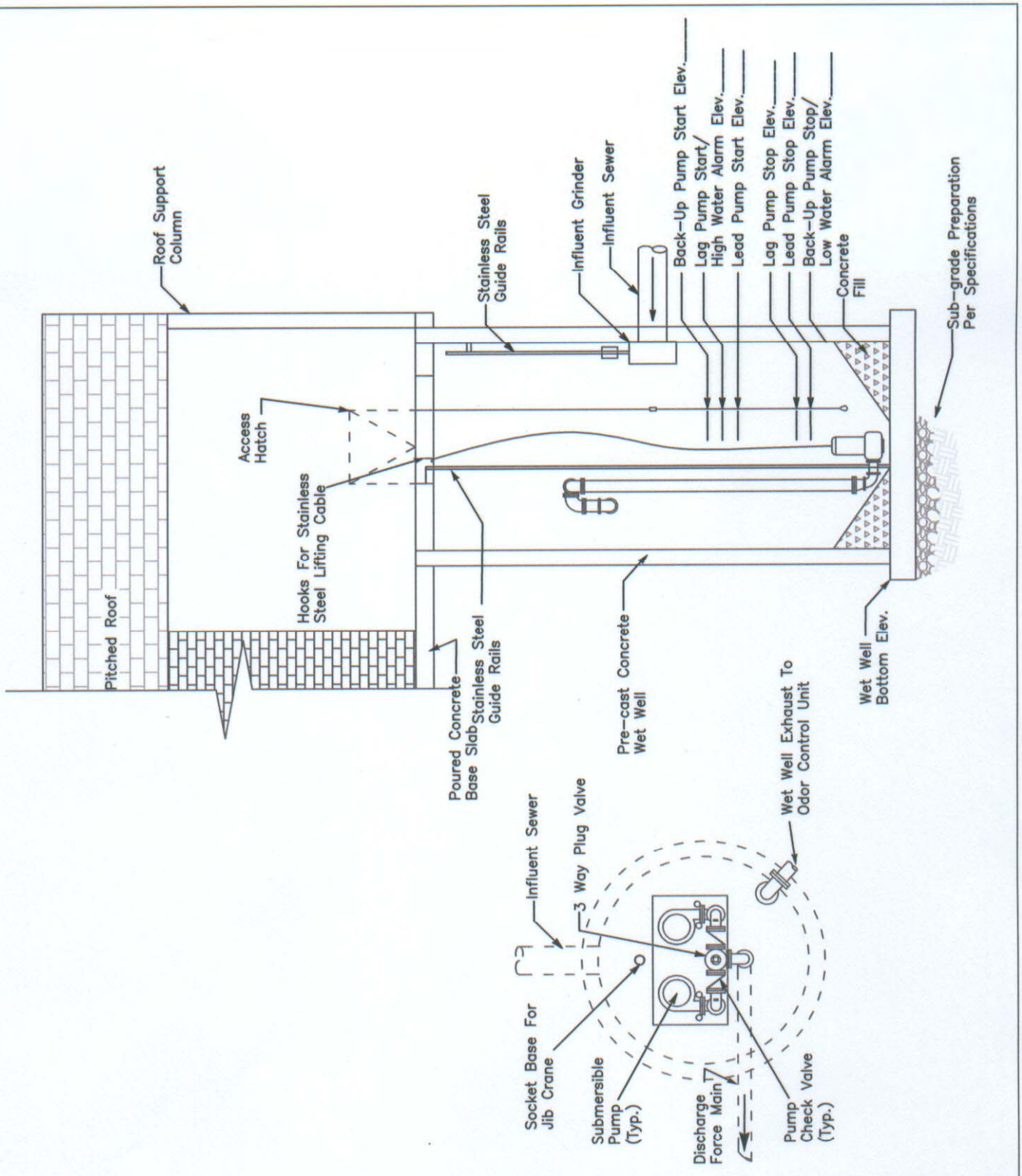

	APPROVED C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS**		*ST. MARY'S COUNTY METROPOLITAN COMMISSION* **STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		DATE	INITIALS	
		6/18/09	J.E.C.	Submersible Wastewater Pumping Stations Section B-B
				STANDARD NO. PS-6

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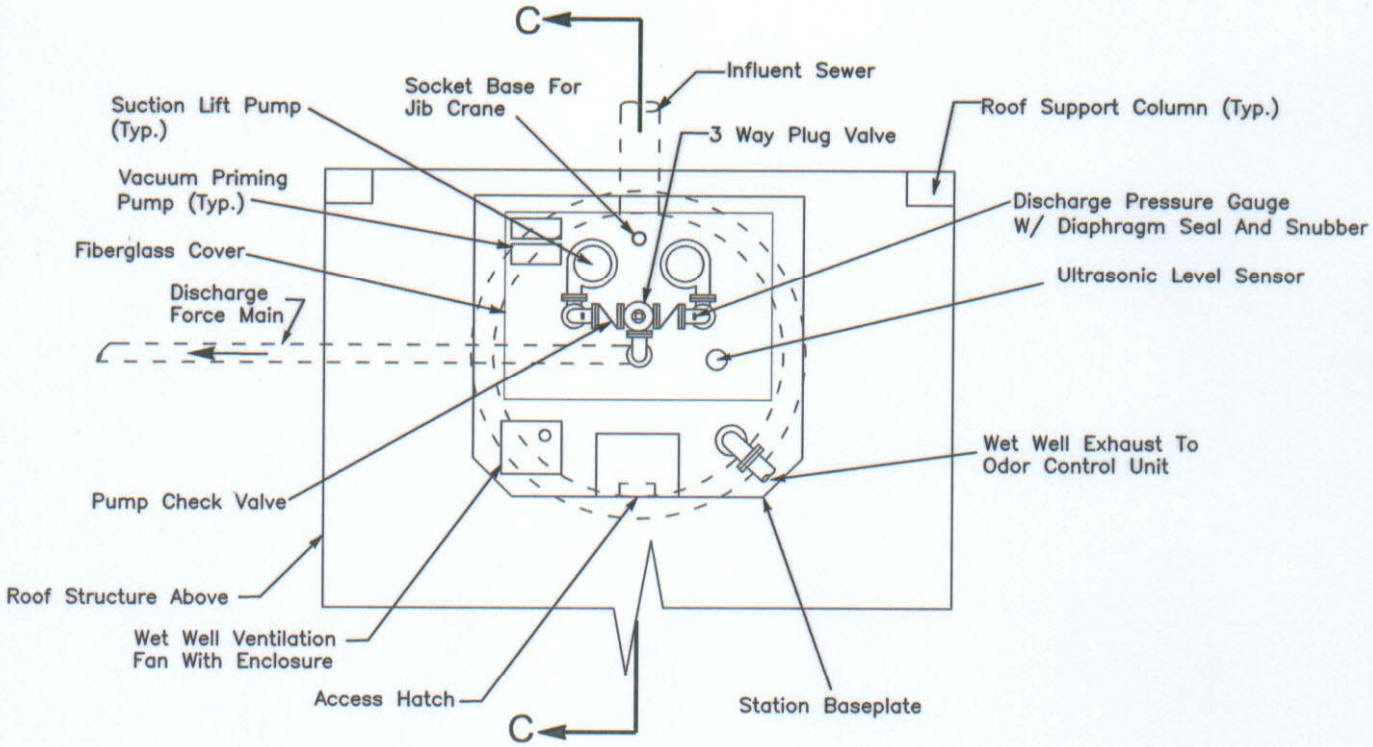

St. Mary's County Metropolitan Commission — Since 1954 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09	INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Suction Lift Wastewater Wet Well Plan **STANDARD NO. PS-7**

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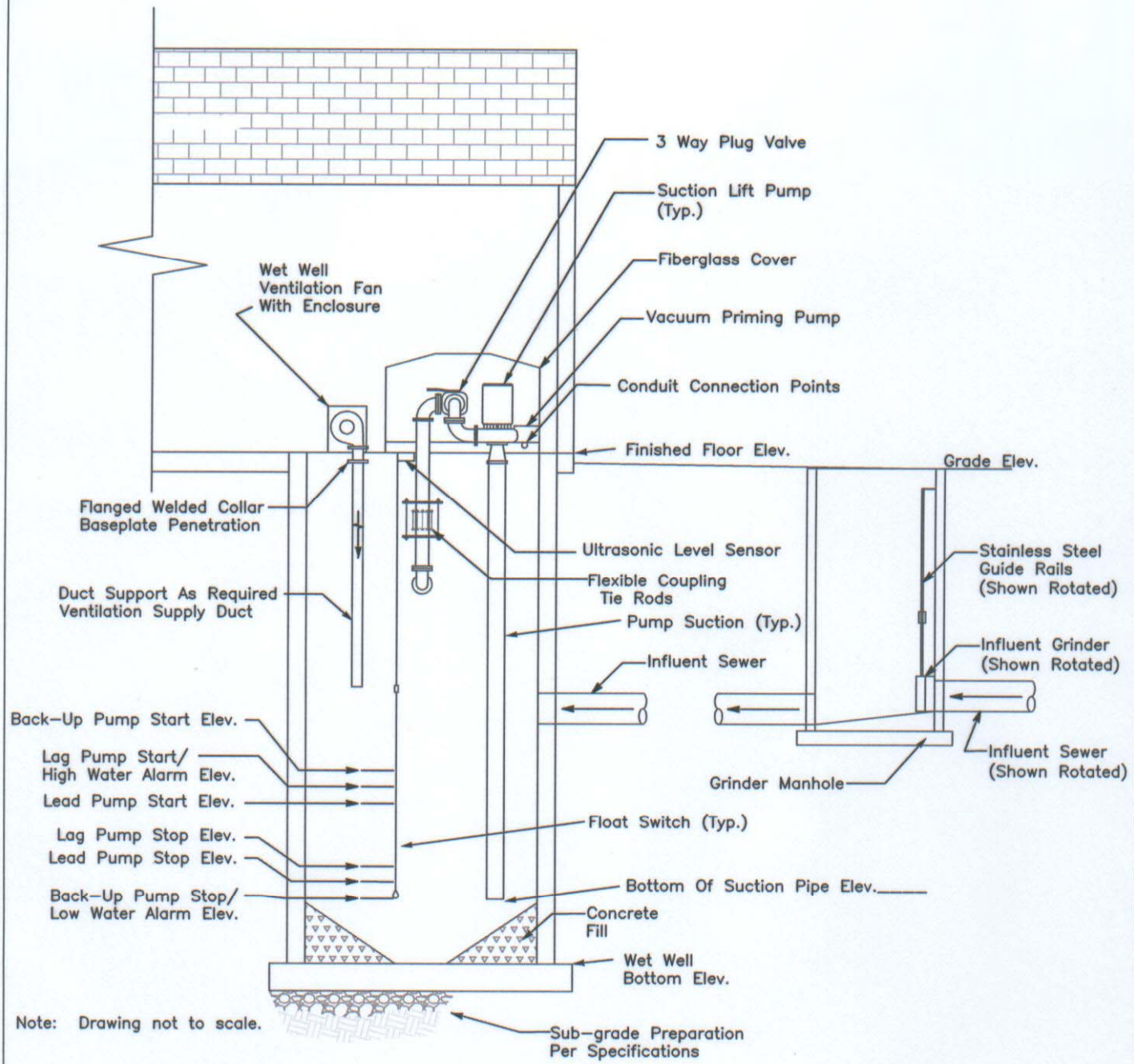

	APPROVED	**REVISIONS**	*ST. MARY'S COUNTY METROPOLITAN COMMISSION*
		DATE / INITIALS	***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES***
		6/18/09 J.E.C.	Suction Lift Wastewater Wet Well Section C-C
	C. I. FREDERICK JR., P.E. CHIEF ENGINEER		
	DATE: 7/1/09		**STANDARD NO. PS-8**

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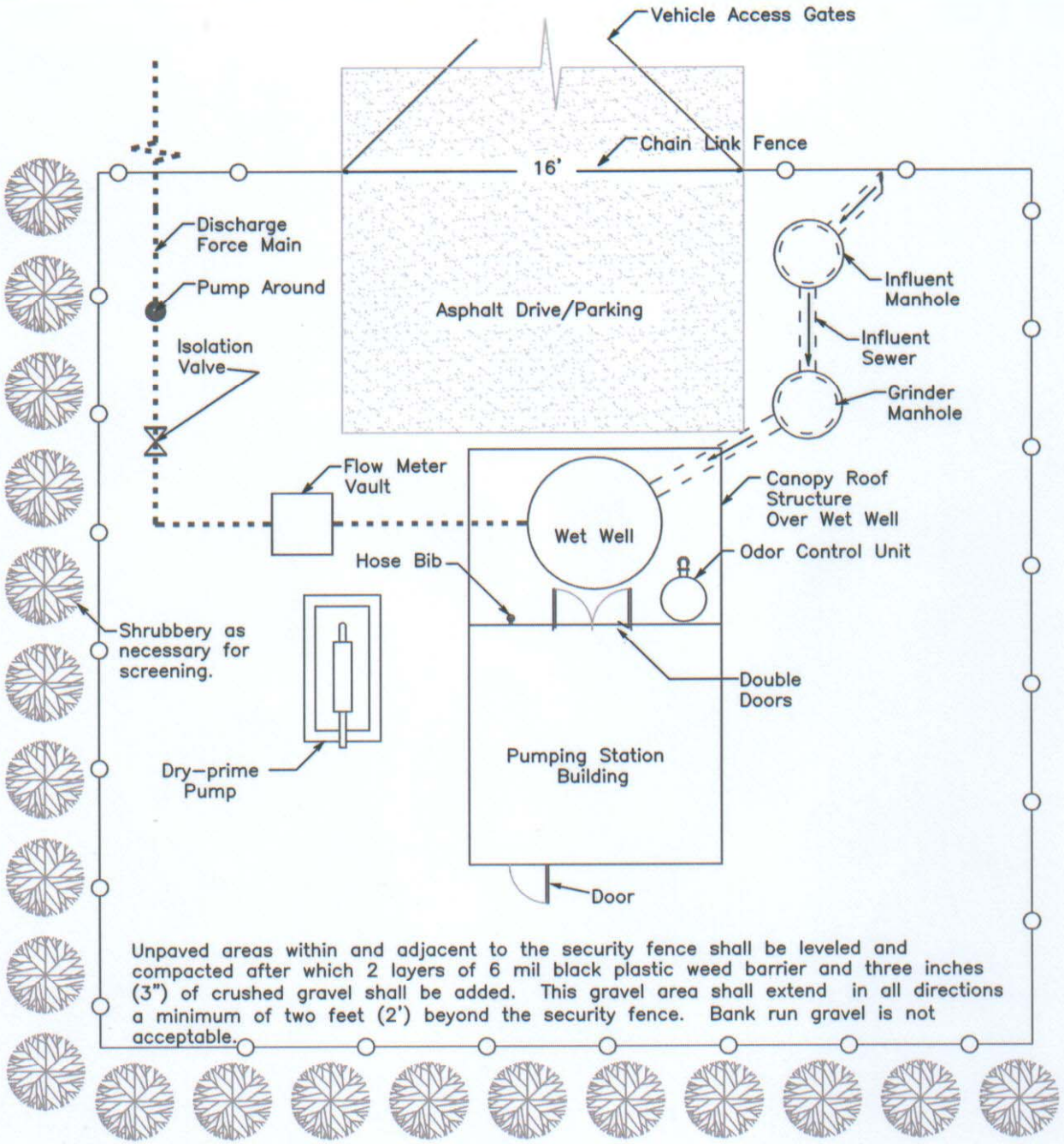

Unpaved areas within and adjacent to the security fence shall be leveled and compacted after which 2 layers of 6 mil black plastic weed barrier and three inches (3") of crushed gravel shall be added. This gravel area shall extend in all directions a minimum of two feet (2') beyond the security fence. Bank run gravel is not acceptable.

Note:
Drawing not to scale. Site Layout is one of several possible layouts and is for illustrative purposes only.

Dry–prime pump may be substituted with a generator with the approval of the Engineer.

Asphalt parking and drive shall be constructed in accordance with Standard Detail G–23 or as directed by the Engineer.

St. Mary's County Metropolitan Commission – Since 1964 – Potable Water Distribution – Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09	INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Typical Site Plan For Suction Lift & Submersible Wastewater Pumping Station **STANDARD NO. PS-9**

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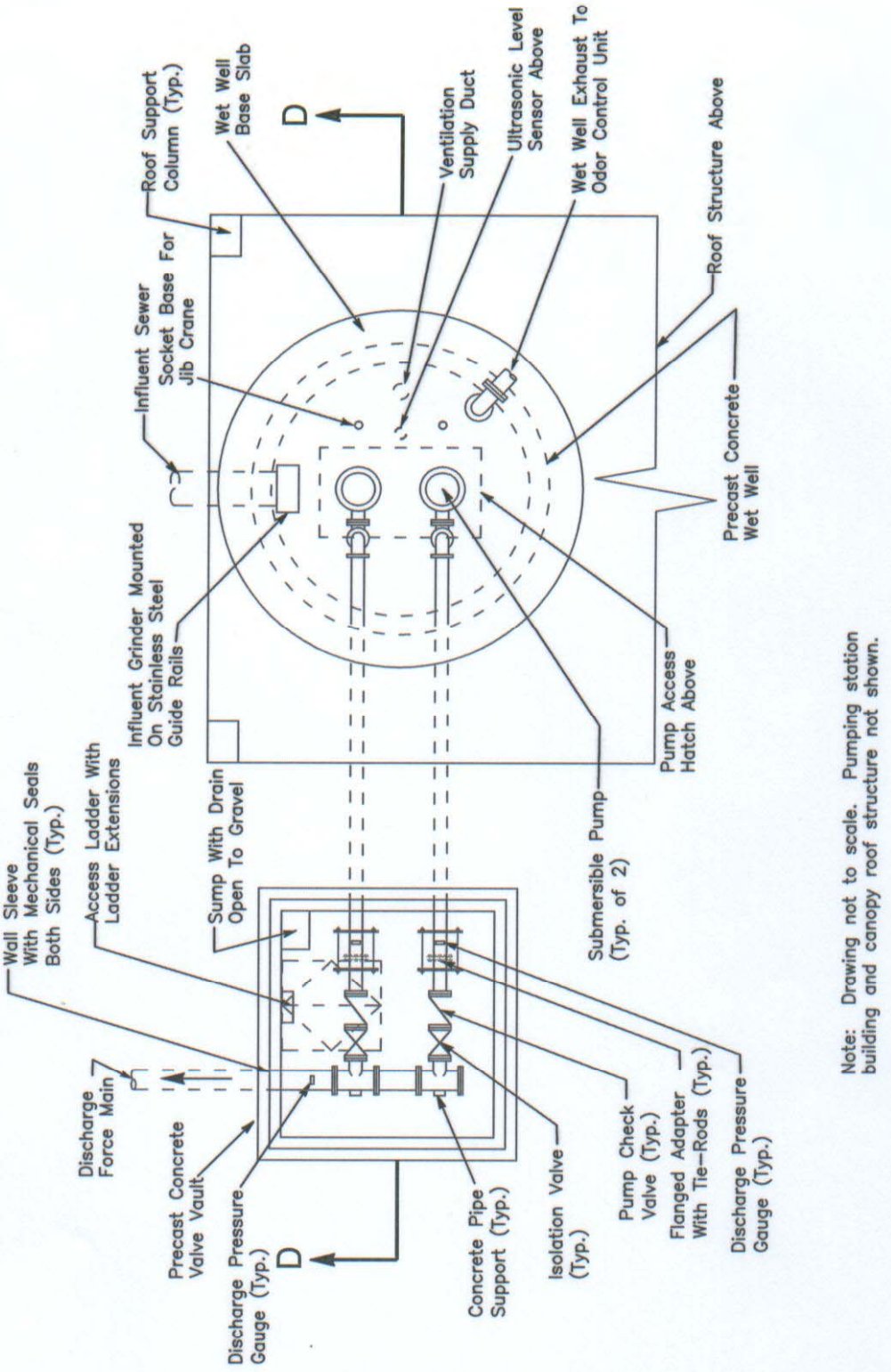

Note: Drawing not to scale. Pumping station building and canopy roof structure not shown.

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Submersible Wastewater Pumping Station Wet Well & Valve Vault Plan **STANDARD NO. PS-10**

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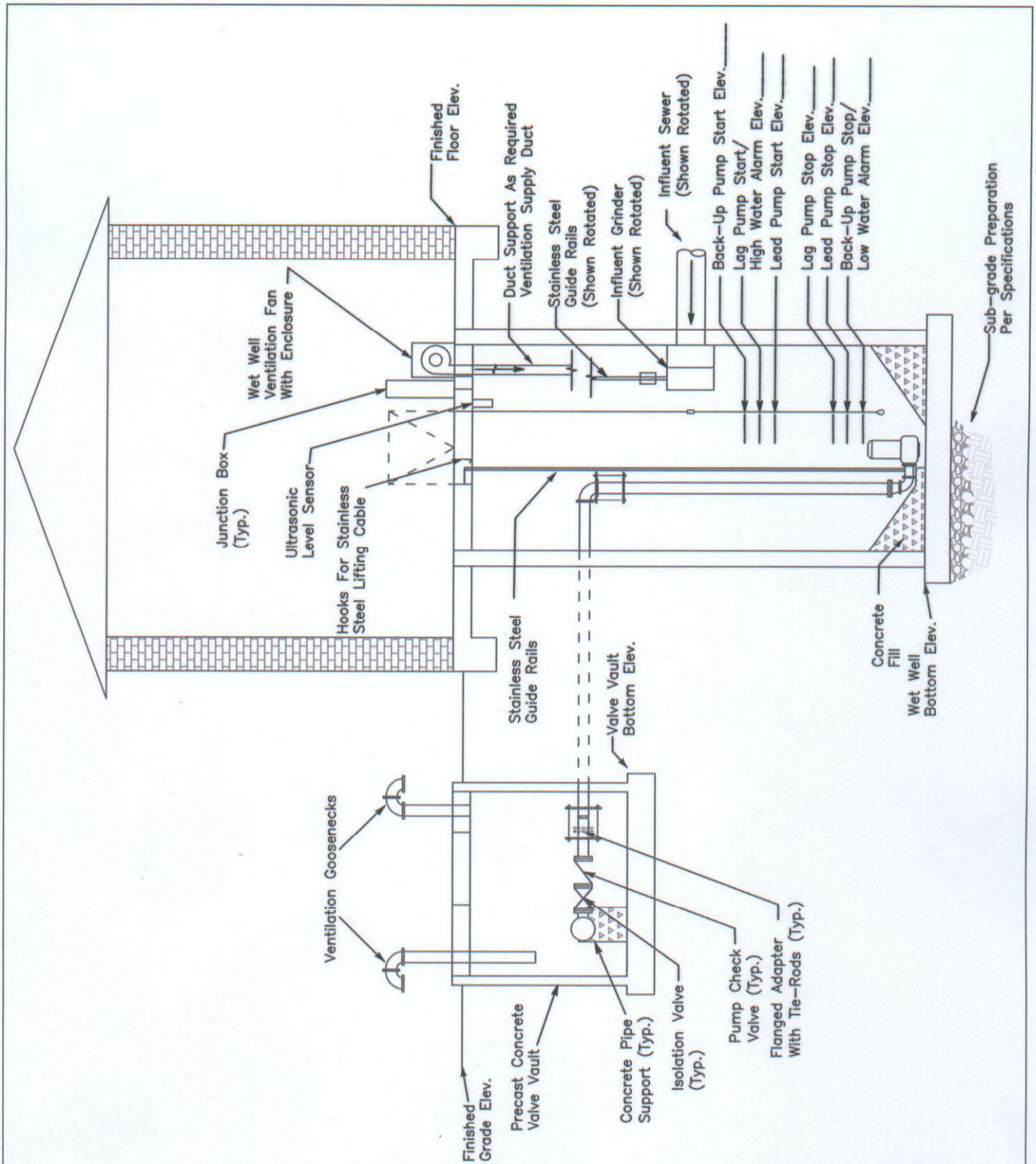

St. Mary's County Metropolitan Commission — Since 1964 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Submersible Wastewater Pumping Station Wet Well And Valve Vault Section D-D **STANDARD NO. PS-11**

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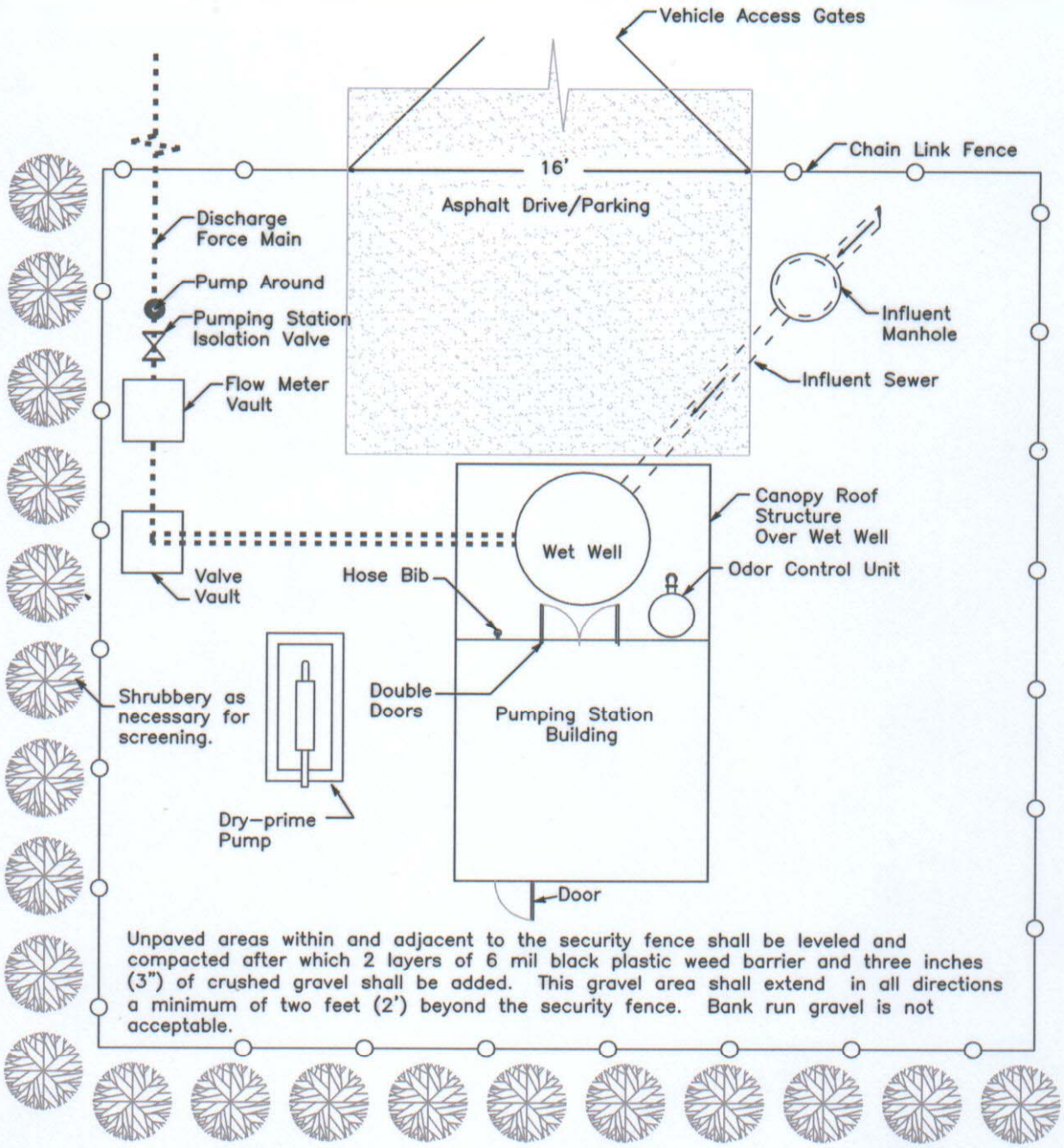

Unpaved areas within and adjacent to the security fence shall be leveled and compacted after which 2 layers of 6 mil black plastic weed barrier and three inches (3") of crushed gravel shall be added. This gravel area shall extend in all directions a minimum of two feet (2') beyond the security fence. Bank run gravel is not acceptable.

Note:
Drawing not to scale. Site Layout is one of several possible layouts and is for illustrative purposes only.

Dry-prime pump may be substituted with a generator with the approval of the Engineer.

Asphalt parking and drive shall be constructed in accordance with Standard Detail G-23 or as directed by the Engineer.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Submersible Wastewater Pumping Station Site Plan **STANDARD NO. PS-12**

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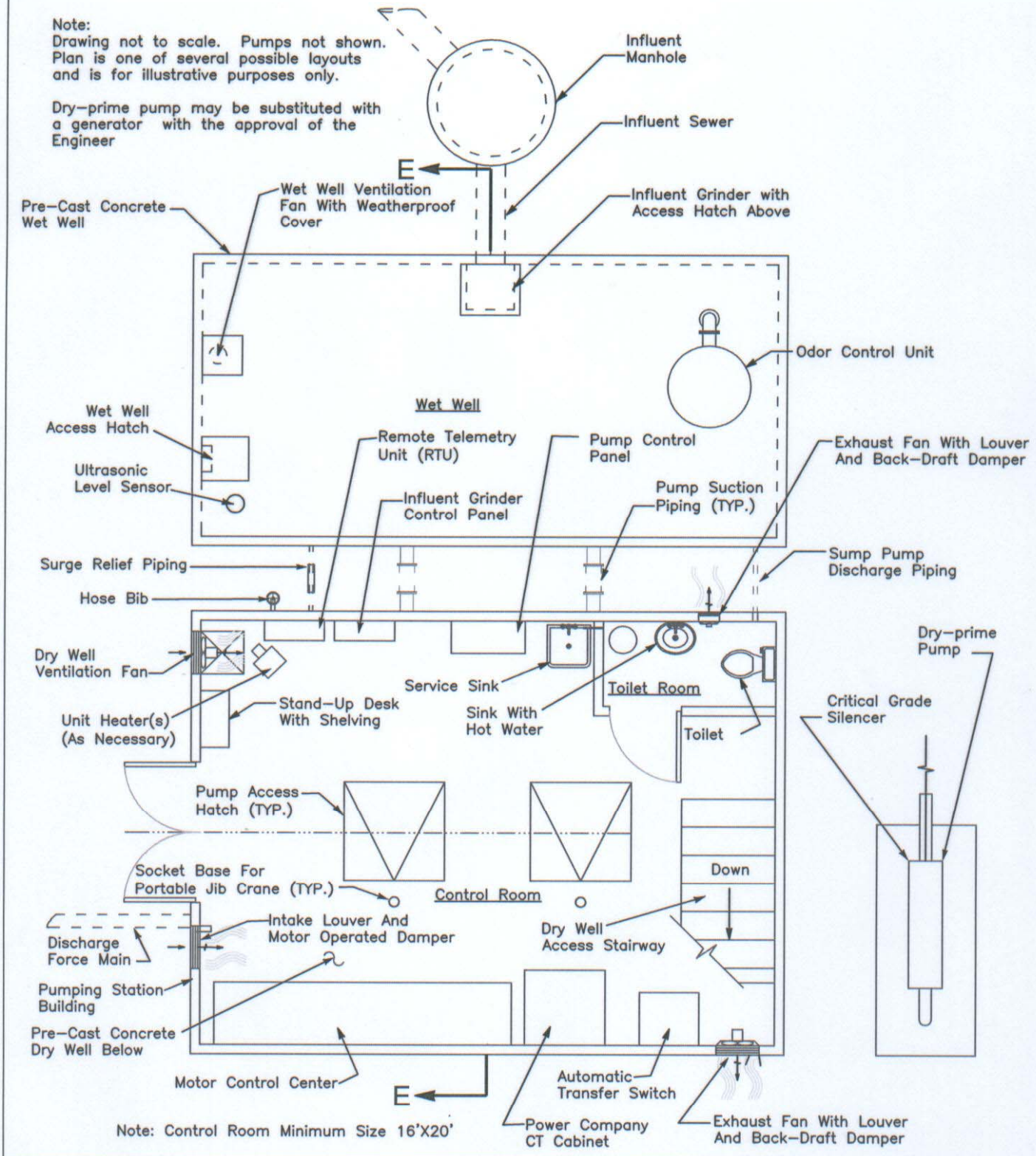

	APPROVED	**REVISIONS**	ST. MARY'S COUNTY METROPOLITAN COMMISSION
		DATE / INITIALS	**STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES**
		6/18/09 J.E.C.	
	C. I. FREDERICK JR., P.E. CHIEF ENGINEER		Typical Plan For Package Wastewater Pumping Station
	DATE: 7/1/09		**STANDARD NO. PS-13**

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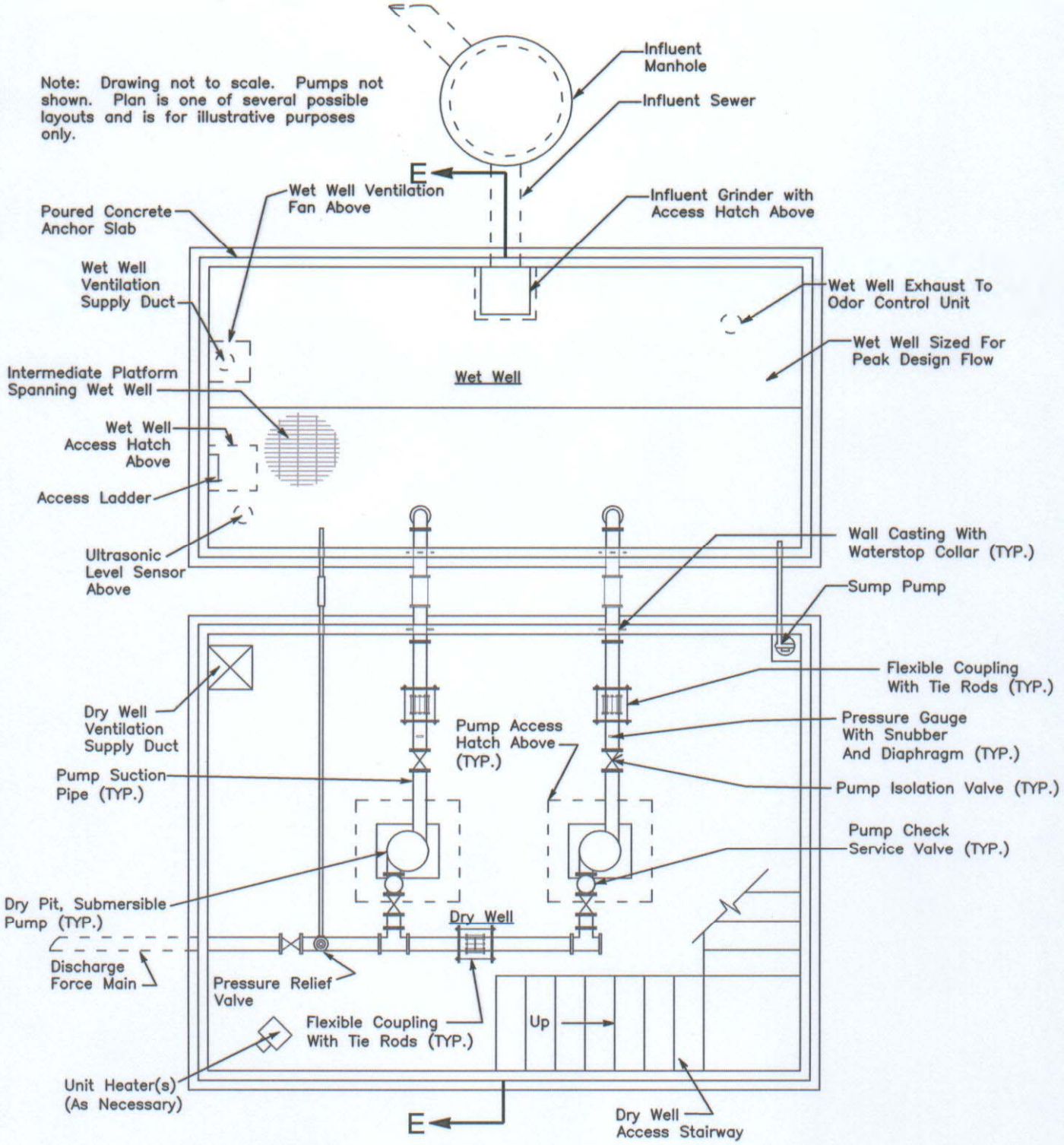

St. Mary's County Metropolitan Commission — Since 1954 — Potable Water Distribution — Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Package Wastewater Pumping Station Wet Well and Dry Well Plan **STANDARD NO. PS-14**

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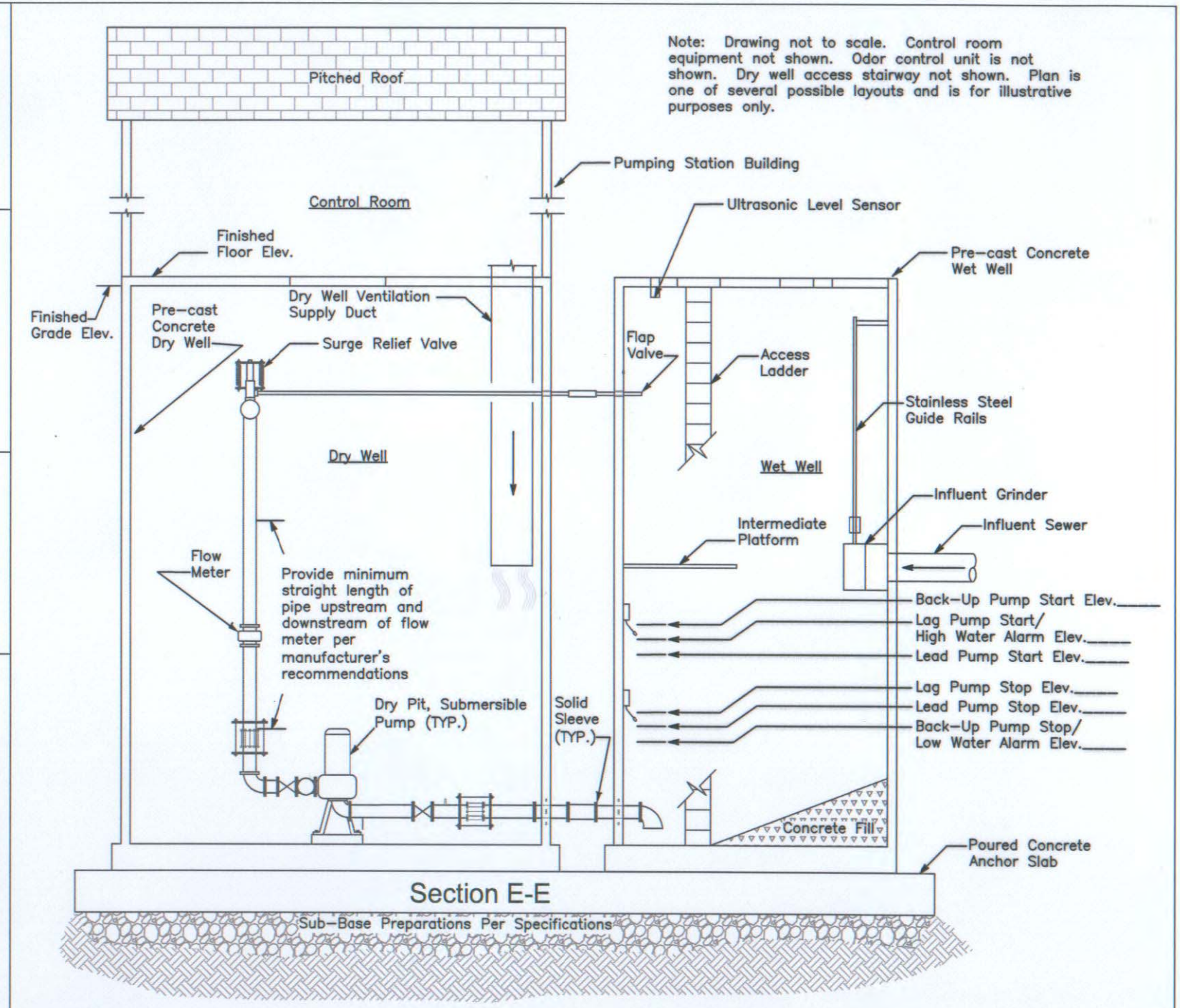

Potable Water Distribution
St. Mary's County
Since 1964
Metropolitan Commission
Wastewater Treatment

APPROVED

C. I. FREDERICK JR., P.E.
CHIEF ENGINEER

DATE: 7/1/09

REVISIONS			
		DATE	INITIALS
		6/18/09	JEC

ST. MARY'S COUNTY
METROPOLITAN COMMISSION
STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES

Package Wastewater Pumping Station
Wet Well and Dry Well Plan
Section E-E

STANDARD NO. PS-15

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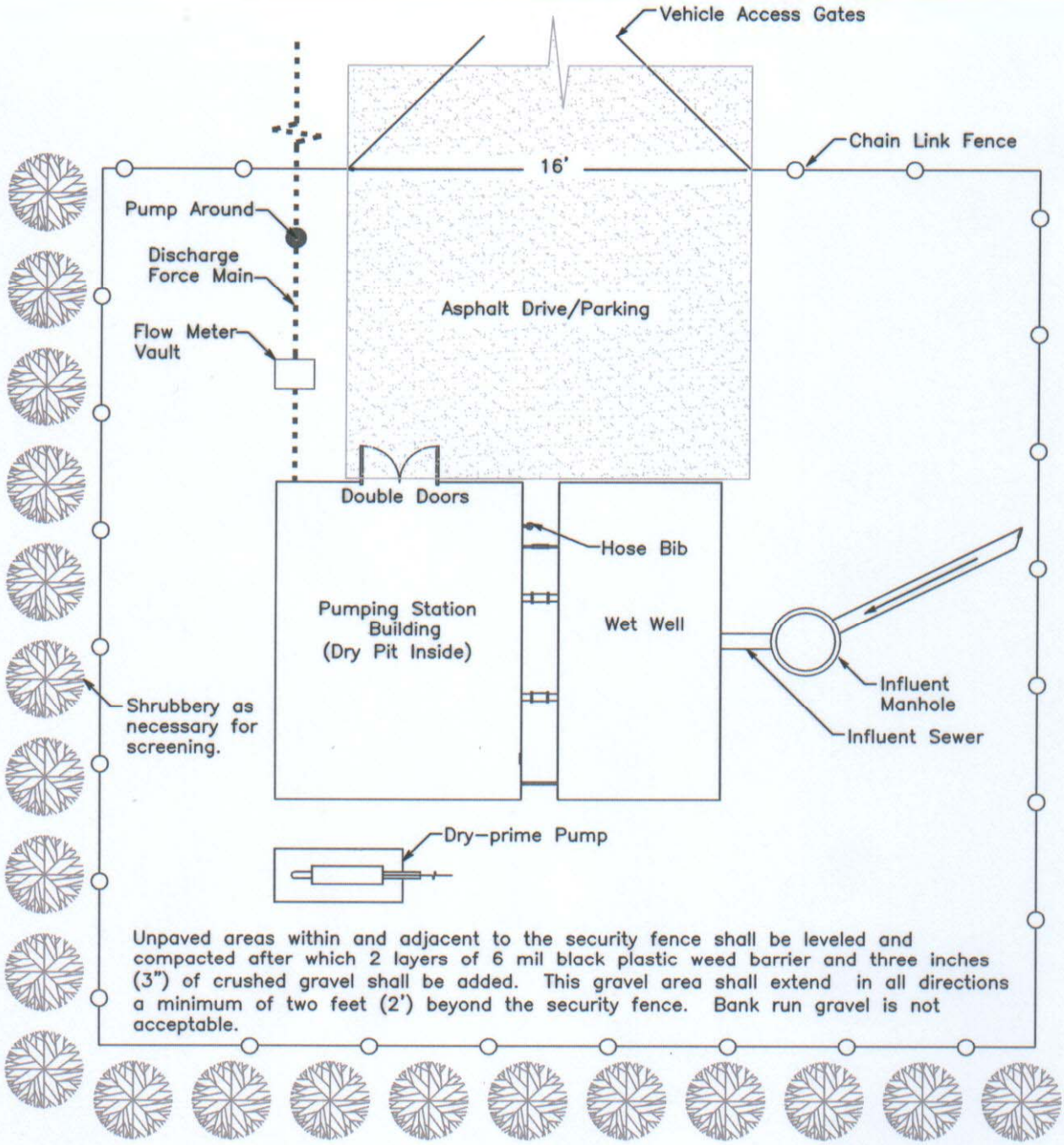

Unpaved areas within and adjacent to the security fence shall be leveled and compacted after which 2 layers of 6 mil black plastic weed barrier and three inches (3") of crushed gravel shall be added. This gravel area shall extend in all directions a minimum of two feet (2') beyond the security fence. Bank run gravel is not acceptable.

Note:
Drawing not to scale. Site Layout is one of several possible layouts and is for illustrative purposes only.

Dry-prime pump may be substituted with a generator with the approval of the Engineer.

Asphalt parking and drive shall be constructed in accordance with Standard Detail G-23 or as directed by the Engineer.

St. Mary's County Metropolitan Commission Since 1964 Potable Water Distribution Wastewater Treatment	**APPROVED** C. I. FREDERICK JR., P.E. CHIEF ENGINEER DATE: 7/1/09	**REVISIONS** DATE: 6/18/09 — INITIALS: J.E.C.	*ST. MARY'S COUNTY METROPOLITAN COMMISSION* ***STANDARDS FOR PUBLIC WATER, SEWER AND INCIDENTAL STRUCTURES*** Package Wastewater Pumping Station Site Plan **STANDARD NO. PS-16**

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St. Mary's County Metropolitan Commission

www.metcom.org

Technical Specifications

Effective July 11, 2019

23121 Camden Way, California, MD 20619
Telephone: 301-737-7400
Website: www.metcom.org

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TABLE OF CONTENTS

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SECTION 01107

CONSTRUCTION STAKEOUT

1.0 GENERAL

A. Description

A. The Owner or the Commission will or has established baselines, bench marks, coordinates or other necessary controls for the Contractor's use. The Contractor shall hire professional surveyor licensed to practice in State of Maryland to perform stakeout from the furnished control points (traverse, property lines, corners, bench marks, coordinates). The Contractor shall furnish qualifications to the owner and the Commission before commencing the work.

B. The Contractor shall preserve and maintain in proper position: survey points, bench marks, and baselines provided. The professional surveyor shall reset points disturbed; The Owner or the Commission may arrange for resetting points and deduct cost from monies due Contractor.

C. The Contractor shall notify the Owner and the Commission of any construction stake out deviations from Drawings. Discrepancies will be resolved under the direction of the Owner and the Commission before proceeding with work.

2.0 MATERIALS

A. Materials Furnished by the Commission.

3.0 EXECUTION

A. For construction:

1. Stake out test pits and furnish the Owner and the Commission with actual utility locations and elevations or as otherwise directed by the Owner and the Commission.

2. Stake out centerlines and offset lines with spacing of stations a maximum of 50 feet (stakes, nails, crosses).

3. Stakeout intermediate points (P.C., P.T., structures, fittings, ends of lines and topographic changes) and as deemed necessary by the Owner and the Commission.

4. Submit grade sheets showing for each station the marked point elevation, invert elevation required and corresponding cut for both centerline and appropriate offset.

    a. Each set of notes shall check within plus or minus 0.04 feet.

5. Flag stakes for protection of all stakes installed to aid in their preservation and maintenance.

6. Perform other Engineering and stake out necessary for setting of batterboards, forms, string lines and finished grade control, slope stakes and other controls which may be required for proper construction of work.

4.0 MEASUREMENT AND PAYMENT

Construction stakeout will not be measured but will be incidental to the installations. Including furnishing, placing and maintaining construction layout stakes, flagging of clearing limits and wetlands, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

**** END OF SECTION 01107 ****

SECTION 01108

MOBILIZATION

1.0 GENERAL

A. Description

1. This work shall consist of the construction preparatory operations, including the movement of personnel and equipment to the project site and for the establishment of the Contractor's offices, buildings, and their facilities necessary to begin work.

2.0 MATERIALS

A. Not Applicable.

3.0 EXECUTION

A. All work performed in providing the facilities and services shall be done in a safe and workman like manner.

4.0 MEASUREMENT

Measurement shall be in accordance with the Measurement and Payment Section or as indicated elsewhere, or if not indicated shall be considered incidental to other work.

5.0 PAYMENT

Payment shall be in accordance with the Measurement and Payment Section or as indicated elsewhere, or if not indicated shall be considered incidental to other work.

**** END OF SECTION 01108 ****

SECTION 02012
TEST PITS

1.0 GENERAL

A. Description

1. Test pits shall include, but not necessarily be limited to, excavation to determine the exact horizontal location and/or elevation of underground structures, utilities, and other obstructions; the backfill and compaction of the excavation; and the stabilization of the surface, in accordance with the Contract Documents.

2. Prior to construction it shall be the Contractor's responsibility to establish the location and/or elevation of existing utilities and structures that may affect the proposed work.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250

2. Restoration: Section 02800

C. Quality Assurance

It is intended that all suitable materials removed from the test pit excavation, exclusive of paving materials, be used for backfill. The Commission has the right to inspect all material used as backfill to determine the material's suitability for use as backfill.

2.0 MATERIALS

A. Materials Furnished by the Commission

None

B. Contractor's Options

1. Use of Excavated Material

All suitable material excavated from test pits shall be used, as far as practicable, for backfill. The Contractor shall properly store or stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the Commission. All unsuitable material shall be removed from the excavation and disposed of off-site in accordance with local, state and federal regulations by and at the expense of the Contractor.

2. Borrow

Borrow material for test pit backfill shall meet the requirements of Section 02250.

3. Graded Aggregate Subbase

Graded aggregate subbase for test pit backfill shall meet the gradation requirements specified in Section 02240.

C. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

It shall be the Contractor's responsibility to determine the location and/or elevation of underground structures and utilities by the use of test pit excavation prior to initiating excavation operations for the installation of the proposed facility. Test pits shall be of the size, depth and location as approved by the Commission. Should the location and/or elevation thus determined be different from that shown on the Plans, the Contractor shall promptly furnish the correct information to the Commission so that the impact on the project may be determined.

B. Test Pits

1. The Contractor shall provide all necessary traffic control in accordance with the applicable regulations.

2. Surface preparation, excavation, backfill, compaction, and maintenance of the backfilled excavation shall be as specified in Section 02250 for trenches, except that the limits of the work shall be as approved by the Commission.

3. Restoration shall be as specified in Section 02800 unless otherwise specified or directed by the Commission.

4.0 METHOD OF MEASUREMENT

Measurement for test pits will be made on the basis of the volume of material actually removed from within the limits specified by the Commission.

5.0 BASIS OF PAYMENT

Payment for test pits will be made at contingent prices established in the bid proposal. The price bid shall include furnishing all labor, material, equipment, and incidentals necessary to perform the traffic control, excavation, backfill, compaction and surface restoration or pavement patch for the test pit.

No payment will be made for test pit excavation performed to establish the location of existing utilities shown on the Plans.

****END OF SECTION 02012****

SECTION 02050
REMOVAL OR ABANDONMENT OF EXISTING UTILITIES

1.0 GENERAL

A. Description

1. Removal or abandonment of existing utilities and underground structures shall include, but not necessarily be limited to, the removal, salvage, demolition in place, abandonment, or other disposition of existing utilities, underground structures, or other facilities shown on the plans, encountered in the course of the work, and/or as directed by the Commission and in accordance with the Contract Documents.

2. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the Contractor's property. Salvaged materials specified to remain the property of the Commission shall be transported to another location designated by the Commission.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250

2. Water Main Installation and Chlorination: Section 02551

3. Gravity Sanitary Sewer and House Connections: Section 02561

4. Sanitary Sewer Manholes: Section 02562

5. Cast-in-Place Concrete: Section 03300

6. Flowable Fly Ash: Section 03500

7. Mortar: Section 04100

8. Brick Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials and work to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the Commission

Not Applicable.

C. Contractor's Options

None

D. Detailed Material Requirements

1. Borrow material for backfilling the space left by removal of facilities or backfilling abandoned structures shall meet the requirements specified in Section 02250.

2. Pipe plugs and caps for water or sewer main abandonment shall be as specified in Section 02551 and 02561 respectively.

3. Portland cement concrete for abandonment of utilities shall be Mix No. 1 as specified in Section 03300.

4. Flowable Fly Ash shall be as specified in Section 03500.

5. Mortar shall be as specified in Section 04100.

6. Brick for pipeline and structure bulkheads shall be sewer brick as specified in Section 04200.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Utilities to be abandoned or removed shall not be abandoned or removed until all required utility work is installed and tested to the complete satisfaction of the Chief Engineer. The Contractor shall notify the Commission at least five (5) working days prior to beginning the abandonment or removal.

2. The area over the existing facility to be removed shall be excavated and, after removal or abandonment as specified, backfilled and compacted in accordance with Section 02250.

3. Brick construction shall be as specified in Section 04200 and as specified herein.

4. Rubbish and debris shall be removed from the site unless otherwise directed so as to not allow accumulations inside or outside the project site. Materials that cannot be removed daily shall be stored in areas approved by the Commission.

5. Where as indicated by the governing agency flowable fly ash will be required to fill the pipeline sections.

B. Removal

Where indicated on the Plans, or directed by the Commission, existing utility pipelines and/or appurtenances shall be removed by the Contractor.

C. Abandonment

1. Sanitary Sewers 15-inch Diameter and Smaller

   a. All open ends of abandoned sewer pipe shall be sealed by setting an approved plug in the pipe or constructing a minimum 12-inch thick brick and mortar or concrete bulkhead.

   b. Where a sewer is to be abandoned while the adjacent manhole is to remain active the Contractor shall seal (watertight) the pipeline opening in the manhole with an approved plug or constructing a minimum 12-inch thick brick and mortar or concrete bulkhead. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.

   c. Abandon sewer services by removing the vertical stack to a minimum depth of 2 feet below finish grade. The stack shall be detached by saw cutting. A waterproof plug shall be installed on the abandoned vertical stack and encased in concrete. Backfill shall be as specified in Section 02250.

2. Sanitary Sewers 18-inch Diameter and Larger

   a. All open ends of abandoned sewer pipe shall be sealed by setting an approved plug in the pipe or constructing a minimum 20-inch thick brick and mortar or concrete bulkhead.

   b. Where a sewer is to be abandoned while the adjacent manhole is to remain active the Contractor shall seal (watertight) the pipeline opening in the manhole with an approved plug or constructing a minimum 20-inch thick brick and mortar or concrete bulkhead. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.

3. Sanitary Manholes

   a. Frames and covers of abandoned manholes will remain the property of the Commission. They shall be removed from the structure and transported to a designated location.

   b. The Contractor shall remove the structure to at least two feet (2' - 0") below finished grade.

   c. Pipe openings within the manhole shall be sealed as noted within this section prior to backfilling the structure with approved backfill material that meets the compaction requirements noted in Section 02250, 3.0, D.

4. Water Mains and Appurtenances

   Where indicated on the Plans, or directed by the Commission, the Contractor shall abandon existing water mains and/or appurtenances as follows:

a. The section of water main remaining in service shall be capped or plugged and strapped and/or buttressed in accordance with the Contract Documents.

b. When abandoning water mains 20-inches in diameter and larger, construct a 20-inch thick brick and mortar or concrete bulkhead, or plug, or cap each end of the abandoned sections. All open ends of abandoned water pipe shall be sealed.

c. For water mains smaller than 20-inch diameter, install plugs or caps at each end of the abandoned sections.

d. Abandon water services by exposing the corporation stop at the main, turning stop off, disconnecting the service line from the corporation stop, inserting a plug or cap on the exposed end of the corporation stop, encasing corporation stop in 6 inches of concrete, and backfilling excavation to finished grade.

e. The Contractor shall remove all structures to a minimum depth of two feet below finished grade, break or drill holes in the bottom of the structure to provide drainage, and backfill the structure as specified in Section 02250.

4.0 METHOD OF MEASUREMENT

A. Removal

Measurement for removal of existing utilities and appurtenances will be made horizontally along the centerline of the pipe for each size and type of pipe removed without deduction for valves or fittings. Measurement for removal of existing structures will be made on the basis of the count or number of structures removed.

Measure for removal of existing utilities and appurtenances underground structures will not be made unless the appropriate item is provided in the proposal.

B. Abandonment

Measurement for abandonment of existing utilities and underground structures will be made on the basis of the horizontal measurement of each pipeline section abandoned or on the basis of each count or number of structures abandoned.

Measurement for abandonment of existing utilities and underground structures will not be made unless the appropriate item is provided in the proposal.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.

2. The price bid for removal or abandonment of existing utilities and underground structures shall include the following:

   a. Excavation, backfill, and compaction as specified in Section 02250.

   b. Furnishing and installing borrow material for backfilling the space left by removed facilities, initial excavation, and/or abandoned structures as required by the Contract Documents.

   c. Storage of materials to be retained by the Commission, and disposal of those materials which the Commission does not want to retain.

   d. Furnishing materials for and constructing or installing caps, plugs, and/or bulkheads and appropriate concrete blocking on pressurized mains.

   e. Furnishing materials for and reconstructing channels or benches in existing manholes and/or structures.

3. Payment will be made for contingent items when approved by the Commission.

   a. Removal

      Payment for removal of existing utilities and appurtenances will not be paid for as a separate item and will considered incidental to other items of work unless the appropriate item is provided in the proposal. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

   b. Abandonment

      Payment for the abandonment of existing utilities and underground structures will not be paid for as a separate item but is considered incidental to other items of work unless the appropriate item is provided in the proposal. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work..

****END OF SECTION 02050****

SECTION 02110
CLEARING AND GRUBBING

1.0 GENERAL

A. Description

1. Clearing and grubbing shall include, but not necessarily be limited to, clearing areas of trees, brush, shrubs, down timber, rotten wood, other vegetation, debris and rubbish, as well as removal of fences and incidental structures; and grubbing or removing from the ground all stumps, roots and stubs, brush, organic materials, and debris, in accordance with the Contract Documents and within the limits of disturbance.

2. Contractor shall be responsible for acquiring all required permits associated with tree removal and tree trimming.

B. Related Work Included Elsewhere

None

C. Quality Assurance

The Commission will inspect the work to insure that it is performed in accordance with the Contract Documents.

2.0 MATERIALS

Not applicable.

3.0 EXECUTION

A. Limits

1. General

   a. Unless otherwise indicated in the Contract Documents, all trees and other growth within the site easement or rights-of-way may be removed. Designated trees in temporary construction easements are to be saved.

   b. Within the limits indicated on the Contract Documents to be cleared and grubbed, the Commission has the right to designate trees and other growth which the Commission may desire to leave standing.

   c. The clearing and grubbing operation shall be completed before major construction is under taken.

2. Utility Construction

   Limits of clearing and grubbing include only those areas within the easement or right-of-way which are actually necessary for construction. Clearing will not be permitted in temporary construction easements unless specifically indicated in the Contract Documents or approved by the Commission.

B. Unsuitable Materials

Note that after the clearing and grubbing operations are completed, unsuitable materials such as unstable formations, root mat, or swamp muck encountered below the surface of the ground must also be removed and properly disposed.

C. Salvaged Materials

When indicated, such materials as leaf mold or other organic materials above the surface of the ground and suitable for use as mulch or topsoil shall be salvaged and stockpiled.

D. Trees, Shrubbery and Plants

The Commission will designate and clearly mark any trees, shrubbery, and plants which are not to be removed, and the Contractor shall protect them from any damage, as outlined in the **"General Provisions**." Where trees which are left standing are trimmed or become scarred by the Contractor's operations, the cuts or scars shall be repaired by the Contractor. All trimming and repairs shall be done by skilled workmen and in accordance with good tree surgery practices under the supervision of a tree expert licensed by the State of Maryland.

E. Burning

If allowed, the Contractor shall obtain the appropriate permits to allow the burning of trees, brush, trash, or other perishable materials. If burning is prohibited by the Fire Marshal, the Contractor shall remove these materials and dispose of them off-site in permitted disposal facilities.

F. Disposal Locations

Perishable materials and debris shall be removed from the site easement or right-of-way and disposed of at locations off the project and outside the limits of view from the project by the Contractor. The Contractor shall make all necessary arrangements with property owners, in writing, for obtaining suitable disposal locations, and furnish the Commission with a copy of the agreement. The cost involved shall be included in the price bid. The Contractor shall be responsible for obtaining all State and local permits for the disposal locations and furnish the Commission with evidence indicating the sites are approved for disposal.

G. Fences

All fences within the easement or right-of-way that are identified to remain shall be removed as carefully as practicable and replaced so that it remains in a condition equal to or better than what existed prior to construction.

H. Excavation Areas

Within areas to be excavated, all imbedded stumps, root mats, etc., shall be removed to a depth of not less than 1-foot below the subgrade or slope surfaces. All depressions made below the subgrade or slope surfaces by the removal of stumps or roots shall be refilled with materials suitable for embankment and shall be compacted in accordance with the requirements in Section 02250.

4.0 METHOD OF MEASUREMENT

The amount of clearing and grubbing will not be measured.

5.0 BASIS OF PAYMENT

Payment for clearing and grubbing will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

**** END OF SECTION 02110 ****

SECTION 02240
AGGREGATE BACKFILL

1.0 GENERAL

A. Description

Aggregate backfill shall include, but not necessarily be limited to, furnishing and placing granular material for the installation of pipes, fire hydrants, manholes, vaults, and other structures as directed by the Commission, indicated on the plans, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02551
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Fire Hydrants: Section 02554
5. Gravity Sanitary Sewer and House Connections: Section 02561
6. Sanitary Sewer Manholes: Section 02562
7. Sanitary Sewer Force Mains: Section 02563

C. Quality Assurance

All aggregate fill material will be subject to test by the Commission to determine the material's compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish aggregate fill material.

B. Contractor's Options

When properly compacted, sand that meets the Maryland SHA requirements for fine aggregate may be used for PVC water mains and sanitary force mains in lieu of AASHTO M43, Size 57 as shown on the Standard Details.

C. Detailed Material Requirements

1. Aggregate fill material for the installation of pipes, hydrants, manholes, vaults and miscellaneous structures as noted in the Standard Details shall meet the requirements of AASHTO M43, Size 57.
2. Aggregate fill material for subgrade stabilization shall meet the requirements of AASHTO M43, Size 3.

3. Aggregate backfill material that meets the Maryland SHA requirements for graded aggregate subbase may be used with the approval of the Chief Engineer.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. If areas of the foundation are soft, composed of mud, or are, in the Commission's judgment, unfit to receive the pipe, structure, concrete, or masonry, then such unacceptable material shall be removed and replaced with aggregate fill material as directed by the Commission.

B. The aggregate backfill material shall be carefully placed to the dimensions indicated on the plans or directed by the Commission.

C. Except for Size 57 or 3, all aggregate backfill material shall be compacted.

E. Aggregate fill shall not be dropped from heights in excess of 5 feet above utility.

4.0 METHOD OF MEASUREMENT

A. Except when shown as a bid item or noted otherwise, measurement for aggregate fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

When shown as a bid item, measurement for borrow backfill material will be based on the section computed as follows:

Length will be the entire horizontal distance on a linear-foot basis measured along the centerline of the trench, deducting volume measurement for pipe, conduits, fittings, couplings, manholes, structures, bedding materials, any existing facilities, overlap of prior paid utility trenches, and measurement through any items in the proposal that contains a separate provision for payment.

Width for calculating backfill payment for utilities shall be the actual trench width or the outside diameter of the pipe plus 12 inches, whichever is less.

Trenches that exceed 4 feet in depth will be allowed one extra foot in width for shoring box, should shoring be required. No allowance will be made for over-width trenches when in the opinion of the Engineer adequate shoring would have prevented sloughing of the trench walls beyond the designed width. Contractor shall immediately notify Engineer when encountering unstable material that will not stand under normal shoring practices. Failure to notify Engineer will result in loss of any allowance for over-excavation or backfill.

Depth will be the vertical measurement from the top of the pipe or pipe bedding material (whichever is greater elevation) to the original ground or subgrade (whichever is lesser in

elevation), deducting volume measurement for pipe, conduits, fittings, couplings, manholes, structures, bedding materials, any existing facilities, overlap of prior paid utility trenches, and measurement through any items in the proposal that contains a separate provision for payment. Depth of trench will be measured at minimum intervals of 20 feet along the centerline of trench between linear pay limits as specified herein, unless physical conditions necessitate a change that is mutually acceptable to both Engineer and Contractor. Trench depth will be the average depth between measuring points. Pay depth shall not exceed depth shown on the Plans unless authorized by Engineer.

5.0 BASIS OF PAYMENT

A. General

1. Except when shown as a bid item or noted otherwise, payment for aggregate fill will not be made, as it shall be included in the unit price item for all pipe and structures installed.

2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

3. Payment will be made for items only when approved by the Commission.

B. Aggregate Fill

1. The price(s) shall be as shown on the bid form and shall include the furnishing borrow material, providing an approved spoil site, and disposing of all spoil or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas temporary stockpiling, placing, compaction and all incidentals required to complete this work.
2. In addition to the work listed above, trench excavation, backfill, and compaction shall also include the traffic control, removing, storing, and rehandling of surface materials over the trench, including paving; the scoring of existing paving in a straight and uniform line; the excavation of all materials encountered in the trench including excavation at manholes, structures, vaults, and other appurtenances that may be shown or required, and any extra excavation necessary for sheeting or bracing or installation of other excavation support systems; the backfilling and compaction of trenches; the removal and disposal of unsuitable and/or surplus material; and all other incidental items to complete the work.

3. No payment will be made for any aggregate fill which is used because of any error in the Contractor's operations, such as excavating beyond specified lines or grades, etc.

**** END OF SECTION 02240 ****

SECTION 02250
TRENCH EXCAVATION, BACKFILL AND COMPACTION

1.0 GENERAL

A. Description

1. Trench excavation, backfill and compaction shall include, but not necessarily be limited to, the excavation, backfill, and compaction of trenches for pipelines, fire hydrants, valves, manholes, vaults and other structures shown on the Plans, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Test Pits: Section 02012
2. Removal and Abandonment of Existing Utilities: Section 02050
3. Aggregate Backfill: Section 02240
4. Boring and/or Jacking Pipe: Section 02300
5. Tunneling: Section 02400
6. Water Main Installation and Chlorination: Section 02551
7. Water Valves and Appurtenances: Section 02552
8. Water Services, Water Meter Settings and Vaults: Section 02553
9. Fire Hydrants: Section 02554
10. Gravity Sanitary Sewer and House Connections: Section 02561
11. Sanitary Sewer Manholes: Section 02562
12. Sanitary Sewer Force Mains: Section 02563

C. Quality Assurance

1. All materials removed from trench excavations and used for backfill will be subject to test by a geotechnical engineer at the Contractor's expense. Test results shall be submitted to the Commission prior to use of the material for backfill.

2. Soil Laboratory and Field Density Tests

a. The Contractor shall retain a geotechnical engineer, licensed in Maryland as a Professional Engineer, for all soil laboratory and field density testing. The geotechnical engineer, with the concurrence of the Chief Engineer, shall determine the number of samples to be taken, the location of the samples, and the frequency of tests required to confirm compliance with the specifications. The Contractor shall assist the geotechnical engineer in obtaining samples and shall provide a smooth surface for conducting field density testing. The Contractor will not be entitled to any claim for additional compensation due to the testing requirements specified herein.

b. At the start of the trenching operation, the Contractor shall demonstrate to the geotechnical engineer, with the concurrence of the Chief Engineer, that the compaction density specified herein can be attained by the compaction equipment and methods the Contractor intends to use. Once the method and equipment has been approved, no substitutions will be permitted with written concurrence by the geotechnical engineer and written approval of the Chief Engineer. Actual demonstration of the suitability of the compaction equipment and methods will be required whenever there is a change in trench conditions.

c. Should testing determine that the required density is not being met, or the material is outside of the specified moisture range, the Contractor shall, without additional compensation, re-excavate, rework and/or recompact the particular layer or section until the required density and/or moisture content is attained.

3. Submittals

a. The Contractor shall submit for approval a list of the compaction equipment the Contractor intends to use on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction.

b. Submit soil test results on a bi-weekly basis. Prior to Operational Acceptance the Contractor shall submit a certification from the geotechnical engineer certifying that all fill areas have been compacted according to the codes, plans and specifications.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for trench backfill other than those materials which are available from the trench excavation limits as shown on the Standard Details and the Contract Documents.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Material for backfills may be from on-site excavations (if of proper quality) or from borrow sources. The material shall be free from organic material, sludge, grit, trash, muck, roots, logs, stumps or frozen material and other deleterious substances. Except as otherwise specified or approved, the material shall not contain rocks or lumps larger than six inches in greatest dimension. The material shall not contain mica in quantities which, in the judgement of the Commission are sufficient to affect compaction characteristics. Materials having a maximum dry density of less then 100 pounds per cubic foot (AASHTO T 180) shall not be used unless specifically approved in writing by the Commission. Cinders, ashes, rubble and construction debris shall not be used in the work. The use of any soil additive that in the judgement of the Chief Engineer may adversely affect the proposed utility is strictly prohibited. Materials having moisture content greater

than 6% points above or below the optimum shall not be used as backfill and shall be considered unsuitable material.

2. Use and Ownership of Excavated Material

   a. All suitable material excavated from utility trenches shall be used, as far as practicable, for backfill in trenches.

   b. The Contractor shall properly store, stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at his own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the Commission. All unsuitable and surplus suitable material, as determined by the Commission, shall be removed from the excavation and disposed of off-site by and at the expense of the Contractor in accordance with all applicable Federal, State, and local regulations.

   c. If insufficient suitable soils are identified from the excavation on the contract project, the Contractor may obtain suitable soils from sources outlined in the Special Provisions, or from such sources approved by the Chief Engineer and/or the governing regulatory agency. Suitable soils obtained from other sources shall be supplied and placed at the contact unit price or when not provided for in the contract shall be considered incidental to other specified work.

3. Excavation Backfills on rights-of-way, improved easements or supporting pavements or surface loads shall be constructed of Class 1 Soils compacted as herein specified or noted in the Contract Documents. Class 1 Soils shall meet the requirement for materials as classified by AASHTO, A-1, A-2 or A-3, or as classified by the Unified Soil Classification System as GW, GP, GM, SW, SP, SM or SC.

4. Excavation Backfills not supporting surface loads or pavements and in unimproved easements shall be constructed of Class I or Class II Soils placed as herein specified or noted in the Contract Documents. Class II Soils shall include all materials designated in Class 1 Soils and Unified Soil Classifications ML, CL, MH or CH.

5. Aggregate backfill for pipe and structure installation, bedding and trench backfill shall meet the gradation requirements specified in Section 02240.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Surface Preparation

1. Sediment Control

The Contractor shall install all required sediment control devices in accordance with permits and all applicable Federal, State and local regulations.

2. Clearing and Grubbing

The Contractor shall clear and grub the surface over the line of the trench in accordance with the requirements of Section 02110.

3. Removing Pavement, Sidewalk, Curb, etc.

a. The Contractor shall remove pavement, sidewalk, curb, etc. over the line of the trench in accordance with Standard Details.

b. The Contractor shall remove paving only to the width shown on the Standard Details, noted in the Special Provisions, or as directed by the Commission. When the Contractor removes paving for a greater width than is deemed necessary or disturbs paving, sidewalk, curbs, etc. due to settlement, slides, or cave-ins, or in making excavation outside the limits of the trench without written order of the Commission, the Commission will require the Contractor to replace the excess damaged area and may retain from payments due the Contractor such amounts required to permanently replace the excess material removed. The Contractor shall be responsible for repaving or surfacing roadbeds or replacing sidewalk, curbs, etc. that have failed, settled, or have been damaged at any time before expiration of the Contract maintenance period due to work or any other activities by the Contractor, his subcontractors, or suppliers.

4. Maintaining Traffic

The Contractor shall furnish all labor, tools, equipment, and materials required for the maintenance of traffic during construction in accordance with the traffic control plan or permits.

B. Trench Excavation

1. General

a. Excavation for the installation of utilities shall be unclassified and shall consist of the excavation removal and/or disposition of all material encountered to the lines, grades, and sections shown on the Plans and/or the Standard Details, as specified, or as directed by the Commission.

b. Unless otherwise indicated, excavation shall be by open cut, except that short sections of a trench may be tunneled, or the pipeline jacked, if, in the opinion of the Commission, the pipe can be safely and properly installed.

c. For saw cutting existing pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

d. Trenches may be excavated and backfilled either by hand or by machinery. The Contractor shall have no claims, nor will extra compensation be allowed, for hand excavation or backfill which may be required by these Specifications or by the Commission for protection of existing utilities or structures.

e. Ground profiles shown on the Plans represent the elevations along the centerline of the trench.

2. Protection of Property and Structures

The Contractor shall, at his own expense, sustain in place and protect from direct or indirect injury all existing facilities in the vicinity of the excavation, whether above or below the ground, or that may appear in the trench. The Contractor shall be responsible for the implementation of protective measures associated with the presence or proximity of pipes, poles, tracks, walls, buildings, property markers, and other structures and property of every kind and description in or over his trenches or in the vicinity of his work whether above or below the surface of the ground. The Contractor shall repair or replace damaged facilities at his expense.

3. Utility Adjustments

a. All adjustments to utilities other than those owned by the Commission shall be performed by the utility owner.

b. Adjustments to water services between the property line and the water main shall be performed by qualified utility contractors. Adjustments between the property line and the house shall be performed in accordance with the County Plumbing Code. It shall be the Contractor’s responsibility to obtain all permits necessary for the performance of this work.

c. Adjustments to sanitary sewers within the Commission Easement or right-of-way shall be accomplished by a qualified utility contractor. Adjustments to sanitary sewers outside the Commission Easement or right-of-way shall be performed in accordance with the County Plumbing Code. It shall be the Contractor's responsibility to obtain all permits necessary for the performance of this work.

4. Obstructions Shown on Plans

a. Certain information regarding the reputed presence, size, character, and location of existing underground utilities and structures has been shown on the Plans based upon available records. There is no certainty of the accuracy of this information, and it shall be considered by the Contractor in this light. If test pit data is not shown on the Plans, the Contractor shall excavate test pits in advance of his work in accordance with Section 02012 to locate existing utilities. The Contractor shall hereby distinctly understand that the Commission is not responsible for the correctness or sufficiency of the information given. The Contractor shall have no claim for delay or extra compensation on account of incorrectness of information given, or on account of the insufficiency or absence of information regarding obstructions. The Contractor shall have no claim for relief from any obligation or responsibility under the Contract in case

the location, size, or character of any underground facility is encountered that is not shown on the Plans.

b. It shall be the responsibility of the Contractor to notify "MISS UTILITY," all municipal utilities, all utility line owners, and any other parties affected prior to the beginning of work. It is the Contractor's responsibility to reference and maintain the location markings during the construction of the project. In the event that a utility location needs to be re-established by the Commission, the cost to provide this shall be borne by the Contractor.

5. Removing Obstruction

a. Should the position of any pipe, conduit, or other structure above or below ground be such as, in the opinion of the Commission, to require its removal, realignment, or change due to the work to be done under the Contract, the work of removal, realignment, or change will be done as extra work, or will be done by the owner of the obstructions without cost to the Contractor; but the Contractor shall uncover and support the structures in the limits of his trench at his own expense before such removal, and before and after such realignment or change. Whether the obstruction is shown on the Plans or not, the Contractor shall not be entitled to any claim for damage or extra compensation on account of the presence of said structure or on account of any delay in the removal or rearrangement of the same; however, if said structure is not shown on the Plans, time extension will be allowed if deemed to be warranted by the Commission.

b. In the event that obstructions would delay the work of pipe installation, the Contractor may, with Commission approval, be permitted to leave a gap in the work and return to fill the gap after the obstructions have been removed. The installation shall be completed by laying full pipe lengths and appropriate closure pieces.

c. The Contractor shall not interfere with any persons, firms, or corporations or with the Commission in protecting, removing, changing or replacing pipes, conduits, poles, or other structures.

d. In the event that the Commission has entered into any agreement with an affected utility owner or owners which will have an effect on the operations or financial responsibilities of the Contractor, the requirements of these agreements will be included in the Special Provisions of the Contract.

6. Change of Trench Location

a. In the event the Commission directs that the location of a trench be changed to a reasonable extent from that proposed on the drawing on account of the presence of an obstruction, or from other cause, or if a changed location shall be authorized upon the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damages; provided that the change is made before the excavation is begun. If, however, such change, made at the direction of the Commission involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill, will be considered extra work and the Contractor shall be compensated

accordingly. In the event that the trench is abandoned in favor of a new location, at the Contractor's request, the abandoned excavation and backfill shall be at the Contractor's expense.

b. If an obstruction shall lie within the trench in such manner that the trench has to be excavated to extra width in order that sheeting or bracing may be properly placed, or in order that a structure to be placed in the trench may be properly built, such extra width of trench shall be considered as miscellaneous excavation. No sloping of sides of excavation, however, for the purpose of avoiding the necessity of placing sheeting or bracing, either in the presence or absence of obstructions, will be considered as excavation beyond pay limits.

7. Trench Width and Depth

a. Trenches shall be excavated to the necessary width and to the necessary depth to allow for installation of the pipe. This width and depth may be shown on the Plans or Standard Details, as specified in the Special Provisions, or as directed. The trench subgrade shall be such as to provide a uniform and continuous bearing and support for the pipe on solid undisturbed earth for the full length of each pipe, except for that portion at the bell hole. Any part of the bottom of the trench excavated below subgrade shall be backfilled with approved material and compacted in accordance with Contract Documents.

b. Subgrade, in the case of pipe lines, shall be six (6) inches below the underside of the pipe barrel, where the pipe is laid on a granular bedding. Where the pipe is laid on a natural foundation, subgrade shall be four (4) inches below the underside of the pipe barrel.

c. The sides of the trenches shall be practically plumb and under no circumstances will they be permitted to be sloped except with the written approval of the Commission. Should the Contractor elect to slope or cut-back the sides of the trench, no additional payment will be made for extra excavation, backfill, restoration, or contingent items beyond the limits indicated on the Standard Details.

d. Bell holes shall be excavated in the bottom of the trench to ensure that pipe has continuous bearing.

e. Where sheeting or trench boxes are used, the maximum width shall be as noted on the Contract Drawings.

8. Length of Open Trench

a. The Contractor shall keep the backfill operation to the top of trench for offsite and existing areas and to road subgrade in areas of new construction, within 100 feet of excavation and pipe laying operations. The Commission reserves the right to require the backfilling of open trenches over completed pipe lines if, in its judgment, such action is necessary; and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said backfilling, it are compelled to temporarily to stop excavation or other work at any place.

b. All trenches shall be closed at the end of each work day.

c. The excavation of all trenches shall be fully completed at least one full pipe length in advance of pipe installation, unless otherwise authorized.

9. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by him.

10. Trench Support

a. The support of the trench shall be the sole responsibility of the Contractor.

b. The Contractor shall support the sides and ends of all excavations wherever necessary with braces, sheeting, shoring or stringers, trench boxes, or other acceptable excavation support systems. All trench support systems shall be installed by men skilled in such work and shall be so arranged that they may be withdrawn as backfilling proceeds, without injury to the utility or structure constructed or to any roadbed, adjacent structure or property.

c. All timbering in excavations, trench boxes, or excavation support systems shall be withdrawn as the backfilling is being done, except where and to such extent as the Commission shall order in writing that said timbering or excavation support system be left in place or where the Commission permits the trench support to be left in place at the Contractor's expense and upon his request. The Contractor shall cut off any sheeting left in place 2 feet below finished grade and shall remove the material cut off without compensation therefore.

d. Wherever necessary, in running sand, or soft ground, or for the protection of any structure or property, sheeting shall be driven without extra compensation to such a depth below the bottom of the trench as may be required or directed. Where directed by the Commission to leave sheeting in place, payment will be made under the appropriate contingent item.

e. All work shall be performed in accordance with the latest applicable Federal, State, and local safety and health regulations.

11. Drainage and Dewatering

a. The Contractor shall grade the site as necessary to prevent surface water ponding or from flowing into the trench or other utility excavations and shall provide all necessary temporary surface drainage and keep the same operating to the satisfaction of the Commission until permanent drainage or finished grading and permanent surface stabilization has been completed.

b. It shall be the Contractor's responsibility to adequately control water that may be present in the excavation. He shall provide for the disposal of water removed from excavations in such a manner not to cause damage to public or private property or to any portion of the work completed or in progress or cause any impediment to the use of any area by the public; nor shall the Contractor discharge any flushing or ground water or any material of any nature into existing sanitary sewer system during the

construction of the facilities. All water shall be discharged through an approved sediment control device. The costs of dewatering trench excavations will not be paid for directly, but will be included in prices bid for other related items.

12. Excavation Below Subgrade

a. The Contractor shall, without additional compensation, before any pipe or appurtenance is installed, fill all unauthorized depressions or irregularities in the bottom of the trench or tunnel with aggregate fill.

b. Where the bottom of the trench, at subgrade, is in unstable or unsuitable material, excavation shall be carried a minimum of six additional inches or to such depth as ordered by the Commission. The trench bottom shall be restored to subgrade with aggregate fill or a concrete foundation may be constructed. The specifications for the concrete foundation shall be approved by the Chief Engineer. Excavation and backfill for removal of unsuitable material will be paid for under the appropriate contingent item.

C. Backfill

1. The Contractor shall backfill all trenches as rapidly as practicable after the installation of the utility therein, or after the excavation has served its purpose.

2. Subgrade to 2'-0" above top of pipe: Suitable material, defined as gravel or bank run gravel that will pass through a one-inch (1") sieve, shall be carefully placed around and to a depth of two feet over the pipe. These initial lifts shall be carefully placed and hand-tamped in 6 inch layers. Care shall be exercised in this operation to ensure that the alignment of the utility is not disturbed.

3. 2'-0" above top of pipe to top of trench: The remainder of the trench may be backfilled in layers of 6 to 12 inch lift depths. However, if lift thickness is followed and the specified compaction is not obtained based on the testing during backfilling, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compactions. In backfilling the remainder of the trench, stones of not more than 6 inches in largest dimension which have been taken out in excavating may be mixed with earth in an amount not exceeding 25% of the backfill volume. Stones of larger size or in greater quantities shall not be used, unless directed by the Commission. The Contractor shall not permit excavations to be used for the disposal of refuse.

4. In paved areas, the Contractor shall furnish and backfill the trench as per the requirements of the governing regulatory agency, and/or Contract Documents.

5. Should additional material be required for backfilling in excess of that obtained from excavation, the Contractor shall obtain Borrow material from off-site sources, to complete the trench backfill.

6. No layer of soil shall be placed on a frozen surface of a preceding layer or on a frozen subgrade.

D. Compaction

2. In unimproved areas where full trench compaction is not specified on the plans, compaction shall be accomplished as follows for the remaining depth of trench: Backfill material shall be placed in maximum 1 foot layers or as approved by the

Commission and compacted in such a manner that a completely dense refill is obtained which is free of voids and not susceptible to undue settlement or depression.

3. Full trench compaction as described below will be required within all improved easements or rights-of-way except as noted on the contract drawings.

   a. Rights-of-Way, Commercial/Industrial Zoned Property and Trenches in Easements Supporting Driveways and Sidewalks. The remaining trench depth less any thickness left for crusher run, paving, or concrete specified hereinafter shall be backfilled with suitable material and mechanically tamped in layers not to exceed twelve inches to not less than 92% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180 to within the top foot of subgrade which shall be compacted to 97% of the maximum density determined as noted above. All compaction must comply with the aforementioned or the latest edition of the governing applicable road code or permit whichever is most stringent.

   b. Residentially Zoned Property (Areas not in Rights-of-Way or supporting driveways or sidewalks)

      The remaining trench depth shall be backfilled with suitable material and mechanically tamped in layers not to exceed twelve inches to not less than 85% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180.

   c. The Contractor shall be responsible for adjusting the moisture of suitable backfill as necessary to meet the specified compaction requirements.

4. Insofar as the specifications for mechanical tamping equipment or methods are concerned, no specific requirements are included in these Specifications other than that the use of any particular type of equipment is subject to the approval of the Commission and that the Commission has sole right to judge what equipment is suitable for the uses intended.

E. Maintenance of Backfilled Trench

1. All backfilled trenches shall be maintained in an acceptable condition by and at the expense of the Contractor for a period of twelve (12) months following the date of conditional acceptance of the work.

2. If the Contractor fails to fill depressions in the backfilled trench within 24 hours after the receipt of notice from the Commission, the Commission may refill said depressions and the cost thereof shall be retained from any monies due the Contractor, under the Contract. In case of emergency, the Commission may refill any dangerous depression or protect with lights wherever necessary without giving previous notice to the Contractor; and the cost of so doing shall be retained from any monies due to become due the Contractor under the contract.

3. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to final acceptance of the Project.

4.0 METHOD OF MEASUREMENT

A. Trench Excavation, Backfill and Compaction

Except when shown as a bid item or noted otherwise, trench excavation, backfill, and compaction will not be measured as a separate item, but will be included with other items of work contained in the Bid Documents.

When shown as a bid item, measurement for borrow backfill material will be based on the section computed as follows:

Length will be the entire horizontal distance on a linear-foot basis measured along the centerline of the trench, deducting volume measurement for pipe, conduits, fittings, couplings, manholes, structures, bedding materials, any existing facilities, overlap of prior paid utility trenches, and measurement through any items in the proposal that contains a separate provision for payment.

Width for calculating backfill payment for utilities shall be the actual trench width or the outside diameter of the pipe plus 12 inches, whichever is less.

Trenches that exceed 4 feet in depth will be allowed one extra foot in width for shoring box, should shoring be required. No allowance will be made for over-width trenches when in the opinion of the Engineer adequate shoring would have prevented sloughing of the trench walls beyond the designed width. Contractor shall immediately notify Engineer when encountering unstable material that will not stand under normal shoring practices. Failure to notify Engineer will result in loss of any allowance for over-excavation or backfill.

Depth will be the vertical measurement from the top of the pipe or pipe bedding material (whichever is greater elevation) to the original ground or subgrade (whichever is lesser in elevation), deducting volume measurement for pipe, conduits, fittings, couplings, manholes, structures, bedding materials, any existing facilities, overlap of prior paid utility trenches, and measurement through any items in the proposal that contains a separate provision for payment. Depth of trench will be measured at minimum intervals of 20 feet along the centerline of trench between linear pay limits as specified herein, unless physical conditions necessitate a change that is mutually acceptable to both Engineer and Contractor. Trench depth will be the average depth between measuring points. Pay depth shall not exceed depth shown on the Plans unless authorized by Engineer.

5.0 BASIS OF PAYMENT

A. General

1. Except when shown as a bid item or noted otherwise, no separate payment will be made for trench excavation, backfill, and compaction. The cost shall be included in the price bid for installing pipe, or constructing the various appurtenances included in the Contract. The bid prices shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment will be made when approved by the Commission.

B. Trench Excavation, Backfill and Compaction

The price(s) shall be as shown on the bid form and shall include the furnishing borrow material, providing an approved spoil site, and disposing of all spoil or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas temporary stockpiling, placing, compaction and all incidentals required to complete this work.

In addition to the work listed above, trench excavation, backfill, and compaction shall also include the traffic control, removing, storing, and rehandling of surface materials over the trench, including paving; the scoring of existing paving in a straight and uniform line; the excavation of all materials encountered in the trench including excavation at manholes, structures, vaults, and other appurtenances that may be shown or required, and any extra excavation necessary for sheeting or bracing or installation of other excavation support systems; the backfilling and compaction of trenches; the removal and disposal of unsuitable and/or surplus material; and all other incidental items to complete the work.

****END OF SECTION 02250****

SECTION 02300
BORING AND/OR JACKING PIPE

1.0 GENERAL

A. Description

Boring and/or jacking pipe shall include, but not necessarily be limited to, furnishing and installing carrier pipe and/or casing pipe beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Removal or Abandonment of Existing Utilities
2. Aggregate Backfill: Section 02240
3. Trench Excavation, Backfill, and Compaction: Section 02250
4. Water Main Installation and Chlorination: Section 02551
5. Water Services, Water Meter Settings, and Vaults: Section 02553
6. Gravity Sanitary Sewer and House Connections: Section 02561
7. Sanitary Sewer Force Mains: Section 02563
8. Cast-in-Place Concrete: Section 03300
9. Flowable Fly Ash: Section 03500
10. Mortar: Section 04100
11. Brick Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for boring and/or jacking pipe.

B. Contractor's Options

Directional drilling or micro-tunneling may be used with prior approval from the Commission.

C. Detailed Material Requirements

1. Portland Cement Concrete
   Portland cement concrete for inverts or cradles shall be Mix No. 1 as specified in

Section 03300.

2. Mortar for Grout

   a. Mortar used for grouting voids outside the casing pipe shall conform to the requirements of Section 04100 except that it shall be composed of one part Portland cement and three parts sand.

   b. Mortar used for bulkheading sleeve ends shall conform to the requirements of Section 04100.

3. Flowable Fly Ash

   Flowable fly ash fill shall be as specified in Section 03500, and used as fill inside the casing pipe to the levels shown on the Contract Drawings.

4. Brick Masonry

   Brick Masonry for bulkheading sleeve ends shall conform to the requirements of Section 04200.

5. Steel Casing Pipe

   a. Steel casing pipe shall be smooth walled and have a minimum yield strength of 36,000 psi. Minimum wall thickness shall be as noted herein or as specified in the Contract Documents.

Casing Pipe

Normal Pipe Size (inches)	Wall Thickness (inches)
6	0.375
12	0.375
20	0.375
24	0.375
30	0.500
36	0.500
48	0.500

   b. The pipe shall be fabricated and field connected in accordance with Section 02551. Joints shall be fully welded around the circumference of the pipe.

   c. The exterior of the pipe including field connection shall be bituminous coated before installation. Bituminous coating shall meet the requirements of AWWA C210.

6. Carrier Pipe

   Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02551, 02561, or 02563 as appropriate.

7. Skids/Blocking

Skids and/or blocking for securing carrier pipes shall be constructed of pressure treated lumber suitable for exterior use or of a Commission approved molded plastic construction (insulators).

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Preparation

1. Bored and/or jacked pipe greater than 4 inches in diameter shall receive a casing pipe unless directed otherwise.

2. Preliminary work shall consist of excavating and sheeting a suitable shaft on the lower side of the crossing and installation of a backstop and guide rails. The guide rails shall be long enough to hold at least two lengths of pipe and shall be carefully checked for line and grade before any pipe is placed on them.

B. Boring and/or Jacking

1. When augers or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The arrangement shall be removable from within the pipe in the event an obstruction is encountered. The excavation by the cutting head shall not exceed the outside diameter of the pipe by more than ½ inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft material.

2. If an obstruction is encountered during installation that stops the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations shall cease and the pipe abandoned in place and filled completely with flowable fly ash.

3. Bored or jacked installations shall have a bored hole essentially the same as the outside diameter of the pipe plus the thickness of the protective coating. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe (plus coating) by more than approximately 1-inch, grouting or other methods approved by the Commission shall be employed to fill such voids.

4. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. The pumps shall be in constantly attended operation on a 24 hour basis until their operation can be safely halted. When dewatering, close observation shall occur to detect any settlement or displacement of surface facilities. Should settlement or displacement be detected, the Contractor shall notify the Commission immediately and take such action as necessary to maintain safe conditions and prevent any further damage.

5. All operations shall be conducted so as not to interface with, interrupt, or endanger the operation of traffic, or damage, destroy, or endanger the integrity of any surface facilities.

6. Carrier pipe shall be tested in accordance with Section 02551, Section 02561 or Section 02563 as applicable, prior to bulkheading the ends of the sleeve.

7. Each end of the sleeve shall be bulkheaded in accordance with Section 02050.

C. Installation of Carrier Pipe

1. Carrier pipe installed within the casing pipe shall be restrained with locking gaskets as shown in the Contract Documents and as specified in Sections 02551, 02561, and 02563.

2. Where shown or specified in the Contract Documents, the annular space between the casing and carrier pipes shall be filled with sand.

4.0 METHOD OF MEASUREMENT

A. Casing Pipe

Measurement for bored and/or jacked casing pipe will be made of the length of casing pipe satisfactorily installed. Measurement will be made horizontally along the centerline of the pipe between the ends of the casing pipe.

B. Carrier Pipe

Carrier pipe will not be measured as it will be incidental to the casing pipe installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the Commission.

3. Should a contractor elect to make a boring and/or jacking pipe under trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a boring and/or jacking operation in the Contract Documents it shall be done at no additional cost to the Commission.

B. Casing Pipe

Payment for bored and/or jacked casing pipe will be made per linear foot for the various diameters of casing pipe furnished and installed by boring and/or jacking. The price(s) bid shall include the traffic control, compaction, excavation, support, and restoration of the boring and receiving pits; removal and disposal of excess excavated material; dewatering, settlement monitoring; furnishing and placing flowable fly ash fill within the

casing pipe, carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. Carrier Pipe

Payment for bored and/or jacked carrier pipe will not be made as it will be incidental to the casing pipe installation.

****END OF SECTION 02300****

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SECTION 02310
DIRECTIONAL BORING OF PRESSURE SEWER, WATER MAINS AND GRAVITY SEWERS

1.0 GENERAL

A. Description

8/9/10 The pressure sewer, water main or gravity sewer shall be located within the easement and within 1 foot horizontally and 2 inches vertically of the alignment shown on the contract plans and shall be installed by directional boring. Directional boring shall be conducted so as to minimize the number and size of excavation holes.

B. Operating Expertise

The Contractor or his Subcontractor shall demonstrate expertise in trenchless methods by providing the Commission a list of ten utility references for whom similar work has been performed within the last three years prior to the Pre-Construction meeting. The references shall include a name and telephone number where contact can be made to verify the contractor capability. The Contractor shall provide documentation showing successful completion of the projects used for reference. The Pre-Construction meeting may not be scheduled until after the Commission approves of the above expertise. Conventional trenching experience will not be considered applicable.

C. Submittals

1. The Contractor shall submit technical data for equipment, method of installation, and proposed sequence of construction for approval by the Commission. The submittal shall include information pertaining to working and receiving shaft, dewatering, method of spoils removal, size and capacity of equipment, capabilities for installing pipes on a curve, type of cutter head, drilling fluid type, method of monitoring line and grade, and detection of surface movement.

2. Prior to the pre-construction meeting and Commission approval to perform the directional boring, the Contractor shall submit the names of supervisory field personnel and historical information of directional boring experience. In addition, the Contractor shall submit for approval the name plate data for the drilling equipment and mobile spoils removal unit and MSDS information for the drilling slurry compounds.

D. Related Work Specified Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250

2. Low Pressure Sewer Systems: Section 02566

3. Sewage Grinder Pumping Units: Section 11307

E. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials shall be in accordance with Section 02566.

3.0 EXECUTION

A. Installation

1. Installation shall be in trenchless manner producing a continuous bore. The number of access pits shall be kept to a minimum. The maximum continuous bore lengths is not to exceed 400 feet. If the bore length is greater than 400 feet then multiple pits will be required.

2. The drilling system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. Accurate placement of pipe at up to eight feet deep, within a ± 2-inch vertical tolerance is required. The drilling device shall be capable of drilling a 90 degree, 35-foot radius curve.

   a. For gravity sewers, the drilling system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. Accurate placement of pipe at depth shown on the drawings, with a 0.1% pitch resolution is required.

3. The equipment must be capable of boring the following lengths in single bores, and successive boring pits will not be allowed to be any closer than the following distances:

Pipe Size	Boring Distance
1 in. to 1 ½ in.	400 feet
2 in. to 2 ½ in.	350 feet
3 in. to 6 in.	300 feet

   a. For gravity sewers, the equipment must be capable of completing boring for the proposed pipe size at a minimum length from manhole to manhole in a single bore.

4. Drilling shall be performed by a fluid cutting process (high pressure/low volume), utilizing a liquid/clay slurry, i.e. bentonite. The clay slurry shall be totally inert. The Contractor shall provide a vacuum spoils recovery vehicle on site to remove the drilling spoils from the access pits. The spoils shall then be transported from the job site and be properly disposed of. Under no circumstance will the drilling spoils be permitted to be disposed of into sanitary, storm, or other public or private drainage systems.

5. Mechanical, pneumatic, or water jetting methods will be considered unacceptable due to the possibility of surface subsidence.

6. Upon Owner request, the Contractor shall prove the accuracy of the electronic monitor every fifty (50) feet of directional bore in the presence of the Owner during directional drilling operations via test pit every 50 feet of bore. If the above accuracy is not met, the Contractor shall adjust or provide the necessary equipment which will meet the accuracy requirements. All such calibration costs shall be at no cost to the Owner.

7. After an initial bore has been completed, a reamer head shall be installed at the termination pit, and the pipe and reamer head shall be pulled back to the starting pit. The reamer must also be capable of discharging liquid clay to facilitate the installation of the pipe into a stabilized and lubricated tunnel. Reaming diameter shall not exceed 1.5 times the outside diameter of the pipe being installed.

8. The pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.

9. Pullback forces shall not exceed the manufacturer's recommended allowable pulling force for the product pipe.

10. The Contractor shall allow sufficient lengths of pipe to extend past the termination point to allow connections to adjacent pipe sections. Pulled pipe shall be allowed a minimum of twenty-four (24) hours of stabilization prior to making tie-ins. The extra length of pipe shall be sufficient to make all necessary connections and tests.

11. Upon completion of boring and pipe installation, the Contractor shall remove all spoils from the starting and termination pits. All pits shall be compacted as per Commission and contract documents and be restored to their original condition. Disposal of excess drilling fluid and spoils shall be the responsibility of the Contractor.

B. Safety

1. Because the directional boring may encounter existing buried electrical lines, the following safety requirements shall be met.

   a. All drilling equipment shall have a permanent inherent alarm system capable of detecting an electrical current. The ground system shall be equipped with an audible alarm to warn the operator when the drill head nears electrified cable.

   b. All crews shall be provided with grounded safety mats, heavy gauge ground cables with connectors, and hot boots and gloves.

   c. All supervisory personnel shall be adequately trained and have direct supervisory experience in directional boring.

C. Obstruction/Alignment

1. The bore shall not deviate from the horizontal alignment shown on the drawings by more than one (1) foot. If obstructions are encountered during the drilling operation, the Owner shall be notified immediately. With approval of the Owner, the Contractor shall attempt to go around the obstruction. If a deviation of more than three (3) feet from the horizontal alignment is required to bypass the obstruction, the Owner shall be immediately consulted to determine if adjustments in the alignment are required. At no time shall the alignment be allowed to exit the sewer easement or right-of-way. To prevent dips and high points in the pipeline profile, a vertical deviation in the pipeline profile may not exceed two (2) inches.

2. The Contractor shall employ all means necessary to complete the pipe installation as specified at no additional cost to the Owner. Any deviation from the

previously approved means and methods shall be approved by the Owner prior to the implementation.

3. The Contractor shall mark the location and depth of the alignment with spray paint on paved surfaces and wooden stakes on non-paved surfaces at twenty-five (25) foot intervals. The Contractor shall record the depth of the sewer at the twenty-five (25) foot intervals and provide a copy of the record to the Owner upon completion of the installation of each bore. The Contractor shall measure or survey locations where the horizontal alignment deviates from the proposed alignment and incorporate the changes in the as-built drawings.

4. If the bore pipe installation has deviated beyond the specified tolerances, it shall be the Owner's option to require the Contractor to abandon the bore, or remove the installed pipe, and rebore or reinstall the pipe on the correct alignment at no additional cost to the Owner.

5. Alignment of gravity sewer pipe: Laser technology shall be used to align the pipe to the proper accurate grade. The Contractor is responsible to monitor the line and grade horizontally and vertically in order to assure proper quality control and maintain laser alignment.

D. Detection

8/9/10 1. Tracer Wire: All non-metallic pipes shall have #8 AWG tracer wire marked for direct burial use installed with the pipe secured with duct tape to the top of the pipe. The wire shall be continuous for the full length of the pipeline. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.

2. Detector wire shall be terminated from each pipe run in each structure along the system, i.e. flushing connection vaults, air release vaults, service valve assembly vaults, etc. Allow adequate length of each wire in the structure, so it may be pulled one (1) foot out of the top of the structure for connection of detection equipment.

3. The detection wire shall be tested for continuity for each bored installation before acceptance by the Owner.

4.0 METHOD OF MEASUREMENT

The amount of directional boring of pressure sewer shall be measured in accordance with Section 02566.

5.0 BASIS OF PAYMENT

Payment for directional boring of pressure sewer will not be made, as it shall be included in the unit price item for low pressure sewer Section 02566.

****END OF SECTION 02310****

SECTION 02400
TUNNELING

1.0 GENERAL

A. Description

Tunneling shall include, but not necessarily be limited to, furnishing and installing tunnel liners beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents.

B. Related Work Include Elsewhere

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Aggregate Backfill: Section 02240
3. Trench Excavation, Backfill, and Compaction: Section 02250
4. Water Main Installation and Chlorination: Section 02551
5. Gravity Sanitary Sewer and House Connections: Section 02561
6. Sanitary Sewer Force Mains: Section 02563
7. Cast-in-Place Concrete: Section 03300
8. Flowable Fly Ash: Section 03500
9. Mortar: Section 04100

C. Quality Assurance

The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for tunneling.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Portland Cement Concrete

   Portland cement concrete for invert cradles shall be Mix No. 1 as specified in Section 03300.

2. Mortar for Grout

For filling voids outside the liner plate, the grout shall conform to the requirements of Section 04100 and the following. The mortar shall be composed on one (1) part Portland Cement (Type 1) and three (3) parts sand with only enough water to permit the material to flow properly. The grout shall remain fluid long enough to be injected through the lining and to fill the voids and shall set promptly enough to avoid grout flowing into the new annular space after the next advance.

3. Flowable Fly Ash

Flowable fly ash fill shall be as specified in Section 03500, and used as fill inside of the tunnel to the levels shown on the Contract Drawings.

4. Liner Plate

a. Steel liner plate shall conform to requirements of ASTM A 569. Liner plate steel shall have the minimum mechanical properties of flat plate before cold forming as follows:

Tensile strength	=	42,000 psi
Yield strength	=	28,000 psi
Elongation, 2 inches	=	30%

At least 10% of the number of liner plates shall be drilled, tapped, and fitted with a cast iron grout plug. The actual location and spacing of the plugs shall be determined by the Contractor and approved by the Commission.

b. Bolts and nuts shall conform to requirements of ASTM A 307. The bolts shall have rolled threads.

c. Coatings

1. Liner plate shall be hot dipped galvanized to meet requirements of AREA Chapter 1, Part 4, Section 4.13 Specification for Corrugated Structure Steel Plate Pipe, Pipe Arches and Arches. Bolts and nuts shall be galvanized to meet requirements of ASTM A 153.

2. Liner plate shall be bituminous coated to meet requirements of AREA Chapter 1, Part 4, Section 4.6.1. Specification for Bituminous Coated Galvanized Steel Pipe and Pipe Arches. Provide prime coat as required to assure compatibility with galvanized surface.

5. Carrier Pipe

Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02551, 02561, or 02563 as appropriate.

6. Surface Settlement Markers

a. Surface settlement markers within pavement areas shall be P.K. nails.

b. Surface settlement markers within non-paved areas shall be wooden hubs.

7. Skids/Blocking

Skids and/or blocking for securing carrier pipes shall be constructed of pressure treated lumber suitable for exterior use or of a Commission approved molded plastic construction (insulators).

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Construction Criteria

1. Tunnels for installing pipelines or other utilities shall be of sufficient size to allow, at all points, the proper joining of pipes and the proper refill around them. Tunnels shall be timbered or lined where and to such extent as may be necessary to support the tunnel in accordance with accepted methods. All methods of tunneling used shall be subject to the approval of the Commission, however, the safety of the tunnel construction and the protection, repair, or replacement of the tunneled obstruction shall be the sole responsibility of the Contractor.

2. Tunnel construction shall be performed in a manner that will minimize movement of the ground in front of and surrounding the tunnel, and prevent subsidence of the surface above and in the vicinity of the tunnel. During all stages of tunnel construction, the ground shall be continuously supported and controlled in a manner that will prevent loss of ground and keep the perimeters and face of the tunnel stable. The Contractor shall be responsible for all settlement resulting from tunnel operations and shall repair and restore damaged property to its original condition at no cost to the Commission.

3. The Contractor shall comply with applicable ordinances, codes, statutes, rules, and regulations of the State of Maryland, SHA, applicable Commission building codes, and/or affected Railroad Company and applicable regulations of the Federal Government.

B. Job Conditions

1. Maintain an adequate supply of straight and tapered liner segments at the site at all times.

2. Prevent damage to protective coatings during storage and delivery. Keep wire ropes, chains, or hooks from direct contact with the coated surfaces.

3. Dewatering, if required, shall be performed in accordance with Section 02512.

C. Equipment

1. Tunneling equipment shall be of U.S. Bureau of Mines approved types.

2. Tunnel shields shall have uniform exterior surface from leading edge of head or poling plates to the rear edge of the tail. A horse-shoe-shape shield may have a closed or open bottom; a circular shield shall have a closed bottom.

3. A substantially proportioned hood shall be provided which projects not less than 2 feet beyond the shield bottom with sufficient rear overhang or tail to provide at least 12 inches of overlap beyond the last element erected when the shield has been shoved forward to the fullest extent possible. The annular space between the tail and the lining shall be as small as current practice indicates, but in no case shall it be greater than 1 ½ inches.

4. Provide each shield with suitably designed breast-jacks or breast-tables or both, and such other bracing as is necessary to support the face of the tunnel excavation without loss of ground.

5. Provide on each shield a propulsion system capable of moving the shield in a forward direction while maintaining line, grade, and direction. The propulsion system shall be designed to prevent the shield from moving backward despite a failure of any element of the propulsion system and shall not over stress or distort the lining.

6. Prevent grout from leaking into the tunnel space between the shield and lining by incorporating a seal in the tail of each shield.

7. The shield shall be equipped with an erector arm or system capable of handling the largest sizes of lining and of erecting the sections of the lining to the required tolerances without damage to the lining.

D. Power Supply

1. All power machinery and tools within the tunnel shall be operated by electricity, compressed air, diesel with approved scrubber, or other approved power. All electrical tools and equipment shall be grounded in accordance with the latest requirements of the National Electrical Code.

2. Temporary electric lights shall be provided to properly and safely illuminate all parts of the tunnel construction area including special illumination at the working faces. Lighting circuits shall be thoroughly insulated and separated from power circuits; and all lights shall be enclosed in wire or plastic cages. The Contractor shall secure all electrical permits necessary for the installation and operation of this service.

E. Operations by Tunnel Shields and Machines

1. On initial set-up, the tunnel shields or tunneling machines shall be supported and properly set at lines and grades which will permit the correct installation of the tunnel lining. During forward movement of the shield provide sufficient support at the excavation face to prevent movement of any materials except such materials as are physically displaced by the elements of the shield itself.

2. The face shall be controlled using such support procedures as breasting, poling plates, face jacks, sliding tables, either singly or in combination, spaced as necessary.

3. Advance excavation for the tunnel liner in increments sufficient for the erection of one ring of liners and install liner plates immediately after each increment of excavation. Carry on excavation in such a manner that voids behind the liner plates are held to a minimum. Completely fill such voids with grout placed under pressure.

4. Whenever tunnel excavation is suspended or shut down, and there is danger of water infiltration from any source, maintain on duty qualified personnel to observe conditions that might threaten the stability of the heading. Contractor may substitute acceptable observation devices such as closed circuit TV that enables continuous monitoring of conditions at the face by qualified observers from outside the tunnel.

5. During shut down periods, support the face of the excavation by positive means; no support shall rely solely on hydraulic pressure.

F. Installation of Tunnel Linings

1. Install the tunnel lining in a manner that will not damage the lining or coating.

2. Ensure that the edges are clean and free from material that could interfere with proper bearing.

3. Install bolts for liner plates in accordance with liner plate manufacturer's recommendations and retention or replace any bolt which does not meet the requirements.

4. Assemble liners to the lines and grades shown on the Plans or as directed by the Commission.

G. Grouting

1. Fill annular voids between the tunnel excavation and the tunnel liner with grout mix.

2. Filling voids with grout shall generally proceed from the bottom grout hole of each ring to the top hole.

3. Vent air through one of the upper holes.

4. The grout pump and injection system shall be a type that will deliver the grout in a smooth even flow without surge. The grouting circuit shall contain a return line to allow return of the grout from the nozzle to the supply tanks. The grouting equipment shall be capable of developing a uniform pressure of 50 psi at the grout hole connection and equipped with hoses with a minimum inside diameter of 1 ½ inches. The grouting equipment shall have a minimum capacity of ½ cubic yards.

5. Grouting between the liner plates and excavation shall follow progressively with each adjacent set of holes provided in the liner plates.

6. In general, grouting shall proceed from the lowest grout hole of each ring and proceed progressively upward. When going from lower to higher grout holes, do not make connection to the higher holes until grout has completely filled the space below. Fill all voids completely at the close of each 8 hour work period.

7. Continue grouting until grout appears in the next set of grout pipes, which shall be kept open during grouting to permit escape of air and water.

H. Installation of Carrier Pipe

1. Carrier pipe shall be installed within the tunnel liner as shown in the Contract Documents and as specified in Sections 02551, 02561 and 02563.

2. Provide bedding and anchorage in accordance with the Plans and Contract Documents.

3. Provide wooden skids or other approved devices as required to eliminate damage to pipe.

4. After line is tested, fill annular space between pipe(s) and tunnel with sand or with flowable fly ash fill in SHA rights of way or if approved by the Commission. Positive means shall be provided to hold the pipe in place and to prevent flotation.

I. Closing

1. Each end of the tunnel shall be bulkheaded in accordance with Section 02050.

4.0 METHOD OF MEASUREMENT

A. Tunneling

Measurement for earth tunneling and liners will be made horizontally along the centerline of the tunnel satisfactorily installed between the ends of the tunnel.

B. Carrier Pipe

Carrier pipe will not be measured as it will be incidental to the tunnel liner installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum price bid. The price bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the Commission.

3. Should a contractor elect to install a tunnel in lieu of a bore and jack under roads trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a tunneling operation in the Contract Documents it shall be done at no additional cost to the Commission.

B. Liner Plate

Payment for liner plate will be made per linear foot for the various diameters of liner plate furnished and installed by the tunneling operations. The price(s) bid shall include the traffic control, excavation, support, grouting, backfill, compaction, and restoration; removal and disposal of excess excavated material; dewatering, settlement monitoring; furnishing and placing flowable fly ash fill within the tunnel liner plate; carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. Carrier Pipe

Payment for carrier pipe will not be made as it will be incidental to the tunnel installation.

****END OF SECTION 02400****

SECTION 02512

DEWATERING

1.0 GENERAL

A. Description

1. Dewatering shall include, but not necessarily be limited to, designing, furnishing, installing, maintaining, operating, and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; and disposing of pumped water in accordance with the Contract Documents.

2. Dewatering includes lowering the water table and intersecting seepage which would otherwise emerge from the slopes, trench sidewalls, or bottom of the trench or excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavating and hauling characteristics of sandy soil; and preventing rupture or heaving of the bottom of an excavation.

3. The Contractor shall note the date and method(s) of data collection. The interpretation of the data and its applicability to the project are the responsibility of the Contractor and the Contractor is responsible for satisfying himself as to the actual conditions and/or confirming the data provided prior to submitting his bid.

B. Related Work Included Elsewhere

a. Trench Excavation, Backfill and Compaction; Section 02250.

C. Quality Assurance

1. It shall be the Contractor's responsibility to select materials, methods, and equipment, and design a dewatering system which will:

1. Effectively reduce the hydrostatic pressure and lower the groundwater levels below the excavation;

2. Develop a substantially dry and stable subgrade for the prosecution of subsequent operations;

3. Not result in damage to adjacent properties, buildings, structures, utilities, private and public water wells, and other work;

4. Assure that after 12 hours of initial pumping, no soil particles will be present in the discharge.

2. Methods may include sump pumping, single or multiple stage well point systems, eductor and ejector type systems, deep wells, and combinations thereof.

3. Locate dewatering facilities only where they will not interfere with utilities and construction work to be done by others. If observation wells are used, they shall be placed both perpendicularly and longitudinally along the excavation to demonstrate the effectiveness of the dewatering system and its impact on the surrounding unexcavated areas.

4. Modify dewatering procedures which cause, or threaten to cause, damage to new or existing facilities, so as to prevent further damage. The Contractor is responsible for determining the modifications to be made, which shall be implemented at no additional cost to the Commission.

D. Submittals

The Contractor shall, at the preconstruction meeting or a minimum of fourteen days prior to installation of the dewatering system, submit to the Chief Engineer a letter report, including working drawings and/or design data that is required to detail any or all of the following:

1. The proposed type of dewatering system, including relief of hydrostatic head and maintenance of the excavation in a dewatered and in a hydrostatically relieved condition;

2. Arrangement, location, and depths of the components of the system;

3. A complete description of equipment to be used, with installation, operation, and maintenance procedures;

4. Standby equipment and power supply;

5. Location and size of berms, dikes, sumps, and discharge lines, including the relation to water disposal ditches;

6. Types and sizes of filters;

7. Design calculations demonstrating adequacy of the selected system and equipment.

2.0 MATERIALS

Not used.

3.0 EXECUTION

B. General

It shall be the Contractor's responsibility to adequately control both surface drainage and drainage of excavated areas as follows:

1. Surface Drainage: Intercept and divert precipitation, surface water, and groundwater away from excavation through the use of dikes, curb wails, ditches, pipes, sumps, or other means.

2. Drainage of Excavated Areas: Provide and maintain ditches of adequate size to collect surface and seepage water which may enter the excavations. Divert the water into sumps and drain or pump into drainage channels or storm drains. The discharge of flushing or ground water into existing sanitary sewers is strictly prohibited. Discharge all water to a settling basin or other sediment control device with approval of the St. Mary's County Soil Conservation District to reduce the amount of fine particles which may be carried into the drain. If a storm drain becomes blocked or its capacity restricted due to dewatering operations, the Contractor shall clean the drain at no additional cost to the Commission.

1. Dewatering

1. Organize dewatering operations to lower the groundwater level in excavations as required for prosecution of the work, and to provide a stable, dry subgrade for the prosecution of subsequent operations.

2. Maintain the water level at such lowered elevations until no danger to the structure or facility can occur because of buildup of excessive hydrostatic pressure, and in any event maintain the water level a minimum of 2 feet below the subgrade, unless otherwise permitted by the Chief Engineer.

3. If approved by the Chief Engineer, the extent of dewatering may be reduced, for structures designed to withstand uplift pressure, to maintain the water level a minimum of 5 feet below the prevailing level of backfill as it is being placed, provided such water level

does not result in uplift pressures in excess of 80% of the downward pressure produced by the weight of the structure and backfill in place.

4.0 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

5·0 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

****END OF SECTION 02512****

SECTION SP-02550

TEMPORARY BYPASS FOR WATER SERVICES

1.0 GENERAL

A. Description

At the Contractor's option, provide all labor, materials, and equipment to furnish, install, and test temporary bypass system for water services during construction of the new water main.

B. SUBMITTALS

1. Catalog data for pipe material

2. Working drawings with description of sizes and locations

C. JOB CONDITIONS

Provide temporary bypass water service piping of adequate size to maintain water services and fire protection to abutting properties at all times.

2.0 MATERIALS

A. The Contractor shall provide temporary bypass and fire hydrant piping, hose, fittings, valves and hydrants to maintain water service and fire protection. Such piping shall be of a material that will withstand the working pressure at the location without leakage. All bypass piping shall not impart objectionable color, taste or odor to the water being supplied and shall meet National Sanitary Foundation (NSF) requirements for potable water. Piping and hose shall be approved for potable water by NSF and bear the approval stamp "NSF-PW".

B. Backflow prevention shall be provided as required. Backflow preventers shall be in accordance with AWWA C 510 latest edition.

C. Bypass piping for temporary fire protection shall be a minimum of four inch (4") diameter. Temporary bypass piping for service connections only shall be three inch (3").

3.0 EXECUTION

A. Property Owner Notification

1. The Contractor shall notify owners adjacent to the Work in advance of the work.

2. Two notifications shall be provided.

   a. One for property owners whose water service will be temporarily interrupted while their service connections are being connected and disconnected from temporary bypass piping.

   b. Two, the Contractor shall through the METCOM Engineer, notify in writing all consumers placed on bypass piping and provide them with an emergency phone number and contact person in case of bypass emergencies. Additionally, the information shall advise the consumer to flush in house plumbing by running water and temporarily removing aerators after they are returned to regular service. The information shall be distributed at least three (3), but not more than seven (7) working days, in advance of placing the consumers on bypass piping.

B. TEMPORARY BYPASS WATER SERVICE SYSTEM

1. The general Work shall consist of, but not be limited to the following: furnishing and installing temporary bypass piping, temporary fire hydrant connections and disconnections, temporary house service connections, temporary connection to existing service main, bypass valves and temporary pressure reducing valves.

2. The Contractor shall maintain the temporary bypass water service system in safe and operative condition at all times and shall be responsible for the protection of property and the prevention of injury to persons and structures. Safeguards shall be provided by the Contractor to the satisfaction of METCOM, but such provisions shall not relieve the Contractor of full responsibility for the adequacy of protection.

3. The Contractor shall have a maintenance crew on standby ready to respond to emergencies. The crew shall be available on a twenty-four (24) hour basis and the Contractor must furnish the Engineer with the address and telephone number of the contact person for this purpose. A telephone answering machine is not acceptable.

4. It is the total responsibility of the Contractor to remove and store all consumers' water meters in a safe and secure place. METCOM will not assume any liability for damage or theft to water meters that have been removed by the Contractor and left at the job site. All meters must be capped at both ends and tagged for proper identification. Removal and handling of all meters is to be done under METCOM's supervision.

5. Before the existing water main to be replaced is shut down, provide temporary bypass piping system of adequate size to provide water service and fire protection to affected properties as required herein and as directed by the METCOM Engineer. Notify the METCOM Engineer:

    a. At least 48 hours in advance for installation of temporary connections.

    b. When additional bypass service are made.

    c. When problems develop with any meters or services.

6. Water for the temporary bypass service shall be taken from the nearest available fire hydrant. Where a fire hydrant cannot be used, excavate and tap existing water main at METCOM's direction. Backflow preventers are to be provided as required.

7. The Contractor shall furnish, install, maintain and remove temporary fire hydrants with individual control valves. Unless otherwise indicated on the plans, temporary fire hydrants shall be placed adjacent to existing hydrants.

8. Temporary service connections shall be provided to each property affected by the water main shutdown. Connections are to be made by removing the outside meter and making the temporary connection to the existing house connection, or as directed by METCOM. Notched meter covers are to be used with the temporary services.

9. Placement and protection of temporary bypass piping system.

    a. Temporary bypass piping is to be placed so as not to interfere with vehicular and pedestrian traffic and the general public. The temporary piping should not be placed during freezing weather. If already installed, protect from freezing. In general, bypass piping should not be installed and charged prior to March 15 and be removed by November 15.

b. A cap and sampling connection is to be provided at the downstream end of each separate bypass piping segment. Do not loop downstream end of segment back to or near inlet of segment.

c. Sections of temporary bypass lines that cross driveways or sidewalks are to be covered with a bituminous cold patch. Protection of concrete driveways or sidewalks shall be provided to prevent discoloration from the bituminous material.

d. Where connection of the domestic service to the bypass piping must cross a roadway, the service lead must be sized at least equal to the existing service and must be secured in place to allow passage of vehicular traffic. In no case will rubber hoses be allowed for this type of installation. All lines, including bypass lines, at road crossing shall be below the existing road surface.

e. House to house connections for service connections are prohibited.

f. The layout of the temporary bypass piping must be approved by METCOM prior to allowing the Contractor charge the piping for testing purposes. METCOM maintains the rights to have the Contractor relocate any unacceptable layout at the Contractor's expense.

10. The pipe, hoses and other materials which are to be used shall be clean, sanitary, watertight, and adequate to withstand the existing pressures. All bypass piping, hoses and other materials shall be disinfected prior to be being placed into service in accordance with the Standard Specifications Section 02551, Water Main Installation and Chlorination.

11. Upon completion and placing into service of the new water main, the Contractor shall remove all aspects of the temporary bypass water service system and reinstall all consumers' water meters. Installation of all meters is to be done under METCOM's supervision. The Contractor shall leave the area in a neat and orderly condition equal to or better than its original condition.

4.0 METHOD OF MEASUREMENT

Measurement for furnishing and installing a temporary bypass piping system will not be made as it will be incidental to the new water main construction.

5.0 BASIS OF PAYMENT

Payment for furnishing and installing a temporary bypass piping system will not be made as it will be incidental to the new water main construction.

**** END OF SECTION SP-02550 ****

SECTION 02551
WATER MAIN INSTALLATION AND CHLORINATION

1.0 GENERAL

A. Description

Water main installation shall include, but not necessarily be limited to, furnishing and installing water pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on a firm foundation true to line and grade in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02552
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Fire Hydrants: Section 02554
5. Cast-In-Place Concrete: Section 03300
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Manufacturers and Materials for Water and Sewer Main Construction.
2. The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents. When specific tests of materials are called for in the referenced standards and specifications, the Commission has the option of requiring that any or all of these tests be performed at the Contractor's expense.
3. To minimize the number of joints, only standard manufacturers' length of pipe shall be furnished and installed for all water mains unless otherwise indicated on the Plans, or as approved by the Chief Engineer.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

DIP - Ductile Iron Pipe
PVC - Polyvinyl Chloride Pipe
HDPE - High Density Polyethylene Pipe

C. Materials Furnished by the Commission

1. The Commission will not furnish any materials for water main construction.

2. Unless otherwise noted in the "Special Provisions," the Contractor shall pay for all water used for testing. The Contractor shall contact the Commission to coordinate its use.

D. Contractor's Options

1. The Contractor may furnish polyvinyl chloride pressure water pipe (PVC) and compatible specified fittings for water mains equal to or small than 12-inches in diameter unless specified otherwise by the Commission.

2. The Contractor may furnish ductile iron pipe (DIP) and compatible specified fittings for water mains 4-inches in diameter and greater unless specified otherwise by the Commission.

E. Detailed Material Requirements

1. Portland cement concrete for pipe fitting buttresses and anchorages shall be as specified in Section 03300.

2. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible discoloration cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or other imperfections which may impair the performance or life of the pipe. Polyvinyl Chloride Plastic Water Pipe 4 inch through 12 inch shall be Class 150 (DR18) and shall meet the requirements of AWWA C900. PVC Water Pipe smaller than 4 inches shall be PVC 1120 (SDR21) and shall meet the requirements of ASTM D 2241. The outside diameters of DR18 shall be equivalent to cast-iron pipe. PVC Water Pipe shall have an integral bell with a rubber gasketed joint as listed in the AWWA C900 standard. Pipe and couplings shall be marked and factory tested in accordance with AWWA C900. Water mains in State rights of way and major County roadways, and water mains larger than 12 inch diameter shall be Class 52 ductile iron.

3. Ductile Iron Pipe and Fittings

a. Pipe

1) Pipe shall be designed and manufactured in accordance with ANSI/AWWA C151/A21.51 unless otherwise directed in writing by the Commission.

2) All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden as indicated on the profile and traffic loads to which the pipe may be subjected.

3) Pipe shall be double thickness cement mortar lined in accordance with AWWA C104 with an interior seal coat of

bituminous material. The outside surface shall also be bituminous coated.

4) The minimum special standard thickness class shall be Class 52 or as shown on the plans or specified in the "Special Provisions".

5) Ductile iron pipe (DIP) and fittings shall be sound and without defects that might impair its service.

b. Joints

Joints may be mechanical or rubber gasketed push-on type. Unless otherwise noted, all joints shall be in accordance with ANSI/AWWA C111/A21.11 Standard.

c. Fittings

1) All fittings shall have mechanical joints.

2) All fittings 3-inches through 24-inches shall be manufactured in accordance with the ANSI/AWWA C153/A21.53 Standard. All fittings 30- inches through 48-inches shall be manufactured in accordance with the ANSI/AWWA C110/A21.10 standard for a working pressure of 250 psi unless specified or directed otherwise by the Commission.

d. Joint restraint for pipe and fittings shall be specified in the Approved Materials and Manufacturers List or approved equal.

4. Joint Restraint

a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design for ductile iron, and fittings.

b. Mechanical joint restraining systems for ductile iron pipe may be used at fittings, valves, fire hydrant leads, vault bypasses and when connecting to existing utilities unless noted otherwise by the Commission. The mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which when actuated imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. 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 ANSI/AWWA C153/A21.53 of the latest revision. Twist-off nuts shall be used to ensure proper actuating of the restraining devices. The 3 inch through 16 inch mechanical joint restraining device shall have a working pressure of at least 350 psi with a minimum safety factor of 2. The 18 inch through 48 inch mechanical joint restraining device shall have a working pressure of at least 250 psi with a minimum safety factor of 2. Restrained joints on straight lengths of pipe shall be as manufactured by the pipe manufacturer and the restraining mechanisms shall be an integral part of the bell and spigot.

c. Rod for tie rod assemblies shall be stainless steel, and shall be threaded for at least 4 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted. Nuts shall meet the requirements of ASTM A 194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

5. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in yellow graphics.

6. Tracer Wire for Pipelines

Tracer wire shall be #12 AWG, solid continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have UL markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

F. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.

2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.

3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.

4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.

5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the Commission and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported the full length of the barrel.

Aggregate bedding shall be installed to grade prior to laying pipe.

B. Pipe Installation

1. All pipe shall be installed in accordance with the approved manufacturers' written recommendations and as specified herein. These recommendations shall include: maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:

   a. Polyvinyl chloride water pipe (PVC) shall be installed in accordance with the Standard Details and the manufacturer's recommendations.

   b. Ductile iron pipe (DIP) shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Association.

2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.

3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to ensure that each joint is watertight, has met the required manufacturer's insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the Commission.

4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.

5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.

6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.

7. Jointing Pipe

   a. General

      Before any joints are made in the trench, the Contractor shall demonstrate to the Commission by making a sample joint that methods he will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.

b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the Commission. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. The method of inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the Commission.

c. Mechanical Joints

Mechanical joints shall be joined in accordance with the manufacturer's recommendations as approved by the Commission. All nuts shall be tightened uniformly with a torque of not less than 75 or more than 90 foot-pounds.

d. Other methods of jointing pipe will be given consideration by the Commission, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.

e. All jointing material and workmanship shall be in accordance with the manufacturer's recommendations as approved by the Commission.

7. Tracer Wire: All water mains shall have tracer wire secured with duct tape to the top of the pipe at ten (10) foot centers. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.

8. Detector Tape: Install visual detection tape 12 inches below the surface at final grade.

9. Restrained joints and joint restraint systems shall be assembled in accordance with the manufacturer's recommendations. Tie rod nuts shall be uniformly tightened and double nutted to prevent movement. Joint restraint systems shall be field protective coated with two coats of a bituminous coating after assembly.

10. Connections to existing work shall be made by the Contractor in the presence of the Commission at such a time and in such manner as directed and approved by the Commission. The Contractor shall notify the consumers in the area to be affected by the shut-off. All valves necessary for making connections will be operated by the Commission. The Contractor shall complete the connections with the greatest possible speed and all work shall proceed without interruption until the existing system is returned to operation, so that the public will be inconvenienced as little as possible.

11. Buttresses and anchors shall be installed at all caps, horizontal bends, tees, branches and vertical bends as required in the Contract Documents, Standard Details, and as directed by the Commission.

C. Field Tests

1. General

a. All portions of water mains and appurtenances shall be tested. The Commission shall have the final decision as to the methods used.

b. During installation water mains will be visually inspected for compliance with these specifications and the contract documents by the Commission with the assistance of the Contractor. Further inspections and tests will be conducted by both parties after the section of pipeline being inspected and tested has been backfilled and has had ample time for the curing of buttresses.

c. The Contractor shall schedule all tests with the Commission at least 48 hours in advance of the test, and shall conduct all tests in the presence of the Commission. On Commission Capital Projects, the Commission will witness one test at no cost to the Contractor. Should the pipeline fail the first Commission witnessed test, the Contractor shall reimburse the Commission for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the Commission for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.

d. The pipeline shall be flushed free of all debris, silt, earth, gravel, rock or other foreign material. It shall be done in a manner to prevent debris or flushing water from entering the existing water mains.

e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.

f. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the Commission by the Contractor at his expense.

g. Water mains shall be tested in sections dictated by the operational breaks noted on the Contract Documents or as approved by the Commission.

h. No water mains shall be connected to existing mains, except through 3/4" loading line, at any point until they have been tested and chlorinated.

i. All stub valves shall be open and testing will be through caps or blow-offs at buttress.

j. After approval of test results by the Commission, the Contractor shall drain the line and connect to existing mains.

k. After connection to existing mains the Contractor shall refill and flush the lines and the Commission Inspector will check to see that the chlorine residual is back to acceptable levels before any water services are installed.

l. Once the line is permanently tied into the Commission system the line shall remain charged unless directed otherwise by the Commission.

2. Chlorination and Field Tests

a. General

1) When mains are completed, they shall be flushed, chlorinated, and tested. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the tests specified and to chlorinate the water mains.

2) Testing and tying in will be coordinated through the Commission. Under no circumstances shall any existing valves or fire hydrants be operated by the Contractor without prior approval of the Commission.

3) The section of water main being tested shall be filled from an existing fire hydrant or main as designated by the Commission. The Contractor shall furnish an approved backflow preventer at the point of supply. When charging and testing water mains which are not sufficiently close to existing water mains, the Contractor may use an approved potable water truck to haul water from an approved source.

b. Chlorination, Dechlorination, Flushing, and Bacteriological Testing

1) When the water mains are completed, each section (between
8/9/10 operational breaks) shall be flushed, chlorinated and sampled in accordance with AWWA C651 "Disinfecting Water Mains" standard. Calcium Hypochlorite or approved equal shall be discharged into the water main near the point where the water main is being charged. This solution shall be of such strength and quantity as may be necessary to provide 25 parts per million residual chlorine after 24 hours, in the section of water main being charged.

8/9/10 2) After the 24 hour (minimum) disinfection period and final flushing, the water mains shall be tested for bacteriological contamination. Two (2) samples shall be taken 24 hours apart for each section of main completed by a State Certified sampler and tested by a State Certified Laboratory at the expense of the Contractor. Sampling locations will be designated by the Commission Inspector and shall be taken in the presence of that Inspector. Samples not taken in the presence of the inspector shall be repeated at no additional cost to the Commission. Should the chlorine residual or bacteriological results not be satisfactory, the Contractor shall flush and re-chlorinate the water main until satisfactory results are obtained.

3) The discharge of chlorinated water into a sanitary sewer without permission from the Commission Inspector is prohibited. Permission will be granted on a case by case basis depending on chlorine content, geographic location and quantity.

4) The discharge of all water on the ground surface shall be in accordance with all applicable federal, state and local requirements.

5) Water main dechlorination shall be performed by a professional dechlorination company or by a utility contractor that has
8/9/10 received approval by the Commission. Dechlorination approval will only be granted to a contractor that has successfully demonstrated the proper use of approved dechlorination equipment. Contractor dechlorination approval will have a three month duration.

c. Hydrostatic Testing

1) Water mains and appurtenances shall be hydrostatically tested between operational breaks by the Contractor, in the presence of the Commission, in accordance with AWWA C600 and as specified herein.

2) The pressure in the main shall be increased to 200 psi at the highest point of the section of main under test, provided the design static pressure is under 150 psi. Where the design static pressure is over 150 psi, the test pressure shall be 50 psi above static pressure. This test pressure shall be maintained, without pumping for at least two (2) hours. Should this test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the test requirements are met.

3) In the event that air is trapped within the main to be tested, the Contractor, with Commission approval, shall make additional taps at his expense to release the trapped air. Locate these taps at proposed service locations whenever possible.

5) Hydrostatic testing against a closed valve shall not be permitted.

d. Continuity Testing for Non-Metallic Pipe

1) After backfilling, the Contractor shall test the tracer wire to demonstrate electrical continuity between valve boxes and through the length of the non-metallic pipeline installed. The Contractor shall schedule all tests with the Commission at least 48 hours in advance. Any discontinuity shall be located, repaired, and retested at the Contractor's expense until continuity is demonstrated.

4.0 METHOD OF MEASUREMENT

A. Water Mains

Measurement for furnishing and installing water mains will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for fitting or valves less than 4 inches in diameter.

B. Fire Hydrant Leads

Measurement for furnishing and installing fire hydrant leads will be made along the centerline of the pipe from the valve to the hydrant

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

2. The prices bid for furnishing and installing water mains shall include the following:

   a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

   b. Furnishing and installing granular pipe bedding materials and concrete for pipe fitting anchorages and buttresses as shown on the Standard Details and as required elsewhere in the Contract Documents.

   c. Furnishing and installing restrained joints and/or joint restraint systems where required by the Contract Documents.

   d. Abandonment of existing water mains and appurtenances.

3. Payment will be made for contingent items when approved by the Commission.

B. Water Mains and Fire Hydrants

Payment for furnishing and installing water mains and fire hydrant leads, complete and in place, will be made per linear foot of the size and type of pipe installed at the unit price bid. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, jointing and restraining materials, tracer wire and test stations where required, buttresses, strapping, cradling, testing of the installation, removal and disposal of pavement, removal and disposal of sidewalk, removal and disposal of paved ditches, removal and disposal of curb and gutter , providing an approved spoil site, and disposing of all spoil or excess materials; backfilling, suitable bedding and backfill materials, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, milling, paving, pavement materials, removing existing buttresses when necessary, connecting to existing pipelines, structures; testing, temporary bracing and protection of the utility poles and obtaining authorization from the utility companies, and all incidentals required to complete the work.

****END OF SECTION 02551****

SECTION 02552
WATER VALVES AND APPURTENANCES

1.0 GENERAL

A. Description

Water valve and appurtenance installation shall include, but not necessarily be limited to, furnishing and installing gate, butterfly, air release, vacuum, combination air valves or assemblies with appurtenant valve vaults, roadway valve boxes and accessories in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02551
3. Cast-In-Place Concrete: Section 03300
4. Precast Concrete Utility Structures: Section 03400
5. Mortar: Section 04100
6. Brickwork Masonry: Section 04200
7. Miscellaneous Metals: Section 05500

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any water valves or appurtenances.

C. Contractor's Options

None

D. Detailed Material Requirements

1. Aggregate for bedding, leveling, and drainage shall meet the gradation requirements of AASHTO M 43, Size Number 57.
2. Water mains and appurtenances shall be as specified in Section 02551.

3. Tapping saddles and corporation stops shall be as specified in Section 02553.

4. Portland cement concrete for miscellaneous valve appurtenances and cast-in-place vaults shall be the mix number indicated on the Standard Details and as specified in Section 03300.

5. Precast concrete vaults, manhole sections and grade rings shall be as indicated on the Standard Details and as specified in Section 03400.

6. Brick for valve support and miscellaneous valve appurtenances shall be sewer brick as specified in Section 04200.

7. Mortar for brickwork shall be as specified in Section 04100.

8. Frames, covers, and steps shall be as indicated on the Standard Details and as specified in Section 05500.

9. Valves 16" and greater shall not have less than 2 feet from top of operating nut to finish grade. All vertical adjustment shall be at no additional cost to the Commission.

10. Gate Valves

    a. Gate valves shall be iron body, resilient-seated, non-rising stem, 2-inch square operating nut which shall turn left (counter-clockwise) to open, with ample strength to withstand and operate under a working pressure of 150 psi, unless otherwise noted. The thrust collar shall be effective for both opening and closing. Valves up to and including 12" shall be manufactured in accordance with AWWA C 509. Valves greater than 12" shall be manufactured in accordance with AWWA C 509 or C 515. Valves shall be furnished with mechanical joint ends unless flanged or other type ends are indicated in the Contract Documents.

    b. Gate valves through 20-inch diameter shall be vertical type with O-ring stem seals. Gate valves 20-inches and greater shall have gearing as approved by the Commission.

    c. Gate valves shall be coated in accordance with AWWA C550. Both the inside and outside surfaces of the body and bonnet shall be epoxy coated.

    d. Buried valves shall be furnished with an extension in accordance with the Standard Details.

    e. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets, or similar fasteners.

    f. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.

    g. Wedge shall be constructed of gray or ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas.

11. Tapping Valves and Sleeves

a. Valves for tapping service shall meet all the requirements for gate valves. In addition, the body seat rings shall have a clear opening equal to the nominal size of the tapping valve. Tapping sleeves shall be stainless steel, or as approved by the Commission. Tapping valves for ductile iron pipe shall have flange by mechanical type ends unless otherwise shown on the Plans. All tapping sleeves shall be furnished with an outlet for testing.

b. Tapping sleeves shall be stainless steel, similar to types H 610, 611 or 613 as manufactured by the Mueller Company, Decatur, IL. Tapping valves shall be similar to types H 667 or H 642 as manufactured by the Mueller Company. The direction to open the valve shall be counterclockwise.

12. Butterfly Valves

a. Butterfly valves shall be permitted only with the specific approval of the Chief Engineer on water mains 16-inches or more in diameter, where the depth of cover precludes use of vertical gate valves.

b. Butterfly valves shall be manufactured in accordance with AWWA C504 as modified herein. Valves shall be Class 150B, and designed for a differential pressure across the valve of 150 psi and a minimum flow of 16 feet per second for opening and closing.

c. Valves shall be furnished with mechanical joint ends unless otherwise noted in the Contract Documents. When flanged ends are specified, valves shall be of the short lay length configuration.

d. Valves shall be furnished with a rubber seat, either in the body or on the disc, and a seat mating surface of alloy cast iron conforming to ASTM A 436, Type I, or 18-8 stainless steel, Type 304 or 316. Valves 24-inch diameter and larger shall have adjustable seats of a design that permits replacement in the field without removal of the valve from the line.

e. Valve shafts shall be stainless steel or monel, and shall be horizontal when the valve is installed in the water main.

f. Valve actuators may be worm gear or traveling nut type with a 2-inch square operating nut which shall turn left (counter-clockwise) to open. Operators shall be fully enclosed in a gasketed grease-filled enclosure, and shall withstand an input of 350 foot pounds to the nut at extreme operator position without damage.

g. Valves shall be furnished with an extension stem terminating a maximum of 6-inches below finished grade. The operating nut shall be located in a standard valve box and shall include a sealed valve position indicator which shows a valve position, and direction and number of turns to open or close the valve.

13. Ball Valves

a. Full port true union ball valves shall be used on pipelines 2 inches and smaller in size, and shall be provided with 2-inch by 2-inch operating nut.

b. PVC valve body material shall meet ASTM D 1784, Class 12454-B. Seats shall be PTFE or Teflon. O-rings shall be EPDM.

c. End connections shall be socket-type.

d. Valves shall have pressure rating of 150 psi at 73°F.

14. Swing Check Valves

a. Horizontal swing check valves shall meet the requirements of AWWA C 508 and shall be ductile iron as manufactured by Clow Valve Company or approved equal.

15. Rubber Flapper Check Valves

a. Rubber flapper check valves shall be ductile iron or bronze body, as manufactured by APCO Valve and Primer Corp., or approved equal.

16. Air and/or Vacuum Release Valve

a. Air-release, air/vacuum, and combination air valves shall be manufactured in accordance with AWWA C512 as modified herein. Valves shall be furnished with threaded ends unless otherwise noted in the Contract Documents.

b. The air/vacuum valve shall have a stainless steel body and stainless steel cover. The internal compound level mechanism shall be stainless steel and all other internals including float shall be stainless steel to avoid galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.

c. All materials of construction shall be certified in writing to conform to ASTM standards as follows:

PART	MATERIAL	STANDARD
Body and Cover	Stainless Steel (316SS)	ASTM A351 Gr CF8M
Internal Linkage	Stainless Steel	Type 316
Float and Internals	Stainless Steel	Type 316
Seat	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	FDA approved for Potable Water

d. All internals shall be easily removed through the top cover without removing the main valve from the lines.

e. An isolating valve shall be installed between main and air/vacuum release valve for maintenance.

f. Air/vacuum release valve shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air/vacuum release valve requirement.

g. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.

17. Roadway Boxes

Screw type roadway valve boxes and covers shall be made of cast iron conforming to the requirements of ASTM A 48, Class 30 B and shall meet the dimensional and marking requirements indicated on the Standard Details and Section 05500.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in the Standard Details and Section 02250.

2. Valves shall be restrained, supported, and strapped and/or anchored in accordance with the Standard Details.

B. Gate and Butterfly Valves

1. Gate and butterfly valves shall be installed in accordance with the Standard Details and at the locations shown on the Plans or as directed by the Commission.

2. Roadway valve boxes shall be centered and plumb over the valve operating nut. Backfill shall be compacted under and around valve boxes to ensure that no vertical loads are transmitted to the valve operators.

C. Valves in Vaults or Manholes

Dewatering and air release, vacuum, and combination air valves shall be installed in manholes in accordance with the Standard Details.

D. Field Tests

1. Water valves and appurtenances installed at the same time as a new water main shall be tested, after installation, by the Contractor along with the water main in accordance with Section 02551.

2. Water valves and appurtenances installed in an existing water main will be visually inspected for leakage by the Commission at the existing water main line pressure before the excavation is backfilled. The valve and joints shall be leak free under line pressure.

3. Tapping sleeves and valves shall be tested after assembly on the existing water main but prior to making the tap. The Contractor shall pressurize the complete assembly to 150 psi for 15 minutes with zero leakage, unless otherwise noted, and the Commission will visually inspect the tapping sleeve and valve for leakage. No leakage will be permitted.

4.0 METHOD OF MEASUREMENT

A. Water Valves

Measurement for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 4-inches in diameter and greater and appurtenances will be made of the number of each size and type installed complete.

B. Air and/or Vacuum and Combination Air Valves

Measurement for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made of the number of each size and type installed complete.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.

2. Payment for furnishing and installing water valves and appurtenances will include the following:

   a. Excavation, backfill, compaction, and incidental items as specified in Section 02250.

   b. Furnishing and installing aggregate, tie rods, retainer glands, and concrete valve support and restraint as shown on the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Water Valves

Payment for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 4-inches in diameter and greater and appurtenances will be made of the number of each size and type installed.

The price(s) bid shall include traffic control, furnishing and installing all valves, fittings, vaults, manholes, roadway boxes, jointing and restraining materials, buttresses, strapping, cradling, testing of the installation, removal and disposal of pavement, removal and disposal of sidewalk, removal and disposal of paved ditches, removal and disposal of curb and gutter , providing an approved spoil site, and disposing of all spoil or excess materials; backfilling, suitable bedding and backfill materials, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, milling, paving, pavement materials,

removing existing buttresses when necessary, valve extensions (if required); connecting to existing pipelines, structures; testing, and all incidentals required to complete the work.

C. Air and/or Vacuum and Combination Air Valves

Payment for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made for each size and type installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults, manholes, pipe supports, angle valves, corporation stops, extensions, restoration; testing of the completion installation; and incidental items to complete the valve installation.

D. Payment for furnishing and installing valves on water service connections will be made as specified in Section 02553.

**** END OF SECTION 02552****

SECTION 02553
WATER SERVICES, WATER METER SETTINGS, AND VAULTS

1.0 GENERAL

A. Description

Water Services, Water Meter Settings, And Vaults shall include, but not necessarily be limited to, furnishing and placing water services with appurtenant meter housings and connection to the water main in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02551
3. Water Valves and Appurtenances: Section 02552
4. Cast-In-Place Concrete: Section 03300
5. Precast Concrete Utility Structures: Section 03400

C. Quality Assurance

The Commission will inspect all materials before and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.
2. To minimize the number of joints, only standard manufacturer's length of pipe shall be furnished and installed for all water services unless otherwise indicated on the Plans, or as approved by the Commission.

B. Materials Furnished by the Commission

The Contractor may purchase 5/8-inch and 3/4-inch water meters and remote readouts for water service connections directly from the Commission. Meters larger than ¾-inch shall be purchased from a Commission-specified vendor.

C. Contractor's Options

Refer to Standard Details.

D. Detailed Material Requirements

1. Water Meters

a. Water meters shall be as shown on the Standard Details and the Contract Documents and shall be installed by a licensed plumber.

b. Water meters shall meet the requirements of AWWA C700, C701, C702
8/9/10 and C703 (proportional type only). The maincase and cover shall be cast from an ANSI/NSF 61 certified no lead high copper alloy containing a minimum of 85% copper. The size, model, and arrows indicating direction of flow shall be cast in raised characters on the maincase and cover. The cover shall contain a stainless steel calibration vane for the purpose of calibrating the turbine measuring element while the meter is in-line and under pressure.

2. Water Service

a. Water services less than 3-inches in diameter shall be Type K, annealed copper tubing and shall meet the material, chemical and mechanical requirements of ASTM B 88 or SDR 21 gasketed PVC water pipe that meets the requirements of ASTM D 2241 and ASTM D 1784: PVC 1120. The pipe is to have an integral bell that utilizes a gasket for sealing that meets the requirements of ASTM F477. Water services less than 3 inches in diameter may also be HDPE meeting the requirements of ASTM D 3035 of ASTM F 714. There shall be no joints in HDPE services between the meter and building being served. Tracer wire shall be installed following the requirements in Section 02551.

b. Water services 3-inches in diameter and larger shall be as specified in Section 02551.

c. Water service saddles shall be brass or bronze alloy meeting ASTM B62 or B584 and AWWA C800.

3. Gate valves, roadway valve boxes, curb boxes and tapping sleeves for water services shall be as specified in the Standard Details and Section 02552.

4. All service line valves and fittings shall be manufactured in accordance with AWWA C800. Connection to service lines shall be compression type.

5. Meter vaults for 12-inch or larger service lines shall have aluminum access hatches designed to withstand an H-20 wheel load. Door leaf shall be 3-inch aluminum diamond or safety tread pattern plate. Channel frame shall be 3-inch aluminum with concrete anchor flange around the perimeter, bituminous coated where in contact with concrete, and a 12-inch drainage coupling. Doors shall be equipped with stainless steel hinges and an automatic hold-open arm with release handle. The door shall have a locking mechanism and snap lock with a removable handle. The door shall be operable by a force not to exceed 30 pounds. Fixed ladders shall be equipped with an aluminum LadderUp safety post or approved equal.

6. Meter vaults shall be plumb with the surface.

7. Tapping saddles shall be manufactured of no-lead brass or approved equal. Saddles shall be furnished with Type 304 stainless steel straps with a minimum 2 inch wide bearing area and a rubber gasket suitable for potable water.

8. Pipe wall penetrations shall be as specified in the Standard Details.

9. Meter vaults shall be of the size indicated on the Standard Details furnished and installed as specified in Section 03400.

10. All water services and/or fire service lines shall be equipped with approved backflow prevention devices.

11. All water meters shall be encased in concrete when their location is within 3' of a paved driveway.

12. Meters shall not be located in ditches.

13. Detector Tape

    Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in yellow graphics.

14. Location Lumber

    Lumber for marking meter box locations shall be minimum 2-inch x 6-inch boards of sufficient length to extend from the plug at the end of the house connection to a height of 4 feet, more or less, above finished grade, painted blue above finished grade.

15. Tracer Wire for Pipelines

    Tracer wire shall be THHN solid, soft, continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have UL markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connectors with a water proof binder and underground electrical tape.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, bedding and haunching shall be as specified in Section 02250.

2. Prior to start of utility installation, all rights-of-way shall be graded to within 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.

3. Trench Water: The service trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.

4. Laying Service in Freezing Weather: No service shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the service has been installed.

5. Pipe Bedding: Each service shall be bedded on a solid foundation acceptable to the Commission and in accordance with the Standard Details. When aggregate bedding is required, bedding shall be installed to grade prior to laying pipe.

B. WATER SERVICES, WATER METER SETTINGS, AND VAULTS

1. Water Services, Water Meter Settings, And Vaults shall be installed in accordance with the approved manufacturer's written instructions, Commission Standards, Contract Documents, and as specified herein.
2. Unless otherwise stated, the developer/property owner shall be responsible for the installation of the meter setting, vault, and/or valve and roadway box, and all associated lines necessary to provide service. The developer/property owner shall install at their expense meter setting, vault, and/or valve and roadway box, and all associated lines necessary to provide service. Maintenance and ownership responsibility for all on-site facilities, i.e., downstream of the meter setting, vault, and/or valve and roadway box, shall remain the responsibility of the developer/property owner.

3. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.

4. Water services shall be jacked or driven under paving unless otherwise directed by the Commission. In case jacking or driving house services under any type of paving cannot be made, the Commission with approval of the pertinent agency may permit the Contractor to open cut. In the case of an open cut in paving, trench widths shall not exceed 18 inches or the requirements noted in the utility permit, whichever is most stringent.

5. House services installed in areas other than paving areas shall be open cut or driven at the Contractor's option.

6. All services shall be laid to the grade and lines in accordance with the Contract Documents or as directed by the Commission. Special care shall be taken to insure that the services are well bedded. Any defects resulting from settlement shall be repaired by the Contractor at his expense.

7. Copper service pipe shall be cut square to the run of the pipe and free from burrs. Pipe 3/4-inch to 1-inch can be cut with a disc-type pipe cutter or hacksaw. An abrasive wheel will not be allowed. Copper services larger than 1-inche can be cut with a disc type cutter or an abrasive wheel. Care shall be taken not to deform pipe end.

8. All services shall be thoroughly flushed with potable water at the time the main is tapped. All PVC services and services 3-inch diameter and larger shall be installed, chlorinated and tested as specified in Section 02551.

9. The pipe and fittings shall be thoroughly cleaned before being installed, and shall be kept clean until the acceptance of the completed work.

10. All meter vaults 24-inch in diameter and smaller shall be set at a minimum depth of two feet, eight inches (2' - 8"). They shall be set on brick or precast concrete rings and bedded on firm undisturbed earth.

11. Tracer Wire: All nonmetallic water services shall have tracer wire secured with duct tape to the top of the pipe at ten (10) foot centers. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped.

12. Detector Tape: Install visual detection tape 12 inches below final grade on all water service pipe.

C. Connections to Water Mains

1. All service taps in PVC pipe, existing mains and in ductile iron mains 6-inches and smaller shall have service saddles.

2. Service taps 2-inch and smaller for 8-inch and larger ductile iron mains shall be direct wet taps.

3. Service taps larger than 2-inch in ductile iron mains shall have service saddles, tapped tees, and threaded boss or tapping sleeve and valve.

4. Corporation taps shall be installed on new water mains under operating pressure before the water mains have been chlorinated and tested in accordance with the Contract Documents. Tapping sleeves shall be installed on new water mains under operating pressure after the water mains have been chlorinated and tested in accordance with the Contract Documents.

5. Service connections to existing water mains shall be made as noted in this section only where authorized by the Commission.

6. The Commission reserves the right to require a saddle on any water main service connection where the integrity of the connection or appurtenances is in question.

4.0 METHOD OF MEASUREMENT

A. Measurement for water services will be made per each type and size of service installed.

B. Measurement for meter settings and vaults or curb stops will not be made as it will be incidental to water service installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.

2. The prices bid for furnishing and installing water services shall included the following:

a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

b. Tapping the main or furnishing and inserting saddles or fittings in the main with appropriate buttresses, and furnishing and installing corporation stops or valves at the main.

c. Furnishing and installing cast-in-place or precast concrete or plastic meter vaults with frames and covers and access hatches as per the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Water Services

Payment for furnishing and installing water services will be made per each type and size of service installed. The price(s) bid shall include traffic control furnishing and installing the pipe or tubing, fittings, driving sleeves, curb stops, curb stop valve boxes, meter yoke/meter setting, bypass lines, temporary paving, and incidental items to complete the work.

C. Meter Settings and Vaults

Payment for furnishing and installing meter settings and vaults will not be made for it will be incidental to water service installation.

****END OF SECTION 02553****

SECTION 02554
FIRE HYDRANTS

1.0 GENERAL

A. Description

Fire hydrant installation shall include, but not necessarily be limited to furnishing and installing fire hydrants or relocating fire hydrants in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02551
3. Water Valves and Appurtenances: Section 02552
4. Cast-In-Place Concrete: Section 03300
5. Unit Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any materials for fire hydrant installation or relocation.

C. Contractor's Options

None.

D. Detailed Material Requirements

1. Washed gravel for hydrant foundation shall meet the gradation requirements of ASHTO M43, Size Number 57.
2. Fire hydrant leads shall be 6-inch diameter ductile iron pipe and shall be the length as shown on the drawings. Fire Hydrant leads shall not exceed 25 feet in length. All joints shall be restrained.
3. Fire Hydrants

a. Hydrant valve opening shall be at least 5-1/4 inch diameter net. Inlet connection shall be 6-inch mechanical joint.

b. Hose connections shall consist of two 2-1/2 inch diameter hose connections and one 4-1/2 inch diameter steamer or pumper connection. Hose and pumper nozzle threads shall conform to ANSI Specifications B26 for “National (American) Standard Fire-Hose Coupling Screw Thread.”

c. Operating nut shall be 5-sided, 1-1/2 inches from point to flat, and shall turn left (counterclockwise) to open.

d. Hydrant design shall be such that when the barrel is broken, it may be replaced without excavating or breaking adjacent pavement; and such that the entire barrel, including all working parts along with the main and drain valve seats, may be removed for inspection or repair without excavating or disturbing the ground.

e. The groundline lugs and valve rod shall be frangible so that in the event of accident, damage or breaking of the hydrant above or near the grade level, the main valve will remain closed and reasonably tight against leakage. Breakaway lugs are required, breakaway bolts will not be accepted.

f. The main valve seal shall be compression type sealing against a bronze seat and the valve shall open against pressure. The main valve shall be removed by use of a short-stemmed wrench.

g. Minimum bury depth shall be three and a half (3 ½) feet measured from the top of the connecting pipe to the ground level at the hydrant.

h. Bonnet shall have cast on the top an arrow and the word "open" indicating the direction for opening.

i. Fire hydrants shall meet the requirements of the “AWWA” Standard for fire hydrants for ordinary water works service C502. All lug bolts shall conform to ASTM A307, Grade B.

j. Interior of shoe shall be epoxy coated.

k. Fire hydrant shall be factory painted yellow by the manufacturer.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.

2. Construction methods shall be in accordance with Section 02551.

3. All fire hydrants that are set in the ground but are not yet operational shall have an “OUT OF SERVICE” disc placed on the 4-1/2” discharge outlet by the Contractor.

B. Fire Hydrant Installation

1. Fire hydrants shall be installed and all joints shall be restrained in accordance with the Standard Details, at the locations shown, and to elevations directed by the Commission. Hydrants shall be set within an aggregate drainage well extending the full width of the trench, from the center of the hydrant to a length equal to the width in a direction towards the main line, and from the bottom of the trench to a point 6-inches above the drip opening.

2. Hydrant leads shall be laid level on a firm foundation to ensure that the hydrant is set plumb. Backfill around the hydrant shall be compacted so as to obtain a density of at least 92% of maximum when measured in accordance with AASHTO T180, Method D.

3. Where hydrants are to be relocated, the Contractor shall ascertain whether or not the hydrant valve has been restrained before removing the hydrant to be relocated.

4. Where the existing lead is to be abandoned the lead shall be capped and blocked at the main by removing the hydrant valve and installing the cap or plug. All caps and plugs shall be buttressed and strapped to the main or restrained in accordance with Commission Standards.

5. Main port of fire hydrant shall be directed towards the curb or roadway.

6. There shall be no obstruction within a three foot radius of the hydrant.

C. Field Test

1. Fire hydrants installed at the same time as a new water main shall be tested after installation by the Contractor, along with the water main, in accordance with Section 02551.

2. Fire hydrants installed on an existing water main will be visually inspected for leakage by the Commission at the existing water main line pressure before the excavation is backfilled. The hydrant, valve, and connecting pipe shall be leak-free under line pressure.

4.0 METHOD OF MEASUREMENT

A. Measurement for fire hydrant installations or relocations will be made of the number of hydrants satisfactorily installed or relocated as shown on the Plans or directed by the Commission.

B. Measurement for fire hydrant lead pipe shall be made in accordance with Section 02251 Water Main Installation and Chlorination.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown as specified in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing or relocating fire hydrants shall include the following:

   a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

   b. Furnishing and installing aggregate fill and bedding, tie rods, retainer glands, and concrete thrust blocking as shown on the Standard Details or elsewhere in the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Fire Hydrants

1. New

   Payment for furnishing and installing fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, fittings, roadway boxes, jointing and restraining materials, buttresses, strapping, cradling, testing of the installation, removal and disposal of pavement, removal and disposal of sidewalk, removal and disposal of paved ditches, removal and disposal of curb and gutter, providing an approved spoil site, and disposing of all spoil or excess materials; backfilling, suitable bedding and backfill materials, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, milling, paving, pavement materials, removing existing buttresses when necessary, connecting to existing pipelines, tees, all hydrant and/or valve extensions (if required), furnishing and placing washed gravel under and around the hydrant; bracing, testing and painting of the complete installation; and all incidental items to complete the hydrant installation.

2. Relocations

   Payment for removing and reinstalling fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, investigation of the existing restraint system, capping and plugging if the existing lead line (if required), retapping the existing water main (if required), fittings, roadway boxes, jointing and restraining materials, buttresses, strapping, cradling, testing of the installation, removal and disposal of pavement, removal and disposal of sidewalk, removal and disposal of paved ditches, removal and disposal of curb and gutter, providing an approved spoil site, and disposing of all spoil or excess materials; backfilling, suitable bedding and backfill materials, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, milling, paving, pavement materials, removing existing buttresses when necessary, connecting to existing pipelines, tees, all hydrant and/or valve extensions (if required), furnishing and placing washed gravel under and around

the hydrant; bracing, testing and painting of the complete installation; and all incidental items to complete the hydrant installation

C. Fire Hydrant Lead Pipes

Payment for furnishing and installing fire hydrant lead pipe shall be made in accordance with Section 02251 Water Main Installation and chlorination.

****END OF SECTION 02554****

SECTION 02555
PRODUCTION WELLS

1.0 GENERAL

A. Description

Water production wells shall be double cased, lap or fully double cased construction, drilled by the mud rotary or reverse rotary drilling methods, unless otherwise specified in the Contract Documents. A drawing depicting the general design of a water production well can be found at the end of this section.

B. Related Work Included Elsewhere

C. Quality Assurance

1. Materials

a. Materials supplied for Water Production Wells shall be as outlined in the American Water Works Association Standard for Water Wells (AWWA A100-84), unless otherwise specified in the Contract Documents. The Chief Engineer will inspect all materials before installation to ensure compliance with Contract Documents.

2. Construction Standards

a. Construction of water wells shall be done in accordance with AWWA A-100-84, Code of Maryland, Title 26 Department of the Environment; Subtitle 04 Water Supply, Sewage Disposal and Solid Waste, Chapter 04 Well Construction (COMAR 26.04.04) and as specified herein.

3. Testing

a. Testing for well plumbness and alignment, production and efficiency and water quality shall be in accordance with AWWA A-100-84 and the United States Environmental Protection Agency Safe Drinking Water Act as it pertains to ground water and as specified herein.

4. Acceptance Standards

a. In order to assure that the Commission is provided with a sand-, silt-, bacteria- and turbidity-free and efficient well, certain minimum standards shall be met before the well is accepted. The Chief Engineer may waive the acceptance level of a certain standard if it is determined by the Chief Engineer that the failure to meet the standard was beyond the Contractor's control and/or will not materially affect the long-term use of the completed well.

b. Minimum acceptance standards are:

1) Sand and silt content: Each Group A water sample shall have a concentration of less than 3.0 mg/l total suspended and settleable solids one minute after water from the screen area arrives at the sampling point or any time thereafter.

2) Turbidity: Each Group A water sample shall have a turbidity concentration of 5.0 NTU or less one minute after water from the screen area arrives at the sampling point or any time thereafter.

3) Chlorine Residual: The chlorine residual shall be less than 0.1 mg/l when determined in the field at the time of all bacteriological sampling.

4) Bacteria: Each Group B sample shall have no indication of residual chlorine and shall have less than 1 coliform organism per 100 ml of sample using the membrane filter method of analysis. In addition, the total plate count analysis of each Group B sample shall indicate that bacteria organisms are equal to or less than two (2) organisms per 100 ml of sample.

5) Efficiency: The production well shall be at least 80% efficient, unless otherwise specified in Contract Documents, as determined by the Chief Engineer and based on the results of the long-term pumping test. The values of aquifer transmissivity (T) and storativity (S) used in the determination of well efficiency shall be based solely on data gathered during the construction and long-term pump testing of the production well.

The efficiency of the well shall be determined by comparing the actual drawdown in the production well with the theoretical drawdown in the production well, calculated at a distance equal to the inside diameter of the well screen. The theoretical drawdown in the production well shall be calculated using the Theis nonequilibrium well equation. Partial penetration of the aquifer will not be considered in the determination of efficiency if 75% or more of the aquifer is screened.

In the event that an observation well, which is screened over the same interval as the production well, is available during the long-term pumping test, values of aquifer transmissivity and storativity will be determined from the drawdown data collected in the observation well. In the absence of an observation well, aquifer transmissivity will be calculated using the Time/Time vs. Residual Drawdown method, and aquifer storativity will be estimated from published data, previous reports or other appropriate sources as determined by the Chief Engineer.

The comparison of theoretical and actual drawdown will be made at a specific time, determined by the Chief Engineer, during which long-term pumping test data was used to calculate aquifer parameters. The percentage well efficiency will be calculated as:

(Theoretical Drawdown/Actual Drawdown) x 100

c. Should the Contractor fail to meet any one of the acceptance standards the Contractor may be allowed to continue development or test pumping and/or disinfection of the well for a reasonable period of time, in order to meet the standards, as agreed upon by the Chief Engineer. The well shall then be re-tested, if necessary. Any additional development, test pumping, disinfection or other work will be at the Contractor's expense and will include the Commission's costs for consulting and inspection

services. Should the Contractor not be able to meet any of the required acceptance standards, the Chief Engineer may reject that portion of the Work and require the Contractor to vacate the site.

5. Permits

   a. The Contractor shall arrange for, obtain and pay for all permits, inspections and tests necessary for the proper execution of the work, in accordance with all Federal, State and Local rules, regulations and codes. Copies of the well permit and all other permits shall be presented to the Chief Engineer upon receipt and shall be posted, if required, at the project site. A copy of all completion reports sent to the State of Maryland or other agencies shall be submitted to the Chief Engineer along with the driller's own reports and logs.

6. Warranty

   a. The Contractor warrants that all workmanship, material and equipment furnished and installed by the Contractor shall be free of detects or failure for a period of one (1) year after the well is placed into regular service and, should such defects appear, the Contractor shall repair such defects at no cost to the Owner.

D. Submittals

1. Driller's Report: During construction, the Contractor shall maintain, on a daily basis, a report of all activities pertaining to the work. The report shall be submitted on report forms approved by the Commission. The Daily Report form shall be completed and signed by the Contractor's Licensed Driller in charge of the work and submitted to the Chief Engineer during the Chief Engineer's inspection of the work.

2. Driller's Logs: During installation of the pilot hole, the Contractor shall prepare and keep a complete log of the formations penetrated on a Driller's Log form approved by the Commission. The Driller's Log form shall be prepared and signed by a driller licensed in the State of Maryland. The Driller's Log shall be submitted to the Chief Engineer upon the completion of the pilot hole.

3. Sieve Analysis: Copies of the sieve analysis from selected pilot hole formation samples shall be submitted upon receipt to the Chief Engineer. Sieve analysis shall be performed by the well screen manufacturer or person experienced and qualified to perform such analysis.

4. Shop Drawings: In addition to the shop drawings required in the "General Provisions", the Contractor shall, prior to the installation of any casing or well screen, submit to the Chief Engineer a detailed cross section of the well. The drawing shall indicate exact lengths, diameters, materials, slot sizes, depths and other dimensions of the casing, screens, adapters, blank sections, riser pipe, gravel pack, grout and all other appurtenances pertaining to the well.

5. Manuals and Manufacturer's Literature: After construction, the Contractor shall furnish copies of any documents, certifications, manuals, specifications and manufacturer's literature pertaining to the materials and/or equipment installed permanently or temporarily during the Work. Three copies of these documents shall be submitted to the Chief Engineer.

6. Gravel Pack: The Contractor, prior to delivery, shall submit to the Chief Engineer samples of the gravel pack proposed for use along with a current sieve analysis of the gravel showing gradation and uniformity coefficient.

7. Well Profile: Upon completion of testing, the Contractor shall submit a well profile to the Chief Engineer.

8. Water Samples and Analysis

   a. Sampling Coordination: The Contractor shall notify the Commission 48 hours prior to collecting samples. The State of Maryland Department of the Environment shall also be notified (in the time frame required by them) so that they may collect water samples as required by their regulations.

   b. Analysis Required: The Contractor shall furnish the following water analyses of samples collected at various times during testing. The analyses are grouped according to the times of collection and where the analysis will be performed. The cost of the analysis is to be included in the Lump Sum Amount bid. Samples shall be taken and analyzed in accordance with the requirements of COMAR 26.07.01. The following is a list of parameters to be tested for, however this list is not to be construed as a release from the requirements of COMAR 26.04.01.

      1) Group A: turbidity (NTU) and total suspended and settleable solids.

      2) Group B: total coliform (membrane filter), total plate count and chloride residual.

      3) Group C: pH, eH (redox potential), specific conductance, 3 temperature, M.O. and P alkalinity ($CaCO_3$), free carbon and turbidity.

      4) Group D: chloride, fluoride, total hardness, total iron, nitrate nitrogen, manganese, sodium, total dissolved solids, arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, copper, zinc, carbonate, bicarbonate, magnesium, sulfate, calcium, color, foaming agents, odor, Langlier Index, silica, potassium, volatile organic compounds EPA Method 524.2, radio nuclides, EPA Method 60014-75-008 including beta, radium 226, radium 228, radon EPA Method 600-75-012 and all other compounds regulated under Phase I, Phase II and Phase V amendments to the Safe Drinking Water Act.

      5) Group E: Required samples provided to the Maryland Department of the Environment.

   c. All sample analyses shall be performed by a certified laboratory having all state and/or federal approvals necessary under the Safe Drinking Water Act for the constituents requested. A laboratory representative shall collect the samples in Groups C and D. The Contractor is permitted to collect the samples in Groups A and B using bottles and sample preservation techniques provided by the laboratory. The chlorine residual shall be determined by the Contractor in the field at the time the Group B samples are collected using an approved field test kit capable of

detecting chlorine residual to 0.1 mg/l. The analysis of samples in Group C shall be performed in the field by a laboratory representative as soon as possible after they are collected.

d. Submit results of all water sample analyses.

9. Certificate of Potability from MDE.

10. Pumping test data and recovery test data.

11. Material Warrantees

12. Well Completion Report

2.0 MATERIALS

A. Materials furnished by the Commission

1. The Commission will not furnish any materials for Production Well Construction.

2. The Contractor may obtain water from the Commission's system, if available, for well construction purposes. Water used will be invoiced to the Contractor at prevailing rates. The Contractor shall contact the Commission's Department of Fiscal Services, Meter Section for requirements. A backflow prevention device must be placed in accordance with the Standard Details prior to drawing Commission water.

B. Contractor's Option

The Contractor may furnish any of the specified materials or "equal" materials as approved by the Chief Engineer unless otherwise noted in the "SPECIAL PROVISIONS".

C. Detailed Materials Requirements

1. Surface or starter well casings shall be made of non-galvanized steel and shall be of such a size to allow proper grouting of the outer well casing.

2. Outer well casings shall be new. They shall be made of non-galvanized steel and conform to ASTM Class A53 and AWWA A-100-84 specifications. Casings shall be I.P.S. "STANDARD" schedule wall thickness, unless otherwise specified.

All casings shall be plain end and machine beveled for welded connections. Casing diameters are outlined in the Contract Documents. All steel pipe used in well construction shall bear mill markings that will readily identify it.

3. Stainless steel well screens shall be new, continuous slot, wire wound screen (Johnson Filtration Systems, Inc. or equivalent). The screen shall be constructed of wound wire, reinforced by longitudinal bars. The bars shall have a cross-section that will form an opening between each adjacent coil of wire that is shaped in manner as to increase in size inward. The wire shall be firmly attached to the bars which in turn, will be attached to a coupling adapter. The well screen shall be constructed of Type 304 stainless steel. The screen dimensions are outlined in the contract documents. Water entrance velocities for the screen selected shall not exceed 0.1 feet per second at the anticipated pumping rate stated in the Contract Documents.

4. Blank sections between screen sections, cellar or sump sections, transition sections from the top of the well screen to the relief screen and inner casing shall be the same diameter and constructed of the same material as the well screen, unless specified otherwise. Solid pipe blank sections and inner casings shall be I.P.S. "STANDARD" schedule wall thickness, unless otherwise specified.

5. Relief screens shall have the same slot size and be the same diameter and constructed of the same material as the well screen, unless specified otherwise.

6. The end plate for the well screen, cellar or sump section shall be constructed of the same material as the well screen, unless specified otherwise.

7. Well screens, blank sections, inner casing, relief screens, cellar or sump sections and end plates shall be connected with Type 304 stainless steel welding rings or shall be plain end machine beveled for welded connections.

8. Centralizers shall be made of steel half moon sections or 304 stainless steel expandable straps.

9. The filter gravel for the gravel pack shall consist of material that is composed of sound, durable, subrounded to rounded rock and mineral fragments. The particles shall consist mainly of quartz and/or quartzite and shall contain no limestone or other calcareous material, such as shell fragments and no organic material, such as wood fragments or lignite. The gravel shall be purchased from a commercial supplier who shall certify that the material is suitable for use in potable water wells. The gravel pack material shall be graded and sized to be suitable and compatible with the formations present and screen slot size(s) selected. The gravel shall meet industry standards for sorting and size distribution within the stated range. The uniformity co-efficient of the gravel pack materials shall be no greater than 1.7. The gravel pack material shall be delivered to the site in bags or in bulk. If delivered in bulk, it shall be placed on 6 mil. plastic sheeting at a raised location so as not to be subjected to any type of surface run-off. The material shall be kept clean and dry at all times.

10. Neat cement for grouting production well outer casings shall consist of a mixture of Portland Cement ASTM C-150 Type 2 or Type 3, and water, with not more than 6 gallons of clean water per bag of cement used. If premixed cement is purchased, a certificate of composition must be presented to the Commission Engineer upon delivery. The use of special cement or other admixtures (ASTM C-494) to reduce permeability, increase fluidity and/or control time of set and the composition of the resultants slurry, must be submitted to the Chief Engineer for review and approval prior to use.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. PREPARATION

1. The Contractor shall notify the Chief Engineer one week prior to all Work and tests called for in these specifications, including the start of drilling and the start of pumping tests. The Maryland Department of Natural Resources and the Department of the Environment shall be notified within the time frames required by these Departments, prior to the long-term test, so the test may be observed and samples collected.

2. The Contractor shall be responsible for all necessary measures to prevent erosion or sedimentation on or adjacent to the site as a result of the Work. Settling basins and/or traps shall be employed as necessary during the drilling operation in order to re-use the fluids required for drilling. The Contractor is not permitted to bury cuttings on-site. All supernatant fluid shall be removed from the mud pits and trenches, and the pits filled with clean earth and allowed to stabilize. Obtaining suitable off-site disposal of all discarded fluids and other materials shall be the responsibility of the Contractor. The requirements of this section in no way relieve the Contractor from complying with any site specific soil and sediment erosion control plans for this work.

3. All measurements indicated in these specifications are from the surface of the ground at the site. Actual depths used during the proposed Work will be dependent upon information obtained from drilling. All measurements made in the field during drilling and testing shall be made from a well defined referenced point. A complete description of this reference point (or sampling point) shall be included on all submittals provided by the Contractor. The elevation of each reference point used shall be specified with respect to ground surface and some permanent benchmark established by the Chief Engineer at each site. All depth measurements shall be within +/- 0.1 feet except water-level measurements which shall be +/- 0.01 feet.

4. The Contractor shall employ only competent workers for the execution of this Work and all such Work shall be performed under the direct supervision of an experienced and licensed Master Well Driller (State of Maryland) satisfactory to the Chief Engineer.

B. DRILLING FLUID

1. Only potable water from a source approved by the Chief Engineer shall be used during construction. If available, arrangements may be made with the Commission to secure a source of water from the Department's distribution system as described in Section 02555.02.A.2.

2. Material used by the Contractor to prepare the drilling fluid shall be composed of fresh, non-polluted water and sodium bentonite type drilling clay commercially processed to meet or surpass the viscosity specifications in the American Petroleum Institute "Std. 13-A for Drilling Fluid Materials". Any other drilling fluid additives to be used must, prior to use, be approved by the Chief Engineer. Their use shall comply with recognized industry standards and practices and they shall be applied and used as recommended by the manufacturers. It is expressly understood that toxic and/or dangerous substances shall not be added to the drilling fluid.

3. The drilling fluids program shall be agreed to by the Contractor and the Commission prior to use. Selection and use of the drilling fluid materials shall be a part of this agreement. The Contractor shall be responsible for maintaining the quality of the drilling fluid to assure:

a. The protection of water bearing and potential water bearing formations exposed in the borehole.

b. That representative samples of the formation materials are obtained.

c. That water, free of bacteria and other contaminants, as later described in these specifications, is obtained from the finished well.

C. PILOT HOLE DRILLING

1. A pilot hole, for formation sampling and geophysical logging, shall be drilled from ground surface to a depth and diameter as outlined in the Contract Documents. The sediments penetrated shall be sampled as specified herein.

2. During the drilling of the pilot hole, sediment samples shall be collected as follows:

a. The Contractor shall obtain return flow samples by removing from the circulating drilling fluid a representative sample of the formation by either collecting the samples in a cutting sample box, sediment shaker, a baffle in a ditch, or catching them in a bucket and allowing the sample to settle out. Care shall be taken so that the sampling device is not contaminated with sediments other than those being obtained from the sampling interval. Provision shall be made to determine the exact depth of the formation from which the cuttings are derived by exact measurements of the drill pipe and calculation of up-hole velocity of the drilling fluid. When collecting samples, at a prescribed collection interval, drilling shall be suspended and the drilling fluid circulated for the time required to bring the sample to the collection point. The method of collecting samples and the time interval required for bringing the samples to the collection point must be approved by the Chief Engineer prior to the start of drilling.

b. Formation samples shall be collected at 10-foot and 5-foot intervals as outlined in the Contract Documents. Samples shall also be collected at any pronounced change of formation. Special care shall be used when collecting samples from the aquifer.

c. Two representative samples shall be obtained for each sampling interval of 10 feet. At least three representative samples shall be obtained when the sampling interval is 5 feet.

d. Immediately after retrieval, formation samples shall be placed in suitable containers, securely closed to avoid spillage and contamination and clearly labeled in a permanent manner with at least the following information:

1) Location of the well.

2) Name or number of the well.

3) Depth interval represented by the sample.

4) Date taken.

e. One set of samples collected from the aquifer and selected in conjunction with the Chief Engineer shall be delivered to an approved soils testing facility so that sieve analysis can be performed for tentative selection of the well screen. The remaining samples shall be safely stored until they area accepted by the Chief Engineer.

D. GEOPHYSICAL LOGGING

1. At the conclusion of pilot hole drilling the Contractor shall conduct geophysical logs in the pilot hole and submit results to the Commission.

2. Caliper logs shall be performed, by the Contractor, after the pilot hole has been reamed to accept the outer casing and after the formation area has been reamed to accept the well screen. Results shall be submitted to the Commission.

3. If a geophysical logging tool is lost and not retrievable, the Contractor may drill out or drill by the tool, if in the Chief Engineer’s opinion doing so will not materially effect the well. If the Contractor is unable to drill out or bypass the tool, the Contractor shall abandon the hole, in accordance with the regulations of the Maryland Department of the Environment and shall redrill to the designated diameter and depth.

4. If the geophysical tool is lost due to Contractor negligence or problems with the drilled hole, the Contractor shall reimburse the Chief Engineer for the lost equipment and shall perform the necessary abandonment and redrilling at no additional cost to the Commission. Any cost for additional geophysical logging required due to the Contractor's negligence or problems with the drilled hole shall be borne by the Contractor.

E. WELL CONSTRUCTION

1. The outer casing shall extend to the top of the water bearing aquifer, or as otherwise shown on the drawings.

2. All surface (starter) casing and outer casings shall be grouted in place with a minimum of 2 inches of grout surrounding the casings.

3. Well screens shall be gravel packed in place with a minimum of 4 inches of gravel surrounding the well screen.

4. If the Contractor decides to install a surface (starter) casing, it shall in no way infringe on grouting the outer casing or obtaining a proper seal. Any surface (starter) casing used shall be left in place and shall be included in the Lump Sum bid price.

5. Screen slot size, configuration, setting and gravel pack size shall be selected by the Contractor and approved by the Chief Engineer based on all previous work and the intent of these specifications. The Contractor shall check the driller's logs, geophysical logs, and sieve analysis of the samples obtained from pilot hole to reach a decision concerning screen slot size, gravel size and screen placement.

6. The well casings and screen sections shall be installed in the pre-drilled hole in such a manner as to be suitably aligned and plumb. They shall be grouted or gravel packed in place as required. Centralizers shall be installed between the inner and outer casing at three equal distance points, or as otherwise shown on

the drawings between the bottom of the outer casing and the top of the inner casing. Installation of the casing, grouting same and installation of the well screen and gravel packing same, shall be done around the clock until completion. Well casings and screen connections shall be welded in accordance with the current standardize procedures of the American Welding Society.

7. The outer casing shall be set round, plumb, and true to alignment. The tests for alignment in the outer casing shall be made following the setting of the casing and before the installation of grout. Alignment shall be tested by lowering into the well a section of 6-inch diameter or larger pipe which is 40 feet long with guides on each end and in the middle. The outer diameter of the guides shall not be more than 1/2-inch smaller than the diameter of that part of the casing being tested. The guides shall be a minimum of 1.0 feet long.

8. Immediately after the Contractor has performed the alignment test, the test for plumbness shall be made by the Chief Engineer with a plummet suspended from a tripod on the drill rig. The plummet shall be approximately 1/2-inch smaller in diameter of the well casing being tested. The Contractor shall assist the Chief Engineer in making the test for plumbness.

9. Should the alignment dummy or the plummet fail to move freely throughout the entire length of the casing being tested, or should the well depth vary from the vertical in excess of 2/3 of the smallest inside diameter of that part of the well being tested, per 100 foot in depth, the plumbness and/or alignment of the well shall be corrected by the Contractor at the Contractor's own expense. Should the Contractor fail to correct the faulty plumbness and/or alignment, the Commission may refuse to accept the well and require that another well be constructed at another location on the property. The inside and outside of the existing casing or borehole, if the casing is removed, shall then be abandoned (as specified) at the Contractor's expense. The Chief Engineer may waive the requirements for plumbness and alignment if, in the Chief Engineer's judgment, the defect is due to circumstances beyond the Contractor's control and/or the utility of the completed well will not be materially affected. Any retesting or alignment or plumbness shall be done at the Contractor's expense including the Commission's cost for consulting and inspection services.

10. The annular space between the drilled hole and the outer casing shall be sealed by pressure grouting from the bottom of the casing to ground level. This may be accomplished by the use of a Tremie pipe set to the bottom of the casing or by some other method recommended by the Contractor and approved by the Chief Engineer.

11. After the inner casing and well screen are securely positioned in the well, the Contractor shall furnish and install a gravel pack between the screen and borehole. The Contractor shall be responsible for ensuring that the gravel pack material is adequately disinfected during installation. The gravel pack shall be placed adjacent to the screen using the Tremie Pipe Method, so that the entire open space between the screen and borehole is uniformly filled with gravel. The borehole shall be continually flushed with chlorinated water to remove drilling mud and natural clays, prior to and during gravel packing.

F. WELL DEVELOPMENT

1. A method of development shall be used which will result in the removal of fine material in the vicinity of the well screen, increase the material porosity of the undisturbed formation and remove the mud cake and drilling fluid from the

borehole. This is to be accomplished with a method of development which will cause a reversal of flow through small sections of the well screen combined with pumping to remove color and fine materials. Initial development shall be accomplished by either air surging with a tight fitting double block surge and educator pipe, with the surge blocks spaced no more than 5 feet apart or by a combination of high velocity jetting and pumping. The maximum rate of development, utilizing either of these methods, shall be 5 feet of well screen per hour. After initial development other methods of development such as, but not limited to, mechanical surging, air pumping or high capacity pumping with a test pump may be utilized. Development, by either of the above described initial methods, must be done prior to installing a test pump.

2. Chemical and other development aids to improve the efficiency of the well and to assist in its development may be permitted subject to the prior approval of the Chief Engineer. Concentrated discharges from the well shall be disposed of in a safe and acceptable manner in accordance with these specifications and any applicable State or Federal regulations.

3. The Contractor as part of this Work may conduct tests periodically to check the progress of development and well efficiency. All of these tests shall be included in the Lump Sum bid amount.

4. Development shall be sufficient to provide a minimum acceptable efficiency for the well as defined under the Acceptance Standards outlined in the "Quality Assurance" section of these specifications. After the pumping tests, the Contractor may continue to develop the well for a period of 30 days in order to attain minimum requirements. All additional development and re-testing necessary to meet the Acceptance Standards shall be at the Contractor's expense, including the Commission's cost for consulting and inspection services.

G. TEST PUMPING

1. When the Contractor, at the Contractor's own determination, feels the well can meet the acceptance standards, the well shall be pumped to determine aquifer characteristics, well efficiency and to collect representative water samples from the aquifer. Testing shall be accomplished as follows:

   a. General Equipment: The Contractor shall furnish all labor, tools, pumps, piping, electric cable, controls, generators, flow measuring devices and other appurtenances necessary for the performance of test pumping as required by these specifications. The Contractor shall furnish the necessary pumping equipment and measuring instruments to pump at stepped rates, as outlined in the Contract Documents with throttling control satisfactory to the Chief Engineer, measure the discharge rate in a manner satisfactory to the Chief Engineer and carry the pumped water to an acceptable discharge point as directed. The pump intake shall be set at the depth outlined in the Contract Documents or at some other depth, recommended by the Contractor and approved by the Chief Engineer, determined as a result of tests conducted during development. The pumping unit shall be complete with ample power source, controls, and appurtenances and shall be capable of operation without interruption for a period of at least 24 hours. The test pump shall be fitted with a foot valve or check valve, at the pump head, to prevent the flow of water back into the well during recovery. Oil lubricated test pumps shall not be used for well development or testing.

b. Water-Level Measurement: A clearly marked convenient reference point shall be established at the top of a water-level measuring pipe which the Contractor shall insert in the pumped well along with the test pump.

c. Flow Measurement: The discharge from the well shall be measured using a pipe, piezometer tube and orifice plate. The configuration of this equipment shall meet industry standards and also be acceptable to the Chief Engineer.

d. Sampling Port: The Contractor shall furnish a 1-1/4-inch IPT opening in the discharge pipe before the beginning of the orifice pipe for the installation of sampling equipment to be furnished by the Chief Engineer. The discharge pipe shall be free of valves, changes in pipe diameter or other obstructions for a distance of 24-inches shall be free of any external obstruction except for the discharge pipe itself.

e. Step Test: An initial pumping test shall be conducted in the well at stepped rates as outlined in the Contract Documents and in the field by the Chief Engineer. The total test period for the step test will be 6 continuous hours. The Contractor shall operate the pump and vary the discharge as directed by the Chief Engineer.

f. Long-Term Test: After a rest period of at least 12 hours, during which the well has recovered from the step test, a constant rate test shall be conducted by pumping the well at a rate as outlined in the Contract Documents or as directed by the Chief Engineer, for a period of 24 hours, followed by a recovery test period of 12 hours. The pumping rate for the 24 hour test shall be selected so as to provide maximum drawdown in the well using the following criteria:

1) Results of the step test.

2) Capacity of test pump as stated in the Contract Documents.

3) The available capacity at a pumping level as stated in the Contract Documents.

The long-term test shall be composed of two parts, a drawdown portion and a recovery portion. The Contractor shall wait 24 hours after shut down to remove the Contractor's pump and to allow for the collection of water-level data.

g. Water-level measurements shall be obtained in the pumped well and a test/observation well (if available) by the Contractor as directed by the Chief Engineer. Measurements of water level during the pumping and recovery period shall be made as follows:

Elapsed Time	Measurement Taken
0- 20	every minute
0- 40	every 2 minutes
40- 100	every 5 minutes
100- 240	every 10 minutes
240-1450	every 25 minutes

During testing, the Chief Engineer may designate a frequency which varies somewhat from the above. The Contractor shall provide at least

one (1) person to measure and record pumping test data at times when the Chief Engineer is not present at the site.

h. During the initial step test and during the constant rate 24-hour test, failure of pump operation during the first 150 minutes of pumping or for more than 15 minutes at anytime thereafter shall require suspension of the test until the water level in the pumped well has recovered to its original level. The time of the restart of the test shall be approved by the Chief Engineer and shall take into account staff scheduling and water sampling. The Chief Engineer shall be the sole judge as to whether recovery has been completed and when the pump shall be restarted. During the test, the pumping rate shall not fluctuate more than one (1) percent of the designated rate or the test may be terminated. Any retesting shall be done at the Contractor's expense including the Commission's cost for consulting and inspection services.

i. Water discharged during the pumping test shall be conducted to a point of acceptable disposal as approved by the Chief Engineer and in accordance with State and Local sediment and erosion control regulations. The Contractor shall be responsible for correcting, at the Contractor's own expense, any damage caused by the discharged water.

H. WATER SAMPLING ARRANGEMENTS

1. Water samples for quality analysis, as required under the "Submittals" Section of these specifications and in accordance with COMAR 26.04.01, shall be collected during the long-term pumping test as follows:

a. Group A: Two samples; the first one minute after water from the screen area arrives at the sampling point. The time lapse from the start of pumping to taking this sample shall be determined by the capacity being pumped and the upward velocity of the water in the well casing and the pump discharge column. The second sample shall be taken during the last 30 minutes of the pumping test.

b. Group B: Three samples; one during each of the last 3 hours of the pumping test.

c. Group C: One sample during the last 30 minutes of the pumping test with the analysis conducted in the field at the time of sampling.

d. Group D: One sample during the last 30 minutes of the pumping test for transport to the laboratory for analysis.

e. Group E: Assist in the collection of necessary samples by the State of Maryland during the last hour of the test.

I. WELL DISINFECTION

1. The Contractor shall furnish all labor, materials, transportation, tools supplies, plant equipment and appurtenances necessary for the satisfactory disinfection of the well. Disinfection of the well shall be as provided by "AWWA Standard for Deep Wells A-100-84". The chlorine solution used for disinfecting the well shall be of such volume and strength and shall be so applied that a concentration of at least 100 PPM is established in the well in accordance with the directions of, and to the satisfaction of, the Chief Engineer and shall remain in the well for a period

of at least 12 hours. After the required disinfection period and with the approval of the Chief Engineer, the chlorinated water from the well shall be pumped to a discharge location as approved by the Chief Engineer. The well shall also be disinfected at various times during the Work as deemed necessary by the Contractor.

2. Upon removal of the test pumping equipment, a sufficient amount of disinfectant shall again be added to the well prior to capping to provide a chlorine residual in the well of 50 ppm.

3. All chlorinated waters pumped from the well shall meet the conditions set forth in the Maryland Department of Environment Water Supply Bulletin entitled "Discharge of Chlorinated Waters", July 31, 1989, before being released to any drainage system.

J. TV SURVEY OF THE COMPLETED PRODUCTION WELL

1. At the conclusion of testing and prior to capping the production well, the Contractor shall conduct a TV survey of the well to confirm construction details and dimensions. A copy of the survey shall be submitted to the Commission for review and acceptance.

2. The Contractor shall be responsible to take whatever steps are necessary to clear the water in the well so a clear TV picture is obtainable.

K. WELL CAPPING

1. Whenever the well is left unattended, a temporary well cap or drill tool with suitable plates shall be placed on the well to prevent entry. Upon completion, the well shall be capped to prevent unauthorized entry.

L. WELL ABANDONMENT

1. If the Contractor deems it necessary, or if instructed by the Chief Engineer that the drilled hole or a partially constructed well must be abandoned, it shall be done in accordance with the regulations of the State of Maryland, Department of Environment.

4.0 METHOD OF MEASUREMENT

A. Outer Casing

RESERVED FOR FUTURE USE

B. Well Screens and Blank Section

RESERVED FOR FUTURE USE

5.0 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

END OF SECTION 02555

SECTION 02561
GRAVITY SANITARY SEWER AND HOUSE CONNECTIONS

1.0 GENERAL

A. Description

Sanitary sewer installation shall include, but not necessarily be limited to furnishing all labor, materials, and services necessary to install pipe, fittings, miscellaneous structures of concrete or brick masonry, and appurtenances for gravity sewer and house connections, of the size and type shown, in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250
2. Sanitary Sewer Manholes: Section 02562
3. Precast Concrete Utility Structures: Section 03400
4. Mortar: Section 04100
5. Brick Masonry: Section 04200
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.
2. To minimize the number of joints, only standard manufacturer's length of pipe shall be furnished and installed for all sanitary sewer mains and house connections unless otherwise indicated on the Plans, or as approved by the Commission.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

DIP - Ductile iron pipe

PVC - Polyvinyl chloride pipe

RCSP - Reinforced concrete sewer pipe

C. Materials Furnished by the Commission

1. The Commission will not furnish any materials for gravity sanitary sewer and house connections.

2. Unless otherwise noted in the “Special Provisions,” the Contractor shall pay for all potable water used for testing. The Contractor shall contact the Commission to coordinate its use.

D. Contractor’s Options

1. The Contractor may furnish polyvinyl chloride (PVC) or ductile iron pipe (DIP) for sewers equal to or smaller than 24-inch diameter unless specified otherwise in writing by the Commission.

2. The Contractor may furnish Polyvinyl Chloride Pipe (PVC) or ductile iron pipe (DIP) for sewers equal to or greater than 24-inch diameter unless specified otherwise in writing by the Commission.

3. The Contractor may furnish precast, cast-in-place, or masonry construction for miscellaneous sanitary sewer structures unless specified otherwise in writing by the Commission.

E. Detailed Material Requirements

1. Polyvinyl Chloride Sewer Pipe (PVC) and Fittings

a. Polyvinyl chloride (PVC) pipe and fittings 6-inch through 15-inch in diameter shall comply with ASTM D 3034 and F1336 and have a minimum wall thickness of SDR 35. Pipe and fittings 18-inch through 48-inch diameter shall meet the material requirements of ASTM F679 and F1336 and have a minimum wall thickness of T-1. All PVC compounds for all sizes shall comply with ASTM D1784 and have a minimum classification of 12454B. All PVC pipe stiffness and gaskets shall comply with ASTM D2412 (PS46) and ASTM F477, respectively.

b. All pipe and fittings shall be manufactured with a locked-in gasket.

c. The PVC wye and fitting supporting the house service riser shall be as per the Standard Details.

2. Ductile Iron Pipe (DIP) and Fittings and Cast Iron Fittings

a. Ductile iron pipe (DIP) and fittings shall conform to ANSI/AWWA C150/A21.50 in matters of design and ANSI/AWWA C151/A21.51 for materials. Pipe thickness shall conform to the Special Thickness Class 52 minimum. Pipe class shall be as shown on the Plans.

b. Ductile iron pipe, ductile iron fittings and cast iron fittings shall be ceramic epoxy-lined. The outside surfaces shall be bituminous coated.

3. Pipeline Plugs for Testing

Pipeline plugs shall be rubber gasketed or ribbed, watertight and airtight to the extent required by air testing requirements of this Section, not able to be dislodged by testing pressure (internal or external), and of an approved design.

4. Detector Tape

   Detector Tape shall be 3 inches wide (minimum) nonmetallic green plastic tape lettered “sewer” in black graphics.

F. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.

2. Prior to start of utility installation, all rights-of-way shall be graded to within ±0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.

3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water. In the event significant groundwater is encountered during construction, the Chief Engineer may require the Contractor to prepare a corrective plan of action for review and approval by the Commission.

4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, or at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe had been installed.

5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the Commission and in accordance with the Standard Details. Bedding shall be installed to ensure that joints are properly made and the pipe is firmly supported the full length of the barrel. All sewer mains and services shall be installed with a minimum of six inches of aggregate bedding below the pipe invert, meeting the gradation requirements of AASHTO M43, size number 57. Aggregate bedding shall be installed to grade prior to laying pipe sections.

B. Pipe Installation

1. All pipe shall be installed in accordance with the approved manufacturer’s written instructions, Commission Standards, and as specified herein. These recommendations, if more restrictive than that shown in the Standard Details shall include maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:

   a. Polyvinyl chloride sewer pipe (PVC) shall be installed in accordance with the Standard Details and the recommendations of Uni-Bell.

2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.

3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to ensure that each joint is watertight, has met the required manufacturer's insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the Commission.

4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.
8/9/10 For gravity sewer, place a minimum of 1 foot of gravel over the top of the pipe prior to placement of suitable compactable backfill to maintain laser alignment integrity during construction.

5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from
8/9/10 entering. To protect downstream systems that are in service, the contractor shall plug unused section of pipe at a downstream manhole. The manhole shall be plugged at incoming lines. This stopper shall remain in place at all times when installation is not in progress.

6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.

8/9/10 7. Alignment of Pipe: A laser beam shall be used to align the pipe to the proper grade. The Contractor is responsible to monitor the line and grade in each pipe run between structures at pipe station 0+50, and at each 100-foot interval thereafter as a minimum quality control, or as directed by the Commission. It is the Contractor's responsibility to maintain proper calibration of the equipment throughout the duration of the project.

8. Jointing Pipe

a. General

Before any joints are made in the trench, the Contractor shall demonstrate to the Commission by making a sample joint that methods he will employ to conform to the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.

b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the Commission. The

pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. The method of inserting the spigot into the bell shall be as recommended by the manufacturer and approved by the Commission.

c. Other methods of jointing pipe will be given consideration by the Commission, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.

d. All jointing and workmanship shall be in accordance with the manufacturer's recommendations as approved by the Commission.

9. Detector Tape: Install visual detection tape 12 inches below the surface at final grade on all mains.

10. Connections to existing work shall be made by the Contractor in the presence of the Commission at such a time and in such manner as directed and approved by the Commission. Shut-off operations will not be allowed. The Contractor shall complete the connections with the greatest possible speed and all work will proceed without interruption until the connection operation is complete.

C. Sanitary House Connections

1. Sanitary house connection branch fittings shall be located where designated by the Contract Documents and/or the Commission. Short pieces of sewer pipe shall be field-cut to meet this condition as approved. The Contractor shall have available at the construction site factory approved equipment to machine and adapt the field-cut end to standard couplings and jointing materials.

2. Sanitary Sewer Taps: Connections to active gravity sewer mains shall be made using a "Sewer-Tap" or a similar mechanical device in accordance with the manufacturer's recommendations. The appropriate saddle shall then be placed over the tapped hole in accordance with the Standard Details. Under no circumstances will concrete collar joints be permitted. Saddles shall not be used during construction of new sewer systems.

3. Backfill for the support of Y-branches and bends shall be placed as shown in the Standard Details, or as directed.

D. Field Tests

1. General

a. All portions of the sewers and appurtenances shall be tested. The Commission shall have the final decision as to the method or methods
8/9/10 used, i.e. water infiltration, water exfiltration, air, closed circuit video inspection, or combination of these.

b. After installation, sanitary sewers and sanitary house connections will be inspected by the Commission with the assistance of the Contractor for compliance with these specifications. Inspections and tests will not be conducted until the section of pipeline being inspected and tested has

been backfilled, dewatering pumps have been removed from the area, and the ground water has stabilized.

c. The Contractor shall schedule all tests with the Commission at least 48 hours in advance of the test, and shall conduct all tests in the presence of the Commission.

d. The pipeline shall not contain any debris, silt, earth, gravel, rock, or other foreign material. If deemed necessary by the Commission, the pipeline shall be flushed with water. It shall be done in a manner that prevents debris or water from entering the existing sewer and before the Commission witnessed test.

e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.

f. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the Commission by the Contractor at his expense.

2. Materials

a. When specific test of materials are called for in the referenced standards and specifications, the Commission has the option of requiring that any or all of these tests be performed.

b. Polyvinyl chloride (PVC) pipe and couplings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts or scrapes on inside or outside surfaces or other imperfections which may impair the performance or life of the pipe. Each pipe shall be straight-to-within 1-1/4 inch per 20-foot length of pipe when uniformly supported along its entire length, and shall have a true circular cross-section to within ±1/64 inch.

c. Ductile iron pipe (DIP), and ductile iron fittings shall be sound and without defects that might impair its service.

3. Visual Inspection

a. All equipment necessary for the inspection will be furnished by the Contractor. The Contractor shall provide assistance as may be required to enable the Commission to perform the inspection.

b. The Commission will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection shall be conducted by closed circuit television equipment.

1) Sanitary sewer closed circuit television inspections for new construction shall include the following:

2) Before visual inspection, the pipe shall be cleaned and clear of all debris prior to the inspection.

3) The inspection will be done one pipeline section (between two manholes, upstream to downstream) at a time.

4) The television camera used for inspection shall be specifically designed and constructed for such inspection. Lighting for the camera shall be sufficient 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:
   A. Producing a picture quality satisfactory to the Commission. Unsatisfactory equipment shall be removed and no payment will be made for an unsatisfactory inspection.
   B. Pan and Tilt 360 degrees to view pipe and laterals
   C. Assess pipe grade, slope/ fall, (degree of slope)

5) The camera shall be self-propelled by means of tracks and/or wheels to move the camera through the sewer line. The camera shall be moved through the pipeline in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition and at every house connection and pipe joint. In no case shall the television camera be moved at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices shall not obstruct the camera view or interfere with proper documentation of the sewer conditions. If, during the inspection operation, the television camera will not pass through the entire pipe section, the Commission shall determine if the pipe is obstructed. If the Commission determines the pipe is obstructed, the pipe will be designated as defective. All sewer mains, lateral connections, and manholes will be inspected for deficiencies. The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line. Pipe sections, lateral connections, and manholes with deficient grade and slopes will be designated as defective. No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected. The Contractor will be required to repair, replace, and retest the defective pipe, laterals, and manholes at the Contractors own expense. Additional inspections will be subject to addition fees and charges

6) The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be made above ground by a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be permitted. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device before beginning the inspection work.

c. Documentation of the television results shall be as follows:

1) Television Inspection Logs: Two copies of typed location records shall be prepared from field inspection logs maintained by the Contractor which clearly indicate the location, in relation to an adjacent manhole, of each infiltration point and its estimated quantity of leakage observed during inspection. In addition, other

points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, obstructions, presence of scale and corrosion, and other discernible features will be recorded. The copies of the typed records shall be furnished to the Commission.

2) Electronic media location records shall be kept by the Contractor and will clearly Show the location, by distance 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole of each infiltration point observed during inspection. All points of significance shall be defined in the NASSCO PACP (Pipeline Assessment Certification Program) defection codes and will be recorded on the electronic media and a copy will be supplied to the Commission along with the typed records.

3) Photographs: Electronic photographs of the television picture of problems shall be taken by the Contractor, and furnished to the Commission as a part of the Inspection Logs.

d. Digital Recording:

1) The purpose of recording is to supply a visual and audio record of the entire length of pipeline inspected. Recording playback shall be at the same speed as recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Title to the video recording shall remain with the Contractor; however, the Commission shall be provided a copy of all video recordings at the completion of the project as part of inspection documentation. The Contractor shall have all video recordings and necessary playback equipment readily accessible for review by the Commission during the project until a record copy has been made.

2) Defects shall be documented and quantified verbally by the audio portion of the recordings by the Contractor as well as in the written inspection logs.

3) The recordings will be reviewed by the Commission for focus, lighting, and clarity of view, and technical quality. The Contractor shall maintain sharp focus, proper lightening, and clear, distortion free viewing during the camera operations. Failure to maintain these conditions will result in rejection of the video recording by the Commission. Any recording not acceptable to the Commission shall be re-televised at no expense to the Commission.

4. Acceptance Testing

a. General

1) The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests. Testing shall be conducted only after the section of sewer has passed the visual inspection.

2) Generally sewers will be tested from manhole to manhole or from manhole to terminus of the pipeline if there is no manhole at

the other extremity. Sewers shall only be tested after the brick channel and bench have been installed. Testing shall be by low pressure air and/or infiltration/exfiltration as specified herein and/or as determined by the Commission.

3) If the sanitary sewer or sanitary house connection fails any test specified herein, the Contractor shall, at his own expense, repair or replace any defective component and retest the failed section or component until all requirements are met. Defective material shall be replaced.

4) All equipment used for testing shall be approved by the Commission.

b. Low Pressure Air Test

Low pressure air testing shall not be completed until sewer main lines are backfilled and compacted to final grade; manholes, frames and covers are in place to final grade with backfill in place and compacted; channels and benches are complete and to the satisfaction of the Commission; and sewer service connections are complete and to the satisfaction of the Commission. Failure to comply with these provisions shall be cause for the Commission to require rescheduling of the tests at the Contractor's expense. Sanitary sewers 27-inch diameter and smaller and attached sanitary house connections shall be tested with low pressure air in accordance with the following procedures:

1) Test plugs shall be supplied and installed by the Contractor within the pipeline at each manhole. Each plug shall be securely braced.

2) If the pipeline to be tested is expected to be below the ground water table, the Commission may visually inspect the trench prior to backfilling to determine the elevation of the groundwater table. All gauge pressures for the test shall be increased by an amount to provide 4 psig above the back pressure due to ground water submergence over the end of the probe to a maximum of 6 psi in the pipe system to be tested.

3) If the air pressure required for the test is greater than 6 psig, the pipeline shall not be air tested, but shall be tested for infiltration in accordance with method indicated in Paragraph C, which follows.

4) The Contractor shall add air slowly to the portion of the pipeline under test until the internal pressure is raised to 4.0 psig greater than the average back pressure of any groundwater above the pipe's invert.

5) The Contractor shall not allow personnel in manholes after the air pressure is increased in the sewer. If the test plug is suspected of leaking, the Contractor shall first relieve the pressure before any adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check for leakage.

6) The Contractor shall allow the air temperature to stabilize for at least 2 minutes by adding only the amount of air required to maintain 4.0 psig above groundwater back pressure. After this 2 minute period, the Contractor shall completely disconnect the hose and compressor from the section being tested to assure no additional air is added to the pipeline.

7) The time required for the pressure to drop 1 psig will be observed and recorded. Pipelines which fail to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the table at the end of this Section shall be deemed to have failed the low pressure air test and will not be accepted by the Commission.

8) The portion of the line being tested will be acceptable if the time required in minutes for the pressure to decrease from 4.0 to 3.0 psig above groundwater back pressure shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter in Inches	Minutes
6	5.0
8	5.0
10	5.0
12	5.0
15	5.0
18	10.0
21	10.0
24	10.0

9) Air testing may be required for pipe diameters greater than 24 inch when specified by the Engineer and approved by the Commission.

c. Infiltration/Exfiltration Tests

1) Sanitary sewers 24-inch in diameter and larger and sewers in which air testing is not specified or required shall be subjected to either infiltration or exfiltration tests as determined by the Commission. Testing may be conducted from manhole to manhole, or between more than two manholes, however, the length to be tested shall not exceed 700 feet. Minimum test duration shall be 24 hours unless otherwise directed by the Commission. Testing shall be conducted in accordance with ASTM C 969 as modified herein.

a) Infiltration test shall be made by measuring the amount of water infiltrating into the pipeline section at the lower end of the section being tested by means of a weir installed in the pipe or by other measurement method approved by the Commission.

b) Exfiltration test shall be made by plugging the lower manhole, filling the pipeline section with water to a level of at least 2 feet above the crown of the pipe at the upstream end of the section being tested or 2 feet above groundwater level whichever is greater and measuring the water level drop in the manhole at the end of the specified test period. Pipelines shall be filled with water for at least 24 hours immediately before the test.

c) Test Criteria

The maximum leakage allowance in the completed sewer lines shall not be greater than 25 gallons per inch diameter per mile per twenty-four hours. Note that this is a rate and does not in any way prescribe or infer the length of the line to be included in each test section.

d. Deflection Testing

In addition to other tests detailed in this Section, PVC sanitary sewers may be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5% undersized GO/NO-GO mandrel or sewer ball through the pipeline or measuring deflection

continuously by using a deflectometer. Maximum allowable deflection shall be 5%.

e. Manhole Testing

Manhole leak tests shall be made using a partial air vacuum as the testing method. Place airtight plugs in those pipes entering and leaving the structure, (plugs must be braced against expulsion) after which the manhole top is sealed. Draw a vacuum to 10" of Hg. Close the outlet port valve and start the test for the period of time in the following table.

Vacuum Test Table

Manhole Diameter	Test Period
48"	60 Seconds
60"	75 Seconds
72"	90 Seconds

If the drop in vacuum is more than 1.0" of Hg., the manhole shall be repaired and retested. Any vacuum drop of less than 1.0" of Hg. is satisfactory and the manhole will be accepted.

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewers

Measurement for furnishing and installing sanitary sewers will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for wye or drop connections. The inside lengths of manholes and junction chambers will be deducted.

B. Sanitary House Connections

Measurements for furnishing and installing sanitary house connections will be made horizontally along the center line of pipe for each size and type of pipe from the center line of the sewer to the end of the house connection without deduction for wyes, bends, cleanouts, plugs, or other fittings.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified, in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing sanitary sewers and sanitary house connections shall include trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

3. Payment will be made for contingent items when approved by the Commission.

B. Sanitary Sewers

Payment for furnishing and installing sanitary sewers, complete and in place, will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing of all pipe, fittings, plugs, stoppers, and jointing materials; connection to existing pipelines, structures, or manholes; testing; providing an approved spoil site, and disposing of all spoil or excess materials, aggregate bedding, and backfill; all environmental and erosion or sediment control; restoration of all disturbed areas; and incidental items to complete the sanitary sewers.

C. Sanitary House Connections

Payment for furnishing and installing sanitary house connections complete and in place will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, vertical riser, cleanout, cap, plugs, precast concrete blocks where required, jointing materials; connection to sewer branch fittings; testing; providing an approved spoil site, and disposing of all spoil or excess materials; aggregate bedding, and backfill; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas; and incidental items to complete the sanitary house connection.

****END OF SECTION 02561****

SECTION 02562
SANITARY SEWER MANHOLES

1.0 GENERAL

A. Description

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing sanitary sewer manholes, Interior lining and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Sanitary Sewers: Section 02561
4. Cast-in-Place Concrete: Section 03300
5. Precast Concrete Utility Structures: Section 03400
6. Mortar: Section 04100
7. Brick Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any materials for sanitary sewer manholes.

C. Contractor's Options

1. The Contractor may furnish polypropylene, or plastic-coated steel for manhole steps.
2. Standard sanitary manholes shall be precast construction; however, the Contractor may furnish cast-in-place, or masonry construction for miscellaneous sanitary sewer structures with the approval of the Commission.
3. Contractor may furnish Manhole interior lining sheets or applied coating.

D. Detailed Material Requirements

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, Size Number 57, as specified in Section 02240.
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03300, mix number as indicated on the Standard Details or the Plans.

3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400.

4. Joints shall be “O” ring compression type meeting the requirements of ASTM C-443.

5. Non-shrink grout shall be as specified in Section 04100.

6. Mortar for brickwork and grade rings shall be as specified in Section 04100.

7. Manhole flows channels and benches shall be formed with concrete as approved by the Commission in the bottom of manholes

8. Frames and covers shall be as shown in the Standard Details and as specified in Section 05500.

9. Manhole steps shall be plastic coated and shall be manufactured using a minimum ½ - inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the requirements of ASTM 2146, Type II, Grade 4375B.

10. Force main discharge manholes and above grade manholes shall be seal-coated with 16 mils of a coal tar polyamide epoxy.

11. Manhole-to-Pipeline Connectors

    a. Cast-in-place type connectors shall be:

        1) A compression type for sewer grades less than 18%.

    b. For doghouse type manhole applications a banded-boot type connector shall be used.

    c. Mechanically wedge-in-place type connectors shall be used for cored openings.

12. Manholes shall have sealant between the manhole and the manhole frame. The sealant shall be mastic rope, type B, 3/4 inch minimum diameter, butyl based, and meeting requirements of AASHTO M 198.

13. The insert dish for manholes shall be manufactured of high density polyethylene resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid. The manufacturer shall furnish a load test verification showing a load test failure in excess of 3,000 lbs. The insert shall contain gas relief valves designed to release a pressure of .5 to 2.0 psi and have a water leak down rate no greater than 5 gallons per 24 hours. The handle shall be able to withstand a pull of 500 lbs. without breakage.

14. Linings for interior of concrete manholes which includes but not limited to the channel, bench, and walls shall be thermoplastic sheets of polyvinyl chloride (PVC) meeting the requirements of ASTM D1784, high density polyethylene (HDPE) meeting the requirements of ASTM D1248, or polypropylene (PP) meeting the requirements of ASTM D4101, 16344C. Thermoplastic sheets shall incorporate an anchoring system which permits the sheets to be placed in concrete forms and cast integrally with the concrete of the structure.

15. Resin based lining system shall be suitable for use as a trowel- or spray-applied monolithic surface in sewer manholes suitable for mild to severe hydrogen sulfide environments. The material shall be high strength, high build, corrosion resistant, resin based with no VOC’s.

    a. Epoxy resin based material shall be used to form the sprayed on/structural enhanced monolithic liner covering all interior surfaces of the structure

including benches and inverts of manholes. Must conform to the minimum physical requirements listed below.

Compressive Strength	ASTM D695	10,500 psi
Tensile Strength	ASTM D638	7,000 psi (min)
Flexural Strength	ASTM D790	12,000 psi
Bond	shall exceed tensile strength of substrate	
300,000 (min)		
Flexural Modulus (initial)		735,000 psi
Density		87 pcf

Chemical Resistance: The corrosion resistance of the epoxy coating shall be tested by the coating manufacturer in accordance with ASTM D543. The result of exposure to the chemical solutions listed below shall produce loss of not more than 20 percent of the initial physical properties when tested in accordance with ASTM D543 for a period of not less than 1 year at a temperature of 73.4 ºF plus or minus 3.6 ºF. The finished structure shall be corrosion resistant to: hydrogen sulfide, sulfuric acid, nitric acid, sodium hydroxide as well as other common ingredients of the sanitary sewage environment with the following compositions:

CONCENTRATIONS OF CHEMICAL SOLUTIONS FOR CHEMICAL RESISTANCE TEST	
Chemical Solution	Concentration, %
Tap Water (pH 6-9)	100
Nitric Acid	5
Phosphoric Acid	10
Sulfuric Acid	10
Petroleum Hydrocarbon Based Fuels (e.g. Gasoline, diesel, etc.)	100
Vegetable Oil[1]	100
Detergent[2]	0.1
Soap[2]	0.1
Domestic Sewage	100

[1] Cotton seed, corn, or mineral oil
[2] As per ASTM D543

The wall of the resin based liner will be structurally designed to withstand the hydraulic load generated by the groundwater table & restore structural integrity. The long term, 50 year, value of the flexural modulus of elasticity will be a minimum of 500,000 psi and is an integral part of the engineering equation used to design the wall thickness of the structural liner.

This flexural modulus will be certified by an independent third party testing lab and submitted with design calculations for each structure.

The monolithic high-build epoxy coating shall consist of a 100% solids epoxy formulated with exceptionally high physical strengths and broad range chemical resistance. The coating system coverage shall be a minimum of 100 mils and shall be determined by the manufacturer. The manufacturer

shall provide documentation for the recommended thickness.

The epoxy coating shall have a one-year labor and materials, non-prorated warranty to stop infiltration and further deterioration of the structure.

Other Materials: No other material shall be used with the above mixes without prior approval or recommendation from the manufacturer and the Engineer.

Epoxy coating shall be Mainstay DS-5 manufactured by Madewell; SEL-80HB by Parson Environmental; Raven 405 by Raven Lining Systems or approved equal."

b. Polyurethane resin based material shall be used to form the sprayed on/structural enhanced monolithic liner covering all interior surfaces of the structure including benches and inverts of manholes. Must conform to the minimum physical requirements listed below.

Compressive Strength	ASTM D695	18,000 psi
Tensile Strength	ASTM D638	7,000 psi (min)
Flexural Strength	ASTM D790	14,000 psi
Bond	shall exceed tensile strength of substrate	
300,000 (min)		
Flexural Modulus (initial)		735,000 psi
Density		87 pcf

The monolithic high-build polyurethane coating shall consist of a 100% solids formulated with exceptionally high physical strengths and broad range chemical resistance. The manufacturer shall provide documentation for the recommended thickness.

Other Materials: No other material shall be used with the above mixes without prior approval or recommendation from the manufacturer and the Engineer.

The polyurethane coating shall have a 3 year warranty against defects on materials and workmanship.

16. Coating shall be Spraywall by Sprayroq, Inc. or approved equal.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.

2. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.

3. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the Commission.

   a. Cast-in-place concrete construction shall be as specified in Section 03300.

   b. Brick construction shall be as specified in Section 04200.

4. Pipelines connected to manholes and other structures shall have a pipe joint between 3 and 7 feet from the exterior wall of the structure.

5. All new openings in existing manholes shall be core drilled in a manner acceptable to the manhole manufacturer and the Commission.

6. A high density polyethylene insert dish shall be installed within all manhole covers.

B. Manhole Installation

1. Manholes, frames and covers shall be installed as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.

2. Manhole joints shall be watertight. Exteriors shall be coated with waterproofing in accordance with the Standard Details.

3. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the Commission.

4. Pipes shall be cut flush with the inside wall of the manhole.

5. The frame and cover shall be installed in accordance with the Standard Details.

6. Parging of the interior brick surfaces will not be permitted.

C. Curing

1. Manhole channels and benches shall receive a minimum twenty-four (24) hour cure time prior to being subjected to sewage flow. The Commission reserves the right to adjust this curing period if deemed necessary.

D. Tests

Manholes and other structures shall be visually inspected by the Commission for leakage. Any visible leak shall be sealed or resealed until all leakage into the unit is eliminated. Infiltration testing shall be conducted only when the sewers attached to the manholes or other structures are tested in that manner. Testing shall be in accordance with Section 02561.

E. Manhole Lining

1. Interior Lining

Prior to entering structures, the Contractor shall conduct an evaluation of the atmosphere to determine the presence of toxic, flammable vapors or possible lack of oxygen. The evaluation shall be in accordance with local, state or federal safety regulations.

Place covers over all pipe openings to prevent extraneous material from entering the manhole during repair operations.

All foreign material shall be removed from the structure's wall and bench/floor using a pressure water spray (minimum 3,000 psi). All surfaces shall be clean, free of dirt, grease, and loose particles and shall be prepared according to manufacturer's requirements. The use of acid for cleaning purposes, no matter how dilute, will not be allowed. Loose or protruding concrete shall be removed. The surface to be repaired shall be clean and free of any loose materials.

All repairs to the manhole shall be completed prior to resin interior coating. All infiltration shall be stopped using material compatible with topcoating.

After all preparations and repairs have been completed, remove all loose material and power wash the manhole interior again. The surface to receive the coating shall be clean and sound with adequate profile and porosity to provide strong bond between coating and substrate. All repair materials shall be permitted to cure according to manufacturer's recommendations.

The substrate surface to be coated shall be dry to the touch and meet the manufacturer's requirements for the topcoating.

Cover the steps to prevent adhesion of spray coating or remove all manhole steps prior to coating application if directed by the Engineer.

2. Installation

The Contractor shall furnish and place the resin coating in each manhole as and where directed by the Engineer. The installation of the coating shall be in complete accordance with the manufacturers' specifications.

The resin based coating shall be manually sprayed on or hand troweled on to all surfaces by a trained technician who is experienced in the application of a spray applied resin and has been certified by the manufacturer. Appropriate personal protection equipment shall be utilized but in every case when applying the liner, the sprayer and personnel in direct contact with the spray atmosphere, will always be protected by supplied air.

Application of the spray applied material must be completed in one (1) setup in order to minimize the disruption and cost of traffic control and all other support services. The Contractor shall take precautions to keep overspray or excess material from entering the newly installed pipe and any other pipes in the manhole.

Recoat as needed and in accordance with manufacturer's recommendations until design thickness is achieved.

The structure should be allowed to fully cure and return to ambient temperature prior to any physical testing, including vacuum testing.

The benches shall have the base coat material applied to the required thickness by hand troweling or spray-on methods. Coatings that are spray-applied shall be troweled smooth after application.

Uncover the manhole steps. Do not reinstall steps that were removed unless directed by the Engineer.

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewer Manholes

Measurement for furnishing and installing sanitary sewer manholes will be made per vertical foot for the number of each type constructed, as shown on the Standard Details. Measurement will be made from the lowest point in the manhole invert to the highest external point on the top of the manhole frame and cover.

B. Drop Connections

Measurement for drop connections will be made for the number and type constructed. The manhole on which the drop structure is constructed will be measured and paid for separately as described above.

C. Miscellaneous Structures

Measurement for miscellaneous structures will be made for the number of each type of unit constructed in accordance with the Contract Documents or as directed.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing sanitary sewer manholes shall include the following:

    a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

    b. Furnishing and installing granular bedding for manhole foundation as shown on the Standard Details and as required elsewhere in the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Sanitary Sewer Manholes

Payment for sanitary sewer manholes will be made per each type and size (diameter) of manhole installed. The price(s) bid shall include traffic control, furnishing and installing all precast, masonry, or cast-in-place concrete units, waterproofing, reinforcing bars, ladder rungs, metal frames and covers; all testing; providing an approved spoil site, and disposing of all spoil and excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and incidental items to complete the manholes.

C. Manhole Drop Connections

Payment for drop connections will be made per type and size constructed as shown, specified, and directed. The price(s) bid shall include furnishing and installing all pipe, fittings, precast concrete, concrete encasement, aggregate and incidental items to complete the drop connection.

D. Miscellaneous Structures

Payment for miscellaneous structures will be made for each structure constructed to limits shown on the Contract Documents and shall be full compensation for furnishing all items necessary to satisfactorily complete the work.

E. Waterproofing

No separate payment will be made for waterproofing, but will be considered incidental to unit prices bid.

F. Interior Lining

No separate payment will be made for interior lining, but will be considered incidental to unit bid price.

****END OF SECTION 02562****

SECTION 02563
SANITARY SEWER FORCE MAINS

1.0 GENERAL

A. Description

Sanitary sewer force main installation shall include, but not necessarily be limited to, furnishing and installing pressure rated pipe, fittings, and appurtenances of size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction; Section 02250.

2. Precast Concrete Utility Structures; Section 03400.

C. Quality Assurance

1. Materials

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.

2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all sanitary sewer force mains and house connections unless otherwise indicated on the plans, or as approved by the Commission.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the symbols noted in Section 02551, entitled “Water Main Installation and Chlorination”.

C. Materials Furnished by the Commission

1. The Commission will not furnish any materials for sanitary sewer force main construction.

2. Unless otherwise noted in the “Special Provisions,” the Contractor shall pay for potable water for all testing. The Contractor shall contact the Commission to coordinate its use.

D. Contractor's Options

The Contractor may furnish ductile iron pipe and fittings, polyvinyl chloride pipe and fittings, or high density polyethylene pressure pipe and fittings for sanitary sewer force

mains unless otherwise noted. Ductile or cast iron fittings shall be furnished for use with ductile iron pipe or polyvinyl chloride pipe.

E. Detailed Material Requirements

1. Portland cement concrete for pipe buttresses and anchorages shall be Mix No. 1, as specified in Section 03300.

2. Ductile iron pipe and fittings, polyvinyl chloride pipe and fittings, concrete pressure pipe and fittings shall be as specified in Section 02551. Pressure rating or class shall be as noted in the Contract Documents. Epoxy lining and coatings shall be as required on ductile iron pipe (DIP) and fittings.

3. Joint Restraint

   a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design.

   b. Ductile iron retainer glands for use with mechanical type joints shall be as approved.

   c. Rod for tie rod assemblies shall meet the material requirements of ASTM A193, Grade B7, and shall be threaded for at lease 8 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted.

   d. Nuts shall meet the requirements of ASTM A194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

4. Resilient Seat Gate Valves

   Resilient seat gate valves shall be as specified in Section 02552 for water valves.

5. Valve Boxes

   Valve boxes shall be as specified in Section 02552, except the covers shall be labeled "SEWER."

6. Sewage Air Release and Combination Air/Vacuum Valves

   a. Sewage air and vacuum valves shall be of the type that automatically releases air, gas or vapor under pressure, automatically exhaust large quantities of air during the filling of a system, and allow air to reenter during draining or when a vacuum occurs.

8/9/10 b. Sewage air and vacuum valves shall have an elongated stainless steel body and stainless steel cover. The internal compound lever mechanism shall be stainless steel and all other internals, including float, shall be stainless steel to positively prevent a galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.

   c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

	PART	MATERIAL	SPECIFICATION
8/9/10	Body and Cover	Stainless Steel	ASTM A48, Class 30
	Internals	Stainless Steel	Series 300
	Float	Stainless Steel	Series 300
	Seat	Buna-N	
	Exterior Paint	Phenolic Primer	FDA approved for
		Red Oxide	potable water

d. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.

e. Isolating valve shall be installed between force main and air and vacuum valve.

f. Sewage air and vacuum valves shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air and vacuum valve requirements.

g. All internals shall be easily removed through the top cover without removing the main valve from the lines.

7. Detector Tape

Visual detection tape shall be 3 inches wide (minimum) nonmetallic green plastic tape, lettered “SEWER” in black graphics.

8. Tracer Wire for Non-Metallic Pipelines

Tracer wire shall be THHN solid, soft continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have “UL” markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connectors with a water proof binder and underground electrical tape.

F. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Trench excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.

2. Force main installation shall be as specified in Section 02551, “Water Main Installation and Chlorination,” except chlorination is not required.

i. A minimum 4.5’ and maximum 6’ depth of cover is required for all sewer force mains.

3. Pipe bedding, thrust and anchor blocks, and force main appurtenances shall be installed in accordance with the Standard Details for Water.

4. Resilient Seat gate valve installation shall be as specified in Section 02552 for water valves.

5. Sewage air release and combination air release/vacuum valves shall be installed in accordance with the Standard Details.

B. Field Test

1. The force main and appurtenances shall be tested in accordance with Section 02551, except as modified herein.
   a. The pressure in the main shall be increased to 150 psi at the highest point of the section of main under test, provided the design static pressure is under 100 psi. Where the design static pressure is over 100 psi, the test pressure shall be 50 psi above static pressure. This test pressure shall be maintained, without pumping for at least two (2) hours. Should this test show the main to be defective, the Contractor shall remedy such defects and retest the main as specified above. This procedure shall be repeated until the test requirements are met.
2.

3. Chlorination will not be required.

4.0 METHOD OF MEASUREMENT

A. Force Main

Measurement for furnishing and installing force main pipe and fittings will be per linear foot made horizontally along the centerline of the pipe through all fittings and appurtenances.

B. Isolation, Sewage Air Release and Combination Air/Vacuum Valves
Measurement for isolation, sewage air release and combination air/vacuum valves will be made of the number of each size and type of valves installed complete.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment and materials necessary to complete the work as shown, specified, and in strict accordance with the Contract Documents.

2. Payment for furnishing and installing force main pipelines and appurtenances will include the following:

   a. Trench excavation, backfill, compaction and incidental items as specified in Section 02250.

b. Furnishing and installing bedding material for air release and vacuum valve manhole fill as per the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Force Main

Payment for furnishing and installing force main pipelines, complete and in place, will be made per linear foot of the size and type installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, and jointing materials, removing existing buttresses when necessary, joint restraint, tracer wire and test stations where required, furnishing materials for and constructing all concrete anchorages and buttresses; strapping of fittings, connecting to existing pipelines or structures, testing; all aggregate bedding, and backfill; providing an approved spoil site, and disposing of all spoil or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and for all appurtenances, and incidental items to complete the force main.

C. Isolation, Sewage Air Release and Combination Air/Vacuum Valves

Payment for furnishing and installing isolation, sewage air release and combination air/vacuum valves, complete and in place, will be made for each size and type of valve installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults or manholes, lids or frames and covers, pipe supports, angle valves, corporation stops, extension bar, restoration; testing of the complete installation; and incidental items to complete the valve installation.

****END OF SECTION 02563****

SECTION 02565

SANITARY SEWER REHABILITATION

1.0 GENERAL

A. Description

Sanitary sewer rehabilitation shall include, but not necessarily be limited to, sewer pipe cleaning, sewer flow control, television inspection, sewer pipe joint testing, sewer pipe joint sealing, sewer manhole sealing, sewer manhole rehabilitation, sewer manhole lining, sliplining, cured-in-place pipe lining, pipe and fitting replacement, and sewer manhole replacement in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench excavation, backfill, and compaction: Section 02250.
2. Gravity Sanitary Sewer and House Connections: Section 02561.
3. Sanitary Sewer Manholes: Section 02562.
4. Sanitary Sewer Force Main: Section 02563.
5. Connections to Existing Sanitary Sewer Facilities: Section 02564.

C. Quality Assurance

1. Materials
   a. The Commission will inspect all materials before and after installation to ensure compliance with the Contract Documents.
   b. Special grouts, sealers, and coating systems shall be delivered to the site in the manufacturer's sealed, labeled, and dated containers. Storing and handling materials shall be in strict accordance with the manufacturer's instructions. Failure to properly store and handle material will result in rejection of material for use. Materials beyond the expiration date indicating the manufacturer's recommended shelf life will not be permitted to be used.
   c. Cured-in-place lining materials shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in sewage. The materials may be delivered to the site in either separate or pre-wetted fabrications in transportation containers designed to protect the integrity of the resin, catalyst, and liner. The time of resin and catalyst mixing will be recorded at the location of liner "wetting". Special handling instructions such as minimum or maximum temperature to be maintained during transportation and installation will also be recorded. Liners "wetted" for a time interval which exceeds the resin manufacturer's specified "pot life" at the recommended temperature will not be permitted to be used. Any evidence of setting before installation will result in rejection of material.
2. Field Testing
   a. General

1) After the item in question has been rehabilitated or replaced, it will be inspected by the Commission and, if required herein, shall be Contractor tested for compliance with these Specifications. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests.

2) The Contractor shall schedule all tests with the Commission at least 48 hours in advance of the test, and shall conduct all acceptance testing in the presence of the Commission. The Commission will witness one test and perform one Substantial Completion Inspection and one Final Inspection. If the project is released for service following Substantial Completion acceptance tests, the Commission will perform a final inspection if required. Should the pipeline fail the first Commission witnessed test, the Contractor shall reimburse the Commission for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the Commission for the cost of inspection if the Contractor is not prepared for any test, additional retests, and additional Substantial Completions including Partial Substantial Completion Inspections or additional Final Inspections. Reimbursement shall be made prior to the next Substantial Completion or Final Inspection.

3) If the item in question fails the specified test and/or inspection, the Contractor shall, at the Contractor's own expense repair or replace any defective component in accordance with the manufacturer's recommendations and retest or have the Commission reinspect the item until all requirements are met. Should any work be done by the Commission in the case of an emergency, the Contractor shall reimburse the Commission for the actual cost of replacing such materials and making such installations.

b. Sewer Cleaning

1) After completion of sewer pipeline cleaning, the Contractor shall by closed circuit television camera, inspect in whole the pipe system for which the cleaning task has been completed. The inspection shall be approved by the Commission. Evidence of significant remaining sediment, debris accumulation, or root intrusion will result in rejection of the pipe system. The Contractor shall reperform the Contractor's cleaning operation and retest the line until the sewer is satisfactorily cleared of sediment, debris, grease, and roots.

2) Force mains will be accepted when they can pass a sewer ball which has a diameter of at least 95% of the line being cleaned.

c. Manhole Sealing and Rehabilitation

After manhole rehabilitation procedures have been performed, the manholes will be visually inspected by the Commission for leakage. Any leak or seepage which produces a visible trickle or stream will be cause for rejection of the work.

d. Gravity Sewer Pipe

1) Slip-lined Pipe: After installation, but before any house connections are reinstated, the liner pipe shall be low-pressure air tested by the

Contractor in accordance with the procedures specified in Section 02561.

2) Cured-in-Place Pipe Lining: After installation procedures have been performed and curing is complete, but before any house connections are reinstated, the pipeline shall be hydrostatically tested by the Contractor.

a) The test shall be conducted by using the existing hydrostatic head provided by the inversion standpipe providing this head is at least 7 feet above the prevailing groundwater elevation. The test time shall be 1 hour during which time no makeup water shall be added to the standpipe. If, at the end of the test period, no water loss is observed in the standpipe, the cured-in-place pipe will be accepted.

b) If water loss is observed in the standpipe, the lining will fail the test.

e. Force Mains

1) After installation procedures have been performed for either sliplined or cured-in-place pipe lining, the lined force main shall be hydrostatically tested by the Contractor.

2) The completed liner shall be filled with water to eliminate all air and brought to the test gradient or pressure as indicated in the Contract Documents.

3) After the system has been pressurized to the test pressure and the pumps disconnected, the liner shall hold the test pressure with no visible drop in pressure for 1 hour. Testing pressures and criteria shall be similar to water main hydrostatic testing in accordance with Section 02551.

D. Submittals

1. Shop Drawings

a. Shop drawings shall be submitted as specified in the "General Provisions" for all materials other than those furnished by the Commission. The Contractor shall submit product information and detailed manufacturer's recommendations and instruction on the storage, handling, mixing (where appropriate), and installation of all materials intended to be used for rehabilitation.

b. For those materials which rely on chemical reactions and/or heat (energy) sources to obtain a "cure" of the materials, details shall be submitted indicating "pot life" after mixing; curing time; temperature limitations during transportation, application, and installation; and special handling requirements.

2. Certificates of Compliance

a. Certificates of compliance shall be submitted as specified in the "General Provisions" for materials listed herein when indicated in the paragraph where the materials are specified.

b. Certificates of compliance and current MSDS sheets shall be submitted for glass fiber-reinforced polyester manholes, polyethylene pipe, and reinforced plastic mortar pipe indicating the item supplied is in accordance with the referenced standard.

2.0 MATERIALS

A. Materials Furnished by the Commission

1. Unless otherwise noted in the "Special Provisions", the Contractor shall pay for all potable water used for testing.

B. Contractor's Options

1. The Contractor shall furnish and install cured-in-place liners for lining existing gravity pipelines.

2. The Contractor may furnish and install Polyethylene (PE) or cured-in-place liners for lining existing force mains.

C. Detailed Material Requirements

1. Portland cement concrete for pipe encasement shall be Mix No. 1 as specified in Section 03300.

2. Quick-setting, non-shrink grout shall be as specified in Section 04100.

3. Chemical Sealing Materials

a. General

1) The intent of this Item is to define the properties a sealing material shall have to perform effectively in the intended application and under expected field conditions.

2) Generic chemical sealing materials currently used are listed with the basic properties, performance standards, and mix ratios which have previously given acceptable performance.

3) It is recognized that new and improved chemical sealing materials may become available. Sources, manufacturers, and product names of chemical sealing materials will change and therefore specific sources, manufacturers, and product names are not referred to in this Specification.

4) Sealing materials shall contain a root inhibitor.

b. All chemical sealing materials used in performance of the work specified shall have the following properties and characteristics:

1) While being injected, the chemical sealant shall be able to react/perform in the presence of water.

2) The cured material shall be capable of withstanding submergence in water without degradation.

3) The resultant sealant formation shall prevent passage of water.

4) The sealant, after curing, shall be flexible as opposed to brittle or rigid.

5) In place, the resultant sealant formation shall be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.

6) The sealant formation shall not be biodegradable. Additives may be used to meet this requirement.

7) The cured sealant shall be chemically stable and resistant to concentrations of acids, alkalis, and organics found in sewage.

i. The Contractor shall assume the sewer lines are partially deteriorated.

8) Packaging of component materials shall be compatible with field storage and handling requirements. Packaging shall provide for worker safety and minimize spillage during handling.

9) Mixing of component materials shall be compatible with field operations and not require precise measurements.

10) Cleanup shall be done without excessive use of flammable or hazardous chemicals.

11) Residual sealing materials shall be removable from the sewer after injection to insure no flow reduction, restriction, or blockage of sewage flows.

c. Acrylamide base gel chemical sealing material requirements, properties, and characteristics:

1) A minimum of 10% acrylamide base material by weight in the total sealant mix. A higher concentration (%) of acrylamide base material may be used, when desirable, to increase strength or offset dilution during the induction period.

2) The ability to tolerate some dilution and react in moving water during the induction period.

3) A viscosity of approximately 2 centipoise which can be increased with additives.

4) A constant viscosity during the induction period.

5) A controllable reaction time (induction period) from 10 seconds to 1 hour.

6) A reaction (curing) which produces homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.

7) The ability to increase mix viscosity, density, and gel strength by use of additives, e.g.: diatomaceous earth.

d. Acrylate base gel chemical sealing material requirements, properties, and characteristics:

1) A minimum of 10%* acrylate base material by weight in the total sealant mix. A higher concentration (%) of acrylate base material may be used, when desirable, to increase strength or offset dilution during the induction period.

   *Note: If the acrylate base material is in a 40 solution, it shall comprise 25% by weight of the total sealant mix to have 10% base material.

2) A low toxicity of the acrylate base material, i.e.: acute oral toxicity in 50 rats (LD) of 5000 mg/kg body weight of rats.

3) The ability to tolerate some dilution and react in moving water during the induction period.

4) A viscosity of approximately 2 centipoise which can be increased with additives.

5) An essentially constant viscosity during the induction period.

6) A controllable reaction time (induction period) from 10 seconds to 1 hour.

7) A reaction (curing) which produces homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.

8) The ability to increase mix viscosity, density, and gel strength by the use of additives, e.g.: diatomaceous earth.

e. Urethane base foam chemical sealing material requirements, properties, and characteristics:

1) Approximately 1 part of urethane prepolymer thoroughly mixed with 1 part of water by weight (50% prepolymer).

2) A liquid prepolymer having a solids content of 82% to 88%, specific gravity of 1.1 (9.15 pounds per gallon), and flash point t of 20°F.

3) A liquid prepolymer having a viscosity of 300 to 500 centipoise at 72°F that can be pumped through 500 feet of 1/2-inch hose with a 500 psi head at a 1 ounce/second flow rate.

4) A cure time of 15 minutes at 40°F, 8.2 minutes at 70°F, and 4.6 minutes at 100°F when the prepolymer is reacted with water only.

5) A cure time of 15 minutes at 40°F, 3.5 minutes at 70°F, and 2.6 minutes at 100°F when the prepolymer is reacted with water containing 0.4% accelerator.

6) During injection; foaming, expansion, and viscosity increase take place.

7) Physical properties of the cured foam of approximately: 14 pounds per cubic foot density, 80 to 90 psi tensile strength, and 700% to 800% elongation when a mixture of 50% prepolymer and 50% water undergoes a confined expansion to five times its initial liquid volume.

f. Urethane base gel chemical sealing material requirements, properties, and characteristics:

1) 1 part urethane prepolymer thoroughly mixed with between 5 and 10 parts of water by weight. The recommended mix ratio is 1 part urethane prepolymer to 8 parts of water (11% prepolymer).

2) A liquid prepolymer having a solids content of 77% to 83%, specific gravity of 1.04 (8.65 pounds per gallon), and flash point of 20°F.

3) A liquid prepolymer having a viscosity of 600 to 1200 centipoise at 70°F that can be pumped through 500 feet of 1/2-inch hose with a 1000 psi head at 1 ounce/second flow rate.

4) The water used to react with the prepolymer should be in the Ph range of 5 to 9.

5) A cure time of 80 seconds at 40°F, 55 seconds at 60°F, and 3 seconds at 80°F when 1 part prepolymer is reacted with 8 parts of water only. Higher water ratios give longer cure times.

6) A cure time that can be reduced 5 to 10 seconds for water temperatures of 40°F to 80°F when 1 part prepolymer is reacted with 8 parts of water containing gel control agent.

7) A relatively rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about 10 to 60 centipoise in the first minute for 1 to 8 prepolymer/water ratio at 50°F.

8) A reaction (curing) which produces a chemically stable, nonbiodegradable, tough, flexible gel.

9) The ability to increase mix viscosity, density, gel strength, and resistance to shrinkage by the use of additives to the water.

4. Manhole Liners

Manhole liners shall be manufactured of glass fiber reinforced polyester, engineered to support a standard 16,000 pound vertical dynamic wheel load (AASHTO H-20), and meet materials and workmanship requirements of ASTM D 3753. The manhole reducer cone shall have no sidewall joints, seams, or sections.

5. Polyethylene (PE) Pipe

a. PE sewer liner pipe and fittings shall be manufactured from a polyethylene compound conforming to ASTM D 1248 and meeting the materials requirements for Type III, Class C, Category 5.

1) Pipe made from this compound must have a long-term hydrostatic strength rating of 1600 psi or more, in accordance with ASTM D 2837.

2) When the environmental stress crack resistance (ESCR) of the compound is measured in accordance with ASTM D 1693, Condition C, the compound shall withstand not less than 1,000 hours in 100% solution Igepal C0-630 at 100°F before reaching a 20% failure point (F20).

b. The liner pipe shall be manufactured in accordance with ASTM D 3035 or ASTM F 714.

c. Liner Pipe Dimensions: The outside diameter and minimum wall thickness shall conform to dimensions listed in Table I when measured in accordance with ASTM D 2122. Where construction difficulties prevent use of these pipe sizes, other sizes may be specified.

TABLE I
(all dimensions are in inches)

Size of Sewer	OD of Liner	Nominal OD	Minimum Wall Thickness SDR 32.5	SDR 26	SDR 21	SDR 17
4	3.500	3" IPS			.167	
6	4.500	4" IPS	.214			
6	5.375	5.375"	.165	.207	.256	.316
8	6.625	6" IPS	.204	.255	.315	.390
8	7.125	7.25"	.219	.274	.339	.419
10	8.625	8" IPS	.265	.332	.411	.507
12	10.75	10" IPS	.331	.413	.512	.632
15	12.75	12" IPS	.392	.490	.607	.750
15	13.38	13.380"	.412	.515	.637	.787
18	16.00	16" IPS	.492	.615	.762	.941
21	18.00	18" IPS	.554	.692	.857	1.059
21	18.70	18.700"	.575	.719	.890	1.100
24	22.00	22" IPS	.677	.846	1.048	1.294
27	24.00	24" IPS	.738	.923	1.143	1.305
30	28.00	28" IPS	.862	1.077	1.333	1.647
36	32.00	32" IPS	.985	1.231	1.524	1.882
42	36.00	36" IPS	1.108	1.385	1.714	-----
42	40.00	40" IPS	1.231	1.538	-----	-----
48	40.00	40" IPS	1.231	1.538	-----	-----
48	42.00	42" IPS	1.292	1.615	-----	-----

NOTE: The wall thickness tolerance shall be within plus 12%. The Standard Dimension Ratio of the pipe to be used shall be as specified in the Special Provisions.

6. Reinforced Plastic Mortar (RPM) Pipe

Reinforced Plastic Mortar (RPM) Pipe for liner in existing sewers shall be manufactured in accordance with ASTM D 3262 or ASTM D 3754 as specified. The pipe shall be manufactured by first applying a liner over a solid surface steel mandrel. The liner shall contain a thermosetting polyester, selected for the intended service, and surfacing veil as reinforcement. No aggregate shall be used in the liner. After the liner is applied, circumferentially oriented continuous glass filaments shall be wound around the liner to provide hoop strength and longitudinally oriented filaments shall be added to provide axial strength. Silica sand-resin mortar shall be added to provide correct ring stiffness. Wall thickness shall remain essentially constant regardless of pressure class. The bell of the pipe shall be manufactured as an integral part of the pipe. The basis of design shall be long-term hydrostatic testing and regression analysis. Long-term hydrostatic testing shall be done in accordance with procedures in ASTM D 2992. Circumferential tensile strengths shall be obtained in accordance with ASTM D 2290.

7. Cured-in-Place Pipe Liner

All materials and procedures used in the inversion process shall be the manufacturer's current standards.

b. Resin: The thermosetting resin shall be specifically blended for use with the inversion process and be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage unless indicated otherwise.

b. The felt tubular material shall be lined on one side with a waterproof coating such as polyurethane or polyvinyl chloride (PVC), and fully impregnated with a liquid thermosetting resin as specified. The tubing shall be properly sized to the diameter and length of the sewer pipeline to be rehabilitated. The material thickness shall generally be a minimum of 0.236 inches with a tolerance of .0625 inch plus or minus. The nominal specified thickness for each pipe section shall be designated on the plans. The cured pipe material shall conform to the following minimum structural standards:

Cured Pipe	Material Test	Standard Results
Tensile Stress	ASTM D 638	3,000 psi
Flexural Stress	ASTM D 780	3,000 psi
Modulus of Elasticity	ASTM D 790	300,000 psi

8. Pipeline Replacement

Pipe shall be as specified in Section 02561.

9. Manhole Rehabilitation and Replacement

a. Flexible plastic gaskets shall be as specified in Section 02562.02.

b. Cast-in-place concrete shall be as specified in Section 03300, Mix Number as indicated on the Standard Details or the Plans.

c. Precast concrete sections and grade rings shall be as specified in Section 03400.

d. Mortar for placing precast concrete grade rings shall be as specified in Section 04100.

e. Brick for manhole inverts shall be sewer brick as specified in Section 04200.

f. Manhole frames, covers, and steps shall be as specified in accordance with the Standard Details.

g. Manhole interior wall rehabilitation compounds shall be Drycon as supplied by I.P.A. Systems, Inc., Brush-Bond as supplied by Preco Manufacturing, or Commission approved equal.

h. Curing compound shall be as specified in Section 02562.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Sewer Pipe Cleaning

1. General

The intent of sewer pipe cleaning is to remove foreign materials from the sewer and restore the pipeline to a minimum of 95% of the original pipe diameter or cross-section as required for proper seating of internal pipe joint sealing packers or as required for installation of pipe liners. It is recognized there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor shall notify the Commission of the location and nature of obstruction. The Commission will evaluate the obstruction and will direct the Contractor as to the amount and method to be used to clean those specific pipe sections if cleaning is determined by the Commission to be feasible. If in the course of normal cleaning operations, damage results from preexisting and/or unforeseen conditions such as broken pipe, the Contractor will notify the Commission of the location and nature of the damage. The Contractor will be required to make repairs at the Contractor's cost only when the Commission has determined the contractor was negligent in performance of the Contractor's cleaning operations.

2. Cleaning Equipment

a. Hydraulically Propelled Equipment

1) Equipment used for gravity pipelines shall be of a movable dam type and be constructed in a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be Commission approved equal in diameter to the pipe being cleaned and provide a flexible scraper around the outer periphery to insure removal of grease.

2) Pressure pipelines may be cleaned by use of pipe pigs specifically designed for the condition, size, and type of pipe being cleaned.

b. High-Velocity Jet (Hydrocleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation.

The equipment shall have a selection of two or more high-velocity nozzles.

The nozzles shall be capable of producing a scouring action from 15 to 45 degrees to the axis of the pipe for all size lines designated to be cleaned.

Equipment shall also include a high-velocity gun for washing and scouring manhole walls benches and inverts. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hose reel.

c. Mechanically Powered Equipment

1) Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an

overload device. Machines with direct drive that could cause damage to the sewer will not be allowed.

2) Power rodding machines shall be either sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be fabricated of heat-treated steel.

3. Sewer Cleaning

a. The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. Selection of equipment used shall be based on the method indicated in the "Special Provisions" or at the time work commences where no specific method is indicated in the "Special Provisions." The equipment and methods selected shall be satisfactory to the Commission. The equipment shall be capable of removing dirt, grease, rocks, sand, other materials and obstructions from the sewer lines and manholes.

If cleaning an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning attempted again.

8/9/10 b. Large Diameter Cleaning

For cleaning large diameter sewer consideration should be given to a combination hydraulic high volume water and solids separation system. The flow from the sewer will provide water for the pump operation so no potable water is necessary and treatment costs are not a factor. Water volume of up to 250 GPM at 2000 PSI+ will move solids to the downstream manhole in high flow conditions. The separation system will dewater solids to 95% (passing a paint filter test) and transfer them to a dump truck for transport to an approved sewerage treatment site or landfill. Sewer water will be filtered to a point where is can be used in the pump for continuous cleaning. No by-passing of sewer flows will be necessary. The unit shall be capable of 24 hour operation and the unit shall not leave the manhole until a section is fully cleaned.

8/9/10 c. Cleaning Precautions

During sewer cleaning operations, satisfactory precautions shall be taken in use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewerage on the sewer line shall be utilized to provide necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

4. Root Removal

a. Roots shall be removed in sections where root intrusion is a problem. Special attention should be used during the cleaning operation to assure almost complete removal of roots from pipe joints. Any roots which could prevent seating of the packer, the insertion of a pipe liner, or proper application of chemical crack or joint sealants shall be removed. Root removal techniques may include use of mechanical equipment such as rodding machines, bucket machines or winches using root cutters, and porcupines; equipment such as high-velocity jet cleaners; or chemical root treatment at the option of the Contractor.

b. To aid in removal of roots, manhole sections identified to have root intrusion may be subjected to a chemical root treatment with an approved herbicide. The application of herbicide to the roots shall be done in accordance with the manufacturer's recommendations in a manner as to preclude damage to surrounding vegetation. Any damaged vegetation identified by the Commission shall be replaced by the Contractor at no additional cost to the Commission. All safety precautions recommended by the chemical manufacturer shall be observed by the Contractor during handling and application of the herbicide.

5. Material Removal

All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing of material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage to pumping equipment, will not be permitted.

6. Force Main Cleaning

Force mains shall be cleaned using hydraulically propelled or mechanically powered equipment. Hydraulically propelled pigs shall be inserted into the force main at designated locations or at other approved locations. Mechanically pulled scrapers may be used when conditions warrant. Equipment selected shall be capable of removing dirt, grease, sand, and other materials and obstructions from the lines.

7. Disposal of Materials

All solids or semisolids resulting from the cleaning operations shall be removed from the site, transported in watertight vehicles, and disposed of at an approved disposal facility site obtained by the Contractor, no less often than at the end of each work day.

Under NO circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers approved by the Commission.

B. Sewer Flow Control

1. Flow Reduction

When sewer line depth of flow at the upstream manhole of the manhole section being worked is above the maximum allowable for television inspection, joint testing, and/or sealing; the flow shall be reduced to the level indicated below by operation of pumping stations, plugging or blocking of flow, or by pumping and bypassing of flow as required.

2. Depth of Flow

Depth of flow shall not exceed that indicated below for the respective pipe sizes as measured in the manhole when performing television inspection, joint testing, and/or sealing.

a. Maximum depth of flow for television inspection:

6" - 10" Pipe	20% of pipe diameter
12" - 24" Pipe	25% of pipe diameter
27" & larger Pipe	30% of pipe diameter

b. Maximum depth of flow for joint testing/sealing:

6" - 12" Pipe	25% of pipe diameter

15" - 24" Pipe	30% of pipe diameter
27" & larger Pipe	35% of pipe diameter

3. Plugging or Blocking

   A sewer line plug shall be inserted into the line upstream of the section being worked. The plug shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing, and sealing operations, flow shall be reduced to within limits specified above. After the work has been completed, flow shall be restored to normal.

4. Pumping and Bypassing

   When pumping and bypassing is required, the Contractor shall furnish temporary pumps, conduits, and other equipment to divert the flow of sewage around the section in which work is to be performed. The bypass system shall be of sufficient capacity to transport existing flow plus additional flow that may occur during a rainstorm. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system.

   Pump engines shall be equipped with exhaust silencers to keep noise to a minimum. The system shall be so constructed as to prevent spills from leaving the immediate vicinity of the site. Any spillage that occurs shall be immediately reported to the Commission and shall be cleaned up, and the site returned to a clean sanitary condition.

5. Flow Control Precautions

   When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. In addition, precautions must be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

   The Contractor shall provide sewer service to affected property owners in the event of interruption, at no additional cost. The Contractor shall notify owners adjacent to the Work in advance of the work. Property owners shall be notified whose sewer service will be temporarily interrupted. The Contractor shall through the MetCom Engineer, notify in writing all consumers placed on bypass pumping and provide them with an emergency phone number and contact person in case of emergencies.

C. Television Inspection

1. The Commission will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection shall be conducted by closed circuit television equipment.

   a. Sanitary sewer closed circuit television inspections for new construction shall include the following:

   b. Before visual inspection, the pipe shall be cleaned and clear of all debris prior to the inspection.

   c. The inspection will be done one pipeline section (between two manholes, upstream to downstream) at a time.

   d. The television camera used for inspection shall be specifically designed and constructed for such inspection. Lighting for the camera shall be sufficient 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:
      i. Producing a picture quality satisfactory to the Commission. Unsatisfactory equipment shall be removed and no payment will be made for an unsatisfactory inspection.
      ii. Pan and Tilt 360 degrees to view pipe and laterals
      iii. Assess pipe grade, slope/ fall, (degree of slope)

iv. The camera shall be self-propelled by means of tracks and/or wheels to move the camera through the sewer line. The camera shall be moved through the pipeline in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition and at every house connection and pipe joint. In no case shall the television camera be moved at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices shall not obstruct the camera view or interfere with proper documentation of the sewer conditions. If, during the inspection operation, the television camera will not pass through the entire pipe section, the Commission shall determine if the pipe is obstructed. If the Commission determines the pipe is obstructed, the pipe will be designated as defective. All sewer mains, lateral connections, and manholes will be inspected for deficiencies. The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line. Pipe sections, lateral connections, and manholes with deficient grade and slopes will be designated as defective. No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected. The Contractor will be required to repair, replace, and retest the defective pipe, laterals, and manholes at the Contractors own expense. Additional inspections will be subject to addition fees and charges

v. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be made above ground by a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be permitted. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device before beginning the inspection work.

2. Documentation of the television results shall be as follows:

a. Television Inspection Logs: Two copies of typed location records shall be prepared from field inspection logs maintained by the Contractor which clearly indicate the location, in relation to an adjacent manhole, of each infiltration point and its estimated quantity of leakage observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, obstructions, presence of scale and corrosion, and other discernible features will be recorded. The copies of the typed records shall be furnished to the Commission.

b. Electronic media location records shall be kept by the Contractor and will clearly Show the location, by distance 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole of each infiltration point observed during inspection. All points of significance shall be defined in the NASSCO PACP (Pipeline Assessment Certification Program) defection codes and will be recorded on the electronic media and a copy will be supplied to the Commission along with the typed records.

c. Photographs: Electronic photographs of the television picture of problems shall be taken by the Contractor, and furnished to the Commission as a part of the Inspection Logs.

3. Digital Recording:

a. The purpose of recording is to supply a visual and audio record of the entire length of pipeline inspected. Recording playback shall be at the same speed as recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Title to the video recording shall remain with the Contractor; however, the Commission shall be provided a copy of all video recordings at the completion of the project as part of inspection documentation. The Contractor shall have all video recordings and necessary playback equipment readily accessible for review by the Commission during the project until a record copy has been made.

b. Defects shall be documented and quantified verbally by the audio portion of the recordings by the Contractor as well as in the written inspection logs.

c. The recordings will be reviewed by the Commission for focus, lighting, and clarity of view, and technical quality. The Contractor shall maintain sharp focus, proper lightening, and clear, distortion free viewing during the camera operations. Failure to maintain these conditions will result in rejection of the video recording by the Commission. Any recording not acceptable to the

D. Sewer Pipe Joint Testing

1. Before pipe joint testing, the pipe section to be tested shall be cleaned as specified herein.

2. Before starting the pipe joint testing phase of the work, a two-part control test shall be performed as follows:

a. To ensure accuracy, integrity, and performance capabilities of the testing equipment, a demonstration test shall be performed in a test cylinder constructed in a manner that a minimum of two known leak sizes can be simulated. This technique will establish test equipment performance capability in relationship to the test criteria and ensure there is no leakage of the test medium from the system or other equipment defects that could affect the joint testing results. If this test cannot be performed successfully, the Contractor shall repair or otherwise modify the Contractor's equipment and reperform the test until the results are satisfactory to the Commission. This test may be required at any other time during the joint testing work if the Commission suspects the testing equipment is not functioning properly.

b. After entering each manhole section with the test equipment, but before commencement of joint testing, the test equipment shall be positioned on a section of sound sewer pipe between pipe joints, and a test performed as specified. This procedure will demonstrate reliability of the test requirement, as no joint will test in excess of the pipe capability. Should the barrel of the sewer pipe not meet the joint test requirements, the requirements may be modified as necessary.

3. Pipe joint testing shall be performed on a pipe section (between two manholes) basis.

4. The Contractor shall control flow in the pipe section undergoing crack and joint sealing as specified herein.

5. Sewer pipe joints visibly leaking will not require pressure testing but shall be classified as defective and designated for repair. Each sewer pipe joint not visibly leaking shall be individually tested at a test pressure equal to 0.5 psi per vertical foot of pipe depth below the ground surface plus 1 to 2 psi (not exceeding a test pressure of 10 psi) in accordance with one of the following procedures:

a. Liquid Test Procedure

1) The testing device shall be positioned within the pipeline in a manner to straddle the pipe joint to be tested.

2) The testing device ends (end elements, sleeves) shall be expanded to isolate the joint from the remainder of the line and create a void area between the testing device and pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient pressure to contain a minimum of 10 psi within the void without leakage past the expanded ends.

3) Water or an equivalent liquid shall then be introduced into the void area until a pressure equal to or greater than the required test pressure is observed by the void pressure monitoring equipment. If the required test pressure cannot

be developed (due to joint leakage), the joint will fail the test and will be classified as defective.

4) The flow rate of the test liquid shall then be regulated to a rate at which the void area pressure is observed to be the required test pressure. A reading of the test liquid flow meter shall then be taken. If the flow rate exceeds 1/4 gallon per minute (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.

b. Air Test Procedure

1) The testing device shall be positioned within the line in a manner to straddle the pipe joint to be tested.

2) The testing device ends (end elements, sleeves) shall be expanded to isolate the joint from the remainder of the line and create a void area between the testing device and pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient pressure to contain a minimum of 10 psi or the test pressure whichever is greater within the void without leakage past the expanded ends.

3) Air shall then be introduced into the void area until a pressure equal to or greater than the required test pressure is observed with the void pressure monitoring equipment. If the required test pressure cannot be developed (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.

4) After the void area pressure is observed to be equal to or greater than the required test pressure, the air flow shall be stopped and a 5 second stabilization period shall commence. If the void area pressure decays by more than 0.5 psi within 20 seconds (due to joint leakage), the joint will fail the test and will be classified as defective and designated for repair.

6. During the joint testing work, records shall be maintained by the Contractor which indicate:

Identification of the pipe section tested;

Test method used;

Test pressure used;

Location (footage) of each joint tested;

A statement indicating the test results (passed or failed) for each joint tested.

E. Sewer Pipe Joint Sealing

1. General

The intent of sewer pipe joint sealing work is to seal sewer pipe joints which have been designated as defective using the internal joint sealing method. It is recognized this method may only be used on sewer pipe sections in sound physical condition. Longitudinally cracked or broken pipe will not be sealed. When bell cracks or chips are evident from pipe section offset, sealing may be undertaken where the offset is small enough to allow proper seating of the sealing packer on both sides of the joint to be sealed.

4.0 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

5.0 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

****END OF SECTION 02565****

SECTION 02566
LOW PRESSURE SEWER SYSTEMS

1.0 GENERAL

A. Low pressure sewer system installation shall include, but not necessarily be limited to, furnishing and installing pressure sewer pipe, valves, fittings, and appurtenances of the size and type shown on the Contract Plans and in accordance with the Contract Documents and approved installation details.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02552
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Cast-in-Place Concrete: Section 03300
5. Miscellaneous Metals: Section 05500
6. Sewage Grinder Pumping units: Section 11307

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.
2. To minimize the number of joints, only standard manufacturer's length of pipe shall be furnished and installed for all low pressure sewer unless otherwise indicated on the plans or approved by the Commission.

B. Materials

1. Pressure Sewer Piping, Fittings and Valves

a. All sanitary pressure sewer piping shall be of PVC (DR-18 or SDR-21), high density polyethylene (HDPE) pipe (DR-11) or ductile iron (DI) and fittings as hereinafter specified. (PVC) pipe and fittings shall be homogeneous throughout and free from visible discoloration cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces, or other imperfections which may impair the performance or life of the pipe. Polyvinyl Chloride Plastic Water Pipe 4 inch and larger shall be Class 150 (DR18) and shall meet the requirements of AWWA C900. PVC Water Pipe smaller than 4 inches shall be PVC 1120 (SDR21) and shall meet the requirements of ASTM D 2241. The outside diameters of DR18 shall be equivalent to cast-iron

pipe. PVC Pipe shall have an integral bell with a rubber gasketed joint as listed in the AWWA C900 standard. Pipe and couplings shall be marked and factory tested in accordance with AWWA C900. (HDPE) pipe (DR-11) or ductile iron (DI) and fittings as hereinafter specified. Pipe and fittings shall utilize heat fusion jointing. HDPE pipe shall be DR11 with outside diameters equivalent to cast iron pipe (DIPS). Heat fusion joining of HDPE pipe and fittings shall be done in accordance with ASTM F2620-11.

b. All valves shall be Ball Valve Curb Stop with Female Iron Pipe Thread (NPT) end connections. The valve size shall be same as the pipeline size. Connection to force main shall be packed joint with stainless steel insert, push-on joint or approved equal. Valves shall open left, counter-clockwise and be suitable for the conveyance of wastewater. The ball valves shall turn one-quarter (1/4) turn, ninety degrees to open and shall have a minimum working pressure rating of 200 psi. The ball valve shall be suitable for buried service and shall be manufactured in accordance with AWWA C-500. Valve extension stems shall be manufactured with cold rolled steel and have a centering ring when depth of ball valve is greater than 6' - 0". Top of stem shall be compatible with a standard tee-head wrench and extend to a maximum of 3-feet below finished grade. Bottom of stem shall be compatible with the ball valve tee-head and pinned to top of valve.

c. Roadway valve boxes shall be as specified in Section 02552 except the covers shall be labeled “SEWER.”

d. Detector Tape

Visual detection tape shall be 3 inches wide (minimum) non-metallic green plastic tape lettered “sewer” in black graphics.

e. Tracer Wire for Non Metallic Pipelines

Tracer wire shall be THHN solid, soft, continuous copper wire with a 45 mil polyethylene insulation. The wire shall be green, have “UL” markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

C. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Pressure Sewer, Fittings and Valves

1. The pressure sewer main shall be installed by either directional boring or open cut methods. A minimum 5’ and maximum 6’ depth of cover is required for all sewer force mains.
2.

3. For open cut methods, the installation of pressure sewer pipe shall be in accordance with Section 02551 of the Standard Specifications. For directional drilling methods, the installation of pressure sewer pipe shall be in accordance with Section 02310 of the Standard Specifications.

4. Service valve assemblies (SVA) subjected to test pressure or system operating pressure prior to completion of service pipe installation and backfill shall be provided with adequate temporary bracing or anchorage to prevent valve separation from pipe.

5. Pipe and fittings shall be installed in strict accordance with the manufacturer’s recommendations.

B. Pressure Sewer House Service Connections and Appurtenances

1. Service connections from sewage grinder pump connections or pressure sewer mains shall be installed using service saddles as the pressure sewer main is being installed or with installation of the service valve assemblies as approved by the Commission.

2. Intersection, Flushing Connections, Terminal Flushing Connections and In-Line Cleanouts and Valves: Flushing connections and in-line cleanouts and valves shall be provided where indicated on the Drawings and in accordance with the Construction Details.

C. Concrete Thrust Blocks

1. The Contractor shall provide concrete thrust blocks on all pressure sewer bends, tees, plugs and caps in accordance with the drawings and Standard Details. The entire face of earth against which the thrust block will bear shall be undisturbed earth or soil that meets all required compaction requirements, flat, and at the proper angle to counteract the thrust. Concrete thrust blocks shall be cured for a minimum of 48 hours before testing. Wood for temporary blocking and valve box installation shall be pressure treated with chromated copper arsenate in accordance with AWPA C1. Wood for blocking shall be solid, a minimum of one inch thick. No wood buttressing shall be used except as a temporary restraining measure until remaining work is completed.

D. Tracer Wire

1. All non-metallic mains shall have a tracer wire secured with duct tape to the top of the pipe. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.

E. Detector Tape

1. Tape shall be placed 12 inches below the surface at final grade.

F. Inspection and Field Tests

1. The Commission will inspect all materials before and after installation to ensure compliance with these Contract Documents. When specific material tests are called for in the referenced standards and specifications, the Commission shall have the option of requiring that any or all these tests be performed for materials furnished for a specified project.

2. After installation, pressure piping and appurtenances shall be tested by the Contractor for compliance with the Contract Documents. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests.

3. All tests shall be witnessed by the Commission. The Contractor shall schedule all tests with the Commission at least 48 hours in advance. Commission inspection costs shall be paid for by the Contractor.

4. If any section of the pressure sewer system fails the inspection and/or tests, the Contractor shall, at his own expense, replace, repair, adjust, seal, or reseal the system and retest it until such time as it passes.

5. Inspection and testing of the various components of the low pressure sewer system shall be in accordance with Section 02551 of the Standard Specifications. Specified test pressure shall be 80 psi as measured at the high point.

6. The Contractor shall test the tracer wire for continuity at every installation location.

4.0 METHOD OF MEASUREMENT

Measurement for furnishing and installing low pressure sewer, including appurtenances, flushing connections and service valve assemblies will be made horizontally along the centerline of the pipe for each size and type of pipe.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit prices bid. The prices shall include furnishing all labor, tools, equipment and materials necessary to complete the work as shown, and in strict accordance with the Contract Documents.

2. Payment for furnishing and installing low pressure sewer and appurtenances shall incorporate the requirements of the following sections:

   a. Clearing and Grubbing: Section 02110

   b. Aggregate Backfill: Section 02240

   c. Trench Excavation, Backfill and Compaction: Section 02250

   d. Directional boring of pressure sewer: Section 02310

   e. Restoration: Section 02800

f. Turf Establishment: Section 02820

g. Pre-cast Concrete Utility Services: Section 03400

3. Payment will be made for contingent items when approved by the Commission.

B. Low Pressure Sewer

Payment for furnishing and installing low pressure sewer, complete in place, will be made per linear foot of the size and type installed. The price(s) bid shall include clearing and grubbing, sediment and erosion control, traffic control, furnishing and installing pipe, fittings and jointing materials, joint restraint, buttresses, connection to existing pipelines or structures, testing, aggregate, excavation and backfill, disposing of spoil material, restoration of all disturbed areas and all other incidental items to complete the work.

C. Air/Vacuum Valves

Payment for air/vacuum valves shall be in accordance with Section 02563.

D. In-line Flushing Connections, Terminal Flushing Connections and Service Valve Assemblies.

Payment for furnishing and installing in-line flushing connections, terminal flushing connections and service valve assemblies complete in place, will be made for each unit installed. The price(s) bid shall include clearing and grubbing, sediment and erosion control, excavation and backfill, furnishing and installing all valves, pipe and fittings, furnishing and installing all vaults and manhole frames and covers, restoration and testing for the complete installation and all incidental items necessary to complete the work.

****END OF SECTION 02566****

SECTION 02800
RESTORATION

1.0 GENERAL

A. Description

Restoration shall include, but not necessarily be limited to all clean up and disposal of waste materials and the restabilization of disturbed areas including paved areas, non-paved areas, concrete improvements, street signs, mail boxes, fences, trees, shrubs and other improvements whether shown in the Contract Documents or not.

B. Related Work Included Elsewhere

1. Test Pits: Section 02012
2. Removal or Abandonment of Existing Utilities: Section 02050
3. Clearing and Grubbing: Section 02110
4. Aggregate Backfill: Section 02240
5. Trench Excavation, Backfill and Compaction: Section 02250
6. Boring and/or Jacking Pipe: Section 02300
7. Tunneling: Section 02400
8. Turf Establishment: Section 02820
9. Sodding: Section 02830
10. Soil Stabilization Matting: Section 02850
11. Cast-In-Place Concrete: Section 03300
12. For Milling Existing Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.
13. For Hot Mix Asphalt Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.
14. For Pavement Markings refer to MSHA Standard Specifications for Construction and Materials latest revision.

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any materials for restoration other than those acceptable materials which are available from the trench excavation limits as shown on the Contract Documents.

C. Contractor's Options

Not applicable.

D. Detailed Material Requirements

1. For Milling Existing Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

2. For Hot Mix Asphalt Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

3. For Pavement Markings refer to MSHA Standard Specifications for Construction and Materials latest revision.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

After the completion of backfilling, all materials not used therein shall be removed and disposed of in such a manner and at such point or points as shall be approved or directed by the Commission; and all roads, sidewalks, and other places on the line of the work shall be left free of debris, clean, and in good order. Said cleaning-up shall be done by the Contractor without extra compensation; and if he shall fail to do such work within two working days after receipt of notice, the Commission may arrange to have the cleaning-up done by others; and the cost shall be retained out of the monies due or to become due to the Contractor under the Contract. In case of emergency, the Commission may restore or remove and dispose of materials wherever necessary without giving previous notice to the Contractor, and the cost of doing so shall be retained from any monies due to become due the Contractor under the contract.

B. Paved Areas

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall provide graded aggregate subbase, temporary bituminous surfacing material as per the Contract Documents and/or direction of the governing regulatory agency.

a. For Milling Existing Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

b. For Hot Mix Asphalt Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

c. For Pavement Markings refer to MSHA Standard Specifications for Construction and Materials latest revision.

2. Weather permitting, the Contractor shall remove and dispose of the temporary surfacing materials, cut-back the edge of the existing pavement as per the Contract Documents, and permanently patch-pave the area as specified in the Contract Documents and/or governing agency direction. This shall be done within 30 calendar days after backfilling and compacting the trench as described in the paragraph above or within the time period specified by the governing agency.

C. Concrete Improvements

Sidewalks, curbs, combination curb and gutter, drive aprons, and other concrete improvements soiled or damaged by the Contractor's activities shall be cleaned or replaced by the Contractor in kind as directed by the Commission and/or Contract Documents without extra compensation.

Sidewalks, curbs, combination curb and gutter, drive aprons, and other concrete improvements removed by the Contractor as directed by the Commission shall be replaced by the Contractor as directed by the Commission and/or Contract Documents.

For Concrete Driveway Aprons refer to MSHA Standard Specifications for Construction and Materials latest revision.

For Concrete Combination Curb and Gutter refer to MSHA Standard Specifications for Construction and Materials latest revision.

For Concrete Sidewalk refer to MSHA Standard Specifications for Construction and Materials latest revision.

For Detectable Warning Surface Handicap Ramps refer to MSHA Standard Specifications for Construction and Materials latest revision.

D. Non-paved Areas

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall temporarily stabilize the area in accordance with the Contract Documents.

2. Weather permitting, within 14 days after the completion of trench backfill and compaction, the Contractor shall permanently stabilize the area with seeding and mulching or sodding, as noted in the Contract Documents.

E. Street Signs, Mail Boxes, Fences, Shrubs, Trees, and Other Improvements

1. Existing street signs and traffic control devices stored or relocated by the Contractor will be reset by the Contractor after construction in the area is complete and the work approved by the Commission.

2. In case of emergency, the Commission may reset street signs and traffic control devices wherever necessary without giving previous notice to the Contractor; and the cost of doing so shall be retained from any monies due to become due the Contractor under the contract.

3. Mail boxes shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the Postal Service. It shall be the Contractor's responsibility to temporarily reset mail boxes during construction to maintain service until the boxes are permanently reset in their original locations or at locations designated by the Postal Service. The Contractor shall comply with all Postal Service regulations regarding the location and height of all mail boxes disturbed by his activities.

4. Existing fences, paper boxes, signs, property markers, and other similar items shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the Commission. The Contractor shall safely store all items during the time that they are down and when possible, re-erect them in the original locations or at locations designated by the Commission.

5. Shrubs, hedges, and other plantings shall be transplanted with sufficient earth to ensure that no damage to their major root system occurs. After transplanting has been accomplished, it shall be the Contractor's responsibility to water all plants until their growth is established.

4.0 METHOD OF MEASUREMENT

Restoration will not be measured except as indicated in the Contract Documents

For Milling Existing Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision

For Hot Mix Asphalt Pavements refer to MSHA Standard Specifications for Construction and Materials latest revision.

For Pavement Markings refer to MSHA Standard Specifications for Construction and Materials latest revision.

5.0 BASIS OF PAYMENT

Payment will be made for at the unit prices bid when approved by the Commission, otherwise, restoration will not be paid as a separate item but is considered incidental to other items of work. Payment will include all related items of work and will constitute full compensation for all labor, equipment, tolls, and all incidentals necessary to complete the required work.

****END OF SECTION 02800****

SECTION 02820
TURF ESTABLISHMENT

1.0 GENERAL

A. Description

Turf establishment shall include, but not necessarily be limited to, soil preparation, seeding, fertilizing, mulching, liming as required, over seeding, and refertilizing all areas disturbed by construction and where designated for turf establishment in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110

2. Sodding: Section 02830

3. Soil Stabilization Matting: Section 02850

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

1. The Commission will not furnish any materials for turf establishment.

2. The Contractor may purchase water for hydroseeding or turf irrigation from the Commission's potable water system. The Contractor shall contact the Commission to coordinate its use.

B. Contractor's Options

1. Fertilizer may be furnished in either dry or liquid form unless otherwise noted.

2. Mulch may consist of straw, hay, salt hay, or wood cellulose fiber unless otherwise noted.

C. Detailed Material Requirements

1. Ground Limestone

Ground limestone shall contain not less than 80% calcium and magnesium carbonates. Dolomitic or magnesium limestone shall contain at least 10% magnesium as magnesium oxide. The limestone shall be ground to meet the following size gradation:

Sieve Sizes U.S. Standard	Percent Passing by Weight
No. 10	100
No. 20	98
No. 100	50

2. Fertilizer

   a. Fertilizer analysis shall be 5-10-10. It shall be a standard commercial grade fertilizer meeting the requirements of all State and Federal regulations and standards of the Association of Official Agricultural Chemists. Commercial fertilizer shall provide the minimum percentage of available nutrients specified.

   b. Fertilizer shall be furnished in bulk or new, clean, sealed, and properly labeled bags. Fertilizer failing to meet the specified analysis may be used as determined by the Commission providing sufficient materials are applied to comply with the specified nutrients per unit of measure without additional cost to the Commission.

3. Seed

   a. Seed lots must be state certified and blended under the supervision of the Maryland Department of Agriculture (MDA), Turf and Seed Section.

   b. All seed and labeling must fully comply with the Maryland Seed Law and these Specifications.

   c. Each container shall have permanently affixed to it an accurate analysis tag and a certification tag.

   d. All seed lots to be used in this mixture shall have been pretested by the Maryland Seed Laboratory to insure compliance with Specifications.

   e. A quality control sample of the delivered mixture may be submitted to the Maryland Seed Laboratory for testing prior to payment and any lots found not to comply with the Specifications shall be returned at the Contractor's expense.

   f. The Engineer's representative shall collect all seed certification tags and/or sod certification prior to the beginning of any seed or sod work.

   g. No seed shall be used after date of expiration.

   h. Certified grass seed shall consist of

      Spring (Feb. 1 - May 1) and Fall (Aug. 15 - Nov. 1)

      General: Kentucky 31 Tall Fescue @ 1.37 pounds/1,000 square feet (60 pounds per acre)

      Shade: Kentucky 31 Tall Fescue @ 0.69 pounds/1,000 square feet (30 pounds per acre) and Red Fescue @ 0.69 pounds/1,000 square feet (30 pounds per acre)

Summer (May 2 - Aug. 14)

General: Kentucky 31 Tall Fescue @ 1.37 pounds/1,000 square feet (60 pounds per acre) and Weeping Love Grass @ 0.05 pounds/1,000 square feet (2 pounds per acre)

Shade: Kentucky 31 Tall Fescue @ 1.37 pounds/1,000 square feet (60 pounds per acre) and Weeping Love Grass @ 0.11 pounds/1,000 square feet (5 pounds per acre)

i. All seed varieties shall meet the following minimum specifications:

1) Minimum Purity 98%

2) Minimum Germination 85%

3) Maximum Other Crop 0.1%

4) Maximum Weed Seed 0.1%

5) Noxious Weeds None

* Must be free of ryegrass, timothy, orchard grass, bentgrass, Canada bluegrass, clover, or any other contaminant which shall be unsightly and uncontrollable.

** Must be free of dock, cheat, chess, chickweed, crabgrass, plantain, and black magic.

*** Must be free of all Maryland prohibited and restricted noxious weeds.

4. Mulch

a. Mulches shall be free of clay, stones, foreign substances, plant parts of Canada Thistle and Johnsongrass, and reasonably free of other weed seeds. Mulches containing Canada Thistle and Johnsongrass shall not be used for any purposes.

b. Straw, hay, and salt mulches shall not contain sticks larger than 1/4-inch in diameter or other materials which would prevent matting down during application. No straw, hay, or salt hay mulches shall be used within 48 hours after cutting. Straw, hay, and salt hay shall be free from mold and other objectionable material and shall be in an air-dry condition suitable for placing with mulch blower equipment.

c. The following mulches may be acceptable by visual inspection provided they meet the above and following requirements:

1) Straw: Straw shall consist of thoroughly threshed wheat, rye, or oat straw.

2) Hay: Hay shall consist of native grasses or other plant material approved by the Commission. Hay shall be free of noxious weed seeds as specified in the Maryland Seed Law.

3) Salt Hay: Salt hay shall consist of well cured beach grasses or other approved material.

4) Wood Cellulose Fiber: Wood cellulose fiber shall consist of cellulose processed into a uniform fibrous physical state. Wood cellulose fiber shall contain a green dye that will provide easy visual inspection for uniformity of the slurry spread. The wood cellulose fiber, including dye, shall contain no germination or growth inhibiting properties. The material shall be manufactured and processed in a manner that the wood cellulose fiber will blend with seed, fertilizer, and other additives to form a homogeneous slurry. The wood cellulose fiber shall perform satisfactorily in hydraulic seeding equipment without clogging or damaging the equipment. The manufacturer shall certify that wood cellulose fiber meets the following requirements:

Requirements	Specification Limits
Particle Length	Approximately 3/8 inch
Particle Thickness	Approximately 3/64 inch
Net Dry Weight Content	Minimum stated on bag
pH, ASTM D778	4.0 to 8.5
Ash Content, ASTM D586	1.6% maximum
Water Holding Capacity	90% minimum

The material shall be delivered in packages of uniform weight not exceeding 75 pounds net weight and bear the name of the manufacturer, the net weight, and a supplemental statement of net weight content.

5) Mulch Binder

Mulch binder shall be emulsified asphalts or wood cellulose fiber meeting the requirements of Section 02820.2, Article C, Paragraph 4, Item c, 4).

6) Water

Water used in the planting or care of vegetation shall be free from oil, acids, alkalis, salts, or any substance injurious to plant life. Water from streams, lakes, ponds, or similar sources shall not be used unless the source is approved by the Commission.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Seeding Seasons

Seed shall be sown as specified above as soon as the soil is dry enough to allow proper penetration of a seedbed. Extensions beyond the time periods specified may be granted by the Commission, depending upon weather conditions for the period in question. Any planting outside of these seasons shall be solely at the Contractor's risk and shall not be subject to compensation until stabilization has been accomplished in accordance with these Specifications. No seeding shall be done on frozen ground or when the temperature is 32°F or lower.

B. Schedule of Procedure

The Contractor shall begin his work at a point or points approved by the Commission. When topsoil is required for areas to be seeded, all topsoiling shall be completed before seeding operations are started.

C. Soil Preparation

Topsoil shall be placed at a minimum depth of four inches (4") or as otherwise directed, in areas to be seeded. Topsoil may be stripped from the areas to be excavated, stored, protected and reused. If additional topsoil is required, it shall be of good quality and generally should be selected from cultivated farm fields. Should the pH of the topsoil be less than 6.2, lime shall be spread and raked in at the rate of one (1) ton per acre. All topsoil shall be free of stones and of lumps larger than one inch (1") in diameter. It shall be raked fine, and then fertilized with quick acting fertilizer according to manufacturer's specifications. The fertilizer shall be raked in and the area shall be rolled with a two hundred and fifty (250) pound roller.

D. Seeding

Seeding shall consist of soil preparation and application of seed, fertilizer, and mulch. Seed application shall be by either of the following application methods as the Contractor may elect:

1. Dry Application Method

a. Ground Limestone: Ground limestone, shall be applied, at rates as determined by soil test or no less than 50 pounds per 1000 square feet, separately before the application of any fertilizer or seed on seedbeds which have previously been prepared. Where ground limestone is required to be worked in, the seedbed shall again be properly graded and dressed for seeding. Limestone shall be worked into seedbeds as follows:

Seedbed	Depth of Limestone Incorporation
4 inches of topsoil	3 inches
2 inches of topsoil	2 inches
Subsoil, serrated cut slopes and other non required topsoiled areas 3:1 and steeper	Incorporation not required

b. Fertilizer: Fertilizer of the analysis 5-10-10 shall be applied to topsoiled areas at a rate of 50 pounds per 1000 square feet.

c. Seed Application: Strip seeding along trench excavations, etc., shall be applied at a rate of 6 pounds per 1,000 sq. ft. Seed in large areas, around buildings, along streets, etc., shall be applied at rates specified herein. After seeding, the areas shall be lightly raked and rolled. Areas which do not “catch” shall be reseeded at an interval of fourteen (14) days, which shall continue until a satisfactory growth of grass is established over the entire area.

2. Wet Application Method

a. General: Apply seed and fertilizer (ground limestone, if required) by spraying the material on previously prepared seedbeds in the form of an aqueous mixture using the methods and equipment described herein. The rates of application shall be the same as those specified for the Dry Application Method.

b. Spraying Equipment: The spraying equipment shall have a water tank equipped with a bar or liquid level gage calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity. The gage shall be mounted to be visible to the nozzle operator. The tank shall also be equipped with an agitation system capable of keeping all the solids in the mixture in complete suspension at all times until used.

c. Ground Limestone

1) Ground limestone, if required, shall be sprayed separately from mixtures of seed and fertilizer on areas flatter than 3:1. The water-limestone mixture shall contain a maximum of 600 pounds per 100 gallons. The water limestone mixture shall be applied at a minimum rate of 1000 gallons per acre. The water-limestone mixture shall be worked into the topsoil. After working the ground limestone into the topsoil, the seedbed shall again be properly graded and dressed.

2) Ground limestone shall not be required to be applied separately on slope areas 3:1 and steeper. The water-seed-fertilizer and limestone mixture shall be applied at a minimum rate of 1000 gallons per acre in the relative proportions specified so that these combined solids do not exceed 600 pounds per 100 gallons.

d. Application

1) Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which ground limestone, if required, has been incorporated. Seed and/or fertilizer shall be mixed together with water in the relative proportions specified so that these combined solids do not exceed 300 pounds/100 gallons. The water-seed-fertilizer mixture shall be applied at a minimum rate of 1000 gallons/acre.

2) All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All seed mixtures in aqueous agitation shall be used within eight hours after mixing, except for leguminous seed which shall be used

within one hour after mixing. Seed mixtures not utilized within the time limits shall be wasted and disposed of at locations acceptable to the Commission.

3) The mixtures shall be applied by high pressure spray equipment which shall always be directed upward into the air so the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in a manner to produce erosion or runoff.

4) Particular care shall be exercised to insure that application is made uniformly at the prescribed rate and to guard against misses and overlaps. Proper predetermined quantities of the mixture, as specified, shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or collecting containers over the area at intervals and observing the quantity of material deposited thereon.

5) The spray method shall not be used during periods of high winds which prohibit satisfactory spray patterns.

6) Seed and fertilizer applied by the spray method need not be raked into the soil.

7) Any spray or residual which disfigures or otherwise damages existing structures or vegetation shall be thoroughly cleaned from the damaged surface.

E. Mulch Application

1. Mulch materials shall be furnished, hauled, and evenly applied on the area shown in the Contract Documents and/or as directed by the Commission. All mulch shall be applied within 48 hours after seeding. Mulch applied by hand shall provide a loose depth of not less than 1.5 inches nor more than 3 inches. Mulch applied by the blowing method shall provide a loose depth of not less than 1 inch nor more than 2 inches, and 95% of the mulch shall be 6 inches or more in length. Mulch applied by the above methods shall achieve a uniform distribution and depth so no more than 10% of the soil surface is exposed. Mulch applied either by hand or the blowing method shall be spread evenly over all seeded areas at the rate of 2.0 tons per acre.

2. If the mulch is to be secured with a mulch anchoring tool, the rate shall be 2.5 tons per acre. If the tracking method is used, the rate of mulch shall be 1.5 tons per acre.

F. Securing Mulch

Mulch may be secured by any of the following methods except the mulch anchoring tool. This method may be used with written Commission approval. Where mulch has been secured with either an asphalt binder or wood cellulose fiber binder, it will not be permissible to walk on the slopes after the binder has been applied. The Contractor is warned that in the application of asphalt binder material he must take every precaution to guard against damaging or disfiguring structures or property on or adjacent to the seeded area and that he will be held responsible for any such damage resulting from his

operations. He will be required to place temporary protective covers over existing signs just before seeding and mulching. The covering shall be immediately removed after seeding and mulching operations are completed.

1. Peg and String Method

   If the peg and string method is used, the mulch shall be secured by stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be driven nearly flush to the ground to draw the twine down tight onto the mulch.

2. Spray Method

   If the spray method is used, all mulched surfaces shall be sprayed with the selected binder material so the surface has a uniform appearance. Mulch binder may be sprayed on the mulched slope areas from either the top or the bottom of the slope. A spray nozzle of approved design must be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch. Uniform distribution of the binder material will be required. A pump or an air compressor of adequate capacity shall be used to insure the uniform distribution of binder material.

   a. Asphalt Binder

      Asphalt mulch binder shall be uniformly applied to the mulch at the rate of approximately 8.0 gallons per 1000 square feet, or as directed by the Commission. The minimum-maximum rates of application shall be 6 and 10 gallons per 1000 square feet depending on the type of mulch and the effectiveness of the binder securing it.

   b. Chemical Binder

      Wood cellulose fiber used as a binder shall be applied at a net dry weight of 750 pounds per acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 pounds of wood cellulose fiber per 100 gallons.

3. Mix Method

   If the mix method is used, the mulch shall be blown onto the area by a mulch blower; and the binder material shall be sprayed into the mulch as it leaves the mulch blower. For rates of application, see Spray Method above.

4. Anchoring Tool Method

   If the mulch anchoring tool method is used, the mulch shall be incorporated into the soil to a minimum depth of 2 inches by equipment and a method acceptable to the Commission.

5. Tracking Method

   If the tracking method is used, the mulch shall be incorporated into the soil with a bulldozer having steel cleats with a minimum depth of 1.5 inches. The equipment used and the method of tracking shall be acceptable to the Commission. Upon

completion of tracking, the mulch shall be further secured as described for the spray method.

G. Wood Cellulose Fiber

Wood cellulose fiber used as a mulch shall be applied at a net dry weight of 1,500 pounds per acre. The wood cellulose fiber shall be mixed with water at a maximum rate of 50 pounds of wood cellulose fiber per 100 gallons. This wood cellulose fiber will be permitted to be used in the following areas when approved, and as directed, by the Commission:

1. Narrow disturbed areas up to 8 feet wide adjacent to pavement where traffic created gusts of wind could cause problems with straw;

2. Deep or high slope areas inaccessible to straw application by a mulching machine.

H. Repair of Defective Areas

1. The responsibility for maintaining treated areas shall be as follows. Until the Project is finally accepted, the Contractor will be required to repair or replace any seeding or mulching that is defective or damaged. When, in the judgment of the Commission, such defects or damages are the result of poor workmanship or failure to meet the requirements of the Contract Documents, the cost of necessary repairs or replacement shall be borne by the Contractor. However, once the Contractor has completed the seeding and mulching of any area in accordance with the provisions of the Contract Documents and to the satisfaction of the Commission, no additional work at his expense will be required. Subsequent repairs and replacements deemed necessary shall be made by the Contractor and will be paid for as additional work or extra work.

2. When either the Dry or Wet Application Method is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density. If, when the Contract has been completed, it is not possible to make an adequate determination of color, density and uniformity of such stand of grass, payment for the unaccepted portions of the areas will be withheld until these requirements have been met.

4.0 METHOD OF MEASUREMENT

A. Except when used as a contingent item or noted otherwise, measurement for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.

B. When used as a contingent item or noted otherwise, measurement for turf establishment will be made on the surface area, measured in place, acceptably established.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.

2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

3. Payment will made for contingent items when approved by the Commission.

B. Turf Establishment

1. Payment for turf establishment will be made per square yard at the contingent prices established in the bid form. The price shall include all traffic control and incidental items to complete the turf establishment.

****END OF SECTION 02820****

SECTION 02830
SODDING

1.0 GENERAL

A. Description

Sodding shall include, but not necessarily be limited to, furnishing, hauling, and placing grass sod on prepared areas in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110

2. Turf Establishment: Section 02820

3. Soil Stabilization Matting: Section 02850

C. Quality Assurance

The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

1. The Commission will not furnish any materials for sodding.

2. The Contractor may purchase water from the Commission's potable water system. The Contractor shall contact the Commission to coordinate its use.

B. Contractor's Options

Fertilizer may be furnished in either dry or liquid form unless otherwise noted.

C. Detailed Material Requirement

1. Grass Sod

Grass sod shall be well rooted and shall be a high percentage of Kentucky 31 Tall Fescue. It shall, when placed, have been cut and rolled (stored) not longer than 48 hours. It shall be cut in strips not less than 12-inches nor more than 18-inches wide and have 3/4 inches of soil firmly attached to the roots. The sod thickness shall not be deficient more than 1/4-inch from the required thickness at or just before placement. This 1/4-inch tolerance does not relieve the Contractor of the responsibility of cutting the sod a full 3/4-inches thick. The thickness of sod is measured by the thickness of soil firmly attached to the root system. The height of grass or thickness of thatch has no bearing on the determination of sod thickness. The sod and attached soil shall be free from noxious weeds: Common Bermuda grass, Nutsedge, Quack grass, Garlic, Johnsongrass, Poison Ivy or Poison Oak, and Canada Thistle. Any lot of sod containing the following weeds either individually or collectively exceeding one percent of the total plant population by plant count or surface area covered shall be rejected as follows: Orchard-grass, Nimblewill, Annual Bluegrass, Crabgrass, Goosegrass and

Foxtail. It shall not contain substances deleterious to growth or which might affect the survival or hardiness of the sod when transplanted.

2. Fertilizer shall be as specified in Section 02820.

3. Ground limestone shall be as specified in Section 02820.

4. Water shall be as specified in Section 02820.

5. Pegs shall be wooden wedges ½-inch x 1-inch x 6-inch to ½-inch x 1-inch x 12-inch.

6. Staples shall be made from No.11 or heavier steel wire bent to form a U. The staples shall average 1 to 1-1/2-inches wide. The staple shall be at least 6 inches long from top to bottom after bending.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

Sod sections or strips shall be of a length as may be readily lifted without breaking, tearing or loss of soil. Sections or strips shall be cut by approved sod cutters, hauled or carried to storage piles or the point of installation without breaking, and set in final place as indicated on the Contract Documents and as directed by the Commission. All sod in stacks shall be kept moist and protected from exposure to the air, sun and freezing. Any sod permitted by the Contractor to dry out may be rejected whenever, in the judgment of the Commission, its survival after placing is rendered doubtful. No payment will be made for rejected sod.

In no event shall more than 48 hours elapse between the cutting and placement of sod.

During wet weather, sod shall be allowed to dry sufficiently to prevent tearing as a result of handling and placing. During dry weather it shall be watered before cutting and lifting to ensure its vitality and prevent the dropping off of soil in handling.

B. Ground Preparation

Before placing sod upon any topsoiled surfaces, all shaping and dressing of such surfaces shall be completed. The completed areas to be sodded shall present a smooth, uniform, well tilled surface true to line and cross-section. Any raking required to accomplish this shall be done immediately before placing the sod.

All areas to be sodded shall be fertilized and limed in accordance with Section 02820. The lime and fertilizer shall be worked into the top 2 inches of soil before placing sod.

C. Sod Placement

No sod shall be placed between the dates of June 1st and August 15th inclusive unless adequate irrigation is available to establish the sod, nor any time when the temperature is below 32°F. No frozen sod shall be used. No sod shall be placed upon frozen soil. Sod shall be lifted from trucks or storage piles and placed by approved methods with close joints and no overlapping. All cracks between blocks of sod shall be closed with small pieces of sod. All sod shall be tamped or rolled after laying to close the seams between the pieces and press the sod tight against the ground. A hand tamper shall weigh approximately 15 pounds and have a flat surface of approximately 100 square inches. A roller shall weigh 40 pounds per foot of width. Any slipping of sod is to be corrected by the Contractor without additional compensation.

D. Watering

The sod shall be watered a minimum of 3 times after placement. The sod and soil directly beneath the sod shall be kept moist, by additional waterings if necessary, until acceptance or it has become established. The first watering shall be immediately after laying the sod. The second and third waterings shall be as necessary within 2 weeks of the first watering. No sod will be accepted until the water requirements have been satisfied, and the sod appears in good health.

E. Sodded Slopes and Drainage Ditches

On slopes 2:1 and steeper, sod shall be laid with the long edges parallel to the contour starting at the bottom of the slope. Successive strips shall be neatly matched and all joints staggered or broken. When placing sod in drainage ditches, the length of the strip shall be laid perpendicular to the direction of the flow of the water. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement.

Each strip or section of sod placed on slopes 2:1 and steeper and surface drainage V-shaped or flat bottom ditches or gutters shall be staked securely with at least 2 wooden pegs spaced not more than 2-feet apart with the flat side against the slope and driven flush with the top of sod.

F. Repair of Defective Areas

Until the project is conditionally accepted, the Contractor will be required to repair or replace any sod that is defective or damaged.

G. Contractor’s Responsibility

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of six months, from areas to be mowed, or as directed by the Commission.

4.0 METHOD OF MEASUREMENT

A. Except when used as a contingent item or noted otherwise, measurement for sodding will not be made, as it shall be included in the unit quantity item for utility installation.

B. When used as a contingent item or noted otherwise, measurement for furnishing and installing sodding will be made on the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for sodding will not be made, as it shall be included in the unit quantity item for utility work.

2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Sodding

Payment for furnishing and installing sodding complete and in place will be made per square yard at the contingent prices established in the bid form. The price shall include all pegging, irrigation, traffic control, and incidental items to complete the sodding.

****END OF SECTION 02830****

SECTION 02850
SOIL STABILIZATION MATTING

1.0 GENERAL

A. Description

Soil stabilization matting shall include, but not necessarily be limited to, furnishing and placing excelsior matting over seeded areas, and securing with wire staples on seeded areas in accordance with the Contract Documents.

B. Related Work Included Elsewhere

Turf Establishment: Section 02820.

C. Quality Assurance

The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for soil stabilization matting.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Excelsior Matting

a. Excelsior matting shall be machine produced from wood which has been properly cured to achieve adequately curled and barbed fibers. A maximum of 20% of the fibers may be less than 6 inches in length.

b. The excelsior matting shall have a uniform thickness and distribution of fibers throughout. The top and bottom of the excelsior matting shall be covered with a biodegradable extruded plastic netting having a maximum mesh opening of 2 inches x 2 inches. The average break strength of any two strands running lengthwise shall be 5 pounds minimum. The net shall be entwined with the excelsior to aid handling and provide sufficient reinforcement against damage during handling and placement.

c. The excelsior matting shall be smolder resistant. A chemical treatment may be applied to the matting to make it smolder resistant. The chemical treatment, if used, shall be nonleaching, nontoxic to vegetation and germination of seed, and noninjurious to human skin. Rolls of the excelsior matting shall meet the following requirements: width - 48 + 1 inch; weight - 0.60 pounds per square yard minimum at 0% moisture; nominal roll length - 180 feet.

2. Staples shall be as specified in Section 02830.

3. "T"-pin staples shall be made of No. 8 wire with an 8-inch leg, 4" head and a 1-inch secondary leg.

4. Materials required for seeding shall meet the requirements of Section 02820, except mulch binder will not be required.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

When topsoil is specified for areas where matting is being placed, topsoil placement shall be completed before the soil stabilization matting operations are started.

B. Seeding

Seeding shall be performed in accordance with the provisions of Section 02820, except that Fall season installation of soil stabilization matting shall end on September 30, and the rolling operation shall be omitted. The seed mixture shall be the same as in the areas immediately adjacent to the area where matting is to be placed.

C. Placing and Securing

The matting shall be placed prior to the first rain event or within 48 hours after seeding operations have been completed in the work areas, whichever is less. Matting shall be rolled on in the direction of the flow of water. Where more than one width of matting is required, the strips shall overlap at least 4 inches. Ends shall overlap at least 6 inches. The upgrade end of each strip of matting shall be turned down and buried to a depth of not less than 6 inches with the soil firmly tamped against it. Overlapping shall be done with the upgrade section on top. The Commission may require any other edge exposed to more than normal flow of water be buried in a similar manner. Edges of matting must be similarly buried around the edges of catch basins and other structures. Disturbed areas shall be fertilized and reseeded with the specified seed mixture for the area.

Matting shall be laid smoothly upon the seeded surface, and stretching shall be avoided. Matting shall be securely fastened with staples driven vertically into the soil, flush with the surface. Matting shall be in firm contact with the soil in its entirety. Staples shall be placed 2 feet apart along the edges and center of the matting. On all overlapping edges, staples shall be placed 18 inches apart. At all ends of the matting, staples shall be placed 6 inches apart.

D. Contractor's Responsibility

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of 6 months, from areas to be mowed, or as directed by the Commission.

4.0 METHOD OF MEASUREMENT

A. Except when used as a contingent item or noted otherwise, measurement for soil stabilization matting will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

B. When used as a contingent item or noted otherwise, measurement for furnishing and installing soil stabilization matting will be made of the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for soil stabilization matting will not be made, as it shall be included in the unit quantity item for pipe and structures installed.

2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Stabilization Matting

Payment for stabilization matting will be made per square yard at the contingent prices established in the bid form. The price bid shall include all traffic control, and incidental items to complete the soil stabilization matting.

****END OF SECTION 02850****

SECTION 02870
FENCES

1.0 GENERAL

A. Description

This work shall include, but not necessarily be limited to, the construction of fence and gates in accordance with, and in reasonably close conformance to, the lines and grades shown on the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for fence installation.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. If required by the Chief Engineer, fencing shall consist of chain link fabric topped with three strands of barbed wire mounted on extension arms projecting outward at 45°.

2. Barbed Wire

The barbed wire shall consist of three lines of aluminum coated steel barbed wire which is to be of the four point pattern composed of two strands of 12-1/2 gage line wires with 14 gage aluminum barbs spaced on approximately 5 inch centers. Minimum weights of aluminum coating shall be 0.30 ounces per square foot of wire surface.

3. Chain Link Fabric

a. Fabric shall be aluminum coated steel chain link, No. 9 gage wire woven in a 2 inch mesh. Top and bottom selvages shall be barbed. The fabric shall conform to ASTM Designation A491-74 in its entirety.

b. The aluminum coating shall be a minimum of 0.4 ounces per square foot of wire surface for #6 and #9 gage fabric and 0.35 ounces per square foot for #11 gage. The weight of coating shall be determined by the strip test as defined in ASTM Specifications A428-68.

4. Fabric Connections

   The chain link fabric shall be securely fastened to all terminal posts using 3/16" x 3/4" stretcher bars and heavy 11 gage tension bands. The fabric shall be fastened to all intermediate posts and top rails with #11 gage tie wires.

5. Tension Wire

   The top and bottom tension wire shall be No. 7 gage aluminum coated spring coil or crimped wire. Minimum weight of aluminum coating shall be 0.40 ounce per square foot of wire surface.

6. Framework

   a. All posts and framework (including gates) shall be hot dipped zinc coated with a minimum of 1.8 ounces per square foot of surface and shall conform to ASTM A120-78.

   b. Terminal and corner posts shall be nominal 3-inches outside diameter, nominal weight 5.79 pounds per linear foot.

   c. Line posts shall be nominal 2 ½-inches outside diameter, nominal weight 3.65 pounds per linear foot.

   d. The top rail and brace pipes shall be nominal 1-5/8-inches outside diameter standard weight pipe, wt. 2.27 pounds per linear foot.

7. Gates

   a. Posts for swing gates shall be 4-inch O.D. standard weight pipe, wt. 9.1 pounds per linear foot.

   b. Gate posts shall be equipped with top cap so designed to prevent moisture from entering the post.

   c. Gate frames shall be nominal 2-inches outside diameter standard weight pipe, wt. 2.72 pounds per linear foot. Gates may be fabricated using welded construction or heavy pressed steel or malleable corner fittings securely riveted. Hinges shall be of sufficient strength and design to permit easy and trouble-free operation. Gates shall have center plunger rod to positively hold gates in open or closed positions. Gates shall have barbed wire. All gates shall be equipped with a positive type latching device with a means for padlocking. An approved padlock with three keys shall be provided for each gate. Locks shall be keyed to the Metropolitan Commission.

8. Portland Cement Concrete

   Portland cement concrete for fence post encasement shall be Mix No. 1 as specified in Section 03300.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be

located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. The fence shall be erected at locations shown on the Plans to grades conforming to existing ground contours by experienced fence erectors. The bottom of the fabric shall be placed a normal distance of 1-inch above the finished grade, however, over irregular ground, a minimum clearance of 1-inch and a maximum clearance of 6-inches will be permitted for a horizontal distance not to exceed 8 feet.

2. Any excavation or backfill required in order to comply with these provisions shall be made as approved by the Commission. The fence shall be true to line, taut, and shall comply with the best practice for chain link fence construction. For site fencing projects, the fence fabric shall be placed on the outside of the posts.

3. All posts shall be plumbed and placed at the specified spacing shown on the Contract Documents. Spacing of posts shall be as uniform as practicable under local conditions. The distance between line posts shall not exceed 10 feet.

4. Terminal posts shall be installed at all ends, abrupt changes in grade, and at changes in the horizontal alignment greater than 10 degrees. In no case shall the distance between terminal posts exceed 500 feet.

5. Post lengths shall be adequate in all cases to accommodate the fabricated width of the fence fabric without stretching or compressing the fabric and to obtain, as a minimum, the distance required below the bottom of the fabric.

6. Horizontal brace rails shall be installed at all gate, pull, and corner posts. Horizontal brace rails with diagonal truss rods and turn buckle shall be installed at all terminal posts. Sufficient braces shall be supplied to allow complete bracing from each terminal post to all adjacent line posts. Braces shall be securely fastened to posts by heavy pressed steel and malleable fittings.

7. Fabric shall be tied to brace and top rails at 2-foot intervals maximum. Stretcher bars shall be attached to terminal posts by connectors equally spaced at 12-inch centers maximum. The fabric shall be fastened to all intermediate post at a spacing not to exceed 14-inches.

8. Tension wire shall be stretched taut and run continuously between terminal post near the top and bottom of the fabric and securely fastened to each intermediate post.

9. Gates shall be installed so as to be easily opened and closed by one person and shall be capable of being swung back parallel with the fence unless otherwise noted. Gates shall be properly braced to eliminate any possible sagging condition.

10. Areas contained within and adjacent to the security fence shall be smoothed, level and compacted after which two (2) layers of 6 mil black plastic and three

inches (3") of crushed gravel shall be added. This graveled area shall extend in all directions a minimum of two feet (2') beyond the security fence. Bank run gravel is not acceptable.

B. Concrete

1. Concrete footings shall be constructed in accordance with dimensions shown on the Standard Details. Posts shall be centered in cylindrical concrete footings. The concrete shall be thoroughly compacted around the post by tamping or vibrating. The finish top surface shall be a smooth finish, slightly above the ground line, and uniformly sloped to drain away from the post. The post shall not be disturbed in any manner within 72 hours after the individual post footing is completed.

2. Hand mixed concrete shall not be used without written permission of the Commission. If permitted, the hand mixed batch shall not exceed ½ cubic yard.

4.0 METHOD OF MEASUREMENT

A. Chain Link Fence

Measurement for chain link fence will be made of the length of fence of various sizes installed complete and accepted. Measurement will be made to the centers of end posts.

B. Terminal Posts

No measurement of terminal posts will be made.

C. Line Posts

No measurement of line posts will be made.

D. Gates

No measurement of gates will be made.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified, in strict accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the Commission.

B. Chain Link Fence

Payment for chain link fence will be made at the price bid per linear foot for fence of the size and type specified and shall include traffic control and the furnishing and installation of all terminal posts, line posts, gates, chain line fabric, bracing, fittings, locks, and incidental items to complete the fence installation.

C. Terminal Posts

Payment for furnishing and installing terminal posts will not be made, for it will be incidental to chain link fence installation.

D. Line Posts

Payment for furnishing and installing line posts will not be made, for it will be incidental to chain link fence installation.

E. Gates

Payment for furnishing and installing gates will not be made, for it will be incidental to chain link fence installation.

****END OF SECTION 02870****

SECTION 03200
CONCRETE REINFORCEMENT

1.0 GENERAL

A. Description

Concrete reinforcement shall include, but not necessarily be limited to, furnishing and placing various types and/or sizes of steel reinforcing for embedment in Portland cement concrete as specified in the Contract Documents.

B. Related Work Included Elsewhere

1. Cast-In-Place Concrete: Section 03300

2. Pre-Cast Concrete: Section 03400

C. Quality Assurance

The Commission will inspect all materials before, during and after placement to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for concrete reinforcement.

B. Contractor's Options

Substitution of smaller size bars will be permitted only upon specific authorization by the Commission. Substituted bars shall provide a steel area equal to or larger than that called for by the design provided the spacing is not reduced to a point where the clear distance between the bars is less than one and one-half times the nominal diameter of the bars, nor one and one-half times the maximum size of the course aggregate, nor 1-½ inches, and further provided that the planned cover is maintained. No additional compensation will be allowed because of the substitution of larger areas of steel.

C. Detailed Material Requirements

1. General

   Reinforcing steel shall conform to the requirements of ACI 318.

2. Bar Reinforcement

   Bar reinforcement shall consist of deformed bars meeting the requirements of AASHTO M 31, Grade 60. Grade 40 may be used for #5 and smaller bars where indicated on the Plans.

3. Tie or Dowel Bars

   Tie or dowel bars shall be round steel bars meeting the requirements of AASHTO M 31, Grade 40 or ASTM A 36.

4. Welded Steel Wire Fabric

   Welded steel wire fabric shall meet the requirements of AASHTO M 55. When galvanizing is specified, the fabric shall be galvanized after fabrication.

5. Welded Deformed Steel Wire Fabric

   Welded deformed steel wire fabric shall meet the requirements of AASHTO M 221.

6. Galvanizing

   Galvanizing for deformed steel bars shall be in accordance with ASTM A 153.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Fabrication

1. General

   After bar lists and bending diagrams have been approved, fabricate each unit of reinforcement to the type, shape, size, grade, and dimensions shown on the approved shop drawings.

2. Cutting and Bending

   Perform cutting and bending of reinforcing bars before shipment to the site. Bend all bars cold in a manner that will not injure the material and in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

B. Shipping, Handling, and Protection of Material

Reinforcing steel bars shall be shipped in standard bundles and tagged and marked in accordance with the provisions of the Code of Standard Practice of the Concrete Reinforcing Steel Institute. Bundles shall be kept intact and material undamaged and properly identified until ready for use.

Reinforcing steel bars shall be stored on blocking, racks, or platforms so as not to be in contact with the ground.

Bars shall be kept free from dirt, paint, oil, grease, loose or thick rust, detrimental mill scale, or other foreign substances. However, when steel has on its surface detrimental rust, mill scale, dust, or dirt, it shall be cleaned by a method approved by the Commission.

C. Placing and Fastening

The placing of bars shall conform to the recommended practices in “Placing Reinforcing Bars” as published by the Concrete Reinforcing Steel Institute.

Reinforcing steel shall be accurately placed in the position shown on the plans and firmly held during the placing and setting of the concrete. Cover, or the distance between the external face of the bar and the face of the finished concrete, shall be as indicated on the Plans. Reinforcing steel bars embedded in concrete shall not be bent after they are in place. Bars shall be tied at all intersections with 16 ½ gage black annealed wire except that where spacing is less that 1 foot each direction alternate intersections need not be tied. All intersections shall be tied in the top mat of reinforcement placed on the top slabs of box culverts. Abrupt bends shall be avoided except where one steel bar is bent around the other. Stirrups and ties shall always pass around the outside of main bars and be securely attached thereto. All reinforcing steel shall be securely held at the proper distance from the forms by means of plastic coated steel chains. Blocks for holding reinforcement away from contact with earth shall be precast concrete blocks of approved shape, mix, and dimensions and shall have tie wires embedded in them. Layers of bars shall be separated by approved plastic coated metal chairs or bolsters.

Any broken or damaged concrete spacer blocks shall be removed before concrete is placed. The use of pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks as spacers will not be permitted. Reinforcing steel when placed in the work shall be free from flake rust, dirt, and foreign material before any concrete is placed. Any mortar which may be adhering to the reinforcing steel shall be removed. No concrete shall be placed until the Commission has inspected the placing of the reinforcing steel and given permission to place the concrete. The Contractor shall allow the Commission ample time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before approval is given to place concrete, and such replacements and corrections shall be at the Contractor’s expense. All concrete placed in violation of these provisions shall be rejected and removed.

D. Splicing

Reinforcement shall be furnished in full lengths as indicated on the Plans. Splicing, except where shown on the Plans, will not be permitted without written approval from the Commission and if additional splices are used, the additional weight occasioned by such splices shall be at the Contractor’s expense.

All splices shall conform to Class “B” in ACI 318 or as shown on the Plans. Splices shall be well distributed where conditions permit. Except where otherwise shown on the Plans, lap splices shall be made with the bars placed in contact and wired together. Lapped splices for reinforcement shall not be used for bar sizes larger than No. 11.

No welding of reinforcing steel or attachments thereto will be permitted without written authorization by the Commission, unless so indicated on the Plans. Welding, if permitted, shall be in accordance with AWS D1.4.

4.0 METHOD OF MEASUREMENT

Measurement for concrete reinforcement consisting of deformed bars, or wire mesh will not be made, but shall be included in the unit or lump sum price bid for cast-in-place concrete.

5.0 BASIS OF PAYMENT

A. General

1. Payment for concrete reinforcement consisting of deformed bars, or wire mesh will not be made as such, but the cost thereof shall be included in the lump sum price bid for cast-in-place concrete.

****END OF SECTION 03200****

SECTION 03300
CAST-IN-PLACE CONCRETE

1.0 GENERAL

A. Description

Cast-in-place concrete shall include, Portland cement concrete and the construction of small below grade Portland cement concrete structures constructed to the lines and dimensions and at the locations shown on the Plans and in accordance with the Contract Documents.

B. Related Work Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Aggregate Backfill: Section 02240
3. Water Main Installation and Chlorination: Section 02551
4. Water Valves and Appurtenances: Section 02552
5. Fire Hydrants: Section 02554
6. Sanitary Sewer Force Mains: Section 02563
7. Concrete Reinforcement: Section 03200

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

1. The Commission will not furnish any materials for Portland cement concrete.
2. The Contractor may purchase water from the Commission's potable water system in accordance with the current Commission policies and procedures.

B. Contractor's Options

1. The Contractor may furnish higher strength concrete than specified.

C. Detailed Material Requirements

1. Portland Cement

   Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

2. Fine Aggregate

Fine aggregate shall meet the gradation requirements contained in Table 03300-1 and shall be in accordance with the quality requirements of AASHTO M 6.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO M 43, size numbers 57, 67, or 7, Table 03300-1.

4. Aggregate Gradations

TABLE 03300-1
Mass Percent Passing

Sieves Sizes	AASHTO M 43		
U.S. Standard	No. 57	No. 67	No. 7
1 ½ inch	100 - -		
1 inch	95-100	100	-
3/4 inch	-	90-100	100
½ inch	25-60	-	90-100
3/8 inch	-	20-25	40-70
No. 4	0-10	0-10	0-15
No. 8	0-5	0-5	0-5
No. 16	-	-	-
No. 50	-	-	-
No. 100	-	-	-

5. Water shall be Potable.

6. Admixtures

Admixtures to be used in concrete (except for air entrainment) shall be subject to prior written approval by the Commission. Admixtures for concrete shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610. The relative durability factor of concrete with Admixtures shall be determined in accordance with ASTM C 666, Procedure B.

a. Air entraining admixtures shall be in accordance with AASHTO M 154.

b. Admixtures shall be in accordance with AASHTO M 194.

c. High Range Water Reducing Admixtures

When specified, high range water reducing admixtures shall be liquid and meet the requirements of AASHTO M 194, Type F or G. When this material is used in patching, the admixture shall be liquid and meet the requirements of AASHTO M 194, Type F, for air entrained concrete with the following exceptions.

i. The water content shall be a maximum of 85% of that of the control.

ii. The relative durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B.

iii. The 12 hour compressive strength for Type F admixture shall be 180% of that of control.

Additionally, the admixture shall be nonfoaming when tested in accordance with ASTM D 1173. It shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610.

7. Fly Ash

Fly Ash may be used with prior written Commission approval.

Fly ash shall be in accordance with AASHTO M 295, pozzolan Class C or F.

8. Concrete Reinforcement

Concrete reinforcement shall be the size and type specified and shall be in accordance with the requirements of Section 03200.

9. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be natural rubber, suitable synthetic rubber, or a combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% virgin polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins mechanically blended with polyvinyl.

The waterstop shall be of the shape and dimensions shown on the plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

Tensile Strength, ASTM D 412, psi min.	2000
Elongation at Break, ASTM D 412, % min.	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55+5
Hardness, PVC, Type A Durometer, ASTM D 2240	75+5

10. Forms

Forms shall be constructed of wood, steel, or other approved material. Wall ties approved by Commission shall be used where necessary. Surfaces of metal forms shall be free from irregularities, dents, and sags. Knot holes and broken places in wood forms shall be covered with metal patches. Lumber used in forms for exposed surfaces shall be smooth, uniform, and free from loose knots and other defects that would show defects in the finished concrete surfaces. For unexposed surfaces and rough work square-edge lumber may be used. By ‘unexposed surfaces’ is meant any concrete surface not exposed to view on

completion of the project. Interior and exterior corners shall have chamfer strips. The Contractor may be required to submit details of forming to the Commission before work proceeds.

11. Form Release Compounds

Form release compounds shall effectively prevent the bonding of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds shall be tested in accordance with MSMT 503.

12. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, or liquid membrane-forming compounds.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White burlap polyethylene sheeting shall give a finished product weight of not less than 10 ounces per square yard.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than +/- 0.3 pounds per gallon from the original source sample.

13. Vapor Barrier

a. Building paper shall be Sisal-Kraft building paper, conforming to requirements of FSS UUB 790A.

b. Polyethylene sheeting shall be 0.006 inch thick, conforming to requirements of ASTM D 2103.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. General

1. Concrete shall be mixed as specified in this Section and shall be delivered to the site in accordance with ASTM C 94.

2. The Contractor shall use concrete equipment of sufficient capacity to complete any unit, as indicated on Contract Documents, in one continuous operation consistent with placement operations as approved by the Commission.

3. Hand mixing may be permitted with written approval of the Commission for small volumes of concrete. However, its intended use is for small isolated areas where structural integrity is not critical.

4. Before placing any concrete, the Contractor shall install all sleeves, anchors, fittings, pipes, conduits, or other special devices called for in the Contract Documents. No concrete shall be placed until this work has been approved by the Commission. The Contractor shall ascertain that all material to be installed in the concrete by other trades has been placed prior to pouring any concrete. Any concrete poured without prior provisions having been made for inclusion of the indicated inserts and materials will be subject to rejection by the Commission and/or correction at the Contractor's expense.

5. Coat aluminum accessories and embedded items with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

B. Concrete Mixes

The concrete shall be proportioned by weight. Water and admixtures may be proportioned by volume or weight. The mix shall be homogeneous, placeable, and uniformly workable.

Coarse aggregate shall be maintained at a uniform moisture content at least equaling its absorbed moisture. Water, if used for wetting, shall meet the requirements of this Section.

Portland cement concrete mixtures shall conform to the Maryland SHA Standard Specifications for Construction and Materials (*Latest Version*).

C. Mixers and Agitators

1. All mixers shall display a current Maryland State Highway Administration approval stamp.

Mixers and agitators and mixing and delivery of ready-mixed concrete shall meet the requirements of AASHTO M 157 with the following exceptions:

a. Transit mixed concrete will not be permitted. The following requirements shall apply when additional water is added on the job site:

i. No water shall be added after partial discharge of the batch.

ii. The water-cement ratio shall not be exceeded.

iii. Acceptance will be based upon a retest of the slump and air content.

b. All concrete shall be discharged within 1 hour after the mixing water is added or 1 ½ hours after the addition of the cement to the aggregates, whichever is the lesser time.

c. No mixer or agitator containing free water in the drum shall be loaded.

D. Hand Mixing Portland Cement Concrete

1. No hand mixing of concrete shall be allowed without first obtaining permission from the Commission.

2. The amount of concrete shall be small enough in quantity that, in the judgment of the Commission, the delivery of the same is impractical.

3. Scheduling of mixing and placing shall be coordinated with the Commission's resident inspector so that all work by the contractor is under the supervision of the resident inspector.

4. Under no circumstances shall hand mixing of concrete be allowed for any permanent buttresses that will not be subject to the 150 pound plus pressure test.

E. Forms

1. Design Criteria

Design of the forms shall be the Contractor's responsibility. Forms shall be designed for strength and deflection to resist all loads and pressure of wet concrete. The design shall provide for rate of pour, effect of vibration, and use of retarders, etc. In addition, horizontal surfaces shall have applied to them a live load of 50 pounds per square foot for purposes of designing forms for strength. This load is to be used in the design of the forms for strength only and is not to be used in computing deflections. In the design of forms for horizontal slabs, the live load applied for design purposes shall be a minimum of 120 pounds per square foot. (This does not apply to form joists, form wales, etc.) No form member or support thereof shall have a deflection in excess of L/240 of its span length, and in no case shall said deflection exceed 1/4 inch.

2. Concrete forms shall be built true to line and grade, mortar-tight, and sufficiently rigid to prevent displacement or sagging between supports. All form work shall be provided with adequate clean out openings to permit inspection and easy cleaning after all reinforcement has been placed.

3. Forms at Construction Joints and Corners

At construction joints in concrete, ties or bolts shall be provided 3 to 6 inches from each side of the joint for tightening the forms against the hardened concrete (first pour) immediately prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete immediately prior to placing the fresh concrete. Where forms have been extended, the forms shall be retightened against the concrete already in place immediately before placing fresh concrete.

Forms shall be filleted at all exposed sharp corners, except when otherwise indicated on the Plans and shall be given a bevel or draft in the case of all projections, such as girders, copings, etc., sufficient to ensure easy removal.

4. Bracing and Maintenance

Special attention shall be paid to bracing; and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the Commission will order work stopped until the defects have been corrected. All forms shall be so maintained as to eliminate the formation of joints due to the shrinkage of lumber. All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. For narrow walls where access to the bottom of the forms is not readily attainable, provide temporary openings and at such other locations as may be necessary to clean out all chips, dirt, sawdust, or other extraneous material immediately prior to placing concrete. Existing forms may be extended after the concrete in said forms has been in place for at least 12 hours, provided such form extension can be done without any damage to the previously placed concrete.

Unit stresses for forms, form supports, false work, and bracing shall not exceed the AASHTO Specification.

5. Form Removal

All forms for concrete work shall be removed and disposed of by the Contractor after form work requirements have been complied with, except those which are designated to remain in place.

Forms shall remain in place a sufficient time to allow the concrete to set properly and the Contractor shall assume all responsibility for removing same. In no case shall forms be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. The Chief Engineer may, when he deems it advisable, order the forms to remain for a longer time, but his acquiescence in permitting the removal of forms shall not relieve the Contractor of responsibility for same.

Forms for pipe end walls may be removed after the concrete has been in place for a period of 24 hours unless it is necessary to protect the concrete against cold weather, in which case the forms shall remain in place for the entire protection period.

Forms for vertical surfaces shall remain in place for a period of 48 hours. If forms are removed before the concrete is 7 days old, the vertical surfaces shall be immediately covered with curing material and the concrete kept wet and so covered until the concrete is 7 days old. Horizontal formwork and false work carrying loads shall remain in place for a minimum of 7 days and until the concrete has attained a compressive strength of 3000 psi.

Internal bulkheads used for forming construction joints, contraction joints, expansion joints, etc. may be removed after the concrete has been in place for 24 hours, if it is necessary to do so for the continuance of the work without interruption.

Special care shall be taken not to break concrete edges in taking down forms. Any portion of concrete damaged while stripping forms may be ordered torn

down and recast at the discretion of the Commission. Upon removal of forms, the Commission shall be notified by the Contractor. The Commission after inspecting the newly stripped surfaces, will designate what honey-combed parts, if any, shall be pointed up and how the slightly damaged portions of concrete, if any, shall be repaired or replaced. No freshly stripped surfaces shall be pointed up or touched in any manner before having been inspected by the Commission.

In all cases, the Contractor shall assume all responsibility arising from the removal of forms and shall assure himself that the concrete is properly cured to sustain loads before forms are removed.

F. Concreting

1. Before placing concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from interior of forms. No struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment pending the placing of concrete at their locations, will be permitted.

   All concrete shall be placed in the dry, unless Plans and/or “Special Provisions” require the placement of tremie concrete.

   All concrete shall be placed in a continuous operation. Concrete, after being placed in the forms, shall be thoroughly compacted and shall be spaded, tamped, or vibrated to the satisfaction of the Commission.

   Chuting of concrete will be allowed only as approved by the Commission. No concrete shall have a free fall of over three (3) feet and if this height is exceeded, it shall be conveyed in place by approved spouts and chutes. Open troughs and chutes shall be metal or metal lined. Where steep slopes are required, the chute shall be equipped with baffles or be in short lengths that reverse the direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings or hardened concrete by thoroughly flushing with water after each run.

2. Retempering concrete by the addition of water shall not be permitted. The addition of water to the batch in the mixer, after ten (10) minutes have elapsed after the initial charging or the addition of water at any time after the concrete has been removed from the mixer, shall be construed as retempering. Batches of concrete prepared contrary to these specifications shall be rejected and immediately removed from the project.

   The concrete shall be mixed only in the quantity required for immediate use and concrete not in place within one hour from the time the ingredients were charged into the mixing drums, or that has developed initial set, shall not be used.

3. Cold Weather Specifications

   Under no circumstances will concrete be permitted to be placed on frozen soil. Construction of plain and reinforced cement concrete pavements, curbs, gutters, combination curb and gutters, and sidewalks, except by specific written authorization and under very definite Special Provisions, shall not be continued when a descending air temperature in the shade and away from artificial heat falls below 45°F, or resumed until an ascending air temperature in the shade and away from artificial heat reaches 40°F.

   If temperature is below 45°F then one or more of the following methods shall be used to obtain the required temperature all as approved by the Commission.

a. When the method of heated mixing water is used, the water shall not be above 170°F when introduced into the mix.

b. When the method of heated aggregates is used, aggregates containing frozen lumps, ice, or snow shall be allowed to enter the mixer. Aggregates may be heated by steam coils or other dry heat but not by discharging live steam or hot water into them. Heating by means of a flame thrower or any direct flame will not be permitted.

Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever temperatures below 40°F are likely to occur within that period.

4. Construction Joints

Construction joints shall be kept to a minimum and will be permitted only where shown on the approved Plans and/or shop drawings.

In order to bond successive courses, suitable keys shall be formed at the top of the lift where construction joints are permitted and at other levels where work is interrupted. These keys shall be as indicated on the Plans. At horizontal construction joints, the pour shall be allowed to set for about 12 hours before placing concrete above same.

After concrete has been placed and before it has hardened, all laitance and foreign material shall be removed from the surface. Before placing fresh concrete adjacent to hardened concrete, the surface of the hardened concrete shall be cleaned thoroughly of any remaining laitance or foreign material, scrubbed with wire brooms and clean water, and thoroughly drenched with water until saturated. It shall be kept saturated until the new concrete is placed.

Unless otherwise specified, the top surface of the concrete shall be leveled whenever a pour of concrete is stopped; and to ensure a level, straight joint on exposed face, a strip of sheathing shall be attached to the form at the exposed face where the joint occurs. The concrete shall be carried not more than ½ inch above the underside of this strip. About 1 hour after concrete is placed, the strip shall be removed; and any irregularities in the joint line shall be leveled off with a wood float (use steel trowel at exposed face of joint). All laitance shall be removed. To avoid visible joints at chamfers, the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface of the chamfer strip as a guide.

5. Consolidation

All concrete shall be internally vibrated unless herein noted otherwise. Vibration shall be in accordance with the following requirements:

a. All concrete shall be deposited in the forms in its final position and shall be placed in layers of uniform thickness. All concrete shall be consolidated by vibratory methods, unless otherwise specified.

Vibration shall be internal and applied directly to the concrete, except when the use of other methods is authorized by the Commission or provided herein. The Commission will be the final judge as to which sections are unsuited for internal vibration.

The Contractor shall provide a sufficient number of vibrators to properly consolidate each batch immediately after it is placed in the forms and before the next batch is delivered, without delaying such delivery. The vibration shall be of sufficient intensity and duration to thoroughly consolidate the concrete, but it shall not be continued to such an extent as to cause segregation. Vibration shall not be continued at any one point to the extent that any localized areas of grout are formed.

Vibration shall be applied at points uniformly spaced not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be used to transport concrete in the forms or to make it flow in the forms over distances so great as to cause segregation. Vibration shall not be applied directly or through the reinforcement or forms to sections or layer of concrete which have hardened to such a degree that the concrete ceases to be plastic under vibration.

Vibration shall be supplemented by such spading, along form surfaces, in corners, and at locations impossible to reach with the vibrators, as is necessary to ensure smooth surfaces and dense concrete.

The provisions of this section shall apply to precast concrete cribbing and other precast members or units, except that if approved by the Commission the manufacturer's methods of vibrating may be used.

b. Internal vibrators shall be of a type and design approved by the Commission. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4500 impulses per minute. The intensity of application shall be such as to visibly affect a mass of concrete of 1 inch slumps over a radius of at least 18 inches.

Internal vibration shall be applied directly to the concrete at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted in and withdrawn from the concrete slowly. Internal vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Concrete Surface

a. General

Concrete surfaces shall be finished in accordance with one of the following designations. Unless otherwise specified, all concrete work shall have a "Grout Finish" for vertical surfaces and "Troweled Finish" for horizontal surfaces. Strict compliance with the Specifications and the intent pertaining to finished surfaces will be enforced. Any concrete structure or concrete work which exhibits surfaces with defective finish will not be accepted until finishing has been completed in accordance with the Specifications. All concrete surfaces shall be finished within 24 hours after the forms are removed. If the concrete surfaces are not finished as specified within the time limit mentioned, all other work shall be suspended until the concrete surfaces required to be finished are completed.

Application	Finished Designation
Structures	
For all concrete surfaces not exposed to public view and not to be waterproofed	Rough Form Finish
For all concrete wall surfaces exposed to public view	Grout Finish
Tops of footings	Float Finish
Horizontal construction joints	Left Rough
Slabs & Miscellaneous Paving	Floated Finish
Incidental Works	
Sidewalks, curb, combination curb and gutter, concrete paving, safety curb, median paving	Broom or Belt Finish

b. Rough Form Finish

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned and, after having been kept saturated with water for a period of not less than 3 hours, shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in proportions used in the grade of the concrete being finished. Any excess mortar at the surface of the concrete due to filling form tie holes shall be struck off flush with a cloth. The mortar patches shall be cured as specified under Curing. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces shall be repaired to the satisfaction of the Commission.

c. Grout Finish

All fins, projections, etc. shall be removed to the satisfaction of, and by means approved by, the Commission (stone, chipping hammer, sandblasting, etc.). No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accepted. Cleaning as the work progresses will not be permitted.

The surface of the concrete shall then be saturated with water and kept wet for at least 2 hours. Proceeding by sections, a grout mix of 1 part Portland cement and 1-½ parts fine sand with sufficient water to produce a grout having the consistency of thick paint shall be thoroughly rubbed onto the surface using burlap pads or cork floats completely filling all

voids, pits, and irregularities. While the grout is still plastic, remove all unnecessary grout by working the surface with a rubber float or burlap. After this grout has dried sufficiently so that it will not smear, the surface shall be wiped off with dry, clean burlap so as to leave a clean uniform surface.

This surface shall then be cured as required, except that only colorless liquid curing compound will be permitted for this method.

d. Floated Finish

After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10 foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a smooth surface. The slab shall then be refloated immediately to a uniform sandy texture.

e. Broom or Belt Finish

Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

7. Curing

Except for buttresses, provisions shall be made for curing all concrete. Curing shall start as soon as concrete has set sufficiently so that curing applications will not damage the surfaces. Curing will also be required while protecting concrete against cold weather.

The following are methods to be used for curing:

a. Two layers of burlaps shall be used. Successive strips of each layer shall be overlapped a minimum of 6 inches. The second layer shall be placed not less than 45 degrees to the first layer; or the 6 inches overlap of the second layer may be placed midway (one-half width) of this first layer. The layers of burlap shall be kept thoroughly saturated with curing water for the full time specified for curing.

b. The material for liquid membrane-forming compounds shall have a fugitive dye or be white pigmented. The materials shall be thoroughly agitated before use and applied by sprayers.

c. When curing concrete structural slabs, etc., burlap-polyethylene mats or white polyethylene sheets may be used atop the wet burlap on unobstructed flat and reasonably level surfaces.

The burlap-polyethylene mats or white polyethylene sheets shall be placed only on unobstructed flat and reasonably level surfaces. They will not be permitted on vertical surfaces, such as walls, columns, abutments, etc.

Adjacent mats or sheets shall be lapped no less than 1 foot. The ends shall be brought down around the sides of the concrete being cured and securely fastened to the satisfaction of the Commission to make an airtight seal that will be unaffected by wind.

The burlap-polyethylene mats shall be placed on no less than one layer of wet burlap with the burlap side of the mat facing down. White polyethylene sheets, if used, shall be placed on no less than two layers of wet burlap.

The burlap-polyethylene mats or white polyethylene sheets shall remain in place for the same length of time as required for burlap mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats shall be kept wet for the time interval required by the Specifications.

d. The burlap shall be thoroughly saturated just prior to placement. The requirement for keeping the concrete surfaces saturated at all times during the curing period, regardless of the covering, will be strictly enforced. This saturation of the surfaces shall be employed even in areas where there is no ready water supply. The Contractor shall furnish, at his expense, sufficient water to satisfy this requirement.

All vertical surfaces may be cured by leaving forms in place for 7 days. If forms are removed after 48 hours, then the remainder of the 7 days of cure shall be by method “b”.

Immediately after the finishing operation for sidewalks and slabs, the areas of future construction joints shall be covered with two layers of wet burlap which shall extend 6 inches outside the joint area. The finished concrete surface shall then be sprayed with a liquid compound as specified in curing method “b”. The material shall be applied uniformly at the rate of 150 to 200 square feet per gallon, one half applied in a longitudinal direction and the second half in a transverse direction.

After 1 day or as soon as the concrete may be walked upon without damage, the concrete shall be cured using method “a” or “c” for the remainder of the 7 day curing period.

All other horizontal surfaces shall be cured using either method “a” or “c” for a period of 7 days.

8. Prevention and Removal of Stains on Concrete

The Contractor shall prevent rust of unpainted structural steel, staining by bituminous materials, or any other substance from discoloring any portion of the concrete. The Contractor, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the Contractor shall remove such stains and restore the concrete to its original color without damage to the concrete all at his expense and as approved by the Commission. No chemical solvents will be allowed unless previously approved by the Commission.

4.0 METHOD OF MEASUREMENT

Except when used as a buttress, measurement for cast-in-place concrete of the mix number specified will be made on a unit area or volume, or a lump sum per structure basis. In establishing the breakdown between footing concrete and substructure concrete, the division line shall be the top of footing regardless of where the construction joint occurs.

A. Unit Price

Measurement for cast-in-place concrete, when a unit price is provided for in the Proposal, will be made on an area or volume basis for the actual amount of concrete satisfactorily placed and accepted.

B. Lump Sum

Measurement for cast-in-place concrete, when a lump sum price or prices per structure are provided for on the Proposal Form, will be made on the basis of a lump sum for all concrete included in the Project or on the basis of the number of structures satisfactorily placed and accepted.

C. Concrete for buttresses or any joint restraint will not be measured.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices shall include all materials, forms, reinforcing steel, curing materials, sealing, caulking, and dampproof or waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.

2. Payment will be made for contingent items when approved by the Commission.

B. Unit Price

Payment for cast-in-place concrete will be made at the price bid per cubic yard for the various mix numbers specified.

C. Lump Sum

1. Payment for cast-in-place concrete will be made at the lump sum price bid for all concrete on the Project, or for all concrete in each structure or structural unit as indicated in the Contract Documents.

2. To provide for unforeseen changes in planned dimensions affecting concrete on a lump sum basis, the Contract Documents may include an item(s) for contingent concrete. This item(s) shall be used only upon written direction of the Commission and applied only to referenced structure(s). If necessary changes in the planned dimensions result in an enlargement, then the pertinent lump sum price shall be increased by an amount obtained from the product of the increase in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. Should, however, the necessary changes result in a smaller structure than planned, then the pertinent lump sum price shall be reduced by an amount obtained from the product of the reduction in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. The unit price bid on the pertinent contingent concrete item shall include cost of all concrete,

reinforcing steel, expansion material, dampproofing, membrane waterproofing, form work, incidental materials, etc. and work required to complete the structure(s) as revised.

D. Concrete will not be paid for when used for joint restraint unless approved.

****END OF SECTION 03300****

SECTION 03400
PRECAST CONCRETE UTILITY STRUCTURES

1.0 GENERAL

A. Description

Precast concrete utility structures shall include, but not necessarily be limited to, furnishing and installing precast concrete structures, manholes, valve and meter vaults, grade rings, and other miscellaneous structures of the configuration and to the extent indicated and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02552
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Sanitary Sewer Manholes: Section 02562

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for precast concrete utility structures.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Portland cement concrete shall meet the requirements specified in Section 03300 except as modified herein. Portland cement for units to be used in sanitary sewer systems shall be type II.
2. Concrete Reinforcement

   Concrete reinforcement shall meet the requirements specified in Section 03200.
3. Water shall be potable.
4. Joint Seals Between Sections

   Joint sealing material for use in vaults shall be cold-applied preformed sealing compound that meets the manufacturer's recommendations and Commission approval.

5. Precast sanitary sewer manholes and appurtenances shall be as noted within this section and as specified in Section 02562.

6. Dampproofing and Waterproofing

   Dampproofing and waterproofing the exterior of precast structures shall be as per the Contract Documents or the approved list of suppliers and materials for Water and Sewer construction.

7. Steps

   Steps shall be as specified in the Standard Details.

8. Granular Bedding

   Granular bedding beneath precast units shall meet the requirements of AASHTO M 43, No. 57, as specified in Section 02240.

9. Non-Shrink Mortar

   Non-shrink cement mortar shall be as specified in Section 04100.

10. Underground Precast Concrete Vaults

    Underground precast concrete vaults and appurtenances shall be as required in this Section and the Standard Details. See Approved Material List for vault to pipeline connections.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Design Criteria

1. General

   a. Structural design for precast units shall be prepared by a Maryland Professional Engineer for the precast concrete manufacturer. Units shall be designed for HS 20 load designation or 300 pounds per square foot live load, whichever is most critical for determining the concrete and steel stresses.

   b. Where more than one standard is referenced for any given unit, should there be a conflict, the more stringent requirement as determined by the Commission, shall apply.

   c. Unit configuration shall be as shown on the Plans and/or Standard Details.

d. Distribution of earth loading and live load shall be in accordance with ASTM C 857 or ASTM C 890.

e. Walls shall be designed using an equivalent fluid pressure of 83 pounds per cubic foot and a 2 foot surcharge. The units shall also be designed to resist all stress encountered during casting, handling, and erection.

2. Manholes

a. Precast concrete manholes and grade rings shall meet the requirements of ASTM C478 except that the minimum compressive strength of the concrete shall be 4000 psi.

The maximum individual grade ring height shall be 3 inches.

b. Joints shall meet the requirements of ASTM C 443, shall be self-centering, and shall form a uniform water tight joint.

3. Miscellaneous Water and Wastewater Structures

Miscellaneous water and wastewater structures not otherwise covered shall meet the requirements of ASTM C 913.

4. Underground Precast Concrete Vaults

Underground precast concrete utility structures shall meet the requirements of ASTM C 857 and C 858 except that the minimum compressive strength of the concrete shall be 4,000 psi at 28 days of age.

B. Fabrication

1. The precast units shall be factory cast. Job site casting will not be permitted. Concrete in the precast elements shall be continuously placed to prevent formation of seams. The finished units shall be free of voids and cracks. Exposed corners and edges shall be beveled. All inserts shall be securely attached or embedded in their proper location.

2. Concrete strength of all precast units at 28 days shall be 4000 psi minimum, unless otherwise specified. It shall be the precast unit manufacturer's responsibility to ensure that the specified concrete strength is maintained throughout production of the units. Mix design shall be one previously used by the manufacturer which has proven satisfactory for casting units similar to those specified and producing the required strength. All precast concrete shall be air entrained in accordance with AASHTO M154. Admixtures containing calcium chloride shall not be used.

3. Wall sleeves or gaskets for piping, sumps, steps, access hatches, and other inserts as shown on the Plans and/or Standard Details shall be cast into the structure or inserted at the place of manufacture.

C. Product Handling

1. No precast unit shall be shipped less than 7 days from date of manufacture, unless the unit has been tested and is shown to be in full compliance with the Specifications. Date of manufacture shall be stamped on each unit.

2. Precast sections shall be transported and handled with proper equipment to protect the elements from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. Damaged sections that cannot be satisfactorily repaired by the manufacturer shall be replaced by new sections at no additional cost to the Commission.

3. Manufacturer shall identify each manhole section with an identification number that corresponds to the manhole number noted on the contract drawings.

D. Installation

1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.

2. Precast units shall be installed where and as shown on the Contract Documents and Standard Details or as directed by the Commission.

3. Pipe connections, penetrations, and other appurtenances shall be installed as specified in the following sections:

   a. Water Valves and Appurtenances; Section 02552,

   b. Water Services, Water Meter Settings, and Vaults; Section 02553,

   c. Sanitary Sewer Manholes; Section 02562.

4. Field modifications of precast units, such as cutting or enlarging holes or slots, will not be permitted without the specific approval of the precast unit's manufacturer and the Commission.

   Permitted modifications shall be made by the manufacturer in strict accordance with Commission approval and the manufacturer's directions and recommendations.

5. Mating surfaces shall be cleaned of all foreign materials such as dirt, mud, stones, etc., and where appropriate, joint sealing materials applied prior to assembly of the units.

6. Grade rings shall be set on a full bed of mortar.

4.0 METHOD OF MEASUREMENT

Measurement for precast concrete utility structures will be made as specified in the specification section pertaining to the type of structure provided.

5.0 BASIS OF PAYMENT

A. General

1. Payment for precast concrete utility structures, complete and in place will be lump sum or as dictated by the appropriate section for the type of structure provided. The prices shall include all materials, sealing caulking, waterproofing,

and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.

****END OF SECTION 03400****

SECTION 03500
FLOWABLE FLY ASH

1.0 GENERAL

A. Description

1. Flowable Fly Ash fill shall include but not necessarily be limited to the filling of utility trenches, tunnels, and sleeves at the locations shown on the plans and in accordance with the Contract Documents.

2. Flowable Fly Ash fill is intended for use in tunnels, sleeves and utility trenches located within State Highway Administration right-of-ways, and shall be used only when specified in the Contract Documents or approved by the Commission. Records of each placement shall be maintained as specified herein.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250

2. Boring and/or Jacking Pipe: Section 02300

3. Tunneling: Section 02400

C. Quality Assurance

The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for Flowable Fly Ash fill.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Portland Cement

Portland cement shall conform to ASTM M 85, with the fineness and time of setting determined in conformance with ASTM T 153 and ASTM T 131 respectively.

2. Fly Ash

Fly Ash shall be Class F as defined by ASTM Specifications C-618 but with no limits on chemical or physical requirements except that it must be relatively free of calcium oxide when minimum strength is required.

3. Water

Water shall be potable.

4. Admixtures

   a. Admixtures shall be as described in ASTM C-494.

   b. Admixtures included in the mixture for the purpose of affecting setting and strength characteristics shall be permitted provided they have no adverse effects on strength development nor adverse effects on any equipment which the mixture may encapsulate, i.e., pipes, valves, conduit, etc.

5. Fillers

   Fillers, if required, shall be natural aggregates with a maximum size not to exceed 3/4 inch and may include sands. Bottom ash shall not be used as filler.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Flowable Fly Ash Mixes

1. Fly Ash shall be proportioned on the basis of its dry weight. When wet fly ash is used in the batch, the moisture content shall be measured by ASTM Test Method C-566 and the mix water shall be adjusted accordingly. Moisture in the stockpile shall be determined at intervals sufficient to ensure accurate proportioning. Fly Ash shall be measured into the mix by weight or by an approved volumetric device.

2. Cementitious material shall be included in the mix in an amount sufficient to yield strength adequate for the specific application. The cementitious material shall be measured by weight or by an approved volumetric device.

3. Aggregate, when included in the mix, shall be proportioned by dry weight or by an approved volumetric device. Moisture content shall be determined by ASTM Test Method C-566.

4. Requirements for consistency shall generally control the amount of water in the mix. Total water shall be the water included with the fly ash and aggregate plus added water. Unless otherwise noted, the percentage of water in the mix shall be expressed as a percentage of the total batch weight. Measurement of water may be by weight or volume.

5. Record of the material placed in each delivery shall be submitted to the Commission. For each mix design, the record shall include strength data, type of additives, unit weight, consistency and total water.

6. No material which will decompose and allow subsidence shall be permitted as a constituent part of the mix.

7. The self leveling consistency of the flowable fly ash mixture shall have a flow less than 140 seconds when tested in accordance with Corps of Engineers Test Method CRD-C611.

8. Strength

   a. Flowable Fly Ash fill for use in tunnels and sleeves shall meet a 120 day design compressive strength of 50 psi.

   b. Flowable Fly Ash fill for use in trenches within state right-of-ways shall meet a 28 day design compressive strength of 100 psi.

   c. Strength development within 3 days of placing shall be measured in place with a penetrometer of the type described in ASTM Test Method C-403. Minimum strength before paving over the stabilized flowable fly ash with a wearing surface shall be 50 psi as measured by the penetrometer.

   d. Mixtures not within State right-of-way must retain workability. They must be diggable with hand tools.

B. Mixing

1. Stabilized flowable fly ash may be mixed by ready mix truck, or other acceptable equipment or methods.

2. After water has been added to the fly ash, mixing shall be continuous until placement to prevent premature settling.

3. At air temperatures below 40° F (10° C), mix water should be heated to above 140° F (60° C). Temperature of the delivered material shall be between 50 and 90° F (10° - 32° C).

C. Placement

1. Stabilized flowable fly ash shall be placed in the excavation directly from the mixer wherever possible. When pumps or conveyors are needed for placement, premature settling shall be avoided by minimizing the time in which there is no agitation.

2. Self-leveling mixes will ordinarily require no shoveling, raking, or brooming to place.

3. When stabilized flowable fly ash is placed in trenches with appreciable slope at the surface, removable dams shall be inserted at appropriate intervals in order to equalize the depth of material placed.

4. Stabilized flowable fly ash shall be protected from freezing for 24 hours after placement.

5. Flowable Fly Ash fill shall cure for a twenty-four (24) hour period (min.) prior to receiving a bituminous concrete surface.

6. Flowable Fly Ash fill shall only be placed to the limits noted on the Standard Details and Contract Documents.

4.0 METHOD OF MEASUREMENT

A. Except when used as a contingent item or noted otherwise, measurement for flowable fly ash fill will not be made, as it will be included in the appropriate unit cost bid for the installation of pipe lines and/or filling of tunnels or sleeves.

B. When used as a contingent item or noted otherwise, measurement for furnishing and installing flowable fly ash fill will be made on the basis of the volume of material accepted and satisfactorily placed to the lines, grades, and dimensions shown on the Standard Details, noted in the Contract Documents, or as directed by the Commission.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for flowable fly ash fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.

3. Payment will be made for contingent items when approved by the Commission.

B. Flowable Fly Ash

1. Payment for furnishing and installing flowable fly ash fill complete and in place will be made at the contingent prices established in the bid proposal. The price shall include all labor, material, equipment, necessary traffic control, and incidental items to complete the excavation and placement.

2. Payment for removal of unacceptable foundation material will be made under the pertinent contingent item.

3. Payment will not be made for any flowable fly ash fill which is used because of any error in the Contractor’s operations, such as excavating beyond specified lines or grades, etc.

****END OF SECTION 03500****

SECTION 04100
MORTAR

1.0 GENERAL

A. Description

Mortar shall include, but not necessarily be limited to, furnishing site mixed mortar for masonry, pipe connections, grouting, and other uses as specified in the Contract Documents or as directed by the Commission.

B. Related Work Included Elsewhere

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Water Valves and Appurtenances: Section 02552
3. Water Services, Water Meter Settings, and Vaults: Section 02553
4. Sanitary Sewer Manholes: Section 02562
5. Brick Masonry: Section 04200

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

1. The Commission will not furnish any materials for mortar.
2. The Contractor may purchase water from the Commission's potable water system in accordance with the current Commission policies and procedures.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Water shall be potable.
2. Portland Cement

   Portland cement shall meet the requirements of AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

3. Mortar Sand

Mortar sand shall meet the requirements of AASHTO M 45 deleting the requirements for fineness modules and deleterious substances.

4. Hydrated Lime for Masonry

Hydrated lime for masonry shall meet the chemical requirements of ASTM C 207, Type N.

5. Admixture

Only as approved by the Commission.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Mix Requirements

1. Mortar for Masonry

Mortar used for masonry shall be composed in accordance with one of the following:

a. One part Portland cement, or masonry cement, two parts mortar sand by dry loose volume, and hydrated lime not to exceed 20% of the cement by weight.

b. Pointing of masonry after the masonry has been laid shall not be permitted without the approval of the Commission. The mortar used for pointing of masonry shall be composed of one part Portland cement, one part mortar sand by dry loose volume, and hydrated lime not to exceed 20% of the cement by weight.

2. Mortar for Grout

Mortar used for grouting anchor bolts, pipe handrail posts and miscellaneous items shall be composed in accordance with one of the following:

a. One part Portland cement and one part mortar sand by dry loose volume.

b. An epoxy or polyester anchoring system may be used as approved by the Commission and in accordance with the manufacturer's recommendations. Strength values shall be as indicated in the Contract Documents.

c. Nonshrink grout shall be used when specified. The grout shall have a minimum compressive strength of 5,000 psi in seven (7) days when

tested with AASHTO T 106 except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven (7) days when tested in accordance with AASHTO T-160.

B. Mixing

1. Mortar may be mixed in an approved mixing machine or manually in a tight box. The dry materials shall be mixed until the mixture assumes a uniform color. Water shall be added as the mixing continues until the proper consistency has been attained for the intended use.

2. Mortar shall be mixed only in quantities that satisfy immediate use. Retempering of mortar shall not be permitted.

4.0 METHOD OF PAYMENT

Mortar will not be measured.

5.0 BASIS OF PAYMENT

Mortar will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 04100****

SECTION 04200
BRICK MASONRY

1.0 GENERAL

A. Description

Brick masonry shall include, but not necessarily be limited to, furnishing and installing brick masonry above and below grade to the sizes and shapes and at the locations indicated in accordance with the Contract Documents or as directed by the Commission.

B. Related Work Included Elsewhere

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Boring and/or Jacking Pipe: Section 02300
3. Tunneling: Section 02400
4. Water Valves and Appurtenances: Section 02552
5. Water Services, Water Meter Settings, and Vaults: Section 02553
6. Fire Hydrants: Section 02554
7. Sanitary Sewer Manholes: Section 02562

C. Quality Assurance

The Commission will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the Commission

The Commission will not furnish any materials for brick masonry.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Sewer brick shall be grade SM, have dimensions not exceeding 2-1/4" x 3-3/4" x 8", and meet the requirements of ASTM Designation C32. The bricks shall have a fine-grained uniform, and dense structure, free from lumps of lime, laminations, cracks, checks, soluble salts or other defects which may in any way impair their strength, durability, appearance, or usefulness for the purpose intended. Bricks shall emit a clear, metallic ring when struck with a hammer.
2. Mortar shall be as specified in Section 04100.

D. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Environmental Requirements

1. General

a. Cover completed work each day to prevent rain or melting snow from penetrating the mortar of upper courses. Do not uncover until immediately before new work is to be laid. Protect new masonry for a period of not less than 72 hours immediately following laying. This time period may be extended by the Commission.

b. Spray masonry laid during the period from April to November, inclusive, with sufficient water so as to be moist, but not saturated with water just prior to use.

2. Cold Weather Protection

a. No brick masonry work or pointing shall be done when there is frost in the brick or when the air temperature is below 40°F, unless the Contractor has on the project ready to use, if and when directed, suitable housing, covering, tarpaulins, etc. and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 40°F.

b. Protect work by heating and maintaining the temperature of the masonry materials at not less than 40°F but not more than 160°F and maintaining an air temperature above 40°F on both sides of the masonry for not less than 72 hours. Work will not be permitted with or on frozen materials. When the temperature reaches or is above 40°F proceed as under warm weather conditions.

3. Hot Weather Protection

a. During hot weather, protect masonry from direct rays of sun. Cover, and/or wet all finished work for a period of 7 days after laying.

b. Do not erect masonry when the ambient air is warmer than 99°F in the shade and has a relative humidity of less than 40% unless the work is prevented from drying out for not less than 48 hours after having been installed.

B. General

1. Keep joints equal to the difference between the actual and nominal dimensions of the unit being installed.

2. Toothing of new work into existing work will not be permitted.

C. Preparation

1. Clean dirt, debris, oil, grease, and other foreign substances which would affect bond of mortar, from all surfaces to receive mortar.

2. Lay out brickwork to establish accurate spacing of bond pattern, to ensure uniform joint widths, and to locate openings, returns, and offsets. Arrange units in a manner which will result in few or no units to be cut.

3. Wetting Bricks

a. Brick having absorption rates in excess of 0.025 ounces per square inch per minute, when tested in accordance with ASTM C 67 shall be wetted, so that the rate of absorption does not exceed that rate.

b. Wetting methods shall ensure that each brick, immediately before being installed, is nearly saturated but brick surfaces are dry.

D. Erection

1. Workmanship

a. All brickwork shall be laid by competent masons and any workman not deemed to be such by the Commission shall be removed from the work at once.

b. Lay masonry plumb, true to line, with level and accurately spaced courses. Joints shall be not less than three-eighths (3/8) inch or more than one-half (1/2) inch wide.

c. Build in wood blocking, strips, grounds, wedges, pipe sleeves, frames, and similar items of material necessary to properly secure the work for other trades.

d. Remove mortar which has splashed or been smeared on finished surfaces with stiff bristle brushes as the work progresses.

e. Special care shall be taken in laying brick in inverts of manholes, transition sections, junction chambers, brick wyes and similar structures to insure a uniform flow of water through the sections. In such locations joints shall not exceed three-sixteenths (3/16) inch thickness and each brick shall be laid in full mortar joints on bottom side and end performed in one operation; no grouting or working in of mortar after laying the brick will be permitted.

2. Parging

a. Parge exterior masonry in contact with the earth with two coats of Portland cement mortar, each 3/8 inch thick. The first coat shall be cross-scratched; the second coat shall be troweled smooth, beveled at the top, and coved out at the edge of the footing. Extend parging not more than 4 inches above grade, unless otherwise, and keep damp for at least 3 days.

b. Parging the interior surfaces of a manhole is not permitted without prior Commission approval.

3. Brick

a. Lay brick work in common bond. Fill all joints between bricks completely with mortar.

Form bed joints with a thick layer of mortar, which shall be smoothed. The practice of buttering at the corners of brick and then throwing mortar or scrappings into the empty joints will not be permitted. Lay closure brick with a bed joint and with head joints. Place the brick carefully without disturbing the joints. Place the brick carefully without disturbing the brick previously laid. Properly bond each course. Dry or butt joints will not be permitted. Provide grouting where indicated.

b. Use sewer brick whenever brick construction is exposed to sewage flow. Lay sewer brick on edge so that the 2-1/4 by 8 inch side is exposed to the flow.

c. Channel configurations shall be constructed as per the Standard Details.

d. All manhole frame and cover adjustment brick work will be installed in a flat radial pattern.

4.0 METHOD OF MEASUREMENT

Unit masonry will not be measured.

5.0 BASIS OF PAYMENT

Unit masonry will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 04200****

SECTION 05500
MISCELLANEOUS METALS

1.0 GENERAL

A. Description

Miscellaneous metals shall include, but not necessarily be limited to, furnishing and installing anchors, fasteners, hardware, castings, utility specialties, and other miscellaneous metal items in accordance with the Contract Documents or as directed by the Commission.

B. Related Work Included Elsewhere

1. Boring and/or Jacking Pipe: Section 02300
2. Tunneling: Section 02400
3. Water Main Installation and Chlorination: Section 02551
4. Water Valves and Appurtenances: Section 02552
5. Water Services, Water Meter Settings, and Vaults: Section 02553
6. Fire Hydrants: Section 02554
7. Sanitary Sewer Manholes: Section 02562

C. Quality Assurance

1. The Commission will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.
2. All miscellaneous metal items and fabrications shall be anchored firm and tight, in true alignment with neat fits, and without distortions, unsightly fastenings, raw edges, or protrusions.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.

B. Materials Furnished by the Commission

The Commission will not furnish any miscellaneous metals.

C. Contractor's Options

None.

D. Detailed Material Requirements

1. Whenever practicable, items shall be standard products, meeting the requirements specified herein, of a manufacturer regularly engaged in production of such items.
2. All fasteners, hangers, or other miscellaneous connections or accessories shall be of the same material or compatible with the item being fastened or hung.
3. Shapes and Bars

a. Mild steel shall conform to requirements of ASTM A 36.

b. Stainless steel shall conform to requirements of ASTM A 276, Type 304.

c. Aluminum shall conform to requirements of ASTM B 221, Alloy 6061-T6.

4. Plate, Sheet, Strip

a. Mild steel shall conform to requirements of ASTM A 36, or A 283, Grade C.

b. High strength steel shall conform to requirements of ASTM A 242.

c. Corrosion resistant steel shall conform to requirements ASTM A 242; 0.25 to 0.75 percent copper.

d. Stainless steel shall conform to requirements of ASTM A 240, Type 304.

e. Aluminum shall conform to requirements of ASTM B 209, Alloy 6061-T6.

5. Mild steel forgings shall conform to requirements of ASTM A 668, Class F.

6. Castings

a. Unless noted otherwise, gray iron shall conform to requirements of ASTM A48, and AASHTO Designation M306, Class 30 B.

b. Malleable iron shall conform to requirements of ASTM A 47, Grade 35018.

c. Ductile iron shall conform to requirements of ASTM A 536, Grade 60-40-18.

d. Nodular iron shall conform to requirements of ASTM A 220, Grade 45008.

e. Steel shall conform to requirements of ASTM A 27, Grade 65-35. The supplementary requirements of ASTM A 27 for tolerances and deviations shall also apply.

f. Chromium alloy-steel castings shall conform to the requirements of ASTM A 743, A 744, and A 297. The grade shall be as specified in the “Special Provisions” for the particular use requirement of the casting.

g. Aluminum shall conform to requirements of ASTM B 108, Alloy ANSI 356.0, T6.

7. Bolts, nuts, washers

a. General

1) Provide galvanized for use with galvanized material.

2) Provide stainless for use with corrosion resistant metals.

b. Stainless

1) Bolts shall conform to requirements of ASTM A 320, Type 316.

2) Nuts shall conform to requirements of ASTM A 194, Grade 8.

3) Washers shall be Type 316.

c. Expansion bolts shall be the metal shield type.

d. Steel drive bolts shall be the split shank type.

e. Headed steel anchors shall be fabricated from cold finished carbon steel conforming to requirements of ASTM A 108.

f. Cast washers, ogee washers and special cast washers shall meet the requirements of ASTM A 47. Cast washers shall be mechanically or hot-dip galvanized. The coating shall meet the thickness, adherence, and quality requirement of ASTM A 153.

g. Bronze bolts, nuts, and washer shall meet the requirements of ASTM B 21, UNS No. C46400.

8. Hardware

Spikes, wood screws, staples, brads, lag screws, carriage bolts, and other parts coming under the general heading of "Hardware" shall be composed of carbon steel and shall meet the requirements of FSS FF-N-105.

9. Checkered safety plate

10. Aluminum shall conform to requirements of ASTM B 221, Alloy 6063, T6.

E. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Fabrication

1. General

a. Fabricate all work true to shape, size and tolerances as indicated in the Contract Documents and on approved Shop Drawings; with straight lines, square corners, or smooth bends; free from twists, kinks, warps, dents, and other imperfections.

b. Thickness of the metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion during shipment, handling, installation, and under severe service conditions. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.

c. Provide sufficient quantity and size of anchors for the proper fastening of the work.

2. Fabricated Products

a. Pipe wall sleeves in concrete construction shall be standard weight, black steel pipe, with anchors welded to exterior, size as required to accommodate passage of conduits, pipes, ducts, and similar items with proper clearance.

b. Hatch Doors

Provide hatch doors that meet the requirements noted in the standard details and/or Contract Documents.

c. Connections

1) Shop connections in weldable materials, not designed for service removal, shall be welded. All welding shall conform to AWS D1.1 requirements.

Grind all exposed welds smooth. Remove weld, brazing, and solder spatter, flux, slag, and oxides from finished surfaces. Use sheet metal lock seams only when indicated on the Plans or approved shop drawings.

2) Complete all provisions for bolted field connections in the shop unless otherwise indicated.

3) Match exposed work to produce continuity of line and design. Fabricate and fasten metal work so that the work will not be distorted, the finish impaired, nor the fasteners overstressed from the expansion and contraction of the metal. Conceal fastenings whenever practicable.

d. Castings and Forgings

1) Fabricate castings and forgings to the sizes and shapes indicated. Castings and forgings shall be uniform quality, true to pattern; strong, tough, of even grain; sound; smooth; without cold sheets, scabs, blisters and sand holes, cracks or other defects. Plugs, filled holes, and welding will not be allowed.

Castings shall be of thickness and configurations shown on the Standard Details. Abrasive blast as required to remove scale and to achieve a uniform smooth clean surface. Paint with asphaltum or coal tar paint meeting requirements of AWWA C 203, where indicated. Provide raised letters where indicated.

2) Valve boxes shall be Class 30B, round head, screw type consisting of snug fitting top, bottom sections, and screw type extension. Lid shall be removable only by lifting straight up from the shaft shoulder.

3) Meter setting fittings, yokes, and appurtenances for 3/4 through 2-inch metered water supplies, and meter pit frames, lids, and covers shall be as specified on the Standard Details.

4) Manhole frames and covers shall be cast from material meeting the requirements of ASTM A48, Class 30B. Weights, configuration, and lettering shall be as shown on the Standard Details.

e. Miscellaneous anchors, strap anchors, clip angles, and plates, hangers, etc., and other items, together with all miscellaneous structural shapes required for construction of the work shown on the Plans, shall be furnished in accordance with the requirements of the Contract Documents.

B. Painting and Coatings

1. Where indicated, shop and/or field paint miscellaneous metal items according to the paint systems specified in the Contract Documents.

2. Galvanized touch up shall be zinc dust coating conforming to requirements of Military Specification P-26915.

3. Bituminous corrosion protection shall conform to requirements of Military Specification C-18480.

4. Coat aluminum accessories and items embedded in concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

C. Delivery, Handling, and Storage

1. Identify, and match mark if applicable, all materials, items, and fabrications; for installation and field assembly.

2. Wherever practicable, deliver items to job site as complete units, ready for installation or erection, with all anchors, hangers, fasteners, and miscellaneous metal items required for installation.

3. Provide adequate storage facilities at the job site for the protection and storage of all delivered materials. Handle and store in such a manner as to not damage factory finishes. The Contractor shall repair damaged finishes at no cost to the Commission.

D. Erection and Installation

1. Erection and installation of miscellaneous metal items shall be in accordance with requirements specified elsewhere in the Contract Documents.

2. Miscellaneous metal items and fabrication shall be installed in their proper locations as Shown or directed and shall be anchored, rigid and secure, plumb and level unless otherwise shown, and in true alignment with related and adjoining work.

3. The Contractor shall provide shims, washers, anchors, and such additional work as necessary to achieve a satisfactory installation.

4.0 METHOD OF MEASUREMENT

Miscellaneous metals will not be measured.

5.0 BASIS OF PAYMENT

Miscellaneous metals will not be paid for as separate items. The materials and their installation are considered incidental to the work required in the construction of specific structures that will be paid for under various items indicated in the Contract Documents. Payment will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

****END OF SECTION 05500****

SECTION 11307
SEWAGEPUMPING UNITS

1.0 GENERAL

A. Description

Sewage Pumping Units shall include but not necessarily be limited to furnishing and installing the sewage pumping units, including basin, (tank), pumps and motors, check valves, and control and alarm panels of the size and type shown on the plans and in accordance with the Contract Documents.

B. Submittals

Shop drawings shall be furnished for review and approval to the Engineer with subsequent review and approval by the Commission for the following items:

1. Pump Selection

   a. In the interest of limiting inventory of pump units and replacement parts, unless special permission is granted to the contrary, only the units shown in the List of Approved Materials and Manufacturers Appendix shall be allowed for use in St. Mary's County.

2. Design Factors

   a. Design factors shall be based on individual pump specifications in relation to expected usage, i.e., single family dwelling, restaurant, etc. All pumps shall be designed following chapter 5 of the design manual.

   b. Provide calculations to support usage.

3. Plans

   a. Plans and specifications shall clearly state the design engineer's choice as to manufacturer, pump size and model number on each application.

   b. Show easements required for access.

A. Related Work Specified Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250

2. Gravity Sanitary Sewer and House Connections: Section 02561

3. Low Pressure Sewer: Section: 02566

4. Sanitary Sewer Force Mains: Section 02563

5. Cast-in-Place Concrete: Section 03300

B. Quality Assurance

1. All pump installations, regardless of maintenance responsibilities, shall be

inspected, with initial start-up, by a Commission Inspector. The sole purpose behind the Commission Inspector inspecting a non-Commission pump is to affix a sign stating owner maintenance responsibility on the pump and to ensure against inflow/infiltration.

2. The pump shall be free from electrical and fire hazards as required in residential and commercial environments.

3. The pump shall meet accepted standards for plumbing equipment for use for residential and commercial environments and shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the pump shall display the seal of NSF International.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents.

B. Sewage Pump Units

1. The Contractor shall furnish new, factory-built sewage pump units consisting of simplex or duplex pump units and all necessary parts and equipment installed in fiberglass basin.

2. For pumps that will be maintained by the Commission, shall be specified in the List of Approved Materials and Manufacturers, depending on the system providing service, are acceptable.

   For pumps that will be maintained by the property owners, the manufacturers shown in the List of Approved Materials and Manufacturers Appendix are acceptable. Other pumps may be allowed by the Chief Engineer if documentation is submitted (and approved by the Commission) from a reputable source (i.e., Engineer, pump manufacturer, etc.) that the desired pump is completely compatible with the existing system. Other pumps will not be serviced by the Commission in the event of an emergency.

3. Operating Conditions:

   a. Operating characteristics as shown on Contract Drawings.

4. Pump Model:

   a. Pump shall be of the centrifugal type with an integrally built in unit and submersible type motor. The unit shall be capable of macerating all material in normal domestic and commercial sewage including reasonable amounts of foreign objects such as small wood, sticks, plastic, thin rubber, sanitary napkins, disposable diapers and the like to a fine slurry that will pass freely through the pump and discharge pipe.

5. Pump Impeller:

a. The pump impeller shall be of the recessed type to provide an open unobstructed passage through the volute for the ground solids. Impeller shall be cast iron and shall be threaded onto stainless steel shaft.

6. Electric Motor:

a. Pump motor shall be of the submersible type rated 2 horsepower at 3450 RPM. Motor shall be for single phase 230 volts. Single phase motors shall be capacitor start, capacitor run. NEMA L type.

b. Stator winding shall be of the open type with Class F insulation good for 155ºC (311ºF) maximum operating temperature. Winding housing shall be filled with a clean high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell. Air-filled motors which do not have the superior heat dissipating capabilities of oil filled motors shall not be considered equal.

c. Motor shall have two heavy-duty ball bearings to support pump shaft and take radial and thrust loads. Ball bearings shall be designed for 50,000 hours B-10 life. Stator shall be pressed into motor housing.

d. Single-phase motors shall have a heat sensor thermostat and overload attached to the top end of the motor winding to stop the motor if the motor winding temperature reaches 200ºF. The high temperature shut-off will cause the pump to cease operation, should a control failure cause the pump to run in a dry wet well. The thermostat shall reset automatically when the motor cools to safe operating temperature.

e. The common motor pump and shaft shall be of #416 stainless steel thread to take pump impeller and impeller.

7. Seals:

a. Motor shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell.

b. Seal face shall be carbon and ceramic and lapped to a flatness of one light band. Optional seal material shall be used when required by the Commission.

c. An electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control box. This signal shall not stop the motor but shall act as a warning only, indicating service is required.

8. Check Valve:

a. The pump discharge shall be equipped with a factory installed, check valve that is built into the discharge pipe. The valve shall be constructed with a cast iron housing and stainless steel interior components. The valve will provide a full-port passageway when open.

9. Working parts shall be made of 316 stainless steel. The valve operation shall provide maximum seating capability, even at very low back pressure. The check valve will provide a full-ported passageway when open.

C. Controls

1. All necessary controls shall be located in the pump control panel.

2. Non-fouling waste water level detection for controlling pump operation shall be accomplished by float switches.

3. To assure reliable operation of the level controls, installation shall be per manufacturer's instructions and St. Mary's County Metropolitan Commission Standard Details.

4. The importance of using only approved electrical materials cannot be over emphasized. Close adherence to the following is mandatory:

   a. The control/power (cable) leading from the control panel to the basin connection box shall be in accordance to Standard Detail for each pump manufacturer. Wiring diagram and color codes shall be strictly enforced by the Commission.

   b. All wires shall be encased 1¼" in conduit and shall be buried at a minimum depth of 24 inches. Conduit protection is required for wires leading down from the control panel and the cable grips exiting the pump basin. All wires shall enter the basin through the factory provided sealing type cord grips. Any holes otherwise drilled shall be cleared and repaired to water tight integrity prior to final approval of the installation.

   c. All wiring shall be installed in compliance with NEC, state and local codes, with electrical inspection by the designated inspection agency for St. Mary's County. The pump test prior to final approval will not be conducted by Commission inspectors until ALL associated wiring has been inspected and approved by the designated inspection agency for St. Mary's County.

   d. The Contractor shall coordinate the order length of control/power cable between the pump location and the control panel. The control/power cable between the pump and the pump control panel shall be one piece with no splices. The maximum length shall not exceed 150'.

D. Pump Control Panel

1. The control panel, which also serves as an alarm device (flashing light), shall be mounted on the dwelling, easily visible from the pump basin and routinely observable by the home occupants or installed on a 4 x 4 vinyl or composite post, mounted to composite or stainless steel cross members with stainless steel hardware. The post will be secured in concrete adjacent to the pump location. The control panel shall be mounted at a height of 36 inches to the bottom of the panel, For control panels that are located away from the pump basin a 10 foot utility easement is required, centered over the electric lines,

2. Each sewer pumping unit shall include a NEMA 4x, UL listed pump control panel suitable for mounting on the exterior of a residential dwelling. The NEMA 4x enclosure shall be manufactured of UV-stabilized thermal plastic. The enclosure shall include a hinged, pad-lockable cover secured dead front (protection from exposed wires), and component knockouts.

3. For each pump, the control panel shall contain one (1) 20 amp dedicated double pole circuit breaker for the power circuit.

4. The control panel shall contain at least, but not be limited to, terminal blocks, integral power bus, push to run feature, and a complete alarm circuit. The visual alarm lamp shall be inside a red fluted lens. The visual alarm shall be mounted to the top of the pump control in such a manner as to maintain NEMA 4x rating.

5. The audio alarm shall be a printed circuit board in conjunction with an 86-Db buzzer with a quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch which is weather proof and mounted on the enclosure.

E. Interior Piping and Fittings

1. All discharge piping and fittings shall be stainless steel or PVC Schedule 80.

Interior Parts/Stainless

a. Float Rack -- Stainless
b. Lifting Chain -- Stainless

F. Warranty

1. The pump manufacturer shall provide parts and labor warranty on the entire sewage pumping unit and accessories, including but not limited to, control panel, electrical parts, pump core, tank basin and cabling and internal piping, valves and appurtenances for a period of 12 months after pump core is placed into service. All service calls during this 12-month period will be deemed necessary as warranty work. Responsibility for installation flaws, either material or workmanship, shall remain with the contractor for a period of eighteen months from date of installation.

2. When the Commission receives a service call request from a customer, they will determine ownership of the unit and repair/maintenance responsibilities to restore the service as soon as possible. If the unit is deemed defective, the Commission will contact the Contractor and arrange for repair or replacement. The repair or replacement must be completed by the Contractor after the notification. The Commission shall not be responsible for any labor, freight, transportation, taxes or any other costs associated with service deemed as warranty work. If the Contractor cannot or will not perform the repair on a timely basis, the Commission will repair the unit and will back charge the Developer or Contractor as per the Public Works Agreement or the Contract Documents. If the pump is not one of the models approved by the commission, the Commission will not provide repairs. The Commission will provide septic pump truck at the Contractor’s expense until repairs are complete.

3. The Contractor shall supply the Commission with the 24-hour telephone number of their representative who will be responding to warranty service calls.

G. Level Sensor

1. Pump alarm operation shall be accomplished by use of floats specifically designed for use in a sewage basin and installed per manufacturer’s instructions. Level detection shall not require any regular maintenance. The control assembly

shall be specifically approved by Underwriters Laboratories. Conventional mercury floats shall be acceptable.

H. Shut-off Valve

1. The pump discharge piping shall be equipped with a factory-installed, full port, stainless steel or Schedule 80 union type manual ball valve with a minimum rated pressure of 150 psi.

2. The valve shall be equipped with a valve key terminating within 8-inches from top of the cover.

I. Anti-Siphon Capability

1. The pump shall be constructed with a positively primed flooded suction configuration.

2. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the design shall provide protection against siphoning. This device will automatically close when the pump is running and open to atmosphere when the pump is off. Use of small-diameter orifices in the discharge piping between the pump and check valve for anti-siphoning purposes is not acceptable.

J. Material Storage Note: Materials shall be stored in order to insure the preservation of their quantity, quality and fitness for Work. The Contractor shall place materials on wooden platforms, or other hard, clean surfaces, not on the ground, and the materials shall be placed under cover when directed by the Owner. Stored materials shall be located in order to facilitate prompt inspection by the Owner. Lawns, grass plots, or other private or public property shall not be used for storage purposes without written permission of the owner or lessee. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored materials.

3.0 EXECUTION

A. Factory Test

1. All components for the sewage pumping unit shall be factory tested and certified.

Certified test results shall be available upon request by the Commission. The Commission reserves the right to inspect such testing procedures with representatives of the pump manufacturer at the manufacturer's facilities and at their expense.

All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings, and cable connections shall be included in this test along with their respective sealing means (grommets, gaskets, etc.).

B. Delivery

1. All pump tanks, including ball valve, disconnects, and watertight penetrations, shall be delivered to the job site 100% complete assembled including testing, ready for installation.

2. The pump basin with pump lift-out rail system is assembled complete at the factory, except for insertion of the core unit (pump and motor) and preparation of the inlet orifice which is completed with a five inch (5") hole saw in the field. In keeping with manufacturer's warranty provisions, the basin must remain in an upright position at all times.

C. Installation Procedure

1. Location of the Installation

a. Prior to excavation, the Contractor shall contact the Commission to schedule the Pre-construction meeting and to establish the pump in-ground location and/or service connection (Tap) location.

b. Unless otherwise stated, the property owner shall be responsible for the installation of the pump and all associated lines necessary to provide service. The property owner shall install at their expense a (comment #60) valve and roadway box at the property line. Maintenance responsibility for all on-site facilities, i.e., upstream of the ball valve, shall be determined by the Commission. Emergency repairs will be provided by the Commission personnel, if requested by the property owner. Emergency repairs will be on an "as available" and a reimbursable basis.

c. Earth excavation and backfill shall be specified in accordance with the Standard Specifications and/or the Specifications and the Drawings to be done as a part of the work under this section, (including any necessary sheeting and bracing). The Contractor shall be responsible for control of groundwater to provide a firm, dry subgrade for the structure and shall guard against flotation or other damage resulting from general water or flooding. The pump stations shall not be set into the excavation until the installation procedures and excavation have been approved by the Commission Inspector.

2. Installation

a. If a sewer service connection is not available, a connection shall be completed at the low pressure sewer main as shown in the Standard Details. The tapping location point shall be located by the Commission Inspector. All discharge piping shall be through a brass (Ford B11-555) in-line ball valve with the 2" x 2" operating nut (Ford QT67), ¼ turn counter-clockwise to open. Use of 90º bends in the discharge line is prohibited. This service valve shall be located by the Commission Inspector.

b. The operating nut shall be accessible via a six inch (6"), screw type, open base (arched), cast iron, roadway valve box with "SEWER" lid. The valve box shall rest on a standard 3 5/8" x 7 5/8" x 15 5/8", solid building block positioned on undisturbed earth.

c. The Contractor shall remove packing material. User's instructions shall be given to the Commission Inspector. Hardware supplied with the unit, if required, shall be used at time of installation. Appropriate inlet piping shall be used. When moving the basin, use of the lifting eyes provided at the lower end of the concrete collar attached to the tank shall be required. The basin may not be dropped, rolled, or laid on its side for any reason.

d. A concrete anti-floatation collar, as shown on the drawings and details and sized according to the Commission Inspector, shall be required and shall be precast to the pump basin. Each pump basin with its precast anti-floatation collar shall have four (4) lifting eyes embedded, equally spaced for setting purposes.

All anti-floatation concrete collars shall be cast-in place integrally with the pump basin above ground in a form, as shown in the Standard Details.

e. The excavation shall be made as shown in the standard details The Contractor shall remove unsuitable soil s where post-installation settling may damage inlet/outlet piping.

. The unit shall be leveled and plumb.

If the basin cover is not properly set at grade or the basin is not plumb, the Commission Inspector will require adjustment prior to final approval.

f. After a firm, level gravel base has been prepared, the unit shall be carefully lowered into the excavation with correct orientation of the discharge fitting. The basin must remain level and setting firm on the gravel base during placement. This requires continuous evacuation (by pump) of any and all ground water which may invade the hole.

g. The contractor shall provide and install pump house connection piping as shown on the manufacturer's instructions and Standard Details.

The pump inlet orifice shall be cut in the basin wall 36 inches from the bottom of the basin, well clear of the rail lift-out system, as shown on the standard detail (comment # 60) and only with a five inch (5") hole saw. Proceed as follows:

1) Lightly sand inlet hole edges.

2) Coat mating surfaces of the inlet fitting and the five inch (5") orifice with silicon sealant; join mating parts and gasket.

3) Chamber end of four inch (4") SCH 40 sewer soil pipe. Lubricate end of pipe and inlet fitting; insert pipe in fitting not to exceed one inch (1") past basin wall. Note: Use of petroleum or solvent based lube is prohibited-damaged to flex-fitting will result.

4) Generously apply silicon caulk over and around where fitting mates with basin wall and 4 inch sewer soil pipe.

h. The pump exterior discharge piping shall be connected to the discharge flanged through a NPT bronze, one way flow valve as shown on the standard details. Proceed as follows:

1) From the check valve, continue to the property line with SCH 80 with solvent weld pressure couplings.

2) If the low pressure sewer service connection at the property line is already installed, connect the pump discharge pipe to the

existing ball valve. Open all in-line ball valves to ensure proper operation when pump is activated.

3) Thrust blocking shall be required on all bends.

Caution – All work, from inlet fitting to sewer main wet tap (when applicable), must be inspected by a Commission Inspector prior to backfill. Failure to comply with this provision will require uncovering all work prior to final project approval.

4) Backfill with wash gravel from top of concrete anti-floatation collar to six inches (6") minimum above pump discharge pipe, then backfill in accordance with the Contract Documents. Improper backfilling may result in damage. Keep in mind that the basin top must be leveled with the surrounding soil surface, which must be then slope away from basin top.

All piping shall be bedded on a firm base of wash gravel and thereafter covered with at least 6 inches (6") of the same material.

Backfill around and in contact with the basin shall be dry, class one, select backfill only, consisting of sand, gravel or a combination thereof. Special care is required to ensure good support under piping connected.

5) Upon completion of backfilling, Contractor shall secure the pump basin lid.

It is extremely important that the finished grade shall slope away from the surface of the unit. Final grade and restoration inspection will be made when the pump is activated.

3. Start Up

a. Activation of the pump by other than Commission personnel is a violation of Chapter 113, Section 21B of the local public laws of Maryland. This provision is for the protection of the pump purchaser. Any damage caused by unauthorized pump start-up will not be covered by the manufacturer's warranty and neither shall the Commission be responsible for any such damage. The Contractor or Purchaser shall contact the Commission Engineering Department when activation and start-up of pump is desired.

b. All restoration shall be the responsibility of the Contractor. Per unit costs for this item shall be included in the Contractor's bid price for the individual pump stations. All properties shall be restored in all respects including, but not limited to, curb and sidewalk replacement, landscaping, topsoil and seeding, and restoration of the traveled ways as directed by the Commission Inspector. See Standard Details.

c. Final Inspection for Start-Up

1) Electrical Inspection: The Electrical and Code inspections shall be approved prior to the Commission inspection.

2) Accessibility: Access must be provided for the Commission Inspector and personnel to perform the Inspection.

3) Commission Inspector and personnel will verify and /or perform the following at a minimum:

a. Check all wiring color code and gauges, and for the two 12 gauge spares. Wiring diagram shall be provided by the Commission.

b. Check to see if wires are pulled in too tightly, the wires shall have six inches of slack on each end. The Commission Inspector will check to see that the spares are continuous through the conduit.

c. Take amp reading.

d. Test alarm.

e. Check location of service cut off valve.

f. Inspect junction box in vault.

g. Run pump through all float cycles with water. (Test Mode).

h. Check for Final Grade.

i. Grading: All sewer appurtenances and structures shall be finish graded in a 10 ft. radius around each item.

j. Erosion Control: All items, finish graded, must be seeded and strawed at a minimum. Soil erosion fabric, (i.e. curlex), is preferred. Where necessary, such as on slopes, silt fence should be used.

k. Markers: 2 X 4 markers must be staked on each side of each item and painted with green reflective paint.

l. .

m. Place lock or seal on the Control Panel.

n. Affix Inspection sticker (owner ship/maintenance responsibility.)

4.0 METHOD OF MEASUREMENT

A. Measurement for Sewage Pumping unit installations will be made of the number of Sewage Pumping units satisfactorily installed as shown on the plans or directed by the Commission.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown as specified in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing Sewage Pumping units shall include the following:

   a. Trench excavation, backfill, compaction and incidental items specified in Section 02250 and elsewhere.

   b. Cast-in-Place concrete, Section 03300.

B. Sewage Pump Units

1. Payment for furnishing and installing Sewage Pumping units, complete, in-place, will be made per each Sewage Pumping unit placed. The price bid shall include all sediment and erosion control, traffic control, excavation, removal and disposal of spoil materials; furnishing and placing cast-in-place concrete, furnishing and placing washed gravel beneath unit and around basin, backfill and compaction, restoration, warranty and for incidental items to complete the installation.

“END OF SECTION 11307”