



Service Authority

WATER and SEWER
UTILITY STANDARDS MANUAL

Originally Adopted April 1994
October 2022 Edition

Introduction

This manual represents the water and sewer system standards as approved by the Board of Directors of the Prince William County Service Authority (Service Authority) in April 1994 and amended in October 1996; October 2008; January 2012; October 2014; February 2017; November 2017; January 2018; July 2019; February 2021 and October 2022. As such, these standards shall be used for all service areas under the jurisdiction of the Service Authority. The Service Authority *Water and Sewer Utility Standards Manual* is designed to fully supplement Section 300, 400 and 500 of the Prince William County *Design and Construction Standards Manual* (DCSM). Please direct comments and inquiries to the Service Authority.

Approved:

Director of Engineering and Planning:

Samer Beidas

Digitally signed by Samer Beidas
DN: DC=org, DC=pwca, OU=Authority, OU=SPITTLE, OU=ENG, CN=Samer Beidas,
E=sbeidas@pwca.org
Reason: I agree to specified parts of this document
Location: PWCSA - Spittle
Date: 2022-10-06 12:41:40
Foxit Reader/PDF Version: 9.7.1

Date: 10/06/2022

APPENDIX S: SEWAGE BYPASS PUMPING PLAN TEMPLATE 13

CHAPTER 1: PRINCE WILLIAM COUNTY SERVICE AUTHORITY’S ROLE 1

- 1.1 MISSION, VISION, AND VALUES..... 1
- 1.2 INTRODUCTION 1
 - A. Basis and Intent..... 1
 - B. Limitations/Waivers.....2
 - C. Legal Authority3
 - D. Statement of Policy.....3
 - E. Rates, Rules, and Regulations3
 - F. Terms and Abbreviations4
- 1.3 SERVICE AREAS..... 10
 - A. Current Areas Served by the Service Authority..... 10
 - B. Areas Not Served by the Service Authority 10
- 1.4 THE ENGINEERING & PLANNING DIVISION..... 12
 - A. Planning Department..... 12
 - B. Development Department..... 12
 - C. Project Management Office..... 12
- 1.5 PUBLIC INQUIRIES..... 12
- 1.6 REQUEST TO INITIATE A NEW WATER AND/OR SANITARY SEWER CONNECTION 12
- 1.7 PLAN REVIEW 13
- 1.8 UTILITY PERMIT..... 13
 - A. Utility Permit Fees and Requirements 13
- 1.9 CERTIFICATION 14
 - A. Requesting a new Water and/or Sanitary Sewer Service Connection 14
 - B. New Connection to the Service Authority’s System by New Development..... 15
 - C. New Connection to the Service Authority’s System by Existing Development..... 15
- 1.10 METER AND LATERAL SCHEDULING/INSPECTION 15
 - A. Scheduling Meter Installations and Inspections..... 15
 - B. Final Inspection for Occupancy..... 16
- 1.11 CONSTRUCTION METER ACCOUNT 16
- 1.12 CONSTRUCTION METER INSTALLATION 16

1.13	SUMMARY OF FEES	16
	A. Certification Fees.....	16
	B. Local Facilities Charges	18
	C. Capital Recovery Charge – reserved for future use.....	18
	D. Meter and Meter Installation Fees	19
	E. Sub-Meter Service Fee.....	19
	F. Final Inspection Fees.....	19
	G. Other Fees.....	19
CHAPTER 2: PROJECT ADMINISTRATION		21
2.1	EXTENSION OF PUBLIC FACILITIES	21
	A. Determining Project Scope.....	21
	B. Applicant to Furnish Facilities within the Project Area	21
	C. Public Main Required at the Property Served.....	21
	D. Public Gravity Sewer Required.....	22
	E. Easements for Proposed and Future Extensions	22
	F. Blanket Utility Easements	23
	G. Facility Sizing	23
2.2	OFFSITE FACILITIES	23
2.3	SERVICE TO DEVELOPED PROPERTIES	23
2.4	AGREEMENTS.....	24
	A. Bonding	24
	B. Reduction for Work Completed	24
	C. Acceptance of Facilities	24
2.5	CURRENT PROJECT PLANS REQUIRED	25
2.6	LAND DEVELOPMENT PROCESS.....	25
	A. Plan Review	25
	B. Utility Permit.....	25
	C. Construction Inspections	25
	D. Certification.....	25
	E. Closeout/Bond Release	25
2.7	PRECONSTRUCTION CONFERENCE.....	25
	A. Notification.....	26
	B. Approved Project Plans	26
	C. Protection of Existing and Proposed Utilities	26

D.	Construction Crossings.....	28
E.	Safety	28
F.	Responsible Supervision	28
G.	Protection of New Work	28
H.	Operations within VDOT Right of Way or Private Roadways.....	29
I.	Operations within a Service Authority Facility	29
J.	Progress Meetings	29
2.8	FIELD ENGINEERING	29
2.9	INSPECTION	29
A.	Beneficial Use	29
B.	Partial Beneficial Use	30
C.	Final Inspection for Occupancy.....	32
2.10	PROJECT CLOSEOUT	32
A.	As-built Survey and Record Drawings	32

CHAPTER 3: APPLICATION AND PLAN PREPARATION 33

3.1	PURPOSE	33
3.2	PRINCE WILLIAM COUNTY PLANNING AND LAND USE APPLICATIONS	33
3.3	APPLICATION PROCEDURES	33
A.	Initial submission must include the following:	34
B.	Subsequent Submissions	34
C.	Signature Sets	34
D.	Easement Documents.....	34
E.	Revisions to Approved Project Plans.....	35
3.4	CALCULATION OF PLAN REVIEW FEES	35
A.	Pipeline Projects	35
B.	Pumping and Other Non-linear Facilities	36
3.5	LOCAL REVIEW AUTHORITY.....	36
A.	Water Facilities.....	36
B.	Sanitary Sewer Facilities	36
C.	General Design Requirements.....	37
3.6	DIGITAL DATA.....	37
A.	When Required.....	37
B.	CAD Files	37
3.7	REVIEW PROCESS.....	38

A. Pre-application Conference.....	38
B. Reviews.....	39
C. Conferences During Design.....	39

CHAPTER 4: WATER DISTRIBUTION.....	40
4.1 SCOPE.....	40
A. Intent.....	40
B. Standards.....	40
C. Definitions.....	40
D. Minimum Standards.....	41
4.2 HYDRAULIC REQUIREMENTS.....	41
A. General.....	41
B. Hydraulic Analysis Report.....	41
C. Estimating Water Demand.....	42
D. Flows and Pressures.....	43
E. Main Velocity.....	44
F. Sizing Water Mains.....	44
G. Pipe Friction.....	45
H. Hydraulic Analysis Report Content.....	45
4.3 DESIGN.....	49
A. General.....	49
B. Layout.....	49
C. Water Quality.....	50
4.4 WATER MAIN AND APPURTENANCES.....	51
A. Ductile Iron Pipe.....	51
B. Polyvinyl Chloride (C-900) Pipe.....	52
C. Restraint Calculations.....	53
D. Corrosion Protection.....	53
E. Soil Corrosivity Analysis.....	53
F. Separation and Crossings.....	54
G. Depth of Cover.....	55
H. Casings.....	55
4.5 VALVES.....	56
A. Gate Valves.....	56
B. Butterfly Valves.....	57

	C. Insert Valves and Line Stops	57
	D. Fire Line Valves	57
	E. Tapping Sleeves and Valves.....	58
	F. Valve Locations.....	58
	G. Valve Boxes.....	58
4.6	BLOW-OFFS.....	59
4.7	AIR RELEASE	59
	A. Hydrant Air Release	59
	B. Automatic Air Release	59
	C. Manual Air Release.....	60
4.8	HYDRANTS.....	60
	A. Design Parameters for Hydrants.....	60
	B. Hydrant Locations.....	60
	C. Hydrant Color.....	61
	D. Hydrant Designations.....	61
4.9	FIRE SUPPRESSION	62
	A. General	62
	B. Sprinkler Systems	62
	C. Independent Fire Line Connections	62
4.10	WATER SERVICE CONNECTIONS AND METERS	63
	A. General	63
	B. Water Service Connection	63
	C. Water Service Lines.....	63
	D. Meter Locations and Installations.....	64
	E. Meter Sizing and Types	64
	F. Water Only Uses	67
	G. Sewer Only Meter for Process Water.....	67
	H. Meter Vaults	68
	I. Cross Connection and Backflow	70
4.11	WATER MAIN CONSTRUCTION	70
	A. Existing Conditions	70
	B. Materials.....	71
	C. Storing and Handling of Materials.....	72
	D. Line and Grade Stakes.....	72
	E. Cut Sheets	72

	F. Excavation, Bedding, and Backfill.....	72
	G. Pipe and Fitting Installations.....	73
	H. Fire Hydrant Installations.....	75
	I. Connecting to the Existing Water Main.....	75
4.12	TESTING TO PLACE UTILITIES INTO SERVICE.....	76
	A. Pressure Test.....	76
	B. Bacteriological Test.....	77
4.13	WATER MAIN EASEMENTS.....	77
	A. Easement Widths.....	77
	B. Easement Exclusions and Offsets.....	78
	C. Easement Access.....	78
	D. Overlap with Other Easements.....	79
4.14	WATER MAIN INFORMATION REQUIRED IN PROJECT PLANS.....	79
	A. Cover Sheet.....	79
	B. Plan View.....	79
	C. Profile View.....	81
	D. PWCSA Information Sheet.....	82
	E. Unit Price Sheet.....	82

CHAPTER 5: SANITARY SEWER COLLECTION SYSTEMS..... 83

5.1	SCOPE.....	83
	A. Intent.....	83
	B. Standards.....	83
	C. Definitions.....	83
	D. Minimum Standards.....	84
5.2	SANITARY SEWER STUDIES.....	84
	A. Sanitary Sewer Study Parameters.....	84
	B. Sanitary Sewer Study Format.....	84
5.3	GRAVITY SEWER HYDRAULIC DESIGN CRITERIA.....	86
	A. General.....	86
	B. Estimating Tributary Flows.....	86
	C. Main Velocity.....	88
	D. Sizing Sanitary Sewer Mains.....	88
	E. Roughness Coefficient.....	88
	F. Hydraulic Calculations.....	88

5.4	DESIGN.....	90
	A. General	90
	B. Slope	90
	C. Layout	91
	D. Extensions and Access.....	91
	E. Soil Corrosivity Analysis.....	91
5.5	GRAVITY SANITARY SEWER MAINS AND APPURTENANCES.....	92
	A. General	92
	B. Polyvinyl Chloride (C-900) Pipe	92
	C. Ductile Iron Pipe	92
	D. Restraint	93
	E. Corrosion Protection	93
	F. Separations and Crossings	94
	G. Aerial Gravity Sanitary Sewer Crossings.....	95
	H. Depth of Cover.....	96
	I. Casings.....	96
5.6	SANITARY SEWER MANHOLES.....	97
	A. General	97
	B. Design.....	97
	C. Manhole Locations	97
	D. Manhole Frames and Covers.....	98
	E. Manhole Connections	98
	F. Manhole Linings for Force Mains.....	99
5.7	SANITARY SEWER LATERAL CONNECTIONS	99
	A. Materials.....	99
	B. Design.....	99
	C. Sanitary Sewer Connections with Private Wells	100
5.8	LOW PRESSURE FORCE MAINS.....	100
	A. General	100
	B. Grinder Pumps	100
	C. Design	101
	D. Connections to An Existing LPFM System.....	102
	E. Sizes, Pipe Materials, and Fittings	102
	F. Separation and Crossings	103
	G. Depth of Cover.....	103

	H. Casings.....	103
	I. Valves.....	103
	J. Flushing Stations.....	103
	K. Air/Vacuum Release Valves	104
	L. Discharge to a Manhole	104
	M. Enclosures	104
	N. Tracer Wire, Test Stations, and Detectable Warning Tape.....	105
5.9	PRE-TREATMENT & SEPARATORS	106
	A. Pre-treatment	106
	B. Industrial User Survey.....	106
	C. Grease Traps, Interceptors, and Automatic Grease Removal Devices.....	107
	D. Separators.....	107
5.10	FORCE MAIN.....	108
	A. General	108
	B. Design	108
	C. Connections	108
	D. Sizes, Pipe Materials, and Fittings	108
	E. Restraint Calculations	108
	F. Corrosion Protection	109
	G. Separation and Crossings	109
	H. Depth of Cover.....	109
	I. Casings.....	109
	J. Valves.....	109
	K. Air/Vacuum Release Valves	110
5.11	EXISTING UTILITIES, UTILITY RELOCATIONS, & REDEVELOPMENT	110
	A. Abandonment.....	110
	B. Removal.....	111
	C. Private Sanitary Sewer Systems	111
5.12	SANITARY SEWER CONSTRUCTION	111
	A. Existing Conditions	111
	B. Materials.....	112
	C. Storing and Handling of Materials.....	113
	D. Line and Grade Stakes.....	113
	E. Cut Sheets	113
	F. Excavation, Bedding, and Backfill.....	113

	G. Pipe and Fitting Installations	114
	H. Manholes, Frames and Covers	115
	I. Pipe Connections at Manholes	116
	J. Service Connections	117
	K. Cleanouts	117
5.13	ACCEPTANCE TESTS.....	117
	A. General	117
	B. Air Testing Procedure for Sanitary Sewer Mains	118
	C. Manhole Vacuum Testing.....	118
	D. Force Main Testing.....	118
	E. Private Sanitary Sewer Mains.....	118
5.14	SEWAGE BYPASS PUMPING REQUIREMENTS	119
	A. General	119
	B. Required Submittals.....	119
	C. Flow Control	119
	D. Bypass Pumping Plans	120
	E. Monitoring and Equipment.....	121
	F. Required Notifications	121
	G. Emergency Response Requirements	121
5.15	SANITARY SEWER MAIN EASEMENTS	122
	A. General	122
	B. Easement Widths.....	123
	C. Easement Exclusions and Offsets.....	123
	D. Easement Access.....	124
	E. Overlap with Other Easements.....	124
5.16	SANITARY SEWER INFORMATION REQUIRED IN PROJECT PLANS.....	124
	A. Cover Sheet	125
	B. Plan View	125
	C. Profile View.....	126
	D. PWCSA Information Sheet	127
	E. Landscape Sheets	128
	F. Unit Price Sheet.....	128

CHAPTER 6: SEWAGE PUMPING STATIONS129

6.1	SCOPE.....	129
	A. Intent	129
	B. Review and Approval.....	129
	C. Regulations.....	129
6.2	REFERENCE STANDARDS	129
6.3	SUGGESTED REFERENCES	130
6.4	REQUIRED MEETINGS	130
6.5	GENERAL REQUIREMENTS.....	131
	A. Location	131
	B. Alarm Systems.....	131
	C. Instructions and Equipment	131
	D. Sump Pumps.....	133
	E. Protective Coatings.....	133
6.6	PUMP STATION SELECTION CRITERIA.....	134
	A. Design Flow	134
	B. Design Limitations	134
6.7	DESIGN CRITERIA FOR PUMP STATIONS.....	136
	A. Pump Selection.....	136
	B. Protection Against Clogging.....	136
	C. Wet Well	137
	D. Storage.....	137
	E. Surge Analysis	137
	F. Valves and Piping	137
	G. Lighting.....	138
	H. Flow Measurement.....	138
	I. Controls	138
	J. SCADA Field-wired Circuits.....	138
	K. Ventilation	139
	L. Water Supply	139
	M. Structures	140
	N. Odor Control.....	140
	O. Noise Control.....	140
	P. Control Building	140
	Q. HVAC.....	141
	R. Pump Starter	141

S. Reliability.....	141
T. Pump Station Power System Design	142
U. Electrical Equipment Type	142
V. Electrical Equipment Location.....	143
W. Controlled Overflow Diversion.....	144
X. Access and Security	144
6.8 TESTING, ACCEPTANCE, AND WARRANTIES FOR SEWAGE PUMPING STATIONS.....	145
A. Pre-Testing, Start-Up, and Beneficial Use Inspections of Sewage Pumping Stations 145	
B. Five (5)-Day Acceptance Testing of Sewage Pumping Stations	146
C. Final Acceptance & Project Closeout.....	147
D. Sewage Pumping Station Warranty.....	148
6.9 SPARE PARTS, SUPPLIES AND SPECIAL TOOLS	148
APPENDIX A: LIST OF WATER DISTRIBUTION SYSTEM DETAILS.....	150
APPENDIX B: LIST OF SEWER COLLECTION SYSTEM DETAILS	153
APPENDIX C: USM APPROVED PRODUCTS LIST.....	156
APPENDIX D: APPROVED EQUIPMENT MANUFACTURERS.....	157
APPENDIX E: PARTIAL/FULL BENEFICIAL USE DEVELOPER REQUEST TEMPLATE	158
APPENDIX F: USM WAIVER FORM	159
APPENDIX G: COMMUNITY NOTIFICATION & OUTREACH FOR DEVELOPMENT AND SERVICE AUTHORITY PROJECTS CREATING IMPACTS TO EXISTING COMMUNITIES ...	160
APPENDIX H: SERVICE AUTHORITY CUSTOMER HANDBOOK/ DEVELOPER FEES	161
APPENDIX I: SERVICE CONNECTION POLICY.....	162
APPENDIX J: LOW PRESSURE FORCE MAIN AND GRINDER PUMP POLICY	163
APPENDIX K: RESERVED FOR FUTURE USE.....	164
APPENDIX L: DEED OF EASEMENT TEMPLATE	165
APPENDIX M: OFF-SITE EASEMENT ACQUISITION POLICY	166

APPENDIX N: PRE-CONSTRUCTION PACKET167

APPENDIX O: NEW CONSTRUCTION METER & FINAL INSPECTION GUIDELINES..... 168

APPENDIX P: SUB-METER POLICY 169

APPENDIX Q: FACILITIES ACCESS AGREEMENT170

**APPENDIX R: DEVELOPMENT REVIEW PROCESS AND SYSTEM IMPROVEMENT POLICY
..... 171**

APPENDIX S: SEWAGE BYPASS PUMPING PLAN TEMPLATE

Chapter 1: Prince William County Service Authority's Role

1.1 Mission, Vision, and Values

The Prince William County Service Authority's (Service Authority) mission, vision, and values were established by the Service Authority's Board of Directors (BOD) and are deployed to every member of the workforce. Our mission, vision and values are:

Mission: Prince William County Service Authority protects public health and the environment by reliably providing clean, safe and dependable water and wastewater reclamation services to our community

Vision: The Prince William County Service Authority is a trusted public steward and nationally recognized model for performance excellence. We reflect the diverse and vibrant community we serve and nurture diversity, equity and inclusion in relationships with our community, customers, businesses and industry colleagues. We create value for our community through our Areas of Excellence.

Values: Our core competency is a High Performing Culture of Excellence, which is reflected in the following strengths:

- Safety Always
- Customer-First Focus
- Integrity
- Respect and Inclusion
- Excellence
- Ownership

It is our expectation that everyone we engage in business with, follow these same values (behaviors) to ensure we have a common approach that is successful.

1.2 Introduction

A. Basis and Intent

By action dated March 9, 2017, the Service Authority's Board of Directors (BOD) has adopted this edition of the *Utility Standards Manual* (USM or Manual), which provides standards for the design and construction of water and sanitary sewer infrastructure within the utility's Service Areas (*see Chapter 1, Section 1.3*). This Manual is amended and updated from time to time, subject to the approval of the Service Authority's General Manager (GM), without formal action of the BOD. The Service Authority reserves the right to amend or modify this publication without notice, and to interpret the meaning and requirements of all statements made herein.

This Manual documents the accepted practices, policies, standards, and procedures required to design and construct extensions to water mains, sanitary sewers, and minor sewage pumping stations (up to one (1) Million Gallons per Day (MGD), Average Daily Flow (ADF)) to be owned and operated by the Service Authority for projects serving the

following stakeholders:

1. Applicants applying for service shall use the USM for guidance to prepare Project Plans and specifications and for information to work through the administrative procedures that support their projects.
2. Service Authority staff shall use the USM for reviewing Project Plans and inspecting water and sanitary sewer installations.
3. Service Authority staff shall use the USM for the design and construction of Service Authority Capital Improvement Projects as applicable.

Chapters and Appendices in the Manual are read and interpreted together with the Development Review Process and System Improvement Policy to produce optimum designs. For example, *Chapter 4: Water Distribution* and *Chapter 5: Sanitary Sewer Collection*, the Applicant shall use these chapters for all designs and the descriptions of installations and assemblies depicted in *Appendix A: List of Water Distribution System Details*, *Appendix B: List of Sewer Collection System Details*, *Appendix D: Approved Equipment Manufacturers*, and *Appendix C: USM Approved Products List*.

B. Limitations/Waivers

1. All designs must comply with the requirements of all applicable regulatory agencies including, but not limited to:
 - Virginia Department of Health (VDH)
 - Virginia Department of Environmental Quality (VADEQ)
 - Virginia Department of Transportation (VDOT)
 - Prince William County Design and Construction Standards Manual (DCSM)

Where conflicts exist, the more stringent requirement shall apply. Nothing herein is deemed to waive or modify other requirements of existing regulations and law. Applicants are encouraged to bring conflicts to the attention of the Director of Engineering and Planning (Director).

2. Where the Prince William County Service Authority (PWCSA) or the Applicant believes that project-specific conditions warrant a waiver to or from the provisions of this Manual, the Applicant shall submit a completed USM Waiver Form (refer to *Appendix F*) with applicable exhibits electronically to the Service Authority Engineer who is reviewing the plans. USM Waivers are not for policies or standards of a general nature but are for a non-recurring and exceptional nature. A proposed USM Waiver shall incorporate approved engineering design practices before being considered reasonable by the Director or designee. Approval of a USM Waiver is not guaranteed. The Director or designee shall consider the USM Waiver request through the Project Plan review process. The Director or designee shall render a decision, in most cases, within 30 days of receipt of the USM Waiver request. In general, USM Waiver requests are not considered if they result in a negative impact to the Service Authority, such as accepting substandard infrastructure or design. Financial hardship and inconvenience are not acceptable justifications for a USM Waiver.
3. Due to the wide variety of situations that arise, it is impossible to address all scenarios. Exceptional measures required to address project-specific conditions are

addressed on a case-by-case basis. Many criteria listed are minimums. The Service Authority reserves the right to exercise engineering judgment and will make the final determination as to the acceptability of each design and may require additional studies, reports, design justification, etc.

4. Where a conflict occurs between this Manual and Service Authority project-specific contract documents (specifications and drawings) on Service Authority Capital Improvement Projects, the Service Authority project-specific contract documents shall govern. Where the contract for the work has been issued by a Developer, the provisions of this Manual shall govern.
5. The policies, procedures, standards, and regulations that are identified and included in this Manual as an Appendix, or incorporated by reference, are the latest version in effect at the time of publication.
6. The Development Department will provide a written approval letter for all Project Plan approvals.

C. Legal Authority

The Service Authority was created by a resolution of the Prince William Board of County Supervisors (BOCS) on January 11, 1983. The Service Authority is chartered by the State Corporation Commission and is an independent public body responsible for providing a comprehensive county-wide water and sanitary sewer system within the unincorporated areas of Prince William County (*see Chapter 1, Section 1.3*), excluding Dale City. The Service Authority's BOD has eight (8) members appointed by the BOCS. The management of the Service Authority is vested in the BOD by the BOCS. The Service Authority's BOD appoints the General Manager (GM), who is responsible for the daily management of the Service Authority.

D. Statement of Policy

The GM is responsible for the authority and administration of the USM and other related policies, procedures, standards, and regulations. The GM may delegate the administration of these documents to the Director. Designs of service connections and local mains must conform to principles established in this Manual or as directed. These include, but are not limited to, the following companion documents:

- Service Authority Customer Handbook
- Service Connection Policy
- Development Review Process and System Improvement Policy
- Low Pressure Force Main and Grinder Pump Policy
- Community Notification and Outreach for Development and Service Authority Projects Creating Impacts to Existing Communities Policy

Other related policies, procedures, standards and regulations are used by Applicants to plan for and connect to the Service Authority System, establish the terms of receiving service from the Service Authority, establish all fees and charges for such service, and establish all fees pertaining to the application, permitting, and construction processes discussed in this Manual.

E. Rates, Rules, and Regulations

Applicants are subject to all Rates, Fees, Rules, and Regulations based on the types of services that are certified by the Service Authority. How services are configured and how many Equivalent Residential Units (ERU) are purchased determine how an account is eventually billed, so the Applicant will take careful consideration in designing such services. Decisions such as Water-Only accounts versus sub-metered services or ensuring accurate usage estimates are financial considerations that the Applicant will evaluate (refer to *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)* associated with ERU calculations).

It is the responsibility of the Applicant to make all service connections and system extensions/upgrades, both on-site and off-site, to the water and sanitary sewer systems necessary to develop a property in accordance with Service Authority policies (refer to *Appendix R: Development Review Process and System Improvement Policy* and *Appendix I: Service Connection Policy*). The Service Authority has final approval for layout, alignment and connection points.

F. Terms and Abbreviations

Table 1-1: Terms and Abbreviations	
AASHTO	American Association of State Highway and Transportation Officials
Acceptance	Service Authority completion of a review of a plan or study. Acceptance does not constitute approval of the study or the proposed development project nor does it guarantee water and sewer capacity or availability
ACI	American Concrete Institute
ADF	Average Daily Flow
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
Applicant	Applicant shall mean that person or persons (property owner, developer, designated agent, Engineer, etc.) applying for water and/or sanitary sewer service
ASCE	American Society of Civil Engineers
ASSETS	Service Authority owned property (real property, buildings, all associated water and sanitary sewer facilities, etc.)
ASTM	ASTM International (formerly the American Society for Testing and Materials)
AWWA	American Water Works Association
BOCS	Prince William Board of County Supervisors
BOD	Service Authority Board of Directors

Chapter 1: Prince William County Service Authority's Role

Bypass Pumping	Bypass pumping shall consist of pumping arrangements used to bypass the gravity sanitary sewer flow in order to perform work on the gravity sanitary sewer system
By-Right Development Project	A development project in which a property is developed in accordance with its current zoning designation within Prince William County or a Town
CAD	Computer-Aided Design
CCTV	Closed-circuit Television
CD	Compact disc
Certification	A written authorization to establish service and physically connect a new location to the Service Authority's System
CIP	Capital Improvement Projects
Conditional By-Right Development Project	A development project in which a property is developed in accordance with a change in its zoning designation within Prince William County or a Town
Construction Improvements	The entire construction or the various separately identifiable parts thereof required to be provided by the Applicant to complete the requirement of the approved Project Plans
CTC	Certificate to Construct
CTO	Certificate to Operate
DCSM	Prince William County <i>Design and Construction Standards Manual</i>
Development Manager	Manager of the Development Department for the Service Authority
DIP	Ductile iron pipe
DIPRA	Ductile Iron Pipe Research Association
Director	Director of Engineering and Planning for the Service Authority
Easements	Requisite Property Access Rights
Engineer	The Virginia-licensed Professional Engineer or Surveyor responsible for the Project Plans and specifications
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Units
Facility	Infrastructure (buildings, water and sanitary sewer assets, etc.) owned and operated by the Service Authority

Chapter 1: Prince William County Service Authority's Role

Field Inspector	Inspector assigned by the Service Authority Inspections Manager to inspect and approve construction activities for compliance with the approved Project Plans and <i>Utility Standards Manual</i>
Field Services	Field Services Department of the Service Authority
Fire Marshal	Prince William County Fire Marshal's Office
fps	Feet per second
ft	Foot, feet
General Manager (GM)	General Manager of the Service Authority
GIS	Geographic Information Systems
gpd	Gallons per day
GPIN	Grid Parcel Identification Number
gpm	Gallons per minute
GPM	Gallons per Month
Hg	Inches of mercury
hp	Horsepower
HVAC	Heating, ventilation, and air conditioning
IBC	International Building Code
in.	Inch
Inspections Manager	Manager of the Inspections Section for the Service Authority
Land Use Entitlement	Requests submitted to Prince William County's Planning and Zoning Office or the appropriate Town agency by Applicants to change, modify or amend current zoning designations or development requirements for parcel(s) of land for the specific purpose of developing those parcels
LED	Light-emitting diode
LFC	Local Facilities Charge
Low Pressure Force Main (LPFM)	A pressurized sanitary sewer line serving multiple grinder pump connections that does not double as a discharge force main from a centralized sewage pumping station
LUP	Land Use Permit
mADC	Milliamperes direct current
Manual (USM)	Service Authority's Utility Standards Manual
mg/L	Milligrams per liter
MGD	Million gallons per day
USIO	Utility System Improvement Opportunity (formerly Master Plan Utility Adjustment)

Chapter 1: Prince William County Service Authority's Role

NACE	National Association of Corrosion Engineers
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
No.	Number
OSHA	Occupational Safety and Health Administration
PDF	Portable document format
Performance Standards	The Service Authority's System Performance Standards criteria include water quality (0.5 mg/l minimum chlorine residual, looping, and minimizing dead-ends), water pressure (30 psi or greater at the main), water quantity (maximum day demand and fire flow), while maximizing system effectiveness, efficiency, maintainability, operational costs and customer satisfaction
PEX	Cross-linked Polyethylene
Planning Manager	Manager of the Planning Department for the Service Authority
PLC	Programmable logic controller
Polywrap	High-density, cross-laminated polyethylene tube wrap
ppm	Part per million
Products Committee	Committee composed of Service Authority Engineering & Planning and Operations & Maintenance staff members that reviews and approves materials and products to be used in water and sanitary sewer applications.
Project Engineer	Project Engineer for the Development Department of the Service Authority
Project Manager	Project Manager for the Capital Improvement Department of the Service Authority
Project Plans	Project Plans shall mean a set of plans used for site development containing the necessary information to extend utilities and provide water and/or sanitary sewer service sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia.
psi	Pounds per square inch
PVC	Polyvinyl chloride

Chapter 1: Prince William County Service Authority's Role

PWC	Prince William County
SCADA	Supervisory control and data acquisition
SCADA Manager	Senior SCADA Program Manager for the Service Authority
SCAT	Sewage Collection and Treatment Regulations per Virginia Administrative Code, Title 9, Agency 25, Chapter 790 (9VAC25-790).
Service Authority	Prince William County Service Authority (PWCSA)
Service Authority System	The Service Authority utility system includes water and sanitary sewer facilities, water transmission mains, sewer interceptors, collection and distribution lines, storage tanks, and pumping stations
SPS	Sewage Pumping Station
Sub-Meter	A permanently installed meter that may be used for the purpose of eliminating sanitary sewer charges on water consumption that does not enter the sanitary sewer system
System Improvements	Service connection improvements determined by the Service Authority in addition to minimum Performance Standards required for Project Plans in order to increase the hydraulic characteristics of the water or sewer system to serve future anticipated customers, strengthen the utility system, improve reliability and redundancy, and provide better overall customer service. These improvements include but are not limited to: pipeline oversizing, loop closures, multiple feeds, pumping stations, easement dedications for future tanks, control vaults, and pipeline extensions. Improvement projects have generally been previously identified in the County's Comprehensive Plan, Town Comprehensive Plan, the Service Authority's Capital Improvement Program, Preliminary Engineering Reports or Studies, or operational observations and recommendations.
TDH	Total Dynamic Head
THHN	Thermoplastic high-heat-resistant nylon-coated
VADEQ	Virginia Department of Environmental Quality
VDH	Virginia Department of Health

Chapter 1: Prince William County Service Authority's Role

VDOT	Virginia Department of Transportation
VFDs	Variable Frequency Drives
WWF Manager	Water and Wastewater Facilities Manager for the Service Authority

1.3 Service Areas

A. Current Areas Served by the Service Authority

The Service Authority owns and operates drinking water (potable) and sanitary sewer systems within the unincorporated areas of Prince William County (PWC), excluding Dale City. The Service Authority is not the only water and sewer service provider within PWC, and only requests for service within the Service Authority's Service Area, as shown in Figure 1-1, are reviewed. The Service Authority's Service Area is divided into two (2) sub-areas:

1. East-end Service Area

The East-end Service Area is identified as areas south of the intersection of Lake Jackson and Prince William Parkway.

The East-end Service Area includes the Town of Dumfries and Town of Occoquan.

2. West-end Service Area

The West-end Service Area is identified as areas north of the intersection of Lake Jackson and Prince William Parkway and includes Bull Run Mountain Estates and Evergreen Country Club.

The West-end Service Area includes the Town of Haymarket and water-only service for Bull Run Mountain Estates and Evergreen Country Club, and sewer-only service for the Town of Nokesville.

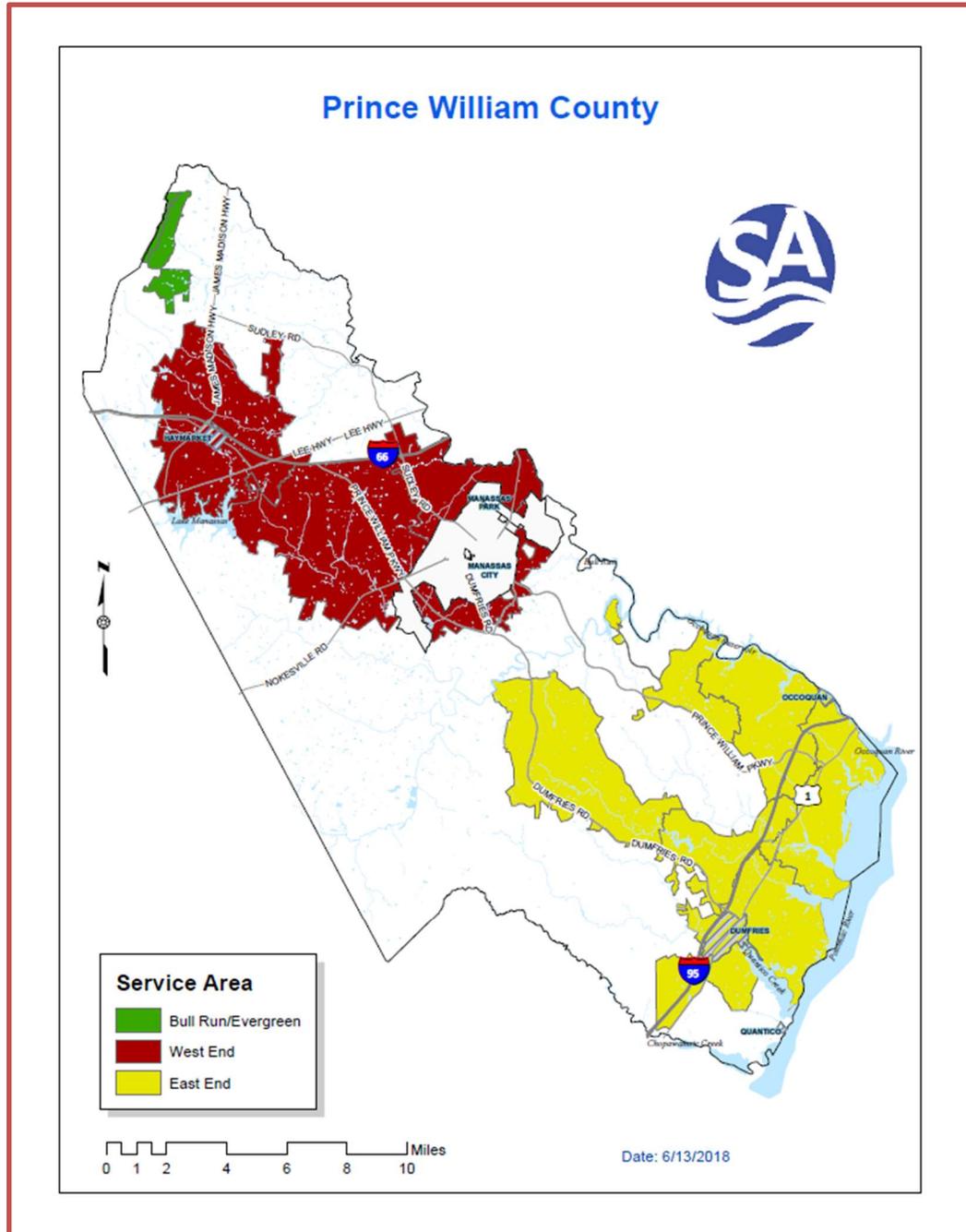
Where Service Authority facilities are not available to a particular location within the service area, as shown in Figure 1-1, and an Applicant is able to obtain service through another service provider, the Service Authority may agree to allow the Applicant to connect to the other service provider's water and/or sewer system. A separate agreement concerning this connection is required between the Service Authority, the Applicant, and the service provider.

B. Areas Not Served by the Service Authority

The Service Authority does not provide service to the following areas: City of Manassas, City of Manassas Park, Dale City or the Town of Quantico.

Properties connected to privately owned wells and sanitary sewer disposal systems are not subject to the standards of this Manual; however, they are subject to the requirements of the PWC Department of Health, which is responsible for permitting individual privately owned wells and sanitary sewer disposal systems. Developers of properties in the Rural Area or beyond the limits of the current available public water or sewer system will be responsible to employ measures as approved by the Service Authority, at their expense, such as flushing to mitigate water quality and or/ age, sewage collection system turn over and odors that may result from significant extensions of public utilities to serve small developments.

Figure 1-1: Current Service Area Map



1.4 The Engineering & Planning Division

The Service Authority's Engineering & Planning Division provides comprehensive oversight for the design and construction of all publicly owned water and sanitary sewer facilities within the Service Authority's Service Area (*see Chapter 1, Section 1.3*); including developing and updating the water and sanitary sewer master plans, managing the design and construction of capital facilities, and reviewing land development applications to ensure compliance with the Service Authority's policies, procedures, standards, and regulations. The Engineering and Planning Division is comprised of the following Departments:

A. Planning Department

Guides future system development and expansion, ensures adequacy of planned facilities with regard to sizing and location, enhancing reliability and readiness for emergency situations, reviews Land Use Entitlement Applications and water and sanitary sewer studies submitted by the Applicant.

B. Development Department

Reviews Project Plans and responds to public inquiries to coordinate the installation of water and sanitary sewer projects initiated by an Applicant. Provides permitting, certification, inspection services for construction of all facilities contributed to the Service Authority, and inspection services for Service Authority capital projects.

C. Project Management Office

Prepares Project Plans, specifications, and administers construction contracts for the Service Authority Capital Improvement Program.

1.5 Public Inquiries

The public is encouraged to visit <http://www.pwcsa.org> where this Manual and other important information and services are available.

During normal business hours, a Development Department staff member is available to answer development related questions for projects not assigned to a Service Authority Project Engineer. Responses to public inquiries are limited to available information.

1.6 Request to Initiate a New Water and/or Sanitary Sewer Connection

Prospective Applicants desiring to initiate a new water and/or sanitary sewer connection will consult the Development Department to determine whether the property in question is eligible for service. The Applicant shall follow the Service Authority's policies, procedures, standards and regulations and will be subject to all applicable rates and fees for new connections (Developer Fees). The Applicant shall certify an account with the Service Authority prior to the commencement of water and/or sanitary sewer service.

In all situations involving the initiation of new service within the Service Authority's Service Area (*see Chapter 1, Section 1.3*), or the modification of an existing service, the Applicant is responsible for acquiring the necessary permits from the Service Authority prior to beginning

work. Utility Permitting is discussed in *Chapter 1, Section 1.8*.

1.7 Plan Review

Applicants seeking water and/or sanitary sewer service for a location in which no prior service has been established and for which new construction is planned shall submit a development or public improvement plan to PWC, which is routed to the Service Authority for review and approval. Lot grading plans and all development plans for properties located in the Town of Haymarket, Town of Occoquan and Town of Dumfries are submitted directly to the Service Authority.

The Applicant's Engineer shall determine the improvements required, subject to Service Authority approval, to provide domestic water, fire protection, and sanitary sewer service that are in accordance with all applicable local, state, and federal policies, procedures, standards and regulations. The Applicant is responsible for submitting the required subdivision and/or site plan and supporting information to the appropriate regulatory agencies.

1.8 Utility Permit

The Applicant may request a Utility Permit from the Service Authority once the Project Plan has been approved by Prince William County or applicable jurisdiction. The Applicant shall acquire a Utility Permit and then hold a pre-construction meeting with the assigned PWCSA Field Inspector prior to commencing utility construction. The Utility Permit authorizes ground work for utility installation. The Utility Permit includes a letter from the Service Authority to the Virginia Department of Transportation (VDOT) which states that the Service Authority will operate and maintain Service Authority approved infrastructure in that portion of the VDOT right of way identified in the Project Plans. The Applicant shall pay all Plan Review and Utility Permit Fees prior to the issuance of a Utility Permit (refer to *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)*).

A. Utility Permit Fees and Requirements

The following requirements and fees apply for acquiring a Utility Permit and are paid prior to issuance:

1. Payment of Utility Permit Fees

The Utility Permit Fee is comprised of four (4) components: Plan Review Fees, Inspection Fees, Closed-circuit Television (CCTV) Inspection Fees, and As-Built Fees:

a. Plan Review Fees

Plan Review Fees cover all submittals necessary to address review comments and are due prior to the issuance of a Utility Permit. There is a base fee and per linear foot charge based upon the amount of water and sanitary sewer main submitted.

b. Inspection Fees

Inspection Fees are charged per linear foot and cover the cost of the water and sanitary sewer main inspections from the start of construction through Beneficial Use and bond release. There is a minimum charge of 100-linear feet for water and 100-linear feet for sanitary sewer. The Applicant may submit a bond release request to the Development Department once final pavement is installed. The

Service Authority will not recommend final bond release of a project until all fees have been paid.

c. CCTV Inspection Fees

CCTV Inspection Fees cover the cost to inspect the sanitary sewer main by CCTV camera. This fee includes one CCTV inspection. Additional CCTV inspections are subject to re-inspection and/or return trip fees.

d. As-Built Fees

As-Built Fees cover the cost of preparing as-built drawings for the Service Authority's records after the utility installation is complete. The As-Built Fee is calculated based on the linear footage of water and/or sanitary sewer main installed. There is a minimum charge per project.

2. Address Listing

Address listings for new subdivisions are submitted to the Utility Services by the PWC GIS Office upon their approval of the listing. The customer submits their address listing to the PWC GIS Office who checks the listing for accuracy. Upon approval, the list is forwarded to the Utility Services Section.

3. Payment of a Local Facilities Charges (LFC), where applicable; see *Chapter 1, Section 1.13.B*.

4. Capital Recovery Charge (reserved for future use)

1.9 Certification

Certification is the written authorization executed by the Development Department's Utility Services Section to establish service and physically connect a new location to the Service Authority's water and/or sanitary sewer system. A separate water and sanitary sewer service connection is required for each property. The Applicant shall pay all Plan Review and Utility Permit Fees prior to applying for Certification. Certification Fees are paid in full and in accordance with the fee schedule in effect at the time of payment. No connection to the Service Authority's System is made without proof of Certification. Certification is required prior to the issuance of a water meter.

A. Requesting a new Water and/or Sanitary Sewer Service Connection

Water and sanitary sewer capacity is allocated on a first-come, first-serve basis provided that capacity is available and such requests are in accordance with the PWC Comprehensive Plan (SEW-POLICY 1 and WA-POLICY 1). A property is eligible if it is zoned and planned by PWC with a land use designation that permits public water and sanitary sewer, or has been authorized by PWC to connect

The Service Authority requires payment of all appropriate Availability Fees prior to the issuance of a Certification of Water and/or Sanitary Sewer Capacity (Certification) for each property where no prior service has been established. Once a Certification is issued, an account for the property is established. Billing will not occur until the construction meter is installed.

B. New Connection to the Service Authority's System by New Development

Applicants requesting service to a premises not already having direct access to an existing public water main or sanitary sewer main shall, upon plan approval, submit an address listing at the time of Utility Permit Fee payment. The Applicant shall complete a Request for Payment of Water and/or Sewer Certification and submit to the Development Department to verify and pay, in full, the appropriate Water and/or Sanitary Sewer Availability Fees. The Service Authority will issue a Certification after payment of the appropriate Availability Fees. The Applicant may schedule a meter set upon issuance of the Certification.

C. New Connection to the Service Authority's System by Existing Development

Applicants of a single lot or parcel seeking water and/or sanitary sewer service for a location with an existing service and/or an existing building or home shall work with the Development Department staff to sketch the desired service. When an existing water service or sanitary sewer lateral is reused as part of a new development, the Service Authority shall inspect the existing water service line or sanitary sewer lateral to ensure that it is serviceable and meets current Service Authority material specifications. The Applicant shall repair or replace any defected or out-of-date materials, at the Applicant's expense, to the satisfaction of the Service Authority before the existing water service or sanitary sewer lateral is placed back into service.

1.10 Meter and Lateral Scheduling/Inspection

A. Scheduling Meter Installations and Inspections

Water meter installation and inspection requests are made online at www.pwcsa.org, by fax to (703) 335-8933 or by phone to the Water Meter Service Line at (703) 335-8980. This is a 24-hour voicemail line. The Applicant shall provide the name, company, and phone number, as well as the subdivision, phase, section, and lot number of the property where the inspection and meter are requested. The Service Authority conducts a limited number of installations and inspections each day. Requests are honored on a first come, first serve basis.

The Service Authority will install all water meters, provided the Applicant's meter assembly meets Service Authority requirements and is in accordance with the current USM. If the meter assembly is unacceptable, the Service Authority will not install the meter and a Return Trip/Re-Inspection Fee is assessed. The Applicant shall pay the Return Trip/Re-Inspection Fee and correct any deficiencies with the meter assembly prior to requesting another meter installation. Re-inspections are scheduled no earlier than two (2) business days following the date of rejection.

The Service Authority will make every effort to perform all installations and inspections within three (3) working days of the initial request. To the extent possible, requests received prior to 2:00 p.m. are scheduled for the next business day. Calls received after 2:00 p.m. are scheduled for two (2) business days after receipt of call. The Service Authority will make every effort to perform the installations and inspections as scheduled; however, extenuating circumstances, such as inclement weather, scheduled holidays, emergencies, or unusually heavy workloads may cause delays. The Service Authority strongly recommends planning ahead to avoid delays.

B. Final Inspection for Occupancy

It is the responsibility of the Applicant to schedule a final inspection with the Service Authority. Prior to the issuance of an occupancy permit by PWC or other applicable jurisdiction, the Service Authority must perform a Final Inspection of the water meter assembly and sanitary sewer lateral to ensure that materials and installation are in accordance with this Manual. The Applicant may submit a Stabilization Waiver for final stabilization (see Section 1.13 G). If the water meter assembly or sanitary sewer lateral is unacceptable, the Service Authority will leave an orange sticker on site listing the deficiencies. The Applicant shall correct all deficiencies before scheduling a re-inspection. Inspection Fees cover one trip. Re-inspection/Return Trip Fees are assessed on re-inspections, as determined by the Service Authority. The Applicant shall provide access to the water meter at all times.

1.11 Construction Meter Account

All public water users within the Service Authority's Service Area (*see Chapter 1, Section 1.3*) are metered and charged according to the adopted rate schedule regardless of the nature of the business. The Service Authority will provide and install all water meters, at the currently applicable Meter and Meter Installation Fee. "Jumpers" (unmetered temporary connections) are not permitted and, if found, the Applicant will be subject to additional fees associated with Unauthorized Use of or Unauthorized Access to Service Authority facilities or assets (*see Chapter 2, Section 2.7*).

The Applicant shall initiate a temporary construction meter account by contacting the Development Department's Utility Services Section at (703) 335-7930 to schedule a construction meter installation. The Applicant is responsible for the payment of water and sanitary sewer bills associated with a temporary construction account. Monthly billing for actual consumption and service charges will begin upon the installation of the water meter. The Applicant shall be responsible for any costs associated with damaged, lost, or stolen meters.

Once initiated, temporary construction water service must continue until the property passes the Service Authority's final inspection for occupancy, at which time it is considered a permanent meter installation/service.

1.12 Construction Meter Installation

The Applicant shall schedule a meter installation with the Development Department's Utility Services Section at (703) 335-7930.

The Service Authority will install all water meters, provided the meter assembly is acceptable. The meter assembly must meet the current USM standards. If the meter assembly is unacceptable, the Service Authority will not install the water meter and a Return Trip/Re-Inspection Fee is assessed. The Applicant shall pay the Return Trip/Re-Inspection Fee and correct any deficiencies with the meter assembly prior to requesting another meter installation.

1.13 Summary of Fees

A. Certification Fees

Certification includes the following fees (refer to *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)*):

1. Application Fees

All new accounts are charged an Application Fee at the time the account is opened. The Application Fee covers the administrative costs associated with establishing a new account.

2. Availability Fees

Water and Sanitary Sewer Availability Fees are charged when applying for Certification to cover the cost of the customer's pro-rata share of water and/or sanitary sewer treatment capacity as well as water transmission mains, sanitary sewer interceptors, storage tanks, reservoirs, pumping stations, infiltration and inflow and Engineering Administration. Availability Fees are not used to pay for operations, maintenance, repairs or capital improvements to benefit existing customers. Availability Fees do not include Service Connections and System Extensions/Upgrades.

Availability Fees are sold in Equivalent Residential Units (ERU) at the time of certification. ERUs are determined for each customer class as follows:

a. Residential

One ERU is assigned to each single-family home or townhouse, based on meter size in accordance with BOD approved rates and fees.

b. Multi-family Residential

ERUs for apartments, condominiums, or like use, are based on 80 percent (%) of one ERU, per dwelling unit.

c. Student Housing

ERUs are based on the specific estimated peak monthly usage.

d. Commercial

ERUs for meter sizes 3/4-inch through 1-1/2-inches are based on a fixed schedule as indicated in the Service Authority's adopted schedule of Rates and Fees. Commercial ERUs for meter sizes 2-inches and greater are calculated on an individual basis based on the specific customer's peak monthly usage.

Connection to the Service Authority's System requires payment of an Availability Fee. The Service Authority shall not waive Availability Fees in accordance with adopted BOD policy. Availability Fees are non-refundable and non-transferable. Certifications are fixed to the property certified and are not transferable to other properties. Should that capacity cease to be needed at the connection initially served, the capacity can be applied in support of any other connection that is located on the same parcel of land. Where a parcel of land with an assigned capacity is subdivided, or its boundaries adjusted, capacity may be applied to support service on the resultant property or properties.

The payment of an Availability Fee allocates an amount of capacity in the Service Authority's System. One ERU of water is allocated as 10,000-gallons maximum usage per month.

The required meter size is approved, by the Director or designee, during the Plan Review process and is based on the customer's maximum instantaneous flow rate as supported by the customer's submitted plans. Should actual consumption exceed the meter's rated capacity, the Applicant is required to upgrade the meter to the appropriate meter type and size and pay any associated meter charges and Supplemental Availability Fees. The Service Authority shall review a customer's estimated instantaneous flow based upon fixture unit computations to verify the rated capacity of the requested meter size is adequate.

In certain circumstances, such as establishing the ERU basis for 2-inches and larger commercial meters, the Service Authority may also consider:

- i. Typical consumption for like facilities or customers;
- ii. Comparable consumption data for like facilities or customers;
- iii. Type of use, principal use, or timing of use;
- iv. Other engineering or hydraulic information when instantaneous demands are not predicted by the fixture units, such as water used in processing or manufacturing applications;
- v. Other factors applicable to the specific Applicant when trying to establish appropriate meter size or ERUs. Commercial customers shall pay High Demand Charges for water consumption above their allotted ERUs as defined by the Service Authority's adopted User Rates. The customer may request or the Service Authority may require additional capacity which is reviewed on a case-by-case basis.

3. Supplemental Availability Fees

The customer may request, or the Service Authority may require additional capacity. Supplemental Availability Fees are calculated in ERUs and are based on either the change in meter size or the amount of capacity added (ERUs used during the peak month, less ERUs previously purchased) based on the current rates in effect on the date of the bill. Customers identified as exceeding the applicable usage limits and who consistently place high demands or a capacity burden on the Service Authority's System are required to pay Supplemental Availability Fees. At any time, the Service Authority reserves the right to seek Supplemental Availability Fees when water or sanitary sewer demand exceeds the amount of capacity purchased, regardless of a change in ownership.

B. Local Facilities Charges

In some cases, new service locations are subject to additional fees established by the BOD, termed Local Facilities Charges (LFC). LFCs are designed to recoup the proportionate cost of designated infrastructure projects from new service locations within a specific Service Area that benefits from the project. If a property is subject to an LFC, the Applicant shall pay the fees in accordance with the terms stated in the resolution adopted by the BOD. Financial responsibility is incurred at the time of issuance of a Utility Permit or Certification.

C. Capital Recovery Charge – reserved for future use

D. Meter and Meter Installation Fees

Applicants connecting to the system are subject to the appropriate Meter Fee and Meter Installation Fee based on the size of the meter and associated labor for installation. The required meter size is approved during the Plan Review process. Water meters are procured and installed by the Service Authority. The Service Authority will install the meter in the meter crock or vault that is provided by the customer. The Service Authority may at its own discretion, at any time, remove any meter for routine testing, repairs, or replacement. Water meters are the property of the Service Authority and are right sized at the discretion of the Service Authority to meet the customer's use. Customers are charged the differential cost for a larger meter size and are subject to applicable Supplemental Availability Fees.

E. Sub-Meter Service Fee

The Sub-Meter Service Fee covers the costs necessary for plan review, field service, and customer service administration. This fee is based on the size of the sub-meter required for the project (refer to *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)*).

F. Final Inspection Fees

A Final Inspection is requested when seeking building occupancy from PWC or other applicable jurisdiction for a specific building or lot. The inspection is conducted when all site construction and landscaping (sod/seed/straw) has been completed as per the approved Project Plans. The meter crock/vault and sanitary sewer lateral are inspected to check that there are no leaks, breaks or foreign material in the crock or lines and that all requirements have been met. If the project passes inspection, the Service Authority will provide a copy of the inspection report, which is used as verification to PWC that the inspection has been completed and is approved. Inspection Fees cover one trip. Re-inspection Fees are assessed on any necessary re-inspections as determined by the Service Authority. In certain situations, a voluntary Stabilization Waiver Fee may also apply (*see Chapter 1, Section 1.13.G*).

G. Other Fees

1. Other Review Fees

Other Review Fees cover the cost of preliminary plan reviews, plat reviews or other miscellaneous reviews.

2. Other Inspection Fees

Other Inspection Fees cover the cost of demolition inspections, replacement inspections or other miscellaneous inspections.

3. Stabilization Waiver Fee

The Applicant may request a Stabilization Waiver if they desire final inspection approval for occupancy prior to final stabilization (sod/seed/straw). The Stabilization

Chapter 1: Prince William County Service Authority's Role

Waiver Fee covers the administration of monitoring and performing additional inspections, as necessary, up to the point of final stabilization and/or bond release. For more information on Stabilization Waivers please contact the Development Department at (703) 335-7930.

4. Re-Inspection or Return Trip Fees

Re-Inspection or Return Trip Fees are charged when a final inspection or request for meter crock/vault and/or sanitary sewer lateral fails inspection. Re-Inspection Fees are paid in advance of the Field Inspector returning to the site to re-inspect.

-- end of Chapter 1 --

Chapter 2: Project Administration

2.1 Extension of Public Facilities

The Applicant, as referred to in this and the following Chapters, is the Property owner or designated agent, with whom the Service Authority will coordinate with for the design and construction of water and/or sanitary sewer facilities. The term Applicant is also understood to include Developers, Engineers, Employees, Agents, Contractors, Subcontractors, and Vendors providing support. Applicants desiring water and/or sanitary sewer service, within the Service Authority's Service Area, shall submit an Application for Connection to the Service Authority and receive the applicable permit(s) before starting construction of any water and/or sanitary sewer facilities. It is the prime responsibility of the Applicant to make all necessary provisions for the construction of the project per the approved Project Plans and specifications. The Applicant must ensure that all work is conducted in conformance with current guidelines and standards of federal, state, and local governing agencies.

A. Determining Project Scope

Prior to design and engineering, Applicants are encouraged to meet with a representative of the Development Department to discuss the project's scope, specific conditions, application of this Manual, and associated policies, procedures, standards, and regulations.

B. Applicant to Furnish Facilities within the Project Area

The Applicant shall furnish, construct and improve all onsite and offsite water and/or sanitary sewer facilities required to serve the development requirements of the project and to complete the Service Authority's planned systems. The Applicant shall transfer these public water and/or sanitary sewer facilities to the Service Authority, free of debts, liens and/or other legal encumbrances, for ownership, operation, and maintenance. Facilities not complying with the Service Authority's standards are not accepted and are not supplied with water and/or sanitary sewer service until the deficiencies are corrected to the satisfaction of the Service Authority.

Where facilities are to be extended in the future, the Applicant shall extend water and/or sanitary sewer mains and services to the limits of proposed site improvements. Terminations of mains are required to be beyond the limits of proposed pavement, past adjacent buildings, and beyond crossings with storm drains, ducts, or other utilities that could otherwise be undermined during subsequent construction activities. In cases where the future extension will provide a water distribution loop that is necessary to support the Applicant's project, the Applicant shall construct the public main to the site or subdivision boundary.

C. Public Main Required at the Property Served

In situations where the property being developed does not already have direct access and frontage to a suitable public water and/or sanitary sewer main, the Applicant shall extend the public water and/or sanitary sewer main, so as to establish sufficient main to receive a service connection for each property being developed. If the water and/or sanitary sewer main is extended within a public right-of-way, the main is owned,

operated, and maintained by the Service Authority as a public main.

The extension of a privately owned water service and/or sanitary sewer lateral crossing an adjacent property is permissible; however, the appropriate property rights are secured by the Applicant prior to Service Authority approval.

D. Public Gravity Sewer Required

To provide for a sustainable system, the Service Authority has planned an integrated sanitary sewer collection system of gravity mains and sewage pumping stations. Gravity sanitary sewers are utilized for the public collection system, except where low-pressure sanitary sewer facilities currently exist or such facilities are specifically planned or approved by the Service Authority.

E. Easements for Proposed and Future Extensions

The Applicant will dedicate easements and convey ownership to the Service Authority for all water and/or sanitary sewer facilities not located within a public right-of-way. All water and/or sanitary sewer facilities within a public right-of-way are conveyed to the Service Authority prior to street acceptance by PWC. Prior to Beneficial Use, the Applicant will convey to the Service Authority all on-site easements needed to enable the extension, installation, operation, maintenance, repair, and replacement of the proposed public water and/or sanitary sewer facilities, including appropriate access easements in accordance with this Section. Where the Applicant proposes facilities across the lands of others, it is the Applicant's responsibility to acquire and convey the necessary easements to the Service Authority prior to construction.

The Service Authority operates and maintains a fully integrated public utility system (water and sanitary sewer). The extensions by each application are an integral part of the overall public utility system. In support of the fully integrated public utility system, on-site easements are required in areas outside of the proposed improvements for the purpose of extending any of the public systems. The Applicant shall extend such easements to the site or subdivision boundary. The Applicant shall dedicate all easements in accordance with the Service Authority Omnibus Deed of Easement Template (see *Appendix L: Omnibus Deed of Easement Template*). The Applicant may eliminate those portions of the Omnibus Deed of Easement Template that are not applicable to the specific project, however, no language can be added. The Applicant shall incorporate the PWCSA easements into a comprehensive deed and plat.

The easement plat is reviewed as part of the Project Plan review and approval process. Prior to Project Plan approval by PWC, signed deeds and accompanying plats for proposed water and/or sanitary sewer facilities are to be submitted directly to the Development Department for review and signature. Easements are not required for domestic service lines, meters, fire lines, sanitary laterals, or private utilities when they fully reside of the property they serve. The Applicant shall submit proof of recorded easements prior to Beneficial Use. Other easement requirements are described in Service Authority policies and include, but are not limited to, the following: *Appendix I: Service Connection Policy* and *Appendix M: Off-Site Easement Acquisition Policy*.

F. Blanket Utility Easements

Blanket Utility Easements may cover an entire parcel of land, not the specific location of a utility. The purpose of the Blanket Utility Easement is to cross a piece of land without describing a specific location within the parcel giving the utility company flexibility for placement of their utilities. Blanket Utility Easements are granted by the Applicant for water and sanitary sewer utilities provided the Blanket Utility Easement width meets the criteria in *Chapter 4 and Chapter 5*.

A single Blanket Utility Easement provided by the Applicant shall include both water and sanitary sewer mains and appurtenances, if applicable. The Applicant shall provide either a Blanket Utility Easement or discreet water and sanitary sewer easements, but not both.

G. Facility Sizing

The Applicant shall size all water and sanitary sewer facilities, which are located within the area being developed, to support the proposed development in accordance with the Service Authority's Performance Standards, master plans, and Capital Improvement Program plans. When improvements above and beyond those needed to support the proposed development are identified as being required by the Service Authority, the Service Authority and Applicant will enter into an agreement to reimburse the Applicant the incremental cost apportionment for the additional required facilities in accordance with the current Service Authority policies (refer to *Appendix I: Service Connection Policy* and *Appendix R: Development Review Process and System Improvement Policy*).

2.2 Offsite Facilities

Applicants are responsible for the design, construction, and improvements of all onsite and offsite facilities, regardless of size, necessary to serve the project.

Offsite facilities shall include, but are not limited to:

- Supply mains, loop closures, pumping or pressure reducing installations, necessary to extend from existing supply mains to the Project area;
- Collection sewers from the Project area to the existing public sanitary sewer system;
- Sanitary sewer pumping stations;
- All necessary accessories and appurtenances to the water and/or sanitary sewer systems.

2.3 Service to Developed Properties

Developed properties are defined as those properties within the Service Authority's Service Area (*see Chapter 1, Section 1.3*) that are already subdivided, improved, and populated by separate owners and/or renters, including commercial and/or industrial establishments. Developed properties currently not provided with water and/or sanitary sewer services may receive water and/or sanitary sewer service from the Service Authority (refer to *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)* and *Appendix I: Service Connection Policy*).

2.4 Agreements

A. Bonding

Water and sanitary sewer facilities for projects subject to PWC review and approval will be bonded through PWC. For projects located in the Town of Haymarket, Dumfries or Occoquan, the Applicant shall furnish a Performance Bond for the water and sanitary sewer facilities using the PWC Unit Price sheet as the cost basis, with the Service Authority named as beneficiary. The bond may take the form of a surety or an irrevocable letter of credit in the amount of 100-percent of the estimated cost of the water and/or sanitary sewer improvements per the Prince William County unit price sheet.

B. Reduction for Work Completed

Applicants may request a bond reduction after the installed facilities have passed Service Authority inspection and testing procedures.

1. The Applicant may request a bond reduction by contacting the PWC Bond Administrator. The PWC Bond Administrator will forward a bond reduction worksheet to the Inspections Manager who will complete and return the form to the PWC Bond Administrator. Bonds are not reduced to less than 20 percent (20%) of the original estimated construction cost.
2. For projects bonded through the Service Authority, there are no reductions.

C. Acceptance of Facilities

The Service Authority's bond release inspection is entirely separate from the PWC inspection process. The Applicant shall request a bond release inspection from the Development Manager in order to obtain the release of the performance bond for the project. The Applicant shall pay all applicable Service Authority fees (including Service Authority overtime) and complete all final paving prior to submitting a request for bond release. The Applicant shall submit a request for bond release inspection in writing (an email is preferred) with the County Plan Name (or Service Authority permit number if a Town project) and the Applicant's name and contact information for addressing any deficiencies.

Once the Service Authority has received a valid request for a bond release inspection, the Field Inspector shall perform a bond release inspection of the public water and sanitary sewer facilities within 30 days. If the Field Inspector notes any deficiencies during the inspection, the Field Inspector shall forward a punch list to the Applicant for correction.

It is the Applicant's responsibility to correct all deficiencies, at the Applicant's cost, and schedule a re-inspection with the Field Inspector within six (6) months. A new bond release inspection is required if the six (6) month period has lapsed. Once the Field Inspector signs off on the project, the Development Manager shall provide a letter, to the Applicant, stating that the Service Authority does not object to the release of the performance bond for the project. At this point, the Service Authority assumes ownership and maintenance responsibilities for the public water and/or sanitary sewer facilities.

2.5 Current Project Plans Required

The Applicant shall resubmit construction drawings and specifications that have been approved for five (5) years or more, in advance of construction permitting, with a new review fee, to determine if the design is still current. The Applicant shall address if the conditions on or adjacent to the project are still accurately depicted on the Project Plans. Additionally, the Applicant shall update the Project Plans to meet all current design standards.

2.6 Land Development Process

The Applicant shall follow the Service Authority's Land Development Process when proposing to extend the Service Authority's System. The process includes the following stages:

A. Plan Review

Applicant's plans are submitted to and reviewed by the Service Authority's Project Engineer for compliance with this Manual.

B. Utility Permit

Once the Project Plan is approved, the Service Authority issues a Utility Permit. A Utility Permit is the Service Authority's written authorization for the Applicant to construct water and/or sanitary sewer facilities.

C. Construction Inspections

During construction, water and/or sanitary sewer facilities are inspected and tested for compliance with this Manual, prior to acceptance into the Service Authority's System.

D. Certification

A Certification is the written authorization to establish service and physically connect a new location to the Service Authority's System. Please refer to the *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)* for rates and fees associated with the Land Development process.

E. Closeout/Bond Release

Water and/or sanitary sewer facilities undergo a final inspection and acceptance process (see *Chapter 2, Sections 2.9 and 2.10*).

2.7 Preconstruction Conference

The Applicant shall request a pre-construction conference by calling the Inspections Manager as directed on the Utility Permit, prior to the commencement of any water and/or sanitary sewer installation. The Applicant shall make the request a minimum of 72-hours prior to any scheduled work.

The Field Inspector will schedule the pre-construction conference with the Applicant. At a minimum, the utility contractor's superintendent and foreman, and the Field Inspector shall attend. As appropriate to the work at hand, other attendees are the Applicant, Applicant's

Engineer, principal subcontractors, suppliers, and the Service Authority's Project Engineer. Participants in the pre-construction conference shall have, on hand, a complete copy of the most recent approved Project Plans for the project, and any supporting permits. Participants will review the scope of work and the installation and inspection procedures to be followed. Project schedules and sequences are reviewed to ensure consensus.

A. Notification

Prior to any work associated with the installation, testing, repair, or replacement of Service Authority facilities, or grading that impacts these facilities, the Applicant or contractor shall contact the designated Field Inspector to request inspection services.

B. Approved Project Plans

The Applicant shall ensure that a copy of the approved Project Plan, revised Project Plan sheets, submittals, and Engineer's cut sheets are available and accessible at all times, on-site, through final acceptance of the work. The Applicant shall provide copies of all water and/or sanitary sewer cut sheets to the Field Inspector prior to installation of any water and/or sanitary sewer facilities. The Applicant shall ensure cut sheets are sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia.

C. Protection of Existing and Proposed Utilities

1. Documentation

When water and/or sanitary sewer construction requires offsite (on property not owned by the Applicant) disturbance within a Service Authority easement, the Applicant shall photograph and/or video record, prior to the start of construction, the work area to document existing conditions such as, but not limited to, existing structures and their condition, existing utilities, and other existing site conditions. The Applicant shall submit a copy of all photographs and/or video recording file(s) to the Field Inspector. The documents shall bare the date and time the photos or video recordings were made.

2. Protection

During construction operations, the Applicant shall properly locate, protect, brace, support, restore and maintain all underground pipes, conduits, drains, and other underground structures uncovered or otherwise affected by the construction work being performed to ensure they are protected from any damage, in accordance with the Virginia State Code 20VAC5-309-140. Applicant shall protect, restore and maintain all pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures (including all sod and shrubs in yards and parks) crossed by or adjacent to the utility under construction.

3. Damage

The Inspections Manager shall observe and document all damage resulting from the Applicant's construction activities.

4. Repair and Replacement

If elements have been removed or damaged, the Applicant is responsible for the cost to replace, repair, or restore any of the elements listed in this Chapter to their existing condition or better with new materials. The Applicant shall, without delay, coordinate with the property owner, agency, or authority having jurisdiction over, the damaged surface or subsurface structure concerning its replacement, repair, restoration, and payment of cost incurred in connection with the damage.

5. Blasting, where required, is done by the Applicant with care and in accordance with all applicable federal, state, and local laws, ordinances, and regulations. The Applicant is responsible for obtaining all required permits prior to blasting. The Applicant shall ensure all permits are onsite and available for review upon request by the Field Inspector.

6. Blasting is not permitted within 25-feet of any Service Authority facility (including, but not limited to: buildings, water storage tanks, buried utilities, or other structures). Approval for blasting closer than 25-feet is granted by the Director or designee, only when the Applicant can certify and demonstrate that the safety and soundness of existing Service Authority facilities will not be impacted by the proposed blasting activities.

a. The Applicant shall notify the Inspections Manager or designee at least 24 hours in advance of each detonation series.

b. The Applicant shall notify the Inspections Manager or designee within 24 hours of completion of blasting.

7. Unauthorized Use and Access

“Unauthorized Use” means any use or operation of Service Authority facilities or assets not authorized by a Utility Permit. “Unauthorized Access” means any access to Service Authority facilities or assets in a manner that is not authorized by a Utility Permit or other permission granted by the Service Authority (including, but not limited to, any easements, rights of entry, license, or similar privilege).

In the event that an Applicant for or holder/assignee of (“Holder”) a Utility Permit commits an Unauthorized Use of or obtains Unauthorized Access to Service Authority facilities or assets, the Applicant and/or Holder, is liable for all of the following costs and fees:

- All of the Service Authority’s costs in responding to incidents arising from an Unauthorized Use or Unauthorized Access;
- Any fees imposed by any federal, state, or local regulatory agency as a result of Applicant and/or Holder’s Unauthorized Access or Unauthorized Use;
- The costs to Service Authority customers arising from the loss of service caused by an Unauthorized Use or Unauthorized Access.

D. Construction Crossings

Where construction traffic must cross a Service Authority facility, or where substantial grading is to occur, the Service Authority may require plan and profile drawings, cross-sections, loading plane diagrams, and loading calculations, sealed, signed, and dated by a Professional Engineer licensed in the Commonwealth of Virginia. Plan and profile drawing shall demonstrate that the existing facility is protected against damage or adversely impacted by construction traffic or grade changes and that the proposed means and methods for protecting the facility are adequate. The Applicant shall demonstrate that all Service Authority facilities are protected against compromised structural integrity, loss of pipe slope, deformation, and loss of water tightness.

If the placement of additional soil over the facility is used to cushion and bridge a Service Authority facility at a temporary crossing, the Applicant shall remove the added material immediately after construction activities cease, unless otherwise directed by the Service Authority.

E. Safety

The Applicant and all contractors are responsible for the safety and protection of persons and property that are directly or indirectly affected by construction activities. The Applicant shall ensure all activities are performed within current industry standards and guidelines set forth by federal, state, and local governing agencies. Field Inspectors have the authority to stop work and shut down a construction site when safety violations are observed by the Field Inspector.

F. Responsible Supervision

The Applicant and/or utility contractor shall appoint a full-time, competent, and reliable employee or consultant, who will speak, read, and write the English language fluently and be able to communicate effectively with the workers at the site and will be responsible for supervising and maintaining:

1. Quality control per Service Authority's standard and guidelines as specified herein.
2. Health and safety of project workers and the general public.
3. Protection of stored materials and equipment, existing utilities, facilities, and properties per federal, state, and local agencies.
4. Corrective measures as necessary to ensure safety and quality assurance.
5. Discipline or dismissal of any employee from the project who does not demonstrate proper industry safe and healthy work habits.

G. Protection of New Work

The Applicant is fully responsible to protect all work completed or under construction. This includes, but not limited to, materials and equipment from theft and/or damage until the project attains final acceptance by the Service Authority.

H. Operations within VDOT Right of Way or Private Roadways

All development related activities within a VDOT right-of-way or privately maintained roadway are the responsibility of the Applicant. The Applicant is responsible for the implementation, maintenance, and safety procedures as outlined in the approved VDOT Land Use Permit (LUP) and Maintenance of Traffic plan(s) or as required by other policies, procedures, standards and regulations of federal, state, or local agencies having jurisdiction over the roadway.

I. Operations within a Service Authority Facility

All development related activities within the fenced limits of a Service Authority facility or on Service Authority owned property shall require an approved and executed access agreement between the Applicant and the Service Authority (see *Appendix Q: Facilities Access Agreement* for template).

J. Progress Meetings

Formal or informal meetings are conducted regularly, as needed, between the Applicant and the Service Authority Field Inspector as the project progresses, to maintain open communication between participants.

2.8 Field Engineering

Changes or corrections to the approved Project Plans are warranted during construction. The Applicant shall notify the Service Authority's Field Inspector and Project Engineer of any proposed changes or corrections. Minor changes to alignment, certain additions, deletions, substitutions, and minor changes to grading, are approved by the Field Inspector. Where the scope of the change is limited, approval may take the form of a Field Revision; whereby, a markup of the plan is made to reflect the desired change and submitted for approval without a full submission of a revision to the approved Project Plan. Where significant changes to line, grade, or utility size are desired, and where additional easements are required, a formal Project Plan revision is submitted through PWC for comment and approval.

All changes made during construction are recorded and reflected on record drawings prepared by the Service Authority.

2.9 Inspection

The Service Authority is permitted to safely access the project at any time to perform inspections and observe the quality of work and construction safety methods. Work not conforming to the approved Project Plans, Service Authority's standards, or industry standards is subject to rejection. Any work that has been rejected must be replaced or corrected to the satisfaction of the Field Inspector.

A. Beneficial Use

Beneficial Use is placing infrastructure in service prior to the final acceptance by the Service Authority and bond release by PWC. Beneficial Use describes the state of a water or sewer main or pumping facility when it is serving one or more Service Authority customers but has not yet received final acceptance by the Service Authority.

Beneficial Use status does not, in any way, constitute final acceptance of the system; it simply allows the Applicant to place the water main or sanitary sewer main or pumping facility in use while the development is under construction. The Applicant remains responsible for all system maintenance and repair until it has been bond released and turned over to the Service Authority for ownership and operation.

Once Applicant has installed and tested water mains and sanitary sewer mains and their associated appurtenances and the Field Inspector has found them to be in accordance with the approved Project Plan and the requirements of this Manual, the Applicant may request, in writing to the Field Inspector, a Beneficial Use inspection. Base pavement must be in place over all applicable water and sanitary sewer facilities prior to requesting a Beneficial Use Inspection.

If the Field Inspector notes any deficiencies during the inspection, the Field Inspector shall forward a punch list to the Applicant. The Applicant shall notify the Field Inspector when all deficiencies identified on the punch list have been corrected. Upon verification by the Field Inspector that all deficiencies have been corrected, the Director or designee shall issue a Beneficial Use letter placing the project in Beneficial Use status. The Applicant may request construction meters after obtaining Beneficial Use status. The Applicant shall provide to the Development Manager proof of recorded instrument numbers of all required easements and proof that all applicable Service Authority fees (including Service Authority overtime) have been paid prior to submitting a request for Beneficial Use status.

The Applicant's failure to operate and maintain the system while in Beneficial Use status, per the Service Authority's Performance Standards, shall result in a suspension of meter installations and/or final meter inspections until all deficiencies are corrected by the Applicant.

Developers or owners of other properties ("Third Party Connectors") may connect to water and/or sanitary sewer infrastructure in Beneficial Use status with the requisite indemnification and assumption of liability. Prior to permitting such connection, the Service Authority may, in its discretion, require a Third-Party Connector to, among other things, post a bond, letter of credit, or other surety in favor of the Service Authority and Applicant and/or obtain a policy of insurance naming the Service Authority and Applicant as additional insureds. Such sureties and insurance policies shall be in amounts satisfactory to the Service Authority.

If a problem occurs during the Beneficial Use status, the Applicant is responsible for making all necessary repairs. If the Applicant fails to initiate corrective action within a timely manner of being notified by the Service Authority Field Inspector, the Service Authority's Operations and Maintenance Division shall repair problems affecting water and/or sanitary sewer services to customers. If this occurs, the Service Authority shall invoice the Applicant for all costs associated with the repairs and shall require payment prior to proceeding with any additional approvals or meter sets for the Applicant (Refer to *Appendix E: Partial/Full Beneficial Use Developer Request Template*).

B. Partial Beneficial Use

Partial Beneficial Use defines the elective decision by the Applicant where portions of the water and sanitary sewer systems are operational and capable of providing continuous

potable water and sanitary sewer service for anticipated occupancy use only to specific portions of a development under construction throughout the build-out of the project. The Service Authority review and approval of Partial Beneficial Use is limited to the water system as a potable water source only. Other reviews and approvals pertaining to fire protection and fire coverage are required from PWC in order to grant occupancy permits.

The Applicant shall provide, to the Development Manager, proof of recorded instrument numbers of all required easements and proof that all applicable Service Authority fees (including Service Authority overtime) have been paid prior to submitting a request for Partial Beneficial Use status.

Once Applicant has installed and tested water mains and sanitary sewer mains and their associated appurtenances and the Field Inspector has found them to be in accordance with the approved Project Plan and the requirements of this Manual, the Applicant may request, in writing to the Field Inspector, a Partial Beneficial Use inspection. Base pavement is in place over all applicable water and sanitary sewer facilities prior to requesting a Partial Beneficial Use inspection.

If the Field Inspector notes any deficiencies during the inspection, the Field Inspector shall forward a punch list to the Applicant. The Applicant shall notify the Field Inspector when all deficiencies identified on the punch list have been corrected. Upon verification by the Field Inspector that all deficiencies have been corrected, the Director or designee shall issue a Partial Beneficial Use letter placing the project in Partial Beneficial Use status. The Applicant may request construction meters after obtaining Partial Beneficial Use status.

The Applicant's Engineer is a Professional Engineer licensed to practice in the Commonwealth of Virginia and shall furnish a written Certification of fire protection/hydrant coverage in accordance with Sec. 300 of the DCSM (Refer to *Appendix E: Partial/Full Beneficial Use Certification Form Template*), which may require hydraulic modeling or on-site fire flow testing of the partially completed infrastructure, at the Applicant's cost. In the event the DCSM requirements are not met, the Professional Engineer must certify the available fire protection/hydrant coverage to the PWC Fire Marshal's Office (Refer to *Appendix E: Partial/Full Beneficial Use Certification Form Template*).

The Applicant's failure to operate and maintain the system while in Partial Beneficial Use status, per the Service Authority's Performance Standards, shall result in a suspension of meter installations and/or final meter inspections until all deficiencies are corrected by the Applicant.

The Service Authority approval letter placing a designated area and partially completed infrastructure in Partial Beneficial Use includes the following language:

Partial Beneficial Use does not constitute certification by the Service Authority that the entire hydraulic system is installed and operational or that service is adequate for fire protection purposes. Available fire flows and hydrants, strategically placed for coverage, may not be available until the entire water system is installed and made operational per the approved development plans and hydraulic model. It is the responsibility of the PWC Fire Marshal's Office to determine if required fire protection

is in place for the areas being occupied and that fire protection service will remain available throughout the build-out of the project. The Applicant is required to provide Certification by the Applicant's Engineer that the section being reviewed for Partial Beneficial Use meets hydraulic performance requirements including continuous fire protection to secure occupancy approval. It is the responsibility of the County Building Official to ensure that the PWC Fire Marshal has determined that fire flows are continuously adequate to provide fire protection for the occupied properties subject to Partial Beneficial Use approval throughout the build-out of the project, before approving occupancy of such properties.

C. Final Inspection for Occupancy

Refer to *Chapter 1* for Certification, Stabilization Waiver, and Meter Inspection requirements.

2.10 Project Closeout

A. As-built Survey and Record Drawings

The Service Authority shall contract separately with a consultant to prepare the water and sanitary sewer as-built plans for all projects, using funds collected during the permitting process.

VDOT requires that Service Authority facilities within public rights of way be permitted, using the form known as a Land Use Permit (LUP).

To initiate the preparation of an LUP, the Applicant must obtain and provide the following items.

1. Provide an LUP form with the project and street information completed in hard copy (or preferably in fillable pdf) to the Development Manager.
2. Provide the name, address, and telephone or e-mail address of the Applicant who is responsible for the road acceptance package.

The Development Manager will complete the Service Authority information and return the completed LUP form to the Applicant.

-- end of Chapter 2 --

Chapter 3: Application and Plan Preparation

3.1 Purpose

The Service Authority reviews the Project Plans for all projects that will extend water and/or Sanitary Sewer facilities within the Service Authority's Service Area (*refer to Chapter 1, Section 1.3*). Conformance to the procedures and standards outlined in this Manual will expedite the review process. This application and review process ensures that projects are built to conform to Service Authority standards.

Applicant shall, at a minimum, meet all standards described in this Manual for all facilities that are incorporated into the Service Authority's water and sanitary sewer utility system. These facilities include those constructed within a public right-of-way or on private property where a dedicated easement exists or are provided by the Applicant. Specific variances to these standards are requested by the Applicant and approved in writing by the Director or designee.

3.2 Prince William County Planning and Land Use Applications

Prior to submission of Project Plans to the Service Authority, the corresponding land use application(s), if required, must first be approved by PWC. Such applications include rezoning, special use permits, and comprehensive plan amendments. The Service Authority participates in the County's referral system as an outside agency. Review of the application can result in the following, but not limited to, responses from the Service Authority:

- Comments are provided on the standard design requirements as defined in the Service Authority's USM.
- Comments are provided on the location of existing facilities, general location, and configuration of proposed water and sanitary sewer facilities.
- Identify the need for special studies to determine feasibility of providing service.
- Identifying transmission mains, trunk sewers, and other facilities traversing or needed to serve the proposed development and may include facilities identified in the Service Authority's Capital Improvement Program.
- Identifying areas for easement and/or line extensions necessary to provide access to water and sewer lines to adjacent properties.

3.3 Application Procedures

The Service Authority's review and approval of Project Plans generally occurs concurrent with other agencies (PWC, VDOT, etc.) and does not require a separate plan submittal to be prepared exclusively for Service Authority review; however, the Applicant must incorporate the Service Authority's submittal requirements, as referenced in this Manual. Except as otherwise provided by law and subject to Section 2.5 and Section 3.3.E of this Manual, Project Plans are subject to the requirements of this Manual that are in effect on the date of approval of such Project Plans

For projects in PWC that are not subject to regulation by a Town, the Applicant shall submit the requisite number of Project Plans for review to PWC Land Development Services, which shall coordinate directly with the Service Authority for concurrent review. The PWC Planning Office is located at 5 County Complex Court, Suite 210, Woodbridge, VA 22192. The Office

hours are 8:00 a.m. to 4:30 p.m., Monday through Friday, excluding federal holidays. Refer to <http://www.pwcgov.org/> for more information.

For projects in the Towns of Occoquan, Dumfries, or Haymarket, the Applicant shall submit one copy of the Project Plans directly to the Service Authority at 4 County Complex Court, Woodbridge, VA 22192. The Service Authority's office hours are 8:00 a.m. to 5:00 p.m., Monday through Friday, excluding federal holidays. Refer to <http://www.pwcsa.org/> for more information or call (703) 335-7930 Initial Application.

A. Initial submission must include the following:

1. Project Plans including completed Service Authority Sheet – one full size set (24-inches by 36-inches).
2. Easement plats – one half size set (18-inches by 24-inches).
3. Hydraulic Analysis Report and/or sanitary sewer capacity analysis (if required) – one copy.

B. Subsequent Submissions

After addressing initial comments, subsequent plan submissions include:

1. Response letter, stating how each comment has been addressed and/or reason for action taken.
2. Revised Project Plans including completed Service Authority Sheet – one full size set if processing through PWC Planning Office; or directly submit updated plan sheets electronically as a single Portable Document Format (PDF) to the Service Authority's Project Engineer. After the first review, an Applicant can coordinate directly with the Service Authority's Project Engineer to expedite reviews.
3. Revised plats – one full size set (if applicable). These are submitted electronically, as a single PDF, to the Service Authority's Project Engineer, if the Applicant coordinates directly with the Service Authority's Project Engineer.
4. Revised hydraulic analysis, if applicable.

C. Signature Sets

Once the Project Plan review is completed by the Service Authority, a Computer-Aided Design (CAD) file is submitted to and accepted by the Service Authority. Hard copies of Final PWC Approved plan sets are distributed to the Service Authority by the PWC Planning Office prior to permitting and construction. For Town plans, the Applicant will provide two (2) full size sets of the Town approved Project Plans directly to the Service Authority.

D. Easement Documents

For all easements required with the project, the Applicant shall submit both a plat sealed, signed and dated by a Professional Surveyor licensed in the Commonwealth of Virginia, and owner executed deed (see *Appendix L: Omnibus Deed of Easement Template*),

directly to the Development Department for review and execution once the Service Authority has completed the review of the plans.

E. Revisions to Approved Project Plans

Revisions to approved Project Plans have the same submittal and approval requirements as a new plan submission. Revisions to approved Project Plans may require subsequent submissions, additional fees, revised bonds, and/or revised easements, depending on the nature of the revision. However, plats and/or Hydraulic Analysis Report are not required to be provided to the Service Authority if the water and/or sanitary sewer configuration or the proposed easements are unchanged/unaffected by the revision.

Minor modifications to the water and/or sanitary sewer design during construction that do not require easements are often processed as a Field Revision, which requires a PDF submittal to the Service Authority’s Project Engineer of the applicable sheets with the modifications circled.

Once the Applicant has addressed all Service Authority comments, the Applicant shall submit the revised Project Plans to VDH and/or VDEQ (refer to *Chapter 3, Section 3.5*), if needed.

3.4 Calculation of Plan Review Fees

A. Pipeline Projects

Plan Review Fees are calculated from the Base Charge which is dependent upon the submission type (new plan, plan revision, minor site plan, etc.) and the Per Linear Foot fee established by lengths of pipeline reported by the Applicant on the Service Authority Sheet included in the plan submission. The lengths of pipeline reported on the Service Authority Sheet must match the current Project Plans submittal. Plan Review Fees are assessed for each new plan or plan revision, regardless of how many submittals are made to the Service Authority prior to PWC plan approval. Plan Review Fees are invoiced and paid concurrently with the Utility Permit Fee for projects requiring a Utility Permit. For projects that do not require a Utility Permit, Plan Review Fees are invoiced and paid prior to the Service Authority’s Project Engineer completing plan review.

For revisions to previously approved Project Plans, the Plan Review Fee is based upon the length of pipe that has been added or subject to redesign since the most recent PWC plan approval. (See Table 3.1)

Table 3.1 – Review Fees

Type of Submission	Basis of Fee
New Plan	Plan Review Fee is based upon the total length of all proposed pipe, with a base fee and a minimum applied to each utility being proposed.
Each Revision to an Approved Plan	Plan Review Fee is based upon length of all pipe that has been added or subject to redesign since most recent approval, with a base charge and minimum applied to each utility being revised.

B. Pumping and Other Non-linear Facilities

Facilities other than pipelines that are to be dedicated to the Service Authority are subject to Plan Review Fees.

3.5 Local Review Authority

The Service Authority reviews plans under Local Review Authority granted by the VDH for water distribution systems and the VADEQ for sanitary sewer collection facilities and small sewage pumping stations. Project Plans do not require a construction permit from VDH for water mains 18-inches or less in diameter, nor from VADEQ for sanitary sewer mains 24-inches or less in diameter, and sewage pumping stations that have a capacity of no more than one (1) million gallons per day (MGD), average daily flow (ADF).

Prior to obtaining a Service Authority Utility Permit, the Applicant shall submit to VDH and/or to VADEQ for review and approval all Project Plans that meet one or more of the following criteria:

- Sewage Pumping stations with a capacity greater than 1 MGD (ADF)
- Water mains with a diameter greater than 18-inches
- Sanitary sewer mains with a diameter greater than 24-inches

A. Water Facilities

The Service Authority has been granted local review authority by the VDH. This applies to public water mains 18-inch or less in diameter. For projects including water mains greater than 18-inches and for all water booster pumping stations, the Applicant shall submit the required documentation directly to VDH after acquiring the Service Authority's written acceptance of the design. Construction of the project may not begin until a Commonwealth's Waterworks Construction Permit has been obtained.

The Applicant shall provide and submit all applications for a Commonwealth's Waterworks Construction Permit with required Project Plans, specifications, hydraulic modeling, summaries and technical memorandums as necessary to meet VDH submission requirements. Materials shall be provided in both paper and digital format as required by VDH with a PDF copy sent to the Service Authority. Plans for submission to VDH shall bear the design Engineer's original signature and seal (wet stamp) on the cover sheet. Seals and signatures must appear on all plan sheets.

B. Sanitary Sewer Facilities

The Service Authority has been granted local review authority by the VADEQ. This applies to public sewers 24-inch or less in diameter and sewage pumping stations up to a capacity of 1 MGD (ADF). For projects including sewers greater than 24-inch and for pumping stations greater than 1 MGD (ADF), the Applicant shall obtain a Certificate to Construct (CTC) from VADEQ. Construction of the project may not begin until the CTC has been obtained. At the completion of these projects, a Certificate to Operate (CTO) is obtained by the Applicant.

C. General Design Requirements

Applicant shall submit Project Plans that have separate plan and profile views of all proposed water and sanitary sewer mains. Plans are sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia. To ensure that utility crossings are accomplished as designed, the Director or designee may require, prior to Project Plan approval, that the Applicant arrange for test holes on all existing utility lines at the Applicant's expense. The resulting test-hole information is shown on plan and profile views.

3.6 Digital Data

A. When Required

Prior to acquiring a Utility Permit, a digital file in CAD format is submitted to the Service Authority's Project Engineer. This file is used in the Service Authority's Geographic Information System (GIS) to track proposed construction.

B. CAD Files

The Service Authority agrees to protect CAD files as intellectual property and will not distribute the drawings in their CAD form to any third party without the owner's consent. Digitally signed/sealed drawings are not required.

The entire project area is included in the file submitted. The Service Authority (SA) will not accept multiple project files corresponding to the individual plan sheets. Topography is omitted and Applicant shall ensure that the file is geographically referenced.

Horizontal control is based on the Virginia State Plane North Coordinate System, North American Datum of 1983. Linear units are US Survey Feet (not International Feet). Projects that were started prior to September 1, 2008 may use the previous NAD27 datum standard. All new projects started after September 1, 2008 must use the Virginia Coordinate System NAD83 U.S Survey Foot horizontal datum. Plans shall clearly note the horizontal datum used.

Vertical measurements, including elevations, are based on the North American Vertical Datum of 1988 (NAVD 88), with feet as the measurement unit. Projects that were started prior to February 18, 2009 may use the previously required National Geodetic Vertical Datum of 1929 (NGVD 29). Plans shall clearly note the vertical datum used.

1. General Requirements:

- a. The CAD file shall match the approved Project Plans.
- b. The drawing image shall be rotated to show North up.
- c. The CAD file shall be titled with the PWC project name and number.
- d. To the extent possible avoid the use of x-references. If there are X-references are needed, they shall be bind prior to submitting the CAD file and cleared x-clips.

- e. Layers not listed in Chapter 3, Section 6.B.2 shall be purged from the CAD file.
 - f. Bind the CAD file.
2. Provide the following layers when applicable:
- a. Right-of-way
 - b. Lot/parcel boundaries
 - c. Building footprints
 - d. Edge of pavement/curb and gutter
 - e. Project limits
 - f. Water mains and appurtenances
 - Water mains with the size, material and external corrosion protection
 - Domestic service laterals with size, material, and external corrosion protection
 - Valves
 - Fire hydrants
 - Meters`
 - Wells, tanks, water related facility
 - Plugs and blow off assemblies
 - Siamese connections
 - g. Sanitary sewer mains and appurtenances
 - Sewer lines with size, material and external corrosion protection
 - Force mains with size, material and tracing mechanisms
 - Manholes
 - Laterals and cleanouts
 - Valves
 - Plugs
 - Pump stations, grinder pumps, grease traps, or sewer related facility
 - h. Easements
3. The following is a list of acceptable formats/version:
- a. ESRI ArcView Shapefile (preferred)
 - b. ESRI File/File Geodatabase
 - c. AutoCAD 2012-2017
 - d. AutoCAD DXF 2012-2017
 - e. Microstation (versions 7-8)

3.7 Review Process

A. Pre-application Conference

No pre-application conference is required; however, the Applicant's Engineer preparing Project Plans for submission to the Service Authority is encouraged to seek information from the Development Department. Among items that can be provided are record

drawings of existing facilities on adjoining or supporting the subject site; the nature of planned facilities that impact the site; capacity limitations that may exist; and preferences as to layout.

B. Reviews

In response to each plan submission, the Service Authority will provide comments or an acceptance letter. Priority is given to PWC due dates and plan revisions, where construction is already underway. The Service Authority's review of all Applicants' Project Plans is based on evaluating the proposed utility layout to ensure that it fully integrates with the System Performance Standards as defined in this Manual. Service Authority comments and requirements related to development applications and Project Plans shall serve to strengthen and enhance the utility system to maximize system reliability, capacity, resiliency, connectivity and performance.

Applicant shall not rely on the timing of Service Authority Capital Improvement Projects (CIP) as shown in the approved CIP for preparation of hydraulic studies to confirm infrastructure requirements. The approved CIP is a planning document, and the timing of projects is subject to change.

The review of an Applicant's Project Plans by the Development Department focuses on the proposed configuration of water and/or sanitary sewer facilities to meet all USM and applicable regulatory requirements. The Applicant is required to fund the design and construction of water and sanitary sewer facilities, regardless of size, both onsite and offsite, necessary to serve the proposed development, including provisions for fire protection.

C. Conferences During Design

Throughout design or redesign, the Applicant's Engineer is encouraged to confer with the Service Authority Engineer, as to the suitability of contemplated layouts or design features. This may take the form of electronic mail and telephone calls, or if needed, meetings.

-- end of Chapter 3 --

Chapter 4: Water Distribution

4.1 Scope

A. Intent

This Chapter describes the planning, layout, design and construction of water systems owned and maintained by the Service Authority.

B. Standards

The Applicant shall apply the information contained in this Chapter in conjunction with the latest edition of the Waterworks Regulations 12 VAC 5-590-10 et seq., published by the Commonwealth of Virginia, Department of Health; standard practices of the American Water Works Association (AWWA); and with other sections of this Manual. The Authority for discretionary provisions for designs lies with the Director or designee.

Connections to the Service Authority's water distribution system are mandated per PWC Municipal Code, Section 32.

C. Definitions

1. "Applicant" shall mean that person or persons applying for a rezoning, submitting plans, analyses, or studies; acquiring permits, constructing utilities, applying for meter certification, requesting inspections, granting easements, requesting bond release, or any activity related to developing land, extending utilities, or establishing water service. All actions performed and the associated expenses are the responsibility of the Applicant.
2. "Furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or other specified location) ready for use or installation and in new, unexpired, usable and operable condition.
3. "Install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
4. "Perform" or "provide," when used in connection with services, materials, or equipment shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
5. "Performance Standards" shall mean system configurations or extensions that maximize reliability, capacity, redundancy, resiliency, connectivity, water quality, operational efficiency, cost-effectiveness of operations, maintainability, customer satisfaction, and a sustainable delivery of water pressure.
6. "Project Plans" shall mean a set of plans used for site development containing the necessary information to extend utilities and provide water and/or sanitary sewer service sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia.

D. Minimum Standards

Applicant shall, at a minimum, meet all standards described in this Chapter for all water facilities that are incorporated into the Service Authority's System regardless if the facility is within public a right-of-way or on private property with dedicated easements.

Many criteria listed are minimums; however, the Applicant shall provide additional separations and clearances as practical to optimize each design and locate utilities so as to facilitate their re-excavation. The Service Authority will consider factors such as depth and magnitude of the facility in determining the adequacy of each design and may relax or increase dimensional requirements accordingly. Designs shall minimize both maintenance and life cycle costs for the Service Authority.

4.2 Hydraulic Requirements

A. General

The Applicant shall configure and size all water mains to meet the Performance Standards. The Service Authority's review of all development applications and Project Plans is based on those plans meeting the Performance Standards of the entire water distribution system and not just a local component of it. When submitting Project Plans for review and acceptance, the Applicant shall submit a Hydraulic Analysis Report meeting the specific requirements and format outlined in this Chapter.

The Hydraulic Analysis Report shall state the assumptions made about the existing water distribution system and provide calculations showing available flow rates at the proposed hydrant locations and node pressures throughout the proposed water distribution system.

B. Hydraulic Analysis Report

The Applicant shall prepare and submit a Hydraulic Analysis Report to the Service Authority's Project Engineer for water distribution system extensions. The Applicant shall perform the hydraulic analysis with modeling software demonstrating that the proposed water distribution system extension fully meets the requirements in this Chapter.

1. When a water distribution system extension is proposed within 1,000-feet of a water storage tank, the Applicant shall configure the model using the tank as a fixed grade node and shall assume the tank is half full at the low hydraulic grade line for the given pressure zone.
2. When a water distribution system extension is proposed at a location greater than 1,000-feet from a water storage tank, the Applicant shall configure the model using a simulated reservoir and pump. The simulated pump is created using data from a Service Authority hydrant flow test and the static and residual pressures adjusted to the low hydraulic grade line for the given pressure zone.
 - a. The Applicant shall locate the simulated reservoir and pump in the same location as the static test hydrant identified in the hydrant flow test report.
 - b. The Applicant shall use no more than one simulated pump in the model unless written approval is obtained from the Development Manager or designee.

3. When a large project will develop as multiple sections or phases, the Applicant shall furnish an overall master Hydraulic Analysis Report with consideration to the sequencing of the development. The overall master Hydraulic Analysis Report shall demonstrate that it meets all hydraulic requirements at full build-out; however, the Applicant shall create a separate hydraulic analysis for each Project Plan section/phase demonstrating the design fully meets the requirements independent of a future section or phase.

C. Estimating Water Demand

Applicant shall use the minimum average day demand factors listed in Table 4-1 unless alternate values for comparable facilities, particularly for office, industrial, and commercial facilities are documented by the Applicant and accepted for use by the Development Manager, or designee, and the Planning Manager.

1. The Applicant shall apply average and maximum day demands in the hydraulic analysis as a flow rate in terms of gallons per minute over a maximum 14-hour day unless the Director or designee specifies otherwise.
2. The Applicant shall apply maximum day demands using a factor of 1.6 times the average day demands and shall assume irrigation demands are included, unless irrigation demands are a primary use for a meter, such as golf courses or ball field irrigation.
3. For applications (e.g., bottling, process, cooling, data centers, etc.) having a maximum day demand greater than the factor of 1.6 times the average day, the Applicant shall apply the greater maximum day demand.

Table 4-1: Minimum Average Day Water Demand Factors

Land Use Category	Density (unit/acre)	Unit	Flow/Unit (gpd)
Residential			
Urban (UR)	15–30	Dwelling unit	250
Suburban—High (SRH)	8–15	Dwelling unit	300
Suburban—Moderate (SRM)	4–8	Dwelling unit	350
Suburban—Low (SRL)	1–4	Dwelling unit	350
Semi-rural (SRR)	0.2–1	Dwelling unit	350
Rural (RR)	0.1–0.2	Dwelling unit	390
Agricultural/Estate (AW)	0.1	Dwelling unit	390
Office			
Regional Employment (REC)	—	Acre ^a	2,000
Office/Flex (OF)	—	Acre ^a	2,000
Community (CEC)	—	Acre ^a	2,000
Office (O)	—	Acre ^a	2,000
Industrial			
Heavy (HI)	—	Acre	2,000
Light (LIF)	—	Acre	1,500
Commercial			
Regional (RCC)	—	Acre ^a	2,000
Community (CC, NC)	—	Acre ^a	2,000
<p>“Acre” refers to gross acreage.</p> <p>For specific demand factors not covered in this table, refer to the Virginia Department of Health <i>Waterworks Regulations</i>, 12 VAC 5-590-690, Capacity of Waterworks.</p> <p>^a If an office, retail or commercial building size is known, use 0.21 gpd per square foot instead of gross acreage factor shown.</p>			

D. Flows and Pressures

For water distribution system extensions of 100-feet or less, the Applicant may provide calculations in the Project Plans demonstrating the available fire flow in the existing water distribution system in place of a formal Hydraulic Analysis Report, with approval by the Development Manager or designee.

The Applicant shall model a water distribution system with extensions greater than 100-feet. Based on the model result, the Applicant shall prepare a design to meet these requirements:

1. Adequate capacity to supply the average (normal) and maximum day demands of all customers while maintaining a pressure of 30 psi or greater at the water main.
 - a. The Applicant shall provide an individual private domestic booster pump, if the minimum delivery pressure, at the building entrance, is less than 40 psi based on the low hydraulic grade line of the pressure zone.
 - b. The Applicant shall provide a private pressure reducing device, if the maximum working pressure within a building is greater than 80 psi based on the high hydraulic grade line of the pressure zone.
2. Adequate capacity to supply the simulated maximum day demands plus fire flow demands, while maintaining a residual pressure of 20 psi or greater throughout the system.
 - a. The Applicant shall apply fire flow demands in the hydraulic analysis as a flow rate in terms of gallons per minute.
 - b. For a project in the County, water distribution systems are designed to meet the fire flow requirements in Section 300 of the DCSM.
 - c. For a project in an incorporated Town, water distribution systems are designed to meet the Town's fire flow requirements.
 - d. If a Hydraulic Analysis Report concludes there is no reasonable way to provide the required flow rates, the Applicant shall acquire a waiver for the available fire flow from PWC Fire Marshal and provide a copy of the waiver to the Development Manager.

E. Main Velocity

The Applicant shall design an extension of the water distribution system to limit velocities in the pipe to no more than 10-fps. The velocity limitation is not applicable to hydrant leads or pipes between a simulated reservoir and pump when modeled as part of a hydraulic analysis. The Director or designee may waive the velocity limit in a modeled fire flow scenario in cases where one or more of the following is true:

1. The high velocity is a trade-off for smaller pipe sizes to improve water quality.
2. An existing field condition cannot be reasonably mitigated.
3. Restrictions in other areas are deemed appropriate to improve water quality.

F. Sizing Water Mains

The Applicant shall size water mains to meet the flow, pressure and velocity requirements in this Chapter and the Performance Standards. Water mains 12-inches or smaller in diameter are considered to be local distribution mains. Water mains 16-inches or larger in diameter are considered to be transmissions mains, unless they are needed to support the proposed development.

1. For single-family detached residential developments, the Applicant shall design the primary supply main with either a minimum 8-inch diameter main (for continuity, hydraulic capacity, and stabilization of the distribution network) or match the diameter of the existing main.
2. For townhomes, multi-family, student housing, mixed-use developments, commercial, and industrial areas, the Applicant shall design the primary supply main with a minimum 12-inch diameter main. The Development Manager may approve, on a case-by-case basis, smaller diameter mains for a looped water network, as confirmed by the Applicant's hydraulic calculations, or to meet the Performance Standards.
3. Ten (10) inch and 14-inch diameter water mains are not standard and are not used without the written approval of the Development Manager or designee with the possible exception of tying into an existing water distribution system.
4. The Development Manager may approve, on a case-by-case basis, smaller water mains, 4-inch and 6-inches in diameter, for cul-de-sacs, pipe stems, and dead-ends. A 4-inch diameter water main may serve up to a maximum of five (5) homes.
5. The minimum water main diameter for fire hydrants is six (6) inches. The Applicant shall exclude hydrant leads less than 50-feet in length from the model.
6. Fire lines shall be sized in accordance with the DCSM, but the Applicant shall exclude them from the model.
7. Water service lines to meters shall be sized in accordance with Table 4-2, but the Applicant shall exclude them from the model.

G. Pipe Friction

The Applicant shall calculate head losses using the Hazen-Williams equation with a roughness coefficient (C) of 120 for pipes 12-inches in diameter and larger and a roughness coefficient (C) of 100 for pipes smaller than 12-inches in diameter. Minor losses from valves and other fittings do not need to be separately quantified based on the conservative C value.

H. Hydraulic Analysis Report Content

The Applicant shall prepare and submit to the Development Department a geographically spatially accurate CAD file or GIS feature class of the hydraulic model along with a hard copy or PDF version of the Hydraulic Analysis Report. The Hydraulic Analysis Report shall contain the following information:

1. Title Page
 - a. Title the report with the same plan name and plan number matching the final engineering plans. Include the date the Hydraulic Analysis Report was last updated.
 - b. A Professional Engineer licensed in the Commonwealth of Virginia shall seal, sign, and date the title sheet.

2. Overview
 - a. Report the site development location, densities (e.g., number of dwelling units) or metrics (e.g., acres) that will be used to calculate water demands.
 - b. Report all pertinent background information for the development.
 - c. Report all surrounding and known proposed developments that may impact, or could be impacted by, the proposed project.
 - d. Describe the source of water and the existing water system. If modeling from a tank as a fixed grade node, report the tank name and location.
 - e. Identify the pressure zone and the associated low hydraulic grade line used for hydraulic adjustments.
3. Basic Data
 - a. Report the modeling software and version.
 - b. State that the selected modeling software is appropriate for the analysis. If a modeling software other than InfoWater is used, the Applicant shall certify in the Hydraulic Analysis Report that the network hydraulic theory is similar to InfoWater.
4. Design Criteria
 - a. Report the roughness coefficient (C) used for the different diameter pipes.
 - b. Report the minimum pressure requirements to meet maximum day demands.
 - c. Report the minimum pressure requirements for concurrent maximum day plus fire flow demands.
 - d. Report the fire flow requirement, per the type of development, and cite the governing standard (e.g., DCSM Section 300).
 - e. Report the velocity requirement that must be met.
5. Assumptions
 - a. Reference the source for the water demand factors used to determine average day demands (e.g., Table 4-1).
 - b. Demonstrate how average day demands are calculated over a 14-hour day and convert to gallons per minute.
 - c. Demonstrate how maximum day demands are calculated by applying a factor of 1.6 to average day demands. The Applicant shall present and explain higher maximum day demands in the study, if the expected maximum day demands are greater than 1.6 times the average day demand.
 - d. Report the nodes where maximum day demands are applied in the model.

6. Analysis
 - a. Report if the model was configured as a tank with a fixed grade node or as a simulated pump and reservoir.
 - b. Report how the tank or simulated pump and reservoir were calibrated for the pressure zone's low hydraulic grade line.
 - c. Report which model scenarios were run.
 - d. Report which design criteria have been met.
 - e. Report which design criteria have not been met and the location of the nonconformance.
7. Conclusion
 - a. Summarize the maximum and minimum pressures in the proposed water system with maximum day demands.
 - b. Report the available fire flow and lowest residual pressure in the modeled water system.
 - c. Report the maximum velocity determined by the model.
 - d. Reference actions or USM Waivers required to mitigate nonconforming results.
8. Schematic
 - a. The Applicant shall provide a schematic on a 24-inch by 36-inch plan sheet.
 - b. The schematic shall contain both the onsite and offsite water distribution systems represented in the model. The Applicant shall scale the schematic with pipe lengths matching the Hydraulic Analysis report.
 - c. The schematic shall identify all pipe segments matching the pipe report and shall report the pipe size with the pipe identifier.
 - d. The schematic shall identify all nodes matching the node report and label in a logical sequence. The Applicant shall report maximum day demands, where applied, with the node in the schematic.
 - e. The Applicant shall superimpose the schematic on an overall project site plan showing streets, buildings, retaining walls, natural drainage features and topographical/contour lines with elevation data.
9. Appendixes
 - a. Appendix A shall contain the Service Authority-generated hydrant flow test report.
 - b. Appendix B shall contain calculations and report tables for the simulated pump and reservoir adjusted to the low hydraulic grade line for the pressure zone. The Applicant shall provide a 3-point pump curve.
 - c. Appendix C shall contain pipe and node reports for a maximum day demand model scenario.

- d. Appendix D shall contain pipe and node reports for fire flow model scenarios. The Applicant shall run a separate fire flow model scenario for each hydrant designated to provide fire coverage with maximum day water demands applied.

10. Report Formats

Figure 4-1: Example Report Format

Table of Water Demands							
* Building ID	† No. Units or # of Lots	Demand Factor (GPD / Unit)	Hours per day	‡ Average Day Demand (gpm)	Max Day Factor	Max Day Demand (gpm)	Applied at node
			14		1.6		
<p>* This column is used to identify multi-family or non-residential structures that have a water demand. † This column is used to report the number of single-family dwellings, acres, seats, students, or sq. ft. ‡ Average day demand (gpm) = No. Units $\times \frac{\text{gallons}}{\text{day}} (\text{Demand Factor}) \times \frac{1 \text{ day}}{14 \text{ hours}} \times \frac{1 \text{ hour}}{60 \text{ min.}}$</p>							

Reservoir Report Table			
Tank Number or Name	Elevation (ft)	Inflow/Outflow	Hydraulic Grade

Pump Report Table							
Pump Number	Elevation (ft)	Pump Definition (3-Point Curve)	Status (On/Off)	Intake Grade (ft)	Discharge Grade (ft)	Discharge (gpm)	Head (ft)

Pipe Report Table						
Pipe Number	From Node	To Node	Length	Diameter	Pipe Friction (Hazen-Williams) C Factor	Velocity

Node Report Table				
Node Number	Elevation (ft)	Demand (gpm)	Hydraulic Grade	Pressure (psi)

4.3 Design

A. General

The Applicant shall configure and size all water mains to meet the Performance Standards. Hydraulic designs are not limited to providing water service to a local area. The Applicant shall adapt the hydraulic design to function properly with the existing water distribution system and support the logical extension of the water distribution system. Designs shall accommodate system improvements when requested by the Director or designee. Extensions from water mains greater than 30-inches require written authorization from the Director.

Relocation of existing water mains or facilities is the responsibility of the Applicant when proposed site development or site improvements creates a conflict or condition that does not comply with this Manual. The Applicant shall replace in kind water facilities in conformance with this Manual and with new materials.

B. Layout

1. Location of Mains

- a. Where possible, the Applicant shall locate water mains under pavement or in a location that will permit the reasonable re-excavation without impacting other underground or above-ground utilities and/or structures.
- b. The Applicant shall locate water mains to minimize impacts to, but not limited to, above ground or underground structures and utilities and concrete work (e.g., curb, gutters, sidewalk, trails, driveways, etc.).
- c. The Applicant shall, to the extent possible, maintain water line alignment within the shoulder of a road or single lane of traffic to provide the least amount of disruption if re-excavated.
- d. The Applicant shall not place water mains in dam/storm water embankments, slopes greater than or equal to 3:1, under structures, in reinforced soil areas (e.g., geo-grid, tie-backs) for a structure, in areas where re-excavation would undermine the support of a structure and require shoring, or in non-accessible areas. The Director or designee may require structural details, sectional views of the building's loading plane, and engineering certification of the building foundation to confirm there are no impacts to future excavation.
- e. For secure sites requiring indirect routes of travel for Service Authority personnel to access its facilities, the Director or designee may require a site-specific access agreement and route map prior to placing the system into Beneficial Use.

2. Reliability

- a. Two (2) sources of supply from the existing water system are desirable to improve reliability, water quality, and operation of the water system. The Director reserves the right to require multiple supply feeds and loop closures.
- b. Virginia Regulation 12VAC5-590-1130, "System Design," requires minimizing dead-end water mains by looping all mains. Where possible, the Applicant shall loop water mains to eliminate dead ends. The maximum length of a permanent dead-end water main is 500 feet.

3. Water Main Stubs

- a. The Applicant shall provide water main stubs in strategic locations, as required by the Development Manager, or designee, to permit access to adjacent properties and for the logical extension of the water distribution system.
- b. The Applicant shall extend water main stubs beyond all site improvements to enable future extensions with minimal disruption.
- c. The Applicant shall utilize existing water main stubs for connection. The Applicant shall extend water mains and close water main loops for all existing water main stubs available for connection. If the Performance Standards can be achieved with an alternate connection, with the approval of the Development Manager, the Applicant shall remove all unused water main stubs and appurtenances as part of the design and cost of the project.

C. Water Quality

Designs shall maximize water quality (0.5 mg/L minimum chlorine residual) by looping, minimizing dead-ends, and proper sizing of water mains while balancing system effectiveness, efficiency, and operational costs. Designs shall not specify water main sizes larger than necessary to meet the Performance Standards.

1. Meter Placement

- a. The Applicant shall design, to the extent possible, the water system layout and building layout to coordinate the placement of the mechanical room in the same vicinity as the terminus of the dead-end water main.
- b. The Applicant shall design, to the extent possible, the location of meters at the end of dead-end water mains.

2. Automatic Flushing Station

- a. Applicant shall provide a dedicated easement area for a future metered automatic flushing station if the design makes maintaining water quality questionable as determined by the Development Manager or designee.
- b. When directed by the Development Manager or designee, the Applicant shall provide a temporary metered Hydro-Guard automatic flushing station, model HG 2 R IN 2 PVC 018 LPLG – TCV, for phased occupancy of residential projects if water quality complaints are registered with the Service Authority. The Applicant shall remove temporary automatic flushing stations prior to bond release.
- c. The Applicant shall provide an easement area and a permanent metered automatic flushing station, prior to bond release, when water quality complaints are not resolved with the full build out of the development.

4.4 Water Main and Appurtenances

A. Ductile Iron Pipe

1. Material

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal requirements. The Applicant shall specify pressure rated ductile iron pipe (DIP) for water main construction by thickness class and in accordance with AWWA C151 (ANSI A21.51).

- a. The Applicant shall specify pipes as double-lined with cement mortar, in accordance with AWWA C104 (ANSI A21.4), and have a protective exterior coating with no defects, gouges or damage.
- b. The Applicant shall specify all pipes as thickness Class 52.

2. Joints

The Applicant shall specify joints for DIP as standard “push-on” or “mechanical” joint and that the joint type is in accordance with AWWA C151 (ANSI A21.51). The Applicant shall specify that joints and gaskets of standard mechanical joint pipe are in accordance with ANSI A21.11. Joint deflection is limited to specifications published by the Ductile Iron Pipe Research Association (DIPRA).

3. Fittings

The Applicant shall specify fittings for DIP are in accordance with AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI A21.53), with a minimum pressure rating of 250 psi.

4. Restraint

The Applicant shall restrain all ductile iron pipe, tees, bends, reducers, plugs, caps, valves, and fire hydrants against movement with mechanical restraining glands (refer to *Appendix C: USM Approved Products List*) in accordance with manufacturer recommendations.

- a. The Applicant may use a proprietary joint restraint system provided by the pipe manufacturer in place of an external restraining gland; however, factory restrained joints, high-strength ductile iron tee-head bolts, hex nuts, ductile iron glands, and rubber gaskets shall remain as the pipe manufacturer has furnished them.
- b. The use of a thrust collar (anchor) is permitted in place of restrained joints provided the Applicant submits, for acceptance by the Service Authority, the necessary calculations and details in the Project Plans.
- c. In addition to mechanical restraining glands, the Applicant shall set all 90-degree bends with a concrete thrust block. The Applicant shall use concrete thrust blocking with permanent plugs and caps. Concrete thrust blocking specified in place of mechanical restraining glands is permitted on a case-by-case basis with the approval of the Development Manager or designee.
- d. The use of gasket restraint devices is only permitted on a case-by-case basis with

the approval of the Inspections Manager or designee.

- e. The Applicant shall restrain all valves connected to a cross or tee fitting configured as a water line stub for a future extension with a non-friction type mechanical fastener (e.g., swivel tee or Foster adapter) or non-friction type proprietary joint restraint.

B. Polyvinyl Chloride (C-900) Pipe

1. Materials

Materials shall comply with the requirements of the Safe Drinking Water Act and other federal requirements. Pressure rated C-900 pipe is permitted on case-by-case basis with the approval of the Development Manager or designee. C-900 pipe shall meet AWWA C-900 and ASTM D1784 with a cell classification of 12454.

- a. The Applicant shall specify pipes 12-inches or less in diameter as C-900 with a minimum Dimension Ratio (DR) equivalent to DR-14.
- b. Pipes greater than 12-inches in diameter must be approved for use by the Director.
- c. All C-900 water mains shall have two (2) locatable tracer wires attached, per the detail(s) of this Manual. Test stations for trace wire shall be provided similar to the requirements listed in *Chapter 5, Section 5.8.N*.

2. Joints

All joints for C-900 pipe require a standard “push-on” joint in accordance with AWWA C-900. Joints and gaskets of standard C-900 pipe are required to meet ASTM D-3139 and ASTM F477. Pipe shall be provided from the manufacturer with two insertion marks on the spigot end of the pipe. No pipe deflection is permitted in the joints or pipe.

3. Fittings

Only one-piece injection molded Polyvinyl Chloride (PVC) fittings meeting ASTM D1784 and AWWA C907 are permitted for C-900 pipe. Fittings shall match the DR rating of the pipe. When PVC fittings are not available, ductile iron fittings are permitted as an alternative.

4. Restraint

Applicant shall restrain all C-900 pipe, tees, bends, reducers, plugs, caps, valves, and fire hydrants against movement with concrete thrust blocking, thrust collars, or a proprietary joint restraint system provided by the pipe manufacturer.

C. Restraint Calculations

Applicant is responsible to calculate, specify, and certify the amount of restraint in the Project Plans for a given design. The Applicant is responsible to determine all system factors and assumptions necessary to support the calculations to include, but not limited to, the following:

1. The Applicant shall classify the soil type used for the calculations.
2. The Applicant shall use a minimum safety factor of 1.5 for the calculations.
3. The Applicant shall use laying condition type 4, in accordance with ANSI/AWWA C150/A21.50, with a minimum pipe bedding of 4-inches of #57 stone for all calculations.
4. The Applicant shall calculate thrust restraints based on a test pressure of 100 psi plus the maximum static pressure, or a minimum test pressure of 200 psi, whichever is greater.
5. The Applicant shall specify in the water line profile of the Project Plans the station where pipe restraint shall begin and the station where pipe restraint shall end.
6. The Applicant shall fully restrain all hydrant leads and ductile iron service lines to meters.
7. The Applicant shall fully restrain all fittings.
8. The Applicant shall fully restrain all pipe within a casing.
9. The Applicant shall fully restraint all pipe installed between two adjoining residential lots.
10. The Applicant shall fully restrain all pipe installed with slopes set at 15 percent or greater.

D. Corrosion Protection

The Applicant shall encase all ductile iron pipe, fittings, and appurtenances with 4-mil high-density, cross-laminated polyethylene tube wrap (polywrap) in accordance with AWWA C105 (ANSI A21.5). In addition, the Applicant shall completely coat all fasteners and appurtenances with Roskote R28 rubberized mastic.

In areas within 100-feet of gas transmission mains with impressed current systems, rectifiers, or other potential sources of stray current, the Applicant shall provide additional engineering analysis by a NACE-certified Engineer to determine a suitable means to protect the water main from corrosion or use C-900 as permitted in Section 4.4.

E. Soil Corrosivity Analysis

Reserved for future use

F. Separation and Crossings

1. Parallel Installations

- a. Water mains shall not pass through or come into contact with any part of a sanitary sewer manhole. The Applicant shall provide water mains with at least a 10-foot horizontal separation from a sanitary sewer main or manhole, septic tank, or drain field. The distance is measured edge to edge. The Applicant shall also provide a 10-foot horizontal separation from other utilities and appurtenances (i.e., storm drainage, gas mains, electric, telecommunications, etc.).
- b. In conditions, as determined by the Service Authority, that prevent a horizontal separation of 10-feet between the water main and sanitary sewer main or sanitary sewer manhole, the Applicant may reduce the horizontal separation to 7.5-feet between the water main and the sanitary sewer main or sanitary sewer manhole, provided:
 - i. The bottom of the water main is a minimum of 18-inches above the top of the sanitary sewer main. Where this vertical separation cannot be obtained, the sanitary sewer main must be constructed of AWWA approved water main and pressure tested, in place, without leakage.
 - ii. The sanitary sewer manhole is of watertight construction and tested in place, without leakage.
- c. In conditions, as determined by the Service Authority, that prevent a horizontal separation of 10-feet between the water main and other utilities, the Applicant may reduce the horizontal separation to 7.5-feet from other utility lines.

2. Utility Crossings

- a. Water mains shall cross above sanitary sewer mains with a minimum vertical separation of 18-inches between the bottom of the water main and the top of the sewer main.
- b. In conditions, as determined by the Service Authority, that prevent an 18-inch vertical separation, the Applicant shall use the following construction methods:
 - i. The Applicant shall construct sanitary sewer mains passing over or under water mains with AWWA-approved water main and pressure tested in place without leakage.
 - ii. The Applicant shall protect water mains passing under sanitary sewer mains by constructing structural supports under the sanitary sewer main joints to prevent excessive deflection and settling.
 - iii. When water mains pass under sanitary sewer mains, the Applicant shall provide a vertical separation of at least 18-inches between the bottom of the sanitary sewer main and the top of the water main. The Applicant shall center the water main at the point of the crossing so that water main joints are equidistant and as far as possible from the sanitary sewer main.
- c. The Applicant shall install water mains a minimum of 12-inches above other utility lines with the exception of crossing over a storm sewer pipe, in which case the minimum separation is 6-inches. Whenever possible, water mains should cross over other utility lines. The Applicant may reduce the cover over the water main at a utility crossing to 36-inches to maintain the minimum separation

between the water main and other utility lines. The Applicant shall center the water main at the point of the crossing so that water main joints are equidistant and as far as possible from the storm sewer pipe.

- d. When water mains cross under storm sewer pipes 36-inches or greater in diameter, the Applicant shall protect water mains passing under storm sewer pipes by constructing structural supports under the storm sewer pipe joints to prevent excessive deflection and settling. The Applicant shall center the water main at the point of the crossing so that water main joints are equidistant and as far as possible from the storm sewer pipe.
3. Stream Crossings
 - a. The Applicant is responsible for obtaining all required Local, State, and Federal approvals and permits to install a water main designed for a surface water crossing. Above-water (aerial) crossings are not permitted.
 - b. All water mains crossing surface water require a minimum of 2-feet clearance under the invert of the creek bed.
 - c. All water mains shall have flexible, restrained, watertight joints. Valves shall be set per Section 4.5.F.2.
 - d. All water mains shall cross perpendicular to the stream, where possible.
 - e. Sampling taps are required at each end of the crossing and at a reasonable distance from each side of the crossing for testing and locating leaks and located outside of and protected against a 100-year storm event.

G. Depth of Cover

1. When possible, the Applicant shall install water mains at a minimum depth of 42-inches, from finished grade to the top of the pipe, without creating intermediate high and low points.
2. The Applicant shall not design or install water mains at depths greater than 8-feet, as measured from finished grade to the top of the pipe.
3. The Applicant shall profile all grade changes over existing water mains, with the exception of 12-inches or less of additional fill. The Applicant shall determine the elevation of an existing water main by test pits to certify an accurate profile. The Applicant shall include the test pit information of the existing water mains in the Project Plans prior to Project Plan acceptance.

H. Casings

1. The Applicant shall install mains that are bored under a right-of-way, roadway, railroad, streams, sensitive environmental area, or installed under an obstruction, in a steel casing, in accordance with the details in this Manual. The Applicant is responsible to adhere to the requirements of the regulatory agency having jurisdiction over the design, installation, and permitting of the casing.
2. The Applicant shall provide design information for the casing pipe installation in the Project Plans, including the material, thickness, diameter, and length in accordance with the details in this Manual. In the case where the size of main proposed is not

listed in the detail, the Applicant shall provide the design calculations for the casing pipe and the means to restrain the main in the casing pipe for Development Manager's approval.

3. The Applicant shall provide welded, one piece, steel casing pipe with a consistent inner and outer diameter.
4. The Applicant shall install the casing pipe on a slope to allow drainage. The casing shall extend as dictated by site conditions to provide easy access for pipe extraction, extension, and maintenance along with the requisite property access rights (easements).
5. The Applicant shall ensure mains are centered and restrained from movement within the casing pipe with prefabricated stainless steel pipe supports with non-conductive skids or other support system as listed on the Approved Products List. Pressure-treated timber skids are NOT permitted.
6. When casings are extended due to road-widening projects, the Development Manager may consider the use of split casings with concrete supports.
7. The Applicant shall mark all casings ends with a fixed metal post and install a 1-inch steel cable welded from each end of the casing to the metal post or as directed by the Field Inspector.

4.5 Valves

The Applicant shall provide valves at all connecting intersections of water mains: four valves are required at crosses and three valves at tees. The Applicant shall provide a valve for each 1,000-foot interval of water main installed, as well as additional valves as directed by the Development Manager. The Applicant shall provide a valve no more than two (2) pipe sections from the end of all dead-end water main segments designed for a future extension, to provide a point to test against and to maintain service to existing customers when the pipe is extended.

A. Gate Valves

1. The Applicant shall provide resilient seated wedge gate valves for water mains 12-inches or smaller in diameter, in accordance with AWWA C509 or AWWA C515. Reference the Approved Products List for acceptable products.
2. Gate valves shall withstand a working pressure of at least 250 psi, unless otherwise directed by the Development Manager.
3. The Applicant shall provide ductile iron bodied gate valves in accordance with ASTM 536, Grade 65-45 or higher strength, with 304 stainless steel fasteners.
4. The Applicant shall provide gate valves with mechanical joints, in accordance with AWWA C111.
5. The wrench nut shall turn counterclockwise to open the valve.
6. The Applicant shall provide valves with a fusion-bonded, epoxy-coated surface, interior and exterior, in accordance with AWWA C550.

B. Butterfly Valves

1. The Applicant shall provide butterfly valves for water mains greater than 12-inches in diameter, in accordance with AWWA C504. Reference the Approved Products List for acceptable products.
2. The Applicant shall provide Butterfly valves with full-circle, 360-degree rubber-seated, tight-closing valve seat. All butterfly valves shall withstand a working pressure of at least 250 psi, unless directed otherwise by the Development Manager.
3. The Applicant shall provide ductile iron bodied butterfly valves and in accordance with ASTM A536, Grade 65-45 or higher strength with 304 stainless steel fasteners.
4. The Applicant shall provide butterfly valves with mechanical joints, in accordance with AWWA C111.
5. The Applicant shall provide completely enclosed and permanently lubricated actuators for direct bury and frequent submergence in water up to 20 feet of head. The actuator shall open the valve with a counterclockwise rotation and supplied by the same manufacturer as the valve.
6. The Applicant shall provide valves with a fusion-bonded, epoxy-coated surface, interior and exterior, in accordance with AWWA C550.
7. The Development Manager or designee may require a bypass for 24-inch or larger butterfly valves, depending upon the available system configuration, to equalize pressure on each side of the valve.

C. Insert Valves and Line Stops

1. Insert valves and line stops are used at the direction of Development Manager or designee to avoid service outages to customers. Insert valves and line stops are eligible for use with 12-inch or smaller diameter water mains. When insert valves are permitted, the Applicant shall provide resilient seated wedge gate valves made with a ductile iron body, in accordance with AWWA C515, with 304 stainless steel fasteners. Reference the Approved Products List for acceptable products. All insert valves and line stops shall withstand a working pressure of at least 250 psi. The wrench nut shall turn counterclockwise to open the valve.
2. The Applicant shall permanently restrain the valve body to the pipe to maintain pipe integrity via an integral mechanical joint.

D. Fire Line Valves

1. The Applicant shall provide a resilient seated wedge gate valve on all fire lines connected to the public water system. The Service Authority's operation and maintenance responsibility stops at this valve. The Fire Marshal approves the design and conducts inspections of all fire line installations beyond the valve.

E. Tapping Sleeves and Valves

1. The Applicant shall provide mechanical joint type tapping sleeves with a ductile iron body, 304 stainless steel fasteners, and a brass test plug suitable for installation on the existing pipe, in accordance with AWWA C110 (ANSI A21.10). Stainless steel tapping sleeves may be used for a specific field condition as directed by the Field Inspector. Reference the Approved Products List for other acceptable products.
2. The Applicant shall provide mechanical joint type tapping valves with O-ring seals, non-rising stem, in accordance with AWWA C500, with 304 stainless steel fasteners and supplied by the same manufacturer as the tapping sleeve. The inlet end shall have a Class 125 flange for the attending sleeve.

F. Valve Locations

1. The Applicant shall place valves in strategic locations to allow segments of the system to be isolated for repairs and maintenance while leaving the rest of the system in service to minimize the number of customers without service.
2. Place valves on both sides of stream crossings, railroad crossings, limited access right-of-way, and casing pipes. The Applicant shall install isolation valves two (2) full pipe segments outside the limits of jack and bore pits. The Applicant shall restrain pipe upstream and downstream of an isolation valve(s) to allow future pipe removal between the isolation valves.
3. Locate valves within paved areas near the fitting where possible. The Applicant shall not place valves or valve boxes within the limits of any curb, gutter pan, driveway, sidewalk, trail, parking space, or in areas subject to flooding.
4. When valves are located outside of paved areas, Applicant shall set the valve boxes in accordance with the details in this Manual and paint all valve box lids blue as directed by the Field Inspector

G. Valve Boxes

1. The Applicant shall provide cast iron valve boxes; bases, extensions, and covers. The Applicant shall provide sliding type valve boxes with a 5.25-inch shaft (with a minimum 5-inch inside diameter) and round cover marked "WATER". Valve boxes shall have a minimum range of extension to fit valves ranging from 2 to 12-inches inclusive and installed on mains at depths of 3 to 8-feet of cover in order that the top cover of the valve box is set flush to finished grade. The Applicant shall ensure all valve boxes are installed straight, at a right angle to the water main and centered over the valve wrench nut. Reference the Approved Products List for acceptable products.
2. The Applicant shall provide a single valve stem extension for all valves in which the operating nut is greater than 5-feet below the normal ground or road surface to bring the operating nut to within 5-feet of finished grade. Use of multiple valve stem extensions is prohibited. The valve extension stem shall come with a 2-inch square operating nut on top and a coupling to connect the extension to the operating nut of the valve. The Applicant shall provide a stem guide to keep the valve stem extension concentric within the valve box. The Applicant shall ensure the diameter of the valve stem extension is the same as the valve stem.

3. For valves installed outside of paved areas, the Applicant shall set the valve boxes in a 2-foot-by-2-foot concrete pad with the top of the concrete pad flush to match final grade and the valve box top set flush with the top of the concrete pad, in accordance with the details in this Manual.
4. The Applicant shall adjust valve boxes in the street so that covers are exposed and flush with the final paved surface.
5. During initial installation of the valve boxes, and before the Service Authority accepts them for ownership, valve boxes can be adjusted only by sliding the top casting up or down. Risers are not permitted. Applicant shall paint all valve box lids blue before the Service Authority shall accept them.
6. Once water mains are placed into service through the Beneficial Use or Partial Beneficial Use process, valve boxes must remain accessible at all times. At no time shall a valve box lid be buried, paved over or obstructed by construction equipment, debris, or storage of materials.
7. Once water mains are placed into service through the Beneficial Use process, debris cap and locking device shall be installed in the valve box as close to the top as possible without interfering with installation of the lid on water valves greater than 12-inch. Reference the Approved Products List for acceptable products.

4.6 Blow-offs

The Applicant shall provide a blow-off assembly at the system's lowest points and on all dead-end mains as a means to discard accumulated sediment from the water main. The Applicant shall show the location of all blow-off assemblies on the Project Plans. The Applicant shall design the blow-off assemblies to provide a minimum flow velocity of 3-fps. On water main 6-inches in diameter or larger, fire hydrants are used as a blow-off. If the main is intended to be extended in the future, the Applicant shall utilize a blow-off assembly outside paved areas or as otherwise directed by the Development Manager or designee.

4.7 Air Release

The Applicant shall provide a means to release trapped air at all high points in the water system to accommodate testing of new water mains during construction and for use during normal operation of the water main.

A. Hydrant Air Release

The Applicant shall set hydrants at all high points in the system to function as an air release when they can be located in an area suitable for future operation and maintenance. The Applicant shall use a tangent tee, for water mains 24-inches in diameter and larger, with the branch side orientated at the top of the pipe for the hydrant connection.

B. Automatic Air Release

The Applicant shall use an automatic air release valve, subject to the approval of the Development Manager or designee, when a hydrant cannot be located in an area suitable for future operation and maintenance. The Applicant shall provide a Type AV automatic

air release valve, with an orifice diameter of 0.25-inch, a 2-inch diameter threaded connection, a working pressure from 0 to 150 psi, and a stainless steel float and resilient seat, in accordance with the details in this manual and the Approved Products List.

C. Manual Air Release

Where an automatic air release valve cannot be located on top of the water main and the area is not suited for a hydrant (e.g., a water main in the middle of divided road), the Applicant shall provide a new manual air release when requested by the Development Manager or designee. The manual air release shall consist of a tap made on top of the water main and a 3/4-inch service line run installed in a meter box and located as directed by the Development Manager or designee.

4.8 Hydrants

Hydrants are provided for the purposes of fire protection and fire coverage to comply with DCSM Section 300 or Town requirements. Additional hydrants may be required for the operation of the water system as directed by the Development Manager or designee.

A. Design Parameters for Hydrants

1. The Applicant shall connect hydrants to the water main with 6-inch DIP and 6-inch isolation valves located as near the main as practicable. Where a 6-inch main to a hydrant is longer than 50-feet, the Applicant shall provide a second 6-inch gate valve within 6-feet, but no closer than 1-foot, of the hydrant.
2. At stream crossings, railroad crossings, limited access right-of-way, or at locations where a water main is installed in a casing pipe, the Applicant shall provide one (1) hydrant to enable draining, sampling, and flushing of the segmented water main between required isolation valves. Position the hydrant as low as practical and out of the bed and banks of natural water courses.
3. The Applicant shall not install hydrants in areas subject to high groundwater, flooding, contamination, pollutants, or surface water ponding. If there are no alternative locations to avoid these hazards, then the Applicant shall take all steps to protect the water system and hydrant from potential backflow and contaminants, subject to the approval of the Director or designee.
4. The Applicant shall use a hydrant for all permanent terminations of a water main, with the exception of pipe stems and/or 4-inch distribution lines.
5. Water service connections and water main branches are NOT permitted between the hydrant and the hydrant isolation valve.

B. Hydrant Locations

1. Hydrants are located to provide the required fire coverage. Take all distance measurements along the centerline of accessible streets, travel ways, or other unobstructed paths used by the fire department. The Applicant shall show all new and existing hydrants providing fire coverage on the Project Plans.

2. The Applicant shall space all hydrants to maximize the coverage area and to minimize the number of hydrants. Designs should avoid multiple hydrants in the same coverage area.
3. The Applicant shall locate and utilize hydrants at high and low points for fire coverage requirements.
4. The Applicant shall offset hydrants a minimum of 5-feet from non-residential ingress/egress entrances that are subject to large vehicles with limited turning radiuses.
5. The Applicant shall locate hydrants a minimum of 10-feet from an intersection.
6. In areas with curbs and gutters, the Applicant shall locate the center of the hydrant between 18 and 36-inches from the face of the curb. Fire hydrants or their parts shall not conflict with or overhang any sidewalk, trail, or vehicle travel way.
7. The Applicant shall provide bollards where hydrants are located outside of the right-of-way, unprotected by a curb, placed in open spaces subject to vehicular traffic, storage yards, or at the rear of commercial/industrial buildings. The Applicant shall provide bollard protection as directed by the Development Manager or designee.
8. On roads with ditches, locate fire hydrants behind the ditch.
9. The Applicant shall avoid locating hydrants in paved areas and sidewalks when possible.
10. The Applicant shall design and provide a 4-foot radius clear-zone around each hydrant, clear of plantings or other obstructions.

C. Hydrant Color

Hydrants are factory painted with yellow enamel. Reference the Approved Products List for acceptable products. The Applicant shall only use approved products from the Approved Products List or an approved substitute.

D. Hydrant Designations

Hydrants that are in Beneficial Use/Partial Beneficial Use, that are not to be used for fire protection, or that are privately owned and maintained are painted by the Applicant as follows:

1. Hydrants in Beneficial Use/Partial Beneficial Use

The Applicant shall paint the barrel and all caps with reflective yellow paint and the bonnet, dirt shield, and nut silver.

2. Hydrants designated as “Not for Fire Department Use”

The Applicant shall paint the barrel and all caps with reflective yellow paint and the bonnet, dirt shield, and nut black. Hydrants designated as “Not for Fire Department Use” are fitted with a Service Authority furnished sign and installed by the Applicant.

3. Fire hydrants that are privately owned and maintained

The Applicant shall paint the barrel and all caps with reflective yellow paint and the bonnet, dirt shield, and nut red.

4. Fire hydrants designated as “Out of Service”

The Applicant shall bag all installed fire hydrants with an OUT OF SERVICE bag, provided by the Service Authority, until the fire hydrant is placed in Beneficial Use or Partial Beneficial Use. The Applicant shall notify the Field Inspector of the location of any additional new or existing fire hydrant(s) temporarily designated as OUT OF SERVICE and bag the fire hydrant(s) accordingly, refer to *Chapter 4, Section 4.11*.

4.9 Fire Suppression

A. General

The design and adequacy of building fire suppression systems is under the purview of the PWC Fire Marshal. The Service Authority reviews and approves only the connection at the main for independent fire lines or the meter detail for individual residential systems. This process ensures that water infrastructure to be owned and maintained by the Service Authority is in compliance with this Manual.

Service Authority Capital Improvement Projects involving the design and installation of new water mains to replace existing water mains are not subject to meeting current fire protection standards.

B. Sprinkler Systems

The Service Authority has no purview over the design, construction, or adequacy of sprinkler systems or any other onsite plumbing. Sprinkler system design and construction are subject to review and approval of the PWC Fire Marshal. The Service Authority does not guarantee a uniform pressure or an uninterrupted supply of water and cautions the Applicant to provide appropriate devices to satisfy specific pressure and/or flow requirements for private plumbing or fire suppression systems.

C. Independent Fire Line Connections

The Applicant shall show on the Project Plans all water lines serving a fire suppression system in a building and its connection to the public water system. Such connections for non-residential or multi-family sprinklered buildings are non-metered and shall consist of a tee connection at the main and an adjacent resilient, seated wedge, gate valve to isolate the fire line from the main, beyond which the fire line is privately owned and maintained.

Residential Systems for individual homes shall be connected on the house side of the water meter and not as a separate connection to the Service Authority’s water main.

4.10 Water Service Connections and Meters

A. General

Each service location shall have its own separate water service connection to the public water main and water meter. A water service connection shall include the corporation stop or fittings from the water main to meter box or meter vault.

B. Water Service Connection

1. A separate water service and meter is required for each residential property (single family home or townhouse) receiving water service. Multiple properties are NOT permitted to share a water service and/or meter.
2. For multi-family properties (apartments, condominiums, or like use), where buildings reside on a common property, each building shall be served with a single service line and meter.
3. For mixed use properties, where a building contains both residential and non-residential use, separate water service lines and meters are required for each use. Independent plumbing systems are required for residential and non-residential uses.
4. Service connections are NOT permitted on water mains greater than 30-inches.
5. Water service connection made via a tapping sleeve shall be offset a minimum of 3 feet from a waterline fitting, valve, or another service connection. The off-set shall be measured from the edge-to-edge of the sleeve, fitting, or valve.
6. Water service connections made via a direct tap into the waterline via a corporation stop shall be offset a minimum of 3 feet for another water service connection including connections made on the opposite side of the pipe. Offset distance shall be increased as directed by the Field Inspector to permit the installation of repair band around the waterline without interfering with other service connections.

C. Water Service Lines

1. The Applicant shall provide a 3/4-inch Type K copper or PEX A water service line for all single-family homes and townhomes. The maximum length of the service line is limited to 100-feet. Couplings are NOT permitted in the service line. The Applicant shall connect Type K copper and PEX A services lines to the water main with a corporation stop.
2. Multi-family, student housing, and non-residential buildings require a minimum 4-inch ductile iron service line and valve. The Applicant shall fully restrain and polyethylene wrap the ductile iron service line and appurtenances.
3. Water service lines outside of the road right-of-way shall reside on the property they serve. Where a water service line must traverse a property it does not serve, the Applicant shall obtain the required easement(s) for the water service line.
4. Authority maintained water service lines and transformers, storm boxes, structures, poles, guidewires, signs, and a tree's root system define by the tree

canopy, is desired. In conditions that prevent a 5-foot horizontal separation, the water service line may be installed with a 3-foot minimum separation. Water service lines shall be offset a minimum of 10 feet from a sanitary sewer manhole.

5. The Applicant shall provide Type K copper or PEX A service lines for ¾-inch or 1-inch irrigation meters. For irrigation meter sizes greater than 1-inch, the Applicant shall provide 4-inch ductile service line. The Applicant shall fully restrain and polyethylene wrap the ductile iron service line and appurtenances.
6. The Applicant shall provide service line sizing calculations, when requested by the Development Manager or designee.

D. Meter Locations and Installations

1. The Applicant shall furnish the water meter box and all appurtenances necessary for a meter installation in accordance with the details in this Manual. Service Authority staff shall provide and install water meters for water & sewer, water only, and sub-meter accounts.
2. The Applicant shall install water meter boxes and vaults outside of buildings in areas that are accessible to Service Authority staff at all times with adequate room and clearance for operation and maintenance. Where possible, meters are to be shown located in grass areas.
3. The Applicant shall install water meter boxes 2 feet behind the property line, in residential areas, unless approved otherwise by the Development Manager or designee. Where a water meter box resides on a property it does not serve, the Applicant shall obtain the required easement(s) for the water meter box.
4. The Applicant shall install water meter boxes as near to the water main as possible when the water main is located outside of the right-of-way within a commercial property to minimize the amount of service line between the water main and meter.
5. The Applicant shall protect water meter boxes from vehicular traffic (e.g., curb, bollards or other means approved by the Field Inspector). The Applicant shall not locate water meter boxes, for new construction and alterations or modifications of existing facilities, in sidewalks, driveways, travel ways, or parking spaces or any other areas difficult to access or in areas that pose a hazard.
 - a. The Applicant shall furnish a water meter vault, with an internal bypass in accordance with the details in this Manual, for water meters 3-inches and larger. Prior to ordering, the Applicant shall submit the shop drawing(s) for the meter vault design to the Development Manager or designee. The Development Manager or designee shall review the shop drawing(s) and provide written acceptance. Meters will not be provided or installed in vaults that have not been accepted by the Development Manager or designee.

E. Meter Sizing and Types

1. The Applicant shall use a 5/8 x 3/4-inch water meter for all single-family homes and townhomes. An increase to a 1-inch water meter is permitted to accommodate a fire suppression demand.

2. For all other uses, the Applicant shall use water meters sized on the basis of the fixture loading imposed by the building and in accordance with AWWA Manual M22, Sizing Water Service Lines and Meters. The Applicant shall provide the fixture list and meter sizing calculations on the Project Plans.
3. Neptune positive displacement water meters are required for domestic applications. Positive displacement compound water meters are required for water meters sizes 3-inches and larger. The Service Authority may consider other meter types with the approval of the Director or designee.
4. The Applicant shall base the size of the water meter for an irrigation system on the peak flow rate needed to operate the system. Upon request by the Development Manager or designee, the Applicant shall provide the necessary information to confirm the irrigation demand.

Table 4-2: Water Meter Table

Maximum Flow (gallons/minute)*	Meter Size (inches)	Name	Type	Use	Water Service (inches)	Standard Detail
20	5/8 x 3/4	Neptune	Positive Displacement	Residential (Single family Detached & Townhouse)	3/4"	W-1 REV-2018
				Irrigation	3/4"	
				Multi-Family Use	4"	W-3 REV-2018
				Student Housing	4"	
				Non-Residential Use (e.g. commercial, office, restaurant, etc.)	4"	
50	1	Neptune	Positive Displacement	Residential (Single Family Detached & Townhouse) for Fire Suppression	1"	W-2 REV-2018
				Irrigation	1"	
				Multi-Family Use	4"	W-5 REV-2018
				Student Housing	4"	
				Non-Residential Use (e.g. commercial, office, restaurant, etc.)	4"	
100	1.5	Neptune	Positive Displacement	Irrigation	4"	W-6 REV-2018
				Multi-Family Use	4"	
				Student Housing	4"	
				Non-Residential Use (e.g. commercial, office, restaurant, etc.)	4"	
160	2	Neptune	Positive Displacement	Irrigation	4"	W-7 REV-2018
				Multi-Family Use	4"	
				Student Housing	4"	
				Non-Residential Use (e.g. commercial, office, restaurant, etc.)	4"	
320	3	Neptune	Positive Displacement Compound	Multi-Family Use	4"	W-8 REV-2018
				Student Housing	4"	
				Non-Residential Use (e.g. commercial, office, restaurant, etc.)	4"	

F. Water Only Uses

1. Water-only Account

- a. Applicants may apply for a Water-only account for water consumption which does not enter the sewer system such as irrigation, pools, or water-cooling tower purposes. Each Water-only account is served by an independent connection to the public water main with a separate domestic service line and water meter. Water-only accounts require certification for water service and not sanitary sewer service. Applicant shall show on the Project Plans the location and size of the domestic service line and water meter serving the Water-only account. Water-only accounts shall comply with all applicable state and local cross-connection ordinances. Cross-connection prevention devices are required downstream of the water meter.
- b. An Applicant may establish a Water-only account for a swimming pool only when the pool drain and the filter backwash discharge line discharge into a storm drainage system and after receiving approval from PWC Department of Public Works. The Applicant shall secure PWC Department of Public Works approval to discharge into the storm drainage system and shall show on the Project Plans the capacity of the pool, location of the pool drain, filter backwash discharge line, and the pool meter. If PWC Department of Public Works does not approve discharging the pool drain and filter backwash into the storm drainage system, the Applicant shall discharge pool water into the sanitary sewer facility with the purchase of a requisite sanitary sewer certification.
- c. The Applicant shall acquire all necessary approvals and permits from PWC prior to installing an irrigation system and prior to establishing a Water-Only account for irrigation use.

2. Sub-meter Service

- a. All customers with both water and sanitary sewer service have the option of using a water sub-meter for the purpose of eliminating sanitary sewer charges on water consumption that does not enter the sanitary sewer system.
- b. Applicant shall furnish the water meter box and all appurtenances necessary for water sub-meter installation in accordance with the details in this Manual. The final exterior location of all water sub-meters are approved by the Development Manager or designee. The Applicant shall locate the water sub-meters within a 5-foot radius of the main water meter, or as close to the main water meter as possible, and in an accessible location. The Applicant shall connect the water sub-meter downstream of the main water meter. Water meter boxes shall remain accessible to Service Authority personnel at all times after construction with adequate room and clearance for maintenance and repair.

G. Sewer Only Meter for Process Water

1. Sewer only meters shall only be used in applications deemed appropriate by the Development Manager where water is returned to the sanitary as part of manufacturing or cooling process. Residential, multi-family, commercial, retail, restaurant, wash down, compactor or trash receptacle waste, and car wash operations are not considered a qualifying use for a sewer only meter.

2. Qualification for use of sewer only meter are as follows:
 - a. Water is a primary component of the manufacturing or cooling process, and such water is provided through a Service Authority metered account that only bills for water consumption.
 - b. The process consumes or evaporates 50 percent or more of the water used in the activity; however, the remaining unused portion of water is tributary to the Service Authority's sanitary sewer system.
 - c. The residual process water is discharged at a rate that can be registered by a Service Authority meter.
 - d. The process water discharge makeup is disclosed in a Service Authority Industrial User survey and all pretreatment requirements are met.
3. Sewer only meters shall be the Optiflux 2000 electromagnetic meter or alternative accepted by the Service Authority's Field Service Department.
 - a. The meter shall be sized by the Engineer to register all flow ranges from the Applicants uses within the accuracy specifications of the meter.
 - b. Service Authority shall provide and deliver the sewer only meter. The Applicant shall install the sewer only meter in accordance with meter manufacturer's requirements and recommendations.
 - c. Meter shall be installed with a remote meter read out devise external to the meter vault in a NEMA 4 cabinet with the appropriate structural supports to withstand all weather events.
 - d. Meter shall be installed with grounding rings and cabling from the manufacturer. Cabling for the meter and remote display shall meet manufacturer requirements. Splicing of cable is not permitted.
 - e. The meter installation shall pass all inspections by the meter manufacturer field representative and the Service Authority. The meter manufacturer field representative shall commission the meter for service in writing with a copy provided to the Service Authority.

H. Meter Vaults

1. The Applicant shall furnish meter vaults and all appurtenances necessary for a water meter sizes 3-inches and greater in accordance with the details in this Manual.
 - a. Meter vault locations shall fully comply with the requirements of USM 4.10 D. Meter Locations and Installations.
 - b. Vaults shall be installed on undistributed soil or area with 95% compaction to prevent settling. At a minimum 6 inches of #57 stone shall be provided as a base.
 - c. The vault shall be set 6 inches above the finished grade and the grade shall be set to provide positive drainage away from the vault. The vault shall not be set in areas subject to flooding or in a collection area of storm water runoff.
 - d. The elevation of the water service line shall be coordinated with the internal pipe inside the vault.

- e. Vaults shall be furnished with valves to isolate the meter, an adjustable coupling to permit the easy removal of the meter, meter strainer, and an internal bypass in accordance with the details in this Manual. A spool piece of pipe shall be provided with the meter vault matching the meter laying length.
 - f. Vaults shall be equipped with a gravity drain to day light to dispenses ground water or with a sump pump in accordance with USM 6.5 D. If a sump pump is needed electric power is to be provided and maintained from the building to the vault at no cost to the Service Authority. A separate Service Authority power account will not be created for the vault. Electrical service to the vault must pass all County trade inspections.
2. The Applicant shall furnish meter vaults and all appurtenances necessary for sewer only meters.
 - a. Sewer only meter shall be owned and maintained by the Service Authority in a vault privately owned and maintained by the property owner.
 - b. Prior to ordering, the Applicant shall submit the shop drawing(s) for the meter vault design to the Development Manager or designee. The Development Manager or designee shall review the shop drawing(s) and provide written acceptance. Sewer only meter shall not be installed in vaults that have not been accepted by the Development Manager or designee.
 - c. Vault must be large enough for a person to stand up and work within. No ducking heads, crawling around, or having to work on knees.
 - d. The meter vault is to be kept secured and protected against vandalism or unauthorized entry. Independent dual access (e.g., locks) to the vault is required for both the property owner and the Service Authority.
 - e. A hatch must be sized appropriately for ingress/egress and equipped with a lock open feature.
 - f. The vault must be equipped with sufficient lighting. Intrinsically safe lighting shall be provided if the enclosed space is deemed a hazardous area.
 - g. The vault shall be provided with a non-corrosive ladder, with hand assist, and non-corrosive mount hardware.
 - h. The vault shall have a vent installed on the tee on the incoming and outgoing piping on both sides of the meter, providing access ports for maintenance. The vent shall extend two (2) feet above grade and terminate on the exterior with a screened removable 90-degree elbow.
 - i. Vaults shall be furnished with full port plug valves to isolate the meter and an adjustable coupling to permit the easy removal of the meter. A spool piece of pipe shall be provided with the meter vault matching the meter laying length. The vertical piping between the tee and the elbow on the line entering the vault on the upstream side of the meter shall be clear to provide ability to identify back-ups from the reducer leading into the meter.
 - j. If necessary, an automatic emergency bypass configuration may discharge to a holding tank. Under no conditions shall sanitary sewer flows bypass the sewer only meter and discharge to the sanitary sewer system.
 - k. Vaults shall be equipped with a gravity drain to day light to dispenses ground water or with a sump pump.

- l. Electric power shall be provided and maintained to the vault for use by the Service Authority and its meter. Electrical service to the vault must pass all County trade inspections.
- m. Pipe and valve supports shall be provided where appropriate.

I. Cross Connection and Backflow

1. The Applicant shall provide backflow prevention devices for buildings and fixtures that comply with Service Authority's cross connection program requirements.
2. The plumbing on all premises served by the Service Authority's System shall include cross connection and backflow prevention conforming to the Virginia Statewide Building Code and other applicable plumbing codes. The Applicant is required to control all cross connections, at all times, in accordance with the requirements of applicable codes and Virginia Waterworks Regulations. Cross connection inspections for commercial buildings are performed by the Service Authority's Environmental Services & Water Reclamation Division's Regulatory Compliance Department.
3. Pipes connected to Service Authority's mains shall not be connected with pipes supplied with water from any other source. Where redundant sources of supply are desired, including fire suppression systems, an approved backflow prevention device must be provided, by the Applicant, to protect the public water system. All backflow prevention devices are subject to review and approval by the PWC Plumbing Inspection Department. Please contact the PWC Plumbing Inspection Department via PWC Building Development Division at (866)-457-5280 or (703)-792-6954 with any inquiries regarding cross connections and backflow prevention devices.
4. The Applicant shall not connect any chambers or pits containing valves, blow offs, meters, or other such appurtenances directly to any storm drain or sanitary sewer facility, nor any flushing devices or air relief valves, as required per 12-VAC5-590-1130C and 12-VAC5-590-1160.

4.11 Water Main Construction

A. Existing Conditions

1. When water and/or sewer construction requires offsite (on property not owned by Applicant) disturbance within a Service Authority easement, the Applicant, prior to the start of construction, shall fully comply with the Service Authority's Community Notification and Outreach for Development and Service Authority Projects Creating Impacts to Existing Communities Policy. The Applicant shall photograph or video record the work area to document the existence and condition of structures or facilities and submit a copy to the Inspections Manager in electronic format by e-mail to inspectionsmanager@pwcsa.org. The Applicant shall date the photo/video record to document conditions.
2. Prior to and during construction operations, Applicant shall properly locate, protect, brace, support, restore and maintain all underground pipes, conduits, drains, and other underground structures uncovered or otherwise affected by the construction work being performed to ensure they are protected from any damage, in accordance with the Virginia State Code 20VAC5-309-140.

- a. The excavator shall plan the excavation in such a manner to avoid damage to, and minimize interference with, underground utility lines in and near the construction area;
 - b. The excavator shall expose the underground utility line to its extremities by hand digging within the excavation area when excavation is expected to come within 2-feet of the marked location of the underground utility line;
 - c. The excavator shall not use mechanized equipment within 2-feet of the extremities of all exposed utility lines;
 - d. The excavator shall maintain a reasonable clearance, to include the width of the utility line, if known, plus 24-inches, between the marked or staked location of an underground utility line and the cutting edge or point of any mechanized equipment, considering the known limit of control of the cutting edge or point to avoid damage to the utility line; and
 - e. The excavator shall provide proper support for underground utility lines during excavation activities. During backfill operations, the excavator shall use the same or similar backfill material that was originally around the utility line, ensure there is proper compaction around the utility line, protect all tracer wires, and protect or replace warning tapes.
3. The Applicant shall protect, restore and maintain all pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures (including all sod and shrubs in yards and parks) crossed by or adjacent to the utility under construction.
 4. The Inspections Manager shall observe and document the extent of damage resulting from the Applicant's construction activities based on photographs or video recording provided the by Applicant or Service Authority Field Inspector. (Refer to *Chapter 2, Section 2.8*)
 5. The Applicant is responsible for the cost to replace, repair, or restore any of the elements listed in *Chapter 2, Section 2.8* to their existing conditions or better with new materials for elements that have been removed or damaged. The Applicant shall, without delay, coordinate with the property owner, agency, or authority having jurisdiction, to replace, repair, or restore all damaged surface or subsurface structures to the satisfaction of the property owner, agency, or authority having jurisdiction.

B. Materials

1. The Applicant shall provide water mains and appurtenances within the Service Authority's Service Area in accordance with the approved Project Plans, specifications, and this Manual's requirements in effect at the time of installation and inspection. All construction improvements are inspected and subject to acceptance by the Field Inspector.
2. The Applicant shall provide new materials, fittings, appurtenances, and equipment, direct from the manufacturer, unused, and free of defects and shall submit proof of purchase to the Field Inspector. The Applicant shall provide a list of all materials and product technical details to be used on the project.
3. The Field Inspector may reject any materials found to be defective, damaged,

improperly stored or handled, or determined to not meet the requirements of this Manual or current Service Authority System requirements.

C. Storing and Handling of Materials

1. The Applicant shall follow manufacturer’s recommendation for handling and storage of materials. The Applicant shall protect all materials, including all pipe, fittings, and other appurtenances stored onsite or in a storage yard, from foreign materials, animals, insects, soil, sun, and water at all times.
2. Applicant shall prevent shocking or damaging any materials during handling and shall load and unload pipe, fittings, valves, hydrants, and appurtenances by lifting them with hoists or skidding. The Applicant shall handle pipe so that the coating and lining are not damaged.

D. Line and Grade Stakes

Before an approved water main is constructed by the Applicant, the Applicant’s Virginia-licensed Surveyor shall place line and grade stakes identifying dedicated easements, the water main, fittings, valves, hydrants, water meters or other appurtenances to ensure the system is constructed in accordance with the approved Project Plans.

E. Cut Sheets

1. The Applicant shall submit a set of cut sheets in hard copy or electronically, sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia, or Virginia-licensed Surveyor, to the Field Inspector for review and acceptance. The Applicant shall prepare cut sheets at 100-foot station intervals and contain all data pertinent to the construction of the water main, such as the station and length of service connections, and appurtenances, including all fittings, valves, hydrants, tees, and bends.
2. The Professional Engineer or Surveyor who seals and signs the cut sheets shall also provide the following statement on all sets: “The professional seal and signature appearing on this document certifies that information shown conforms to the approved Project Plan and/or actual field conditions.”
3. The Applicant shall submit a revision to the approved Project Plans when field conditions require the horizontal location, alignment, or grade of any main, structure, or appurtenance is to be constructed outside of an existing easement, as shown in the approved Project Plans. The Applicant shall provide a sealed, signed and dated, by a Professional Engineer licensed in the Commonwealth of Virginia, revised Project Plan and include the dedication of all additional property rights. The Applicant shall submit the revised Project Plan to the Development Manager or designee for review and acceptance prior to constructing the changes.
4. Field Inspectors may approve field changes that do not change existing easement requirements as a Field Revision.

F. Excavation, Bedding, and Backfill

1. The Applicant shall excavate trenches, provide and install pipe, backfill the excavation, and compact the trench in accordance with the details in this Manual.

- The Applicant shall provide trenches that are wide enough to accommodate timber supports, sheeting, bracing, and handling of special fittings or appurtenances.
2. The Applicant shall provide bell holes at each joint to ensure the bell and spigot are installed properly.
 3. The Applicant shall excavate all trenches to the depth required to provide a uniform and continuous bedding with 4 to 6-inches of #57 stone or crushed aggregate of 1-inch or less on solid and undisturbed ground at every point between bell holes; it is permissible, however, to disturb the finished subgrade surface over a maximum length of 18-inches near the middle of each length of pipe to withdraw pipe slings or other lifting tackle. Under such circumstances, the Applicant shall restore the finished subgrade with #57 stone or crushed aggregate of 1-inch or less.
 4. The Applicant shall remove ledge rocks, boulders, and large stones to provide a clearance of at least 6-inches below and on each side of all pipe, valves, and fittings for pipe up to 24-inches in diameter. The Field Inspector may direct a greater clearance for pipes larger than 24-inches in diameter.
 5. The Applicant shall not install pipe in standing water or when, in the determination of the Field Inspector, trench conditions are unsuitable. The Applicant shall remove and replace pipe installed in unsuitable trenches when rejected by the Field Inspector once proper trench conditions are established.
 6. Backfill within an existing or proposed right-of-way shall conform to all applicable VDOT standards.
 7. Backfill in areas subject to vehicular traffic or structural loading shall begin at the top of the granular bedding and be placed in lifts no greater than 8-inches thick. Compact each lift to 95 percent of the maximum dry density as determined by ASTM-D698, American Association of State Highway and Transportation Officials (AASHTO)-T99, or (Virginia Test Method-1) VTM-1. The Applicant shall provide backfill material that is free of organic materials, frozen clods, highly plastic silts or clays, and other unsuitable materials. Backfill shall consist of #57 stone or crushed aggregate of 1-inch or less. The Applicant shall provide bedding that is 4 to 6-inches deep, along the side wall, and a minimum of 24-inches above the crown of the pipe as directed by the Field Inspector.
 8. The Applicant shall not use stone or rock larger than 10-inches in any dimension in any backfill.
 9. The Applicant shall compact backfill in areas not subject to vehicular traffic to 90 percent of the maximum dry density as determined by ASTM-D698, AASHTO-T99, or VTM-1.
 10. The Applicant shall legally dispose of all surplus materials and debris. The disposal of surplus materials or debris on Service Authority easements or property is prohibited.

G. Pipe and Fitting Installations

1. The Applicant shall inspect pipe, fittings, and appurtenances for defects and notify the Field Inspector of any defects prior to installation. The Applicant shall remove

- lumps, blisters, and excess coal tar coatings from the ends of each pipe, brush the ends of each pipe with a wire brush, and wipe clean the outside of the spigot and the inside of the bell. The Applicant shall ensure spigots are dry and free from oil and grease before pipe is installed.
2. When installing pipe in the trench, the Applicant shall use proper implements, tools, and facilities satisfactory to the Field Inspector and as recommended by the manufacturer for the safe and convenient execution of the work. The Applicant shall carefully lower pipe, valves, fittings, hydrants, and appurtenances into the trench, piece by piece, by means of a derrick, ropes, slings, or other suitable tools or equipment and in such a manner to prevent damage to pipe, valves, fitting, hydrants, and appurtenances, as well as their protective coatings and linings.
 3. The Applicant shall take special care to prevent any foreign materials from entering the pipe, which may cause potential contamination problems. The Field Inspector will not accept any pipe with visible debris. At the end of each workday, the Applicant shall cap pipe ends with a push-on joint plug or mechanical joint cap or plug to match pipe joint (ensuring the seal is watertight).
 4. The Applicant shall follow manufacturers' instructions for connecting pipe segments. Before inserting gaskets and joining pipe sections, the Applicant shall clean pipe joints and pipe ends thoroughly with potable water. After placing a length of pipe in the trench, the Applicant shall center the spigot end in the open bell of the pipeline and push the pipe to the manufacturer-recommended homing mark. The Applicant shall lay DIP with the bells facing the direction of the laying.
 5. The Applicant shall use the proper equipment, per the manufacturer's recommendation, to cut pipe for inserting valves, fittings, or closure pieces; cuts must be made without damaging the pipe's cement lining and must leave a smooth end at a right angle to the axis of the pipe. When machine cutting is not available for cutting pipe 24-inches in diameter or larger, use of an electric-arc to cut the pipe using a carbon steel rod is permitted. Flame cutting using an oxyacetylene torch is not permitted. After the pipe is cut, the Applicant shall bevel the outside cut-end of the pipe to remove any sharp edges or burrs to avoid damage to the gasket.
 6. Whenever it is necessary to deflect ductile iron pipe from a straight line, in either the vertical or the horizontal plane, to avoid obstructions, to set valve stems perpendicular to grade, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that required to satisfactory join the pipes, as specified by the manufacturer.
 7. The Applicant shall apply restraint and corrosion protection requirements from *Chapter 4, Section 4.4 D* in the field.
 8. The Applicant shall remove a minimum of 36 feet of existing water main that is being separated from water service at the connection point for a water main relocation. Pipe shall be removed as necessary to prevent a pipe locating signal migrating to the pipe being separated from water service.
 9. The Applicant shall install a plug with buttress on all water main that is abandoned in place and separated from water service.

H. Fire Hydrant Installations

1. The Applicant shall set the finished compacted grade around the fire hydrant within 3-inches of the bury line on the barrel of the hydrant.
2. The Applicant shall install the hydrant so the bottom of the 4.5-inch nozzle is 18-inches above the elevation of the edge of the shoulder on streets without curb and gutter and 18-inches above the elevation of the curb on streets with curb and gutter.
3. The 2.5-inch hose connections shall have a minimum 4-foot clearance on all sides.
4. Restraint and corrosion protection requirements from *Chapter 4, Section 4.4 D*, shall be applied in the field.
5. The Service Authority shall provide bags labeled “OUT OF SERVICE” for fire hydrants placed in an “OUT OF SERVICE” status. The Applicant shall:
 - a. Bag all installed fire hydrants with a Service Authority provided “OUT OF SERVICE” bag until they are placed in Beneficial Use or Partial Beneficial Use.
 - b. Bag all operational fire hydrants with Service Authority provided “OUT OF SERVICE” bag when operational fire hydrants must be placed into a temporary “OUT OF SERVICE” status for any period of time and notify the Field Inspector. The “OUT OF SERVICE” bag will remain in place until the temporary “OUT OF SERVICE” status expires, at which time the bag may be removed after notifying the Field Inspector.
6. The Applicant shall provide a new hydrant when required to relocate an existing hydrant.

I. Connecting to the Existing Water Main

1. The Applicant is required to test pit the existing water main at the proposed tie in location and to assess the pipe condition and roundness with the Field Inspector. Both the Applicant and the Field Inspector must be satisfied that the existing pipe condition is suitable for the planned connection. If the pipe should be deemed unsuitable for the connection, the Applicant is to consult with their Engineer to determine a suitable tie-in method and location.
2. Prior to the Applicant requesting that the Service Authority shutdown the existing water system, the new water main must be installed, inspected, and pass all pressure and bacteriological testing.
3. Prior to the Applicant connecting to an existing water main, the water main shall be appropriately restrained for safety of construction as well as for future operations. Mechanical restraint, thrust blocks, or anchors are all approved means to restrain the existing pipe. Specialized details shall be prepared by Applicant’s Engineer if a block or anchor is used.
 - a. When mechanical restraint is used, the length of the existing pipe to be restrained shall be specified in the plan profile by a Professional Engineer. All portions of the existing pipe in the restraining zone must be exposed to ensure that all joints are restrained. The Applicant shall only expose limited portions of the existing

pipe at a single time as necessary to keep the pipe from leaking or rupturing. Any excavation under the pipe to install restraint shall be backfilled with #57 stone or other means to achieve 95% compaction.

- b. When thrust blocks or anchors are used, a Professional Engineer shall size the block or anchor accounting for all permanent design criteria including, but not limited to, soil investigation, block configuration, internal design pressure, thrust forces, and anchor resistance. The block/anchor detail shall show and specify all details necessary for structure's construction including block dimensions, fasteners or tie-rods to the pipe, re-bar, concrete compressive strength and time to cure. Disturbed soil, site area needed to accommodate the size of the block, pipe elevation and grade elevation must be considered in the design. The block/anchor structure shall reside a minimum of 6 inches below final grade.
4. Timing, service disruptions and location need to be evaluated to determine the means and method of restraining the existing pipe. The Service Authority reserves the right to dictate means of restraint, qualification of crews, requiring multiple crews to perform concurrent work, and additional requirements to limit disruption to existing customers.
5. The Applicant shall give the Service Authority a minimum of 8 business days of advanced notice when the project needs the water system shutdown. The Applicant's requests shall include a schedule of work, materials, equipment and number of crews to perform the work. The schedule shall disclose any restrictions (e.g., VDOT restrictions in the right-of-way). The schedule shall include a narrative for the sequence of work identifying the key steps and the length of time needed to accomplish the work. An estimate for the total amount of time to accomplish the work shall be provided.
6. The Service Authority reserves the right to dedicate the allowable time for water system shutdown. The Applicant shall request and pay for the needed Service Authority overtime expenses related to the required work if the shutdown is enacted during Service Authority non-business hours.

4.12 Testing to Place Utilities Into Service

The Applicant shall flush, pressure test, and bacteriologically test each section of completed water main, in accordance with AWWA C600, prior to placing the utility into service. The Applicant shall schedule all pressure testing with the Field Inspector at least 48-hours in advance.

A. Pressure Test

1. Prior to making a wet tap, the Applicant shall pressure test the sleeve and valve assembly at 200 psi for 10 minutes.
2. After backfilling, the Applicant shall test new water mains to a hydrostatic pressure of at least 100 psi above the modeled pressure or Service Authority tested nominal operating pressure at the test site or 200 psi, whichever is greater.
3. Before testing, the Applicant shall vent all high points in the portion of the system under test and expel air from the system before beginning the test. Applicant shall

ensure that fittings and hydrants are properly restrained before applying pressure and that concrete thrust blocks, if used, shall have attained their final, 28-day design strength.

4. Once the portion of the system being tested has reached the required test pressure, the Applicant shall maintain the pressure continuously for two (2) hours with no leakage. Should any leakage be detected, the Applicant shall determine the cause of the leak, make the necessary repairs, and the leak test repeated until no leakage is detected.

B. Bacteriological Test

Disinfection process of water main is required in accordance with AWWA C651 including, but not limited to, the following:

1. After pressure testing and before the final inspection of the completed system, Applicant shall flush the system completely at a flow velocity of at least 3.0 feet per second, per the direction of the Field Inspector.
2. A disinfection solution with an initial concentration of 25 ppm shall remain in the main for 24 hours, after which time a minimum chlorine residual, as CL₂, of 10 parts per million throughout the main is required, in accordance with AWWA C651. It is the Applicant's responsibility to have access to AWWA C651, *Disinfecting Water Mains*, at the job site.
3. After chlorination and complete flushing, the Applicant shall fill the pipe with potable water. Before the system can be placed in service, Virginia Waterworks Regulations requires at least two (2) consecutive satisfactory bacteriological samples from the system. Sampling will be conducted at intervals not exceeding every 1,200 feet. The Applicant shall collect bacteriological samples each day over two (2) consecutive days at least 16 hours apart; however, the consecutive days shall not run from Friday to Monday.
4. If the initial disinfection procedure fails to produce satisfactory laboratory results, the Applicant shall repeat flushing, chlorination, and testing procedures until two (2) consecutive satisfactory bacteriological sample results are received.
5. The Applicant shall be responsible for any damage to vegetation, trees, streams, ponds, and lakes caused by the discharge of heavily chlorinated water. The Applicant shall perform the necessary measures to dechlorinate water that has been supplemented with chlorine and used for disinfection purposes prior to discharging water into any storm water system, estuary, or other environmentally sensitive area, in accordance with AWWA C651 and C655.

4.13 Water Main Easements

A. Easement Widths

1. Applicant shall dedicate minimum easement widths of 15-feet for water mains.
2. The Applicant shall dedicate a minimum easement width of 20-feet when a water main runs between structures.

3. The Applicant shall center water mains and hydrants in the easement unless the Development Manager or designee permits the water main to be offset in the easement.
4. The Applicant shall provide a minimum easement of 10-feet by 10-feet, at the request of the Development Manager, to accommodate automatic flushing stations.
5. Increased easement area may be required as deemed necessary by the Director or designee.

B. Easement Exclusions and Offsets

1. The Applicant shall not place trees, fences, monuments, signs, entrance features, sheds, decks, overhanging canopies, light poles, or permanent structures in easements dedicated to the Service Authority without written approval from the Director or designee.
2. All structures (e.g., walls, piers, piling, columns, buildings, footings, foundational elements, storm structures, structural embankments and/or dams, etc.) shall be offset a minimum of 7.5 feet from a water main when located in the right-of-way or a non-easement area (e.g., Service Authority's own property). The Director, or designee, may require additional offset from the water main if the means and methods to install the structure puts Service Authority water main at risk or impedes the Service Authority's ability to maintain its facilities.
3. The Applicant shall offset utilities and easements to avoid undermining structural foundations and the use of shoring to support structures when utility re-excavation is needed.
4. Project Plans that cannot provide the required easement area shall require a variance and is subject to additional mitigation measures as directed by the Director.

C. Easement Access

1. The Applicant shall provide all necessary easements to the Service Authority to allow adjacent properties access to and extension of the water main(s). Easements shall extend to the property line as directed by the Development Manager or designee.
2. As deemed necessary by the Development Manager or designee, and to ensure routine and emergency maintenance access, the Applicant shall provide permanent access (ingress/egress) easements to utility easements and facilities to be owned, operated, and maintained by the Service Authority. The Applicant is responsible for maintaining all easements serving the development site until final acceptance and bond release by the Service Authority. Maintenance shall include cutting vegetation, removing trees, controlling erosion, maintaining access to all utilities, and grading sufficiently to allow maintenance vehicles to traverse the easement.
3. Access to public water facilities and easements located on private properties is to be provided at all times. Properties with security measures need to insure prompt and efficient access can be provided to Service Authority personnel as required in the Customer Handbook and the deed of easement. In addition, the Service Authority may require property owners of secured sites to enter into an appropriate separate access agreement detailing the obligations and means of access for both parties.

D. Overlap with Other Easements

1. Easements of other entities can overlap Service Authority easements, but the physical location of non-Service Authority underground utilities shall remain outside the Service Authority's defined easement; however, crossings are permitted. Applicant shall confirm the location of such underground utilities to ensure that excavations shall pose no danger of undermining the Service Authority's utilities.
2. Although Service Authority easements are non-exclusive, the location and separation requirements of underground utilities shall comply with Virginia State Code 20VAC5-309-140.
3. Buffers, tree-save, conservation, resource protection areas, or other land use-restricting easements shall not overlap Service Authority easements. Applicant shall not restrict the Service Authority's prescribed easement and access rights.

4.14 Water Main Information Required in Project Plans

A Professional Engineer licensed in the Commonwealth of Virginia will prepare, seal, sign and date Project Plans for water main construction. Project plans must be submitted for review to the Development Department. The Applicant shall provide additional information, details, and/or specifications requested by the Development Department Manager or designee to support the review of the Project Plans. The Service Authority shall accept and permit Project Plans prior to the Applicant executing work in the field. At a minimum, Project Plans shall contain the following:

A. Cover Sheet

1. For site plan submission to PWC, the Applicant shall provide a fully completed standard cover sheet. The PWC Cover Sheet can be obtained at: <http://www.pwcgov.org/government/dept/publicworks/pages/site-development-forms.aspx>
 - a. The Service Authority will assign a plan number after the first review; the Applicant shall add the Service Authority plan number to the title block.
2. The Applicant shall report the following information on the cover sheet for Project Plan submission within an incorporated Town:
 - a. A vicinity map and site location.
 - b. Plans shall have a unique title.
 - c. The Service Authority will assign a plan number after the first review; the Applicant shall add the Service Authority plan number to the title block.
 - d. Identify the Town where the project resides and the contact information for the Town representative managing the plan application.
 - e. Title block with the property address and GPIN, owner information, developer information, and Engineer's information.

B. Plan View

1. The Applicant shall provide plan views at 1:30 scale (1-inch to 30-feet). Other scales

are only permitted with written permission from the Development Manager or designee.

2. The Applicant shall provide water main designs in context with site grading, right-of-way limits, structures, buildings, walls, light poles, traffic controls, sidewalks, trails, walkways, concrete pads, and fences.
3. The Applicant shall place water main design information in either the grading and/or utility plan sheets.
4. Show and correctly identify all existing water mains, valves, blow-off assemblies, air releases, meters, and hydrants within 100-feet of the project limits or plan sheet limits, whichever is greater. Existing water mains shall be identified with the pipe size, material, and identifier, example: 12" DIP W/L.
5. Show all proposed water mains, valves, reducers, fittings, and hydrants with the designated line type and symbol per Table 4-3.

Table 4-3: Designated Line Type and Symbols

EXISTING WATERLINE W/ TEE	- - - W - - - - - T T
PROPOSED WATERLINE W/ TEE	— W — — — T T
EXISTING FIRE HYDRANT	I • ⊕
PROPOSED FIRE HYDRANT	I • ●
EXISTING WATER VALVE	- - - W ○ - - -
PROPOSED WATER VALVE	— ● — W — —
PROPOSED WATER METER	●
EXISTING REDUCER	- - - W ▷ - - -
PROPOSED REDUCER	— ▷ — W — —

6. Show and label proposed water main segments with the pipe size, material, and unique identifier that can be matched to the profile.
7. Place hatch layer, x - x - x - x, over the water mains that are to be removed and hatch layer, // - // - // - // - //, over the water mains that are to be abandoned in place.
8. Show and label proposed fire lines as private and specify line size and material.
9. Show and label the stationing of proposed water mains in plan view that corresponds with the stationing in the water main profiles.
10. Specify the removal of blow off assemblies or plugs when a water main extension is proposed from an existing blow off assembly or plug.
11. Specify a tee connection to an existing water main as either a wet tap or cut in tee.
12. Show and specify the size and material of water service lines to water meters for multi-family, mixed use, student housing, or non-residential buildings and label ductile iron service lines as fully restrained and polyethylene encased.

13. Specify the meter sizes for multi-family, mixed use, student housing, or non-residential use.
14. Show, label, and specify the size of sub-meters and water-only meters.
15. Show and identify all existing and proposed water main easements, both on and off-site. Provide the recordation number, with the easement identifier, for existing easements.
16. Show and identify all multi-family, mixed use, student housing, or non-residential buildings, including building use, address, square footage, height, and number of dwelling units, if applicable. Provide each building with a unique building identifier to match to the meter schedule in the PWCSA Information Sheet.

C. Profile View

1. The Applicant shall provide profile views at 1:5 vertical scale (1-inch to 5-feet) and 1:50 horizontal scale (1-inch to 50-feet). Other scales are only permitted with written permission from the Development Manager or designee.
2. Profile water mains separately from road, storm, and sanitary sewer profiles.
3. Profile all existing and proposed grades over the center of existing and proposed water mains. Provide and label elevations of the existing water mains per test pit information.
4. Profile interim and ultimate grade elevations over the water main if grading is subject to change with a future Project Plan.
5. Identify and label water main profiles with a unique identifier that can be matched to the plan view. Specify the water main size and material. The specification shall include, “polywrap”, if ductile iron pipe is specified.
6. Identify and label all proposed valves, reducers, bends, tees, crosses, blow-off assemblies, air releases, meters, and hydrants with stationing in profile view to match the plan view.
7. Profile all hydrant leads 50-feet in length or greater.
8. Profiles shall graphically show and specify the amount of proposed or existing water main to be restrained when applicable. The station restraint is to start, and the station restraint is to end shall be reported in the profile. General notes or the use of restraint tables are not permitted. Avoid small gaps between restraining zones; do not overlap restraint zones.
9. Show, label, and identify all utility crossings in the profile.
10. Show casing pipes graphically in the profile and label with the following: stationing of casing ends, diameter, material, and length.
11. Show and specify vertical separation from other utilities, which are less than 2-feet, in the profile.

12. Label fire lines as “private” in profile view.
13. Show and label limits of engineered fill graphically and include compaction requirements.

D. PWCSA Information Sheet

1. A completed PWCSA Information Sheet is required for all plan submissions. Reference the PWCSA Information Sheet at <https://www.pwcsa.org/service-authority-standard-plan-sheets>

E. Unit Price Sheet

1. The Applicant shall calculate bond values for all water facilities using the values shown on the current PWC Unit Price Sheet.
2. Water service lines are bonded as part of the Standard Meter Crock & Appurtenances line item and are not bonded separately.
3. Hydrant leads and hydrant isolation valves are bonded as part of the Fire Hydrant Assembly line item and are not bonded separately.
4. The Unit Price Sheet must clearly communicate if the Schedule of Values is being posted as a new bond, changing the quantities of an existing bond, or adding quantities to an existing bond.

-- end of Chapter 4 --

Chapter 5: Sanitary Sewer Collection Systems

5.1 Scope

A. Intent

This Chapter describes the planning, layout, design and construction of sanitary sewer collection system owned and maintained by the Service Authority.

B. Standards

The Applicant shall apply the information contained in this Chapter in conjunction with the latest edition of the Sewage Collection and Treatment (SCAT) Regulations 9 VAC 25-790, as published by the Commonwealth of Virginia, Department of Environmental Quality; and with other sections of this Manual. The authority for discretionary provisions for designs lies with the Director or designee.

C. Definitions

1. “Applicant” shall mean that person or persons applying for a rezoning, submitting plans, analyses, or studies; acquiring permits, constructing utilities, applying for meter certification, requesting inspections, granting easements, requesting bond release, or any activity related to developing land, extending utilities, or establishing water service. All actions to be performed and the associated expenses are the responsibility of the Applicant.
2. “Furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or other specified location) ready for use or installation and in new, unexpired, usable and operable condition.
3. “Grinder Pump” shall mean the grinder pump assembly and all piping, which includes piping on private property from the building to the grinder pump and from the grinder pump to the flush station, all electrical connections, and appurtenances.
4. “Install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
5. “Low Pressure Force Main” (LPFM) shall mean the low-pressure force main (in the right of way or easement dedicated to the Service Authority) and the pressure service pipe to the property, up to and including the flush station.
6. “Perform” or “Provide,” when used in connection with services, materials, or equipment shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
7. “Project Plans” shall mean a set of plans used for site development containing the necessary information to extend utilities and provide water and/or sanitary sewer service sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia.

D. Minimum Standards

The Applicant shall, at a minimum, meet all standards described in this Chapter for all sanitary systems that are incorporated into the Service Authority's System regardless of whether the system is within a public right-of-way or on private property with dedicated easements.

Many criteria listed are minimums; however, the Applicant shall provide additional separations and clearances as practical to optimize each design and locate utilities so as to facilitate their re-excavation. The Service Authority will consider factors such as depth and magnitude of the facility in determining the adequacy of each design and may relax or increase dimensional requirements accordingly. Designs shall minimize both maintenance and life cycle costs for the Service Authority.

5.2 Sanitary Sewer Studies

When requested by the Development Manager or the Planning Manager, the Applicant shall prepare and submit, a sanitary sewer study to the Service Authority's Project Engineer for review and acceptance. The sanitary sewer study shall include, but not limited to, the downstream sanitary sewer collection system, trunk mains, interceptor mains, and sewage pumping station(s). The study shall demonstrate that the hydraulic capacity of the existing infrastructure can accept the additional proposed flows. If the proposed and existing flows exceed the capacity of the downstream sanitary sewer mains or sewage pumping station(s), the Applicant shall design and construct off-site improvements in accordance with the Service Authority Development Review Process and System Improvement Policy (refer to *Appendix R*).

A. Sanitary Sewer Study Parameters

1. The scope of the sanitary sewer study will be established on a case-by-case basis by the Planning Manager and may include infrastructure beyond the limits of a Project Plan.
2. The Applicant's Engineer shall validate as-built data utilized for the sanitary sewer study.
3. Consumption data from the Service Authority or flow monitoring may be utilized for the purpose of establishing baseline flows in the existing sanitary sewer system. Flow monitoring requirements are determined by the Development Manager on a case-by-case basis. The adequacy of an existing sanitary sewer collection system is subject to the Service Authority's review and acceptance.

B. Sanitary Sewer Study Format

1. Title Page
 - a. Title the report with the same plan name and plan number matching the final engineering plans. Include the date the sanitary sewer study was last updated.
 - b. A Professional Engineer licensed in the Commonwealth of Virginia shall seal, sign, and date the title sheet.

2. Overview
 - a. State the purpose of the study.
 - b. Describe the proposed site development, location, densities (e.g., number of dwelling units) or metrics (e.g., acres) used to estimate tributary flows.
 - c. Report all pertinent background information for the development. Report all surrounding and known proposed developments that may impact, or could be impacted by, the proposed project.
 - d. Describe the existing sanitary sewer system being studied and report pertinent facility information.
 - e. Identify the existing sewer shed and sewage pump station(s) that will receive flows.
3. Design Criteria
 - a. Use the Manning's formula to calculate the sanitary sewer capacity.
 - b. Report how average daily flows are peaked.
 - c. Define a pipe being full when the ratio for depth of flow at peak flow to pipe diameter (d/D) is 0.80.
4. Assumptions
 - a. Report any assumptions used in the calculations or analysis.
 - b. Report any assumptions made about pipe condition.
 - c. Report how existing and proposed tributary flows are determined.
 - d. Report roughness coefficient for the pipe material used for calculations.
5. Analysis
 - a. Provide a narrative identifying the data and describe how it was used in the study.
 - b. Identify all constraints or uncertainties.
 - c. If applicable, report how flow monitoring data of the existing sanitary sewer was used in the study.
 - d. Provide gravity sanitary sewer design tables in accordance with *Chapter 5, Section 5.3*, for the following conditions:
 - i. Establish the existing sanitary sewer capacity prior to adding the proposed tributary flows.
 - ii. Report the combined effects of existing and proposed flows on the existing pipe capacity.
 - iii. If applicable, determine improvements needed to the existing sanitary sewer facilities to accommodate the proposed flows.
6. Results / Conclusions
 - a. Provide a summary of the results.

- b. If applicable, confirm the adequacy of the existing sanitary sewer collection system, interceptors, and sewage pumping stations.
 - c. If applicable, identify constraints and recommended solutions.
 - d. If applicable, provide a summary of all required improvements needed, to the existing sanitary sewer facilities, to accommodate the proposed flows.
7. Schematic
- a. Provide a schematic plan on a 24-inch by 36-inch sheet with topographic contours, showing where tributary loadings have been applied to the existing sewer collection system, interceptors, and sewage pumping stations.

5.3 Gravity Sewer Hydraulic Design Criteria

A. General

Sanitary sewer mains 12-inch or larger in diameter are considered interceptors. Sanitary sewer mains less than 12-inches in diameter are considered collection mains.

The Applicant shall design sanitary sewer mains to carry peak tributary flows generated by the proposed development in addition to the peak flows from all contributing points within the sewer drainage area, including, but limited to, flows from an existing or planned sewage pumping station and future flows based on land use as outlined in the adopted PWC Comprehensive Plan.

B. Estimating Tributary Flows

1. Average Daily Sanitary Sewer Flows:

The Applicant shall calculate the average daily sanitary sewer flows by multiplying the appropriate flow factor in Table 5-1 by the number of applicable units and report the average flow in units of gallons per day. The unit flows in Table 5-1 include infiltration.

The values listed for office, industrial, and commercial development are rules of thumb and useful for preliminary planning. The Applicant shall use actual values, such as land use, density, and floor-to-area ratios, to more accurately estimate the sanitary sewer flows.

When the expected land use will generate a higher projected tributary flow, the Applicant shall include a description for the deviation from Table 5-1 with the sanitary sewer main design in the Project Plans. In all scenarios, the Applicant shall design the sanitary sewer mains for the highest average day tributary flow.

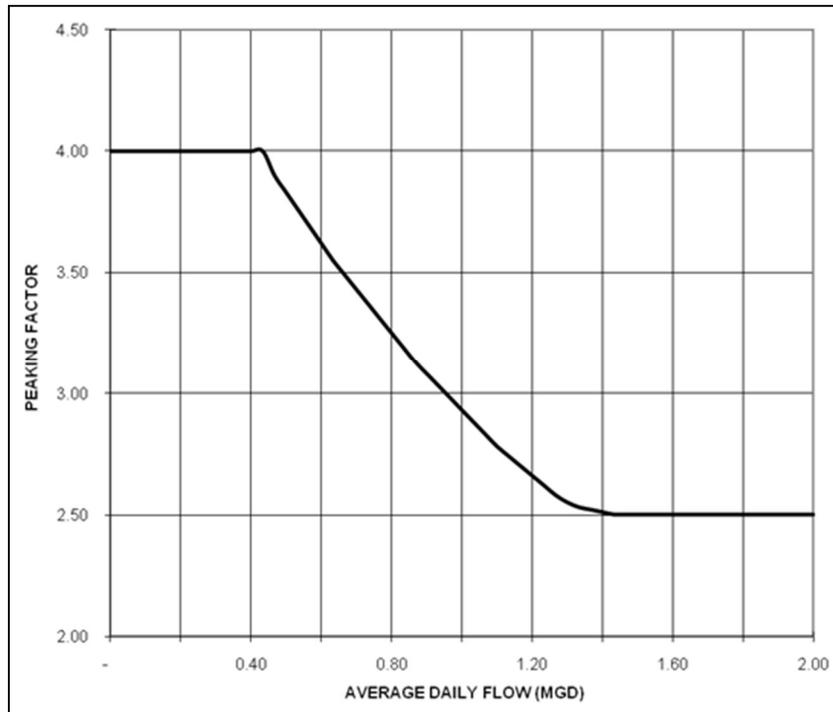
2. Peak Daily Sanitary Sewer Flows:

The Applicant shall calculate peak daily sanitary sewer flows by multiplying the average daily flow by the appropriate peaking factor from Figure 5-1 and report the peak flow in units of gallons per day.

Table 5-1: Average Daily Sanitary Sewer Flows

Land Use Category	Density (Unit/Acre)	Unit	Flow/Unit (gpd)
Residential			
Urban (UR)	15–30	Dwelling unit	300
Suburban—High (SRH)	8–15	Dwelling unit	350
Suburban—Moderate (SRM)	4–8	Dwelling unit	350
Suburban—Low (SRL)	1–4	Dwelling unit	390
Semi-rural (SRR)	0.2–1	Dwelling unit	390
Rural (RR)	0.1–0.2	Dwelling unit	390
Agricultural/Estate (AW)	0.1	Dwelling unit	390
Office			
Regional Employment (REC)	—	Acre ^a	2,000
Office/Flex (OF)	—	Acre ^a	2,000
Community (CEC)	—	Acre ^a	2,000
Office (O)	—	Acre ^a	2,000
Industrial			
Heavy (HI)	—	Acre ^a	2,000
Light (LIF)	—	Acre ^a	1,500
Commercial			
Regional (RCC)	—	Acre ^a	2,000
Community (CC, NC)	—	Acre ^a	2,000
<p>“Acre” refers to gross acreage.</p> <p>For specific flow factors not covered in this table, refer to the Virginia Department of Health Sewage Collection and Treatment Regulations, 12 VAC 5-581-520, Table 3.</p> <p>^a Office use assumed at a floor-to-area ratio of 0.2 unless otherwise specified by the Development Manager.</p>			

Figure 5-1: Peak Flow Factors



C. Main Velocity

1. The Applicant shall design all sanitary sewer mains with slopes sufficient to provide a velocity during peak flow conditions of at least 2.25 fps and a maximum velocity not to exceed 10-fps.

D. Sizing Sanitary Sewer Mains

1. The minimum size for sanitary sewer mains is 8-inches in diameter.
2. The Applicant shall design all sanitary sewer mains with a depth of flow, at peak flow, to pipe diameter (d/D) ratio of 0.80 or less.

E. Roughness Coefficient

1. The Applicant shall use a roughness coefficient (n) of 0.013 for all pipe materials.

F. Hydraulic Calculations

The Applicant shall submit sanitary sewer design calculations for all proposed sanitary sewer mains as part of the Project Plans. The Applicant shall provide a sewer shed map for the proposed and existing sanitary sewer systems if requested by the Service Authority's Project Engineer.

1. The Applicant shall calculate the actual flow velocity, full flow velocity, and capacity of the pipe using Manning's formula, see Figure 5-2.

Figure 5-2: Manning’s Formula

$$v = (1.49/n) R^{2/3} S^{1/2}$$

$$Q = 646,272 (1.49/n) A R^{2/3} S^{1/2}$$

Where:

v = velocity (feet per second)
n = roughness coefficient 0.013
R = hydraulic radius
S = slope (feet per foot)
A = cross-sectional area (square feet)
Q = flow rate (gallons per day)

2. Total cumulative peak flows are calculated by combining the peak daily flows with the anticipated peak day discharge of any connected sewage pumping station. Total cumulative peak flows are reported in units of gallons per day. Cumulative peak flows over one (1) million gallons per day may be reported in million gallons per day.
3. The Applicant shall present the design calculations in a sanitary sewer design table, in the format shown in Figure 5-3, in the Project Plans.

Figure 5-3: Gravity Sanitary Sewer Design Tables

Gravity Sanitary Sewer Design Table (Part 1)										
"n" factor = 0.013										
From Manhole	To Manhole	Units or Area	Flow / Unit	Avg. Flow Increment	Avg. Flow Total	Peak Factor	Q Total (GDP)	Pipe Size (in.)	Length (ft.)	Slope (%)

Gravity Sanitary Sewer Design Table (Part 2)										
							PWCSA Use Only			
Actual Vel. (fps)	Full Flow Vel. (fps)	Capacity (gpd)	q/Q (%)	d/D (%)	Invert Upper	Invert Lower	Date Line Installed	Date Line Passed Test	MH ID	Date MH Pass Vac. Test

5.4 Design

A. General

1. Inverted siphons are not permitted.
2. In accordance with Virginia Waterworks Regulations, sanitary sewer mains shall not pass within 50-feet of a potable water supply source (i.e., a well). All existing and proposed potable and non-potable wells, within 100-feet of all sanitary sewer mains or sanitary sewer easements, are identified in the Project Plans.
3. The Service Authority retains final decision authority for proposed connection point to existing sanitary sewer infrastructure.

B. Slope

1. Sanitary sewer mains shall have a uniform slope and straight alignment between manholes and be designed to be free flowing with a hydraulic grade below the crown of the pipe.
2. Sanitary sewer mains shall only be designed with minimum slopes when conditions require such to reach an existing sanitary sewer or to avoid excessive depth, see Table 5-2 for allowable minimum required slopes. When possible, twice the minimum slope shall be provided with sanitary sewer mains running to a drop connection at a manhole.

Table 5-2: Minimum Required Slopes

Sewer Diameter (in.)	Minimum Slope (ft per 100 ft)
8	0.47
10	0.34
12	0.26
16	0.18
18	0.14
21	0.113
24	0.088
30	0.062
36	0.048
42	0.040
For sewers larger than 42-inches in diameter, compute the minimum slope using $S = v^2 / (1.49R^{2/3}/n)^2$, where $v = 2.25$ fps.	

3. Upper or terminal sewer runs shall have a minimum slope of 0.80 percent unless there is a force main connection or a distinct possibility that the sanitary sewer will be extended in the near future.
4. Sanitary sewer mains with a slope of 20 percent shall be anchored to the ground. The structural and installation details for the anchors shall be provide in the Project Plans.
5. Sanitary sewer mains are not designed with a slope greater than 20 percent.

C. Layout

1. Routes for sanitary sewers shall be selected so as to provide the required separation from buildings and other utilities, while minimizing the use of manholes and the number of crossings with curbs and sidewalks. Sanitary sewer routes and manhole placements are selected so that manholes will be accessible for maintenance operations. Where sanitary sewers are in an easement and beyond the street, the Service Authority's Project Engineer will determine the extent of vehicular access needed to accomplish maintenance operations. Where determined necessary, vehicular access is provided from the street to the easement.
2. Where sanitary sewer passes adjacent to a building or structure, the design will ensure that the sanitary sewer can be excavated for repair or replacement, without undermining the building's foundation. The Applicant shall provide sectional views of the existing building and/or structure's loading plane. For proposed buildings or structures, the Applicant shall provide clear specifications on the site plan, stating the highest elevation at which the foundation will bear. In no case shall the building or building footings encroach into the sanitary sewer easement.
3. Any necessary relocation of existing sanitary sewer facilities is the responsibility of the Applicant and will be replaced in kind, in the form of a new, parallel facility.
4. The Applicant shall place manholes along the centerline of the street. However, manholes may be placed in the center of a travel lane to accommodate the utility separation requirements of this Manual.
5. For secure sites requiring indirect routes of travel for Service Authority personnel to access its facilities, the Director or designee may require a site-specific access agreement and route map prior to placing the system into Beneficial Use.

D. Extensions and Access

1. Sanitary sewer mains shall be extended beyond all site improvements to accommodate future extensions with minimal disruptions.
2. Temporary termination of a public sewer is made at a manhole. Easements for future extensions are provided to the site or subdivision boundary and conveyed to the Service Authority.

E. Soil Corrosivity Analysis

Reserved for future use.

5.5 Gravity Sanitary Sewer Mains and Appurtenances

A. General

1. All proposed pipe material is subject to approval by the Service Authority. The Applicant shall show, on the Project Plans, the type or types of pipe material proposed for use on the project.
2. Pipe material and dimension ratio (DR), or thickness class if applicable, shall remain uniform between manholes with the exception of an inside drop connections. Pipe materials for an inside drop connection shall be provided in accordance with the details of this Manual

B. Polyvinyl Chloride (C-900) Pipe

1. Materials

Polyvinyl Chloride (C-900) sanitary sewer mains are manufactured in accordance with AWWA C900. The DR rating of the pipe is specified for the allowable depth of cover, see Table 5-3.

2. Joints

All joints for C-900 pipe are a standard “push-on” joint and are in accordance with AWWA C-900. Joints and gaskets of standard C-900 pipe are in accordance with ASTM D-3139 with gaskets in accordance with ASTM F477. No pipe deflection is permitted in the joints or pipe.

3. Fittings

All fittings for C-900 pipe are manufactured as a one-piece injection molded Polyvinyl Chloride (PVC) fitting in accordance with ASTM D1784 and AWWA C907. Fittings shall match the DR rating of the pipe.

C. Ductile Iron Pipe

1. Materials

Pressure rated DIP, Class 52, sanitary sewer mains are manufactured in accordance with AWWA C151 (ANSI A21.51) and used for the following applications:

- a. DIP are used at all stream crossings.
- b. DIP are used for all aerial crossings.
- c. DIP are specified where cover is in excess of 25 feet.

DIP mains are double lined with cement mortar, in accordance with AWWA C104 (ANSI A21.4), and have a protective exterior coating with no defects, gouges or damage.

2. Joints

All joints for ductile iron pipe are standard “push-on” or “mechanical” joint and are in accordance with AWWA C151 (ANSI A21.51). Joints and gaskets of standard mechanical joint pipe are in accordance with ANSI A21.11.

3. Fittings

Fittings for DIP are in accordance with AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI A21.53).

D. Restraint

1. Sanitary sewer pipe joints are fully restrained for the following applications:
 - a. For pipe installation in a casing.
 - b. For pipe installation with a slope of 15 percent or greater.
 - c. For pipe installation at a stream crossing.
 - d. For pipe installation at an aerial crossing.
 - e. Joints are fully restrained where determined appropriate by the Development Manager or designee.
2. When pipe joint restraint is required, sanitary sewer mains are restrained against movement with mechanical restraining glands as listed in *Appendix C: USM Approved Products List*.
3. Proprietary joint restraint, by the pipe manufacturer, may be used in lieu of an external restraining gland. Factory restrained joints, high-strength ductile iron tee-head bolts, hex nuts, ductile iron glands, and rubber gaskets are as the pipe manufacturer has furnished them.
4. The use of gasket restraining devices is only permitted on a case-by-case basis with the approval of the Inspections Manager or designee.

E. Corrosion Protection

1. External Corrosion Protection

DIP, fittings, and appurtenances shall be encased with 4-mil high-density, cross-laminated, polyethylene tube wrap (polywrap) in accordance with AWWA C105 (ANSI A21.5). In addition, all fasteners and appurtenances are completely coated with Roskote R28 rubberized mastic.

2. Internal Corrosion Protection (Linings)

- a. DIP aerial sanitary sewer mains are installed with a cured-in-place pipe lining.
- b. A cured-in-place lining are installed in all existing non-PVC sanitary sewer mains between lined manholes.

3. Where DIP is proposed in areas within 100-feet of gas transmission mains with impressed current, rectifiers, or other potential sources of stray current, the Applicant shall provide additional engineering analysis by a NACE-certified Engineer to determine a suitable means to protect the sanitary sewer main.

F. Separations and Crossings

Sanitary sewer mains and sanitary sewer manholes shall not come into contact with any part of a water main.

1. Parallel Installations:

- a. The Applicant shall provide sanitary sewer mains and manholes at least 10-feet horizontally from a water main; the distance is measured edge-to-edge. In unusual conditions that prevent a horizontal separation of 10-feet, the sanitary sewer mains and manholes may be installed up to 7.5-feet from the water main, provided the bottom of the water main is a minimum of 18-inches above the top of the sanitary sewer main. Where this vertical separation cannot be obtained, the following is applied:
 - i. The sanitary sewer main is constructed of AWWA-approved water main and pressure tested in place without leakage prior to backfilling.
 - ii. The sanitary sewer manhole is of watertight construction and tested in place without leakage.
- b. A 10-foot separation from other utilities (i.e., storm drainage, gas mains, electric, telecommunications, etc.) is desirable by the Service Authority. In conditions that prevent a horizontal separation of 10-feet between other utilities and the sanitary sewer main or manhole, the sanitary sewer main or manhole may be installed up to 7.5-feet from other utilities.

2. Utility Crossings:

- a. Sanitary sewer mains shall cross below water mains with a minimum of 18-inches of separation between the bottom of the water main and the top of the sanitary sewer main. When conditions prohibit an 18-inch vertical separation, sanitary sewer mains that pass under water mains are constructed of an AWWA-approved water main and pressure tested in place without leakage.
- b. In unusual conditions, where the sanitary sewer main passes over a water main, the Applicant shall use the following construction methods:
 - i. Vertical separation of at least 18-inches between the bottom of the sewer main and the top of the water main is provided.
 - ii. Sanitary sewer main is constructed of AWWA-approved water main and pressure tested in place without leakage.
 - iii. Structural support for the sanitary sewer main is provided to prevent excessive deflection of the joints and the settling on and breaking of the water main.
 - iv. The length of the sanitary sewer main is centered at the point of the water main crossing so that the joints are equidistant and as far as possible from the water main.

- c. At utility crossings other than water mains, a minimum vertical separation of 12-inches is maintained between the other utilities and the sanitary sewer main.
 - d. When a sanitary sewer main crosses a gas transmission main, the Applicant shall dig test pits on the gas transmission main at the proposed crossings and show the test pit information on the Project Plans. Sanitary sewer mains are installed in a non-metallic casing pipe running the width of the gas transmission main easement (unless otherwise directed by the gas company). If the gas transmission main is constructed of steel pipe, the Applicant shall show the distance to the nearest anode bed on the Project Plans.
3. Streams Crossings:
- a. The Applicant is responsible for obtaining all required Local, State, and Federal approvals and permits to install a sanitary sewer main designed as a surface water crossing.
 - b. All sanitary sewer mains crossing surface water are installed with a minimum of 2-feet under the invert of the stream bed when the creek bed is composed of rock and 3-feet below the invert of the stream bed when the stream bed is composed of unconsolidated material.
 - c. All sanitary sewer main crossings shall have restrained, watertight joints as determined by the Development Manager or designee.
 - d. Sanitary sewer mains shall cross the stream at a 90-degree angle, where possible.
 - e. Sanitary sewer mains and their appurtenances located along streams are designed to be protected against a 100-year storm event.
 - f. Sanitary sewers parallel to streams are of sufficient depth so that future extensions can be made under the stream bed while maintaining minimum cover requirements. Anticipated future extensions are shown on the Project Plans with corresponding surveyed stream bed depths.

G. Aerial Gravity Sanitary Sewer Crossings

1. Aerial sanitary sewer crossings are installed on piers across ravines or streams and approved on a case-by-case basis by the Development Manager or designee when Applicant demonstrates that no other practicable alternative exists.
2. Full structural support is provided under each sanitary sewer pipe joint.
3. The Applicant shall provide the design information and details of the aerial crossing and piers, including security and safety measures to prevent trespassing onto the aerial crossing, on the Project Plans.
4. The Applicant is responsible for obtaining all required Local, State, and Federal permits to install a sanitary sewer main designed as an aerial crossing.

H. Depth of Cover

1. Sanitary sewer mains are designed with a minimum cover of 5-feet above the top of the main.
2. In unusual conditions, sanitary sewer mains may be designed with a minimum cover of 3.5-feet above the top of the main.
3. The Applicant shall not design sanitary sewer mains at depths greater than the depths shown in Table 5-3.

TABLE 5-3: Allowable Depth of Cover

Pipe Diameter	Depth (ft)	
	ANSI/AWWA C900 PVC ^a	
	DR25	DR14
8	18	25
10	18	25
12	18	25
14	18	25
15	—	—
16	18	25
18	18	25
20	18	25
21	—	—
24	18	—
27	—	—
30	18	—

Applicant shall provide design calculations for pipe designed at depths greater than values shown in this table.

4. Laterals are not connected to sanitary sewer mains at depths greater than 18-feet.
5. All grade changes, greater than 12-inches, over existing sanitary sewer mains are shown in the plan and profile.
6. The Applicant shall provide design calculations, when directed by the Service Authority’s Project Engineer, to confirm that the proposed cover will not affect the structural condition of the existing sanitary sewer main(s).

I. Casings

Refer to *Chapter 4, Section 4.4 H*, for information about main installations in casings.

5.6 Sanitary Sewer Manholes

A. General

1. The Applicant shall provide manholes at all junctions with other sanitary sewer mains, for changes in alignment or grade, and at the terminal point of the main.
2. The maximum distance between manholes is 600-feet.
3. A manhole vent shall be provided a minimum of every 1,000-feet for watertight systems installed outside of paved areas, in accordance with the details of this Manual.

B. Design

1. The minimum height for a standard manhole with a cone section is 5 feet. Where deemed acceptable by the Development Manager or designee, the minimum height for a flat top manhole is 4 feet.
2. The minimum inside diameter is 4-feet.
3. A manhole diameter 5-feet or greater is required when connecting sanitary sewer mains greater than 12-inches in diameter.
4. A manhole diameter of 5-feet is required for all new manholes with an inside drop connection for sanitary sewer mains 8 to 12-inches in diameter, or when manhole depths exceed 18-feet.
5. For sanitary sewer mains 24-inches or greater in diameter, the Applicant shall provide a specially designed manhole structure with a manhole transition coupler, if needed.
6. Manholes constructed on fill shall have a false bottom extending to undisturbed ground. For fill depths in excess of 8-feet, the Applicant shall provide an alternative design for a support system (e.g., spread footing) to prevent manhole settlement.

C. Manhole Locations

1. Set locations to minimize the number of needed manholes.
2. Where possible, locate manholes in paved areas.
3. To the extent possible, locate manholes outside the limits of residential lots.
4. Do not locate manholes in areas where storm runoff backs up in the street during a rain event, such as the spread area in front of storm drainage inlets.
5. Do not locate manholes in curb, gutter pan, parking spaces, sidewalks, trails, or other pedestrian travel ways.

D. Manhole Frames and Covers

1. Manholes located outside of pavement
 - a. The Applicant shall furnish watertight frames and covers for manholes located in remote locations and open areas in accordance with the details in this Manual.
 - b. The Applicant shall set the rim elevation 2-feet above finished grade, unless directed otherwise by the Development Manager or designee.
2. Manholes located in pavement
 - a. Applicant shall furnish street frame and covers.
 - b. The Applicant shall set the rim elevation flush with the final grade.
 - c. The Applicant shall provide a waterproof manhole insert. Refer to *Appendix C: USM Approved Products List*.
3. The maximum elevation adjustment permissible, with the use of adjustment rings, is 1-foot. Elevation adjustments greater than 1-foot shall require using precast sections. Concrete adjustment rings are not permitted. Refer to *Appendix C: USM Approved Products List* for approved manufacturers.

E. Manhole Connections

1. Sanitary sewer connections to manholes shall have an angle of entry no less than 90 degrees to the downstream invert-out of the manhole.
2. Applicant shall provide a smooth transition between the inverts.
3. For sanitary sewer mains up to 12-inches in diameter, provide a minimum 0.2-foot difference between the invert-in and the invert-out to account for hydraulic losses.
4. For sanitary sewer mains larger than 12-inches in diameter, the Applicant shall calculate the hydraulic losses at intersections and transitions of sanitary sewer mains separately and submit the calculations to the Development Manager or designee for acceptance.
5. No connections are permitted within 6-inches of a sanitary sewer manhole joint or within the range of 12 to 30-inches above the invert-out.
6. Specify connections made 30-inches or more above the invert as an inside drop connection.
7. Match the crowns of pipes when a smaller sanitary sewer main discharges into a manhole with a larger sanitary sewer main.
8. Manhole connections shall not obstruct the use of existing manhole steps.

F. Manhole Linings for Force Mains

1. Manhole Linings
 - a. For new manhole installations subject to a force main discharge, a cast-in-place high-density polyethylene liner consisting of Agru Sure Grip or GSE Stud Liner is required.
 - b. For Existing manholes downstream of a force main discharge, the manhole shall have a spray-on liner consisting of Raven 405 or Cor+Gard.
2. The Applicant is required to provide manhole linings according to the following:
 - a. Manhole lining is not required when the force main discharge is less than 700-gallons per day (for example, one or two single-family dwellings).
 - b. Manhole lining is required in the first manhole when the force main discharge flows range between 701 and 1,750-gallons per day (for example, three to five single-family dwellings).
 - c. Manhole lining is required for the first three downstream manholes within 1,000-feet of a force main discharge when discharge flows range between 1751 and 8,750-gallons per day (for example, 6 to 25 single-family dwellings).
 - d. Manhole lining is required for all manholes within 1,000-feet of a force main discharge when discharge flows are greater than 8,750-gallons per day.

5.7 Sanitary Sewer Lateral Connections

A. Materials

1. The Applicant shall construct sanitary sewer lateral connections with the same material as the sanitary sewer main to which the lateral is connecting.
2. Sanitary sewer laterals are connected by one of the following means: a manhole connection, pre-manufactured tee or wye connection, insert-a-tee, or saddle-type connection.

B. Design

1. Sanitary sewer lateral connections installed by the Applicant from the sanitary sewer main to the property line or right-of-way shall have a minimum 4-inch diameter. Each lot shall have its own separate sanitary sewer connection to the sanitary sewer main. A building sanitary sewer connection to the sanitary sewer shall not tie into the vertical cleanout riser at the property line. No more than three (3) sanitary sewer lateral connections at permitted at terminal manholes. The Applicant shall avoid sanitary sewer lateral connections to in-line manholes.
2. The Applicant shall provide details pertaining to sanitary sewer laterals in the form of a sanitary sewer lateral table in the Project Plans. The table shall include the lot number, invert of the lateral at the sewer main; the finished floor elevation of the proposed buildings; the size, length, slope of each lateral; and the difference between the lowest floor elevation and the invert at the sewer main. The lowest floor elevation of any structure to be served by gravity shall be a minimum of 4-feet above the invert

elevation of its sanitary sewer lateral connection at the sanitary sewer main or a pumped sanitary sewer operation shall be utilized.

3. The Applicant shall not connect sanitary sewer laterals directly into sanitary sewer mains greater than 12-inches in diameter unless approved by the Director or designee. The Applicant shall not connect sanitary sewer laterals to sanitary sewer mains installed between lots, unless approved by the Development Manager or designee.
4. Sanitary sewer lateral connection shall have an angle of entry no less than 90 degrees to the downstream flow in the sewer main.
5. Where possible, sanitary sewer laterals shall be offset a minimum of 5 feet from a storm box, tree, structure, or sign.
6. Cleanouts are required for all laterals at the property line adjoining a public right-of-way for new construction as well as new connections to existing stubbed out sanitary sewer laterals. All property line cleanouts shall have a brass cap. The Applicant shall not locate cleanouts in a sidewalk, driveway entrance, or in a state right-of-way.

C. Sanitary Sewer Connections with Private Wells

1. The Service Authority requires a water meter between the private well and the building, at the Applicant's expense, prior to making a connection to the sanitary sewer system.
2. The Applicant shall furnish the water meter box and all appurtenances necessary for meter installation in accordance with the details in this Manual.

5.8 Low Pressure Force Mains

A. General

1. A low-pressure force main (LPFM) system is defined as a pressurized sanitary sewer main serving multiple grinder pump connections by different property owners and does not double as a discharge force main from a centralized sewage pumping station facility. LPFM systems are used only where a gravity sanitary sewer system is not possible or feasible as determined by the Director or designee with concurrence from the Director of Operations and Maintenance.
2. The Service Authority shall accept the maintenance responsibility for a LPFM as well as the connection facilities (which includes the tap, the line to the flush station, and the flushing station) that can serve more than one property, provided that the LPFM is installed in a public right-of-way or in a dedicated Service Authority sanitary sewer easement.

B. Grinder Pumps

1. The Service Authority does not provide, install, inspect, maintain, or own grinder pumps for new connections to the sanitary sewer system (*refer to Appendix J: Low Pressure Force Main and Grinder Pump Policy*).

2. All grinder pumps are privately owned and maintained by the property owner who is responsible for procurement, installation, and inspection of the pump and associated appurtenances connected to the property line flushing station. The property owner shall obtain and satisfy the requirements of all required permits from the appropriate Building Official (i.e., PWC, Town of Dumfries, etc.) or permitting agency.

C. Design

The Applicant shall provide LPFM design calculations in the Project Plans sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia, when a new LPFM is proposed in excess of 300 feet or cumulative tributary flows are estimated in excess of 1,750 gallons per day.

1. Each property shall have a separate grinder pump and a separate property line flushing station with a 1.5-inch service connection to the common LPFM. Buildings or facilities on separate properties shall not share a grinder pump or LPFM connection.
2. The installation and future maintenance of LPFMs shall not negatively impact the foundations of buildings or other structures.
3. Estimated tributary flows for LPFM calculations are based on Table 5-1.
4. The LPFM system shall maintain a minimum scour velocity of 2-fps and shall not exceed a maximum velocity of 8-fps.
5. The design of a LPFM system cannot exceed a total dynamic head of 60 psi.
6. If the total retention time in the LPFM exceeds 72-hours, the Applicant shall provide a 10-foot-by-10-foot easement area for a future automatic flushing station in the location designated by the Development Manager or designee.
7. Design calculations shall consist of a LPFM design table and accumulative retention time table submitted in the following format:

a. LPFM Design Table:

Low Pressure Force Main Design Table (Part 1)								
Zone Number	Connections to Zone	Number of Pumps in Zone	Accum. Pumps in Zone	Gallons/Day per Pump	Max. Flow per Pump (gpm)	Max. No. of Simultaneous Operations	Max Flow (gpm)	Pipe Size (in.)

Low Pressure Force Main Design Table (Part 2)								
Max Velocity (fps)	Length of Pipe this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum. Friction Loss (ft)	Max. Main Elevation	Min. Pump Elevation	Static Head (ft)	Total Dynamic Head (ft)

b. Accumulative Retention Time Table:

Accumulative Retention Time Table (Part 1)					
Zone Number	Connections to Zone	Accumulative Pumps in Zone	Gallons/Day per Pump	Pipe Size (in.)	Length of Zone

Accumulative Retention Time Table (Part 2)				
Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (hours)	Accumulated Retention Time (hours)

- c. The Applicant shall submit a schematic of the LPFM system which shows the layout and identifies the pipe sizes of the proposed and existing, if applicable, LPFM. The schematic shall identify all properties and pumps connected to the LPFM and their associated zone.

D. Connections to An Existing LPFM System

1. Existing LPFM systems were typically sized for the properties the system was originally designed to serve. When the total tributary flows in a LPFM system are in excess of 1,750 gallons per day, the Applicant shall provide the following to confirm the existing LPFM system can accept additional pumped flows:
 - a. Provide design calculations demonstrating that the existing LPFM system meets the criteria in *Chapter 5, Section 8.C*.
 - b. Collect information on the existing pumps connected to the existing LPFM system necessary for the design calculations.
 - c. Confirm that the increased total dynamic head does not overpower the existing pumps connected to the existing LPFM system.
2. No connections are permitted to a force main from an existing or proposed sewage pumping station.

E. Sizes, Pipe Materials, and Fittings

1. The minimum LPFM size is 1.5-inches. The maximum size for a LPFM is 4-inches.
2. Provide Schedule 40 PVC pipe, with a minimum pressure rating of 200 psi, with solvent welded bell and spigot joints.

3. Provide Schedule 80 PVC fittings that are manufactured as a one-piece injection molded PVC compound meeting ASTM 1784. Fittings shall have a minimum pressure rating of 320 psi.

F. Separation and Crossings

1. Parallel Installations: Refer to *Chapter 5, Section 5.5.F*.
2. Utility Crossings: Refer to *Chapter 5, Section 5.5.F*.
3. Stream Crossings: Refer to *Chapter 5, Section 5.5.F*. In addition, the Applicant shall install LPFMs in a casing pipe at all stream crossings.

G. Depth of Cover

1. Install LPFMs at a minimum depth of 3.5-feet, where possible, from finished grade to the top of the pipe without creating intermediate high and low points.
2. LPFM shall not be installed at depths greater than 8-feet.
3. The Applicant shall provide a profile of all grade changes, greater than 12-inches, over an existing LPFM. The Applicant shall test pit the elevation of the existing LPFM, as necessary, for the Applicant to certify an accurate profile and include the test pit information in the Project Plans prior to acceptance.

H. Casings

1. Refer to *Chapter 4, Section 4.4.H*.

I. Valves

1. Applicant shall provide valves at all connecting intersections of LPFMs: four valves at crosses and three valves at a tee.
2. Applicant shall provide valves every 1,000 feet of force main, prior to terminal flushing station to permit extension, and at locations directed by Development Manager or designee.
3. Provide valves that are true union Schedule 80 PVC ball valves. All ball valves shall withstand a working pressure of at least 235 psi.
4. Valves are not permitted within the limits of any curb, gutter pan, driveway, sidewalk, trail, or parking space.

J. Flushing Stations

1. All flushing stations shall consist of a valve, piping, and a 1-inch National Pipe Thread plug. The assembly shall extend upward 12-inches from the LPFM pipe in accordance with the details in this Manual.
2. Applicant shall provide a property line flushing station at the property line for each connection to the LPFM pipe in accordance with the details in this Manual.

- a. Tees are required with the construction of a new LPFM for proposed sanitary sewer connections.
 - b. A ball valve and stainless steel saddle are required for service connections installed on existing LPFMs.
3. The Applicant shall provide an in-line flushing station at junctions of two (2) or more LPFMs, at low points, and for each 1000-foot run of LPFM and additional valves and/or flushing stations, as directed by the Development Manager or designee, to enable directional flushing.
 4. The Applicant shall provide a terminal flushing station at the termination of each LPFM in accordance with the details in this Manual.

K. Air/Vacuum Release Valves

The Applicant shall provide an automatic air release valve at all high points to release trapped air, and where intermediate high points occur and column separation is possible, a combination automatic air/vacuum release valve in accordance with the details in this Manual. Refer to *Appendix C: USM Approved Products List* for approved manufacturers.

L. Discharge to a Manhole

1. A LPFM shall not discharge to an in-line manhole.
2. The LPFM shall connect to a gravity lateral prior to discharging into a terminal manhole, in accordance with the details of this Manual, when either the terminus of the LPFM or terminal manhole are located outside a paved vehicular travel way. The clean-out stack for the gravity lateral shall be located out of the pavement.
3. The LPFM shall connect directly to a terminal manhole and discharge to the manhole invert when both the terminus of the LPFM and terminal manhole are located within a paved vehicular travel way. When the manhole inverts are deeper than 8 feet, the LPFM shall turn downward with a 90-degree bend inside the manhole and installed as inside drop connection. The inside drop connection shall be secured to the manhole wall.
4. The terminal manhole receiving the LPFM discharge shall have no additional receiving inverts.
5. Manhole Linings: Refer to *Chapter 5, Section 5.7.F*.

M. Enclosures

1. When valves, flushing stations, or air/vacuum release valves are located within a paved vehicular travel way, the Applicant shall provide these items in a 48-inch (minimum size) standard manhole with a standard manhole frame and cover. A stone base for drainage is required in accordance with the details in this Manual. The Applicant shall provide a minimum of 6-inches between the inner wall of the enclosure and any valves, flushing stations, or air/vacuum release valves.
2. When valves, flushing stations, or air/vacuum release valves are located outside a

paved area and outside areas subject to vehicle loading, the Applicant shall provide these items in a 36-inch crotch with a standard manhole frame and cover, when the depth to the valves in the enclosure is no greater than 3.5-feet. If the depth to the valves exceeds 3.5-feet, the Applicant shall install these items in a 48-inch (minimum size) standard manhole with standard manhole frame and cover. The Applicant shall provide a minimum of 6-inches between the inner wall of the enclosure and any valves, flushing stations, or air/vacuum release valves.

3. Enclosures are not permitted in walkways, sidewalks, driveways, curbs, or gutter pans.
4. Once LPFMs are placed into service through the Beneficial Use or Partial Beneficial Use processes, valve enclosures must remain accessible at all times. At no time shall valve enclosures be buried, paved over or obstructed by construction equipment, debris, or storage of materials.
5. If street surfaces are renewed or replaced while on bond, the Applicant shall immediately re-adjust valve enclosure covers to their proper elevation relative to the new street surface as directed by the Field Inspector.

N. Tracer Wire, Test Stations, and Detectable Warning Tape

The Applicant shall provide tracer wire, test stations, and detectable warning tape in conjunction with LPFM systems. Applicant shall show on the Project Plans the location of needed test stations and provide a table listing the test station with the corresponding station number of the LPFM alignment. Before the LPFM is accepted by the Service Authority for Beneficial Use and prior to placing the LPFM into service, the Field Inspector shall confirm that the LPFM can be located.

1. Tracer Wire:
 - a. Tracer wire shall consist of #12 solid copper wire insulated with 45-mil polyethylene.
 - b. The Applicant shall provide tracer wire along the entire length of the LPFM and along the service connections to the property line flushing station. The Applicant shall loop tracer wire in the property line flushing station enclosure so that it can be extended a minimum of 18-inches above the top of the enclosure.
 - c. The Applicant shall secure tracer wire to the pipe with plastic cable ties no greater than 10-feet apart. The Applicant shall provide tracer wire at the 12 o'clock position of the pipe.
2. Test Stations:
 - a. The Applicant shall provide tracer wire test stations at all junctions of LPFMs, dead ends, every 1,000 feet, or as directed by the Development Manager. Where possible, install all test stations within 5-feet of the LPFM location.
 - b. Test stations are not permitted in curbs, gutter pans, driveways, sidewalks, trails, bike paths, or any pedestrian travel way.
 - c. When test stations are located outside the right-of-way and outside of a paved area, the Applicant shall use Green Rhino TriView test stations with a five-post

internal terminal block. The Applicant shall spool 48-inches of tracer wire inside the test station to allow the removal of the terminal block for testing.

- d. When test stations are located in the right-of-way (whether in a paved or unpaved area), the Applicant shall use Bingham and Taylor ground-level test stations with a cast iron rim, a turning, locking lid, a seven-post terminal block, with a 5-inch shaft. The Applicant shall spool 48-inches of tracer wire inside the test station to allow removal of the terminal block for testing. Additionally, when test stations are located in the right-of-way and in an unpaved area, the Applicant shall provide a 2-foot by 2-foot concrete pad (3,000 psi, 4-inches thick) around the test station.

3. Warning Tape:

The Applicant shall provide detectable warning tape labeled “CAUTION BURIED SEWER LINE BELOW” that is a minimum of 6-inches wide and installed 1-foot above and over the entire length of the LPFM.

5.9 Pre-treatment & Separators

A. Pre-treatment

1. All sanitary sewer discharge shall fully comply with the Prince William County Article IV. Pretreatment requirements.
2. All sanitary sewer discharge shall fully comply with the Service Authority’s Fats, Oil, Grease (FOG) program.
3. Additional pretreatment requirements and permits may be required by the Regulatory Affairs Officer after review of the Applicants discharge disclosed in an Industrial User Survey.

B. Industrial User Survey

1. An Industrial User Survey shall be completed by the Applicant when requested by the Regulatory Affairs Officer, Development Manager, or designee.
2. The Industrial User Survey must be completed by a qualified person knowledgeable of the building’s operation or process representing the Applicant. An Industrial User Survey shall be submitted to the Service Authority Division of Environmental Services & Water Reclamation for the following uses:
 - a. Data Centers
 - b. Laboratories
 - c. Bioresearch
 - d. Pharmaceuticals
 - e. Waste haulers
 - f. Car washes
 - g. Manufacturing

- h. Leachate discharge that is tributary to the sanitary sewer
- i. Fertilizer runoff that is tributary to the sanitary sewer.
- j. Any use that would alter the discharge pH
- k. Any chemical treatment or additive for cooling or manufacturing process

C. Grease Traps, Interceptors, and Automatic Grease Removal Devices

1. Grease traps shall provide for any non-residential facility that has food preparation activity, commercial kitchen, cafeteria use, or distribution of fried foods. The Applicant shall provide a grease trap for other uses when requested by the Development Manager, or designee.
2. Grease traps shall be shown and specified exterior to the building on a private lateral prior to discharge into a gravity collection system of low-pressure force main. Internal grease traps shall be accepted, if a plumbing plan, specifying the grease trap, is included as part of the site plan submitted for Service Authority review.
3. Domestic waste system shall not run through a grease trap.
4. A Professional Engineer shall size the grease trap and comply with all Prince William County's Building governing ordinances. Grease traps shall be designed to be maintained and fully comply with Service Authority's FOG program.

D. Separators

1. Oil, grit, grease, and volatile liquids separator shall be provided for any automotive use or process where wash down or fluid changes are proposed as part of the operations.
2. Separators shall be provided for any washdown of equipment or facilities that are tributary to the sanitary sewer that can clog or damage the sanitary sewer system. The Applicant shall provide a separator for other uses when requested by the Development Manager, or designee.
3. Separators shall be shown and specified exterior to the building on a private lateral prior to discharge into a gravity collection system of low-pressure force main. Internal separators shall be accepted, if a plumbing plan, specifying the separator, is included as part of the site plan submitted for Service Authority review.
4. Domestic waste system shall not run through a separator.
5. A Professional Engineer shall size the separator and comply with all Prince William County's Building governing ordinances. Separators shall be designed to be maintained and fully comply with Service Authority's FOG program.

5.10 Force Main

A. General

1. A force main system is defined as a pressurized sanitary sewer main, owned and operated by the Service Authority, from a centralized sewage pumping station.
2. The Service Authority may accept the maintenance responsibility for a force main and associated appurtenances when the force main is installed in a public right-of-way or in a dedicated Service Authority sanitary sewer easement.

B. Design

1. The Applicant shall provide force main design calculations as part of the sewage pumping station plans that are sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia. The Applicant shall size force mains to meet the flow, pressure and velocity requirements of the specific sewage pumping station and the requirements in this Chapter.
2. The force main system shall maintain a minimum scour velocity of 2-fps and shall not exceed a maximum velocity of 8-fps.
3. The Applicant shall design the force main with a minimal the number of high points, low points, and bends.
4. The Applicant shall determine head losses by using the Hazen-Williams equation with a roughness coefficient (C) of 120 for pipes 12-inches in diameter and larger and a roughness coefficient (C) of 100 for pipes smaller than 12-inches in diameter. All minor losses from valves and fittings are calculated as part of the total dynamic head for the sewage pumping station.

C. Connections

1. The Applicant shall provide a bypass connection downstream of the flowmeter on the sewage pumping station site.
2. The proposed force main shall discharge to the bottom of a terminal manhole with no additional receiving inverts. Refer to *Chapter 5, Section 5.7.F* for required manhole lining information.
3. Connections from a grinder pump or LPFM to a force main are not permitted.
4. Two or more force mains shall not manifold together into a single force main.

D. Sizes, Pipe Materials, and Fittings

1. The minimum diameter for a force main is 4-inches.
2. Force main material: DIP, Class 52. Refer to *Chapter 4, Section 4.4.A*.

E. Restraint Calculations

1. The Applicant is responsible to calculate, specify, and certify the amount of restraint in the Project Plans for a given design. Refer to *Chapter 4, Section 4.4.C*.
2. The Applicant shall anchor force mains within the sewage pumping station.
3. The Applicant shall provide restrained joints at all bends and other required locations.

F. Corrosion Protection

1. External Corrosion Protection: Refer to *Chapter 5, Section 5.5.E*.
2. Internal Corrosion Protection (Linings):

Provide DIP force mains and associated fittings with an interior coating of a minimum 40 mils (dry film thickness) ceramic epoxy lining.

- a. The ceramic epoxy is a high-build, multicomponent, Amine-cured Novolac epoxy lining, Protecto 401, or other approved by the Products Committee.
 - b. Protect all DIP gasket areas and spigot ends (6-inch maximum) with six (6) mils nominal (10 mils maximum) Protecto Joint Compound. The Applicant shall apply all material according to manufacturers' specifications.
 - c. The Applicant shall repair the internal lining in accordance with manufacturer's requirements and recommendations when a ceramic epoxy coated pipe is cut or tapped.
3. Where DIP is proposed in areas within 100-feet of gas transmission mains with impressed current, rectifiers, or other potential sources of stray current, the Applicant shall provide additional engineering analysis by a NACE-certified Engineer to determine a suitable means to protect the force main.

G. Separation and Crossings

1. Parallel Installations: Refer to *Chapter 5, Section 5.5.F*.
2. Utility Crossings: Refer to *Chapter 5, Section 5.5.F*.
3. Streams Crossings: Refer to *Chapter 5, Section 5.5.F*.

H. Depth of Cover

1. Refer to *Chapter 5, Section 5.8.G*.

I. Casings

1. Refer to Chapter 4, Section 4.4.H.

J. Valves

The Applicant shall provide an eccentric plug valve on the force main just outside the flowmeter vault. Applicant shall provide an eccentric plug valve for each 1,000-foot interval of force main installed. Additional eccentric plug valves shall be installed as directed by the

Development Manager.

1. Provide eccentric plug valves with all force mains. Reference the Approved Products List for acceptable products.
2. Eccentric plug valves shall withstand a working pressure of at least 150 psi.
3. Eccentric plug valves shall have a wall thickness conforming to AWWA 504 and constructed of either cast iron (ASTM A126) or ductile iron (ASTM A536), with 304 stainless steel fasteners.
4. Mechanical joint ends are required in accordance with AWWA C111.
5. The wrench nut shall turn counterclockwise to open the valve.
6. The valve body interior and exterior surfaces shall be fusion-bonded, epoxy-coated in accordance with AWWA C550.

K. Air/Vacuum Release Valves

1. Refer to *Chapter 5, Section 5.8.K*.

5.11 Existing Utilities, Utility Relocations, & Redevelopment

A. Abandonment

1. Drain fields shall be specified to be abandoned per PWC requirements when a property will be connected to public sanitary sewer system.
2. Existing unused laterals or sanitary service lines shall be cut and capped at the connection point to the sanitary sewer main or force main as directed by the Service Authority Field Inspector.
3. When an existing lateral or sanitary sewer service line will be reused as part of a new house, structure, or development, the Service Authority Field Inspector shall inspect the existing sanitary sewer service line to ensure that it is acceptable meeting the requirements of this Manual and Details. Any defects or out-of-date materials shall be repaired or replaced to the satisfaction of the Service Authority Field Inspector to ensure the service line is watertight before the existing sanitary service line is placed into service.
4. All sanitary sewer lines abandoned in place shall be flushed clean before they are placed out of service. At the discretion of the Development Manager or Inspection Manager pipe shall be filled with flowable grout.
5. Abandoned sanitary sewer lines shall be cut and separated from the manhole. The ends of all abandoned sanitary sewer lines shall be capped and sealed.
6. A bulkhead shall be installed in unused inverts within a manhole that are to be abandoned. The invert shall be sealed with purged concrete. If abandoned invert cannot be made watertight, the Applicant shall replace the existing manhole with a new pre-cast manhole structure at the discretion of the Service Authority Field

Inspector.

7. Manholes shall be abandoned in place per USM Detail S-13

B. Removal

1. Sanitary sewer facilities specified to be removed shall be excavated and removed from the site.
2. Removal sanitary sewer facilities shall permit any inflow or infiltration to existing facility left in place or abandoned.

C. Private Sanitary Sewer Systems

1. Service Authority easements shall not be applied over private runs of sanitary sewer.
2. Non-PWCSA manhole lids shall be specified on all private manholes.
3. All private sanitary sewer lines and manholes shall be inspected by a qualified third-party inspector. A copy of the third-party inspector's reports, NASCO certified TV inspection, and test results shall be provided to the PWCSA Field Inspector.
4. All private sanitary sewer lines and manholes shall be tested for leakage in accordance with the current PWCSA Utility Standards Manual.
5. All private sanitary sewer lines shall be flushed clean with catch basins temporary installed on downstream line prior to releasing flow to the public sewer.
6. PWCSA reserves the right to CCTV the private sewer lines to check for inflow or infiltration.

5.12 Sanitary Sewer Construction

A. Existing Conditions

1. When sanitary sewer construction requires offsite (on property not owned by Applicant) disturbance within a Service Authority easement, the Applicant, prior to the start of construction, shall fully comply with the Community Notification & Outreach for Development and Service Authority Projects Creating Impacts to Existing Communities Policy. The Applicant shall photograph or video record the work area to document the existence and condition of structures or facilities and submit a copy to the Inspections Manager in electronic format by e-mail to inspectionsmanager@pwcsa.org. The Applicant shall date the photo/video record to document conditions.
2. Prior to and during construction operations, the Applicant shall properly locate, protect, brace, support, restore and maintain all underground pipes, conduits, drains, and other underground structures uncovered or otherwise affected by the construction work being performed to ensure they are protected from any damage, in accordance with the Virginia State Code 20VAC5-309-140.
 - a. The excavator shall plan the excavation in such a manner to avoid damage to, and

- minimize interference with, underground utility lines in and near the construction area;
- b. The excavator shall expose the underground utility line to its extremities by hand digging within the excavation area when excavation is expected to come within 2-feet of the marked location of the underground utility line;
 - c. The excavator shall not use mechanized equipment within 2-feet of the extremities of all exposed utility lines;
 - d. The excavator shall maintain a reasonable clearance, to include the width of the utility line, if known, plus 24-inches, between the marked or staked location of an underground utility line and the cutting edge or point of any mechanized equipment, considering the known limit of control of the cutting edge or point to avoid damage to the utility line; and
 - e. The excavator shall provide proper support for underground utility lines during excavation activities. During backfill operations, the excavator shall use the same or similar backfill material that was originally around the utility line, ensure there is proper compaction around the utility line, protect all tracer wires, and protect or replace warning tapes.
3. The Applicant shall protect, restore and maintain all pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, and other surface structures (including all sod and shrubs in yards and parks) crossed by or adjacent to the utility under construction.
 4. The Inspections Manager shall observe and document the extent of damage resulting from the Applicant's construction activities based on photographs or video recording provided the by Applicant or Service Authority Field Inspector. (Refer to *Chapter 2, Section 2.8*)
 5. The Applicant is responsible for the cost to replace, repair, or restore any of the elements listed in *Chapter 2, Section 2.8* to their existing condition or better with new materials for elements that have been removed or damaged. The Applicant shall, without delay, coordinate with the property owner, agency, or authority having jurisdiction, to replace, repair, or restore all damaged surface or subsurface structures to the satisfaction of the property owner, agency, or authority having jurisdiction.

B. Materials

1. The Applicant shall provide sanitary sewer mains and appurtenances within the Service Authority's Service Area in accordance with approved Project Plans, specifications, and USM requirements in effect at the time of installation and inspection. All construction improvements are inspected and subject to acceptance by the Field Inspector.
2. The Applicant shall provide new materials, fittings, appurtenances, and equipment, direct from the manufacturer, unused, and free of defects, and shall submit proof of purchase to the Field Inspector. The Applicant shall provide a list of all materials and product technical details to be used on the project is required.
3. The Field Inspector may reject any materials found to be defective, damaged,

improperly stored or handled, or determined to not meet the requirements of this Manual or current Service Authority System requirements.

C. Storing and Handling of Materials

1. The Applicant shall follow manufacturer's recommendation for handling and storage of materials. The Applicant shall protect all materials, including all pipe, fittings, and other appurtenances stored onsite or in a storage yard, from foreign materials, animals, insects, soil, sun, and water at all times.
2. The Applicant shall prevent shocking or damaging any materials during handling and shall load and unload pipe, fittings, and appurtenances by lifting them with hoists or skidding. The Applicant shall handle pipe so that the coating and lining are not damaged.

D. Line and Grade Stakes

Before an approved sanitary sewer main is constructed by the Applicant, the Applicant's Virginia-licensed Surveyor shall place line and grade stakes identifying dedicated easements, main, service connections, and other appurtenances to ensure the system is constructed in accordance with the approved Project Plans.

E. Cut Sheets

1. The Applicant shall submit a set of cut sheets in hard copy or electronically, sealed, signed and dated by a Professional Engineer licensed in the Commonwealth of Virginia, or Virginia-licensed Surveyor, to the Field Inspector for review and acceptance. The Applicant shall prepare cut sheets at 100-foot station intervals and contain all data pertinent to the construction of the sanitary sewer main, such as the station and length of service connections and appurtenances; including all fittings and finished grade elevations for manhole rims.
2. The Professional Engineer or Surveyor who seals and signs the cut sheets shall also provide the following statement on all sets: "The professional seal and signature appearing on this document certifies that information shown conforms to the approved Project Plan and/or actual field conditions."
3. The Applicant shall submit a revision to the approved Project Plans when field conditions require the horizontal location, alignment, or grade of any main, structure, or appurtenance is to be constructed outside of an existing easement, as shown in the approved Project Plans. The Applicant shall provide a revised Project Plan, sealed, signed and dated, by a Professional Engineer licensed in the Commonwealth of Virginia, and include the dedication of all additional property rights. The Applicant shall submit the revised Project Plan to the Development Manager or designee for review and acceptance prior to constructing the changes.
4. Field changes that do not change existing easement requirements may be approved by the Field Inspector without a Project Plan revision.

F. Excavation, Bedding, and Backfill

1. The Applicant shall excavate trenches, provide pipe, backfill excavation, and compact the trench in accordance with the details in this Manual. The Applicant shall provide trenches that are wide enough to accommodate timber supports, sheeting, bracing, and handling of special fittings or appurtenances.
2. The Applicant shall provide bell holes at each joint to ensure the bell and spigot are installed properly.
3. The Applicant shall excavate all trenches to the depth required to provide a uniform and continuous bedding with 4 to 6-inches of #57 stone or crushed aggregate of 1-inch or less on solid and undisturbed ground at every point between bell holes; it is permissible, however, to disturb the finished subgrade surface over a maximum length of 18-inches near the middle of each length of pipe to withdraw pipe slings or other lifting tackle. Under such circumstances, the Applicant shall restore the finished subgrade with #57 stone or crushed aggregate of 1-inch or less.
4. The Applicant shall remove ledge rocks, boulders, and large stones to provide a clearance of at least 6-inches below and on each side of all pipe and sanitary sewer appurtenances for pipe up to 24-inches in diameter. The Field Inspector may direct a greater clearance for pipes larger than 24-inches in diameter.
5. The Applicant shall not install pipe in standing water or when, in the determination of the Field Inspector, trench conditions are unsuitable. The Applicant shall remove and replace pipe installed in unsuitable trenches when rejected by the Field Inspector once proper trench conditions are established.
6. Backfill within an existing or proposed right-of-way shall conform to all applicable VDOT standards.
7. Backfill in areas subject to vehicular traffic or structural loading shall begin at the top of the granular bedding and be placed in lifts no greater than 8-inches thick. Compact each lift to 95 percent of the maximum dry density as determined by ASTM-D698, American Association of State Highway and Transportation Officials (AASHTO)-T99, or (Virginia Test Method-1) VTM-1. The Applicant shall provide backfill material that is free of organic materials, frozen clods, highly plastic silts or clays, and other unsuitable materials. Backfill shall consist of #57 stone or crushed aggregate of 1-inch or less. The Applicant shall provide bedding that is 4 to 6-inches deep, along the side wall, and a minimum of 24-inches above the crown of the pipe as directed by the Field Inspector.
8. The Applicant shall not use stone or rock larger than 10-inches in any dimension in any backfill.
9. The Applicant shall compact backfill in areas not subject to vehicular traffic to 90 percent of the maximum dry density as determined by ASTM-D698, AASHTO-T99, or VTM-1.
10. The Applicant shall legally dispose of all surplus materials and debris. The disposal of surplus materials or debris on Service Authority easements or property is prohibited.

G. Pipe and Fitting Installations

1. The Applicant shall inspect pipe, fittings, and appurtenances for defects and notify the field inspector of any defects prior to installation. Before inserting gaskets and joining pipe sections, the Applicant shall clean the outside of the spigot and the inside of the bell. The Applicant shall ensure spigots are dry and free from oil and grease before pipe is installed.
2. When installing pipe or manholes in the trench, the Applicant shall use proper implements, tools, and facilities satisfactory to the Field Inspector and as recommended by the manufacturer for the safe and convenient execution of the work. The Applicant shall carefully lower pipe, manholes, fittings, and appurtenances into the trench, piece by piece, by means of a derrick, ropes, slings, or other suitable tools or equipment and in such a manner to prevent damage to pipe, manholes, fittings, and appurtenances, as well as their protective coatings and linings.
3. The Applicant shall take special care to prevent any foreign materials from entering the pipe. The Field Inspector will not accept pipe with any visible debris. At the end of each workday, the Applicant shall cap pipe ends with a push-on joint plug or mechanical joint cap or plug to match pipe joint (ensuring the seal is watertight).
4. The Applicant shall follow manufacturers' instructions for connecting pipe segments. After placing a length of pipe in the trench, the Applicant shall center the spigot end in the open bell of the pipeline and push the pipe to the manufacturer-recommended homing mark. The Applicant shall lay pipe true to line and grade, with bells facing the direction of laying.
5. The Applicant shall use the proper equipment, per manufacturer's recommendation, to cut pipe for inserting valves, fittings, or closure pieces; cuts must be made without damaging the pipe and must leave a smooth end at a right angle to the axis of the pipe. After the pipe is cut, the Applicant shall bevel the outside cut-end of the pipe to remove any sharp edges or burrs to avoid damage to the gasket.
6. The Applicant shall fully flush a sanitary sewer main that is being removed from service. The Applicant shall install a plug with buttress in the cut end of pipe that is abandoned in place.

H. Manholes, Frames and Covers

1. Provide manholes in accordance with the details in this Manual.
2. Sanitary sewer manholes shall consist of precast reinforced monolithic concrete sections, an eccentric conical section, and an expanded base section. Manholes shall conform to ASTM C478 and be free of defects. Repairs of defective sections are not permitted. Install base sections on a compacted granular foundation prepared in a manner similar to that required for the proper installation of sanitary sewer mains. Manholes shall have lifting lugs or keyways. Lifting holes through the manhole wall are not permitted.
3. Manhole joint design shall meet the requirements of ASTM C443, and gaskets shall meet the requirements of ASTM C361 or ASTM C1619. Provide manhole joints that are formed entirely of concrete using a rubber gasket and, when assembled, shall be self-centering and make a uniform watertight joint. In addition to the manufacturer's approved rubber type gasket, use a cold-applied joint sealer to seal the joint from

internal and external hydrostatic pressure. Mortared joints or repairs of any kind are not permitted. The exterior of all precast manhole sections shall have a bitumastic coating.

4. Provide smooth and semicircular invert channels that conform to the inside diameter of the adjacent sanitary sewer main invert. Construct changes in the direction of flow with a smooth radius of maximum size. Changes in the size and grade of the channels are made by the Applicant as directed by the Field Inspector. The invert of the flow channel(s) shall match the inverts of the sanitary sewer mains. Provide an even float finish on the bench of the manhole outside of the invert channels and slope the bench toward the invert of the channel with a minimum slope of 0.25-inch per foot of run. Provide a bench height of at least 80 percent (%) of the diameter of the pipe. Drop connections are installed in accordance with the details in this Manual.
5. The Applicant shall install a plug and seal the invert inside an existing manhole with a masonry bulkhead when a sanitary main is removed from service. The sanitary sewer main shall be cut and capped within two feet of the outside of the existing manhole, unless directed otherwise by the Inspection Manager.
6. The Applicant shall provide manholes with manhole frames, covers, and stainless steel orange-rubber-coated manhole steps in accordance with the details in this Manual. Adjustment rings may be used by the Applicant, up to a maximum of 12-inches, to bring the top of the manhole to the final grade, in accordance with the details in this Manual. The Applicant shall use riser sections for adjustments greater than 12-inches. Chimney seals are not permitted.
7. The Applicant shall furnish standard covers or watertight covers in accordance with the details in this Manual. The Applicant shall provide waterproof manhole inserts for all standard frames and covers in accordance with the details in this Manual.
8. The Applicant shall provide manhole frame and cover castings of the best-quality, tough, gray iron, be free from imperfections, and meet the requirements of ASTM A-48, Class 30. The Applicant shall provide castings that are sound, true to form and thickness, sandblasted clean, and neatly finished, with bearing surfaces machine ground and finished to ensure satisfactory seating and anti-rocking. Manhole frame and covers shall have one coat of factory-applied black asphaltum paint.

I. Pipe Connections at Manholes

1. The Applicant shall provide manholes with an approved flexible pipe connection suitable for the pipes and manholes specified. The flexible gasket for pipe connections shall meet the requirements of ASTM C923. The flexible connection is secured to the pipe by means of a stainless steel clamp.
2. The Applicant shall provide precast manholes that are manufactured for the specified number and proper location of connections required. The Applicant shall make connections to existing manholes by coring the manhole and installing a rubber boot. New manholes with extra connections or openings, that must be bulk headed and/or reconfigured, are not acceptable.
3. DIP is required for the first full length of incoming main when an inside drop connection is designed and approved.

J. Service Connections

1. The Applicant shall construct service connections in accordance with the details in this Manual.
2. The Service Authority provides full and complete inspection service for service connections to the property line and for lateral replacements.
3. The Service Authority provides TV lateral inspection of all new service connections from the property line to the building to meet, in part, the conditions for acceptance by PWC.
4. The Applicant shall provide strap-on type saddles with an O-ring seal and stainless steel strap when installing a sewer service connection on an existing sanitary sewer main. The Applicant shall provide saddles that are specifically designed to adapt to the type of pipe used. The Applicant shall secure the saddle to pipe with a 24-gauge by 2.5-inch-wide stainless steel strap and silicon bronze or stainless steel T-bolts and nuts.
5. The Applicant shall cut and cap abandoned laterals at the sanitary sewer main or as directed by the Field Inspector.

K. Cleanouts

1. Cleanouts shall have brass caps.
2. The Applicant shall install a traffic-rated cleanout box and lid when cleanouts are located in a paved area or subject to vehicular loading. The Applicant shall not cause any damage or disruption to existing sewer mains or private property.

5.13 Acceptance Tests

A. General

The Field Inspector will inspect sanitary sewer mains to determine if any deviation from line and grade has occurred. The Service Authority will inspect all gravity sanitary sewer mains using closed-circuit television prior to Partial/Full Beneficial Use and final acceptance/bond release. The Applicant shall correct any deficiencies, such as sags (bellies) in the pipe, rolled joints, leaks, damaged pipe, and out of round pipe, prior to Partial/Full Beneficial Use, and final acceptance/bond release.

An acceptance test is required for all sanitary sewer mains and manholes. Acceptance tests are not permitted by the Applicant until the sanitary sewer, manholes, and required sewer service connections, as shown on the approved Project Plans, have been installed and sewer trenches backfilled and compacted to finished sub-grade. The testing methods are: air testing for sanitary sewer mains, in accordance with ASTM F1417 and vacuum testing for manholes, in accordance with ASTM C1244.

The Applicant shall furnish weirs, standpipes, pipe plugs, water, pressure gauges, stop watches, air compressors, hoses, and other materials and assistance required to perform

these tests. The Applicant shall conduct all acceptance tests in the presence of the Field Inspector.

The Applicant shall completely remove all sanitary sewer mains, structures, facilities, and related appurtenances not meeting the requirements of these standards and replaced with new materials.

Whenever it has been necessary for the Applicant to construct under drains or place gravel under pipelines to dewater the trench during construction of the sanitary sewer mains, the acceptance test is not permitted until pumps and pipes (which have been used in the dewatering process) have been disconnected and removed by the Applicant.

Applicant shall schedule all acceptance tests with the Field Inspector at least 48 hours in advance. Testing of each section of completed sanitary sewer is required. Generally, sanitary sewer mains are tested from manhole to manhole.

B. Air Testing Procedure for Sanitary Sewer Mains

The Applicant shall introduce air into the sealed mains until the internal pressure is four (4) psi and maintain this pressure for a period of at least five (5) minutes without leakage.

C. Manhole Vacuum Testing

Applicant shall:

1. Provide the vacuum testing equipment per the manufacturers' requirements. The manhole is tested from the rim of the cover frame to the invert.
2. Use either mechanical or pneumatic plugs capable of resisting test pressures.
3. Secure test plugs against the manhole wall to ensure no movement during the test.
4. Ensure all manhole boots, stub-outs, and pipe plugs are secured to prevent movement while vacuum is drawn.
5. Draw and maintain a vacuum of 10-inch Hg for 60 seconds.

D. Force Main Testing

Fill all force mains with water and pressure test for one (1) hour without leakage.

1. Low-pressure PVC force mains are pressure tested at 100 psi.
2. All DIP force mains are pressure tested at 100 psi above the maximum operating pressure, but not less than 150 psi.

E. Private Sanitary Sewer Mains

Private sanitary sewer mains and manholes are permitted when they fully reside on the property they serve with no additional connections from another property.

1. The Applicant shall install non-PWCSA manhole lids on all private manholes.

2. The Applicant shall arrange for all private sanitary sewer mains and manholes to be inspected by a qualified third-party Inspector. All private sanitary sewer mains and manholes shall be tested for leakage in accordance with this Manual.
3. All private sanitary sewer mains shall be flushed clean with catch basins temporary installed on downstream sanitary sewer main prior to being placed into service.
4. A copy of the inspection reports from the qualified third-party Inspector, NASSCO certified TV inspection, and test results shall be provided to the Field Inspector.

5.14 Sewage Bypass Pumping Requirements

A. General

The Applicant shall safely and adequately bypass sanitary sewer flows around any sanitary sewer main, manhole, or sewage pumping station(s) to be taken out of service for inspection, construction, lining, or any other purpose and shall complete the work without causing or contributing to any spills, discharges, overflows, leaks, or deposits of sewage into the environment, including the land, surface water, groundwater, or backups into public or private buildings/property (collectively, “sewage spill(s)”).

The Applicant shall take precautions to protect the public health and protect the sanitary sewer system from damage resulting from sewer surcharging. Further, the Applicant shall take precautions to ensure bypass flow control operations do not cause flooding or damage to public or private property. The Applicant is responsible for all damage resulting from the bypass flow control operations.

The Applicant shall furnish all labor, materials, equipment, and supplies, and shall perform all work related to control the bypass operation. Bypass pumping plans are subject to review by the Development Manager or designee prior to starting work. The bypass pumping system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

B. Required Submittals

As part of the Service Authority’s bypass pumping requirements, Applicant shall provide the following submittals:

1. Bypass pumping plan – refer to *Chapter 5, Section 5.14.D*.
2. A signed statement by the Applicant that he/she assumes all responsibility and liability for the design, installation, and operations to safely bypass sanitary sewer flows without causing or contributing to any sewage spills. The Applicant shall confirm in writing that if the company they represent cannot complete the work, the Service Authority has the right to complete the work and the Applicant’s company shall reimburse the Service Authority for all costs.

C. Flow Control

1. The Applicant shall provide Xylem Dewatering USA (Godwin) pumps, United Rentals pumps or approved equal for bypass pumping. The Applicant shall arrange the bypass pumps to prevent flows from interfering with the work to be performed on a

given portion of the sanitary sewer system. In cases where flow control includes the operation of a public and/or private sewage pumping station(s) to control flows in the system, the Applicant shall coordinate with the Water and Wastewater Facilities Manager for public sewage pumping stations and/or the operator(s) for private sewage pumping stations; coordination shall take place prior to acceptance of any sewage bypass pumping plan.

2. The Applicant shall provide bypass piping that is watertight and fully restrained.
3. In certain circumstances, other means of flow control, such as utilization of vacuum trucks may be considered by the Development Manager where practical, such as in bypass applications limited to a single working day.

D. Bypass Pumping Plans

The Applicant shall submit a complete sewage bypass pumping plan to the Service Authority's Project Engineer, for review and comment, at least 14 calendar days prior to commencing work in accordance with the Sanitary Sewer Bypass Pump Plan template in Appendix S of this manual. The submittal shall include a cover sheet with the project name, project number, a narrative, a sketch plan of the proposed bypass routing, supporting calculations and equipment materials list to include, but not limited to:

- Calculations demonstrating that the sewer bypass plan is sufficient to accommodate peak flows. Provide calculations that are derived from field measurements or an assumed full pipe. Provide field measurements that are based upon peak flow conditions including inflow and infiltration during a rain event. Design shall ensure adequate storage to anticipate variations in pump start up time and associated pump rate to avoid a sewage spill. The Applicant shall provide additional storage and/or containment measures as directed by the Field Inspector (e.g., a berm).
- Capacities of pumping equipment.
- Equipment list and shop drawings. Identify a spare pump in the equipment list.
- Road crossing details, including paved or unpaved roads, driveways, entrances, or other travel ways, if applicable.
- Sewer plugging methods and bypass time duration for each sewer section. Inflatable plugs will have an external hose to inflate the plug along with an external gauge to monitor pressure. The Applicant shall appropriately secure all test equipment to the manhole to the satisfaction of the Field Inspector.
- Size, length, material, and method of installation for suction and discharge piping.
- Use of sound attenuated bypass pumping equipment to limit noise level to 60 decibels within 50-feet of the equipment.
- Bypass pumping locations.
- Method and equipment utilized to provide 24-hour monitoring of the bypass system.
- Equip each pump, including the backup pump, with its own auto-dialer alarm system. An auto-dialer alarm system cannot be shared among pumps.
- Demonstrate that manholes and equipment are protected from flooding, vandalism, vehicular and pedestrian traffic, or snow removal operations.
- Lock and secure all equipment and controls.

- Statement that the contractor will provide a written schedule to the Field Inspector within 72 hours of the scheduled start date and end date that the bypass system will be in operation.
- The contact name, company name, job title, 24-hour contact number for the person(s) responsible for monitoring the bypass system and their response time to the site.

The pumps and alarms systems are designed, provided by the Applicant to independently meet firm capacity with a minimum of 100 percent redundancy. Increased reliability may be required by the Development Manager.

E. Monitoring and Equipment

The Applicant shall provide 24-hour monitoring. The bypass pumping plan submittal shall specify the means of providing 24-hour monitoring of the bypass pumping system. The Service Authority may require 24-hour onsite personnel for monitoring of the bypass system depending upon existing flows and pipe capacity, the location and number of bypass pumps and the duration of planned bypass operations. All pumps and equipment provided by the Applicant are to be maintained by an individual who is trained and qualified to start, stop, refuel, and maintain the bypass system equipment and monitored with an auto-dialer alarm system.

F. Required Notifications

The contractor shall provide a written schedule to the Field Inspector within 72 hours (excluding holidays and weekends) of the scheduled start date and end date that the bypass system will be in operation. The Field Inspector shall notify customers 48 hours in advance of planned service interruptions (excluding weekends and holidays). The notice shall include the project name, Inspections Manager's and Field Inspector's contact information, and the emergency number for dispatch. Provide the notice in both English and Spanish.

G. Emergency Response Requirements

In the event of a sewage spill occurring in connection with the work being performed by the Applicant, the Applicant shall immediately:

1. Notify the Service Authority Emergency Dispatch at (703) 335-7982 and the Inspections Manager and comply with the currently adopted version of all Federal, State, and Local regulations to include required notifications. All costs associated with a sewage spill are the responsibility of the Applicant and at no cost to the Service Authority.
2. Clean up all spilled solid material, disinfect the affected area, and repair any damage to property in conformance with all applicable regulatory agency requirements.
3. Provide an oral report to the VADEQ within 24-hours from the time Applicant becomes aware of the sewage spill, at the telephone number listed below, and a submit a written report to VADEQ, with a copy to the Inspections Manager, within five (5) days of discovery at the following address:

Department of Environmental Quality

Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193
(703) 583-3800 (voice) or (703) 583-3821 (fax)

For reports to VADEQ outside normal working hours, Applicant shall leave a message to fulfill the immediate notification requirement. If a sewage spill is considered to be an emergency, based on volume, spill location, or public health concerns, or the sewage spill takes place after normal business hours, on a weekend, or on a holiday, the Applicant shall call the Virginia Department of Emergency Services at its 24-hour telephone service at 1 (800) 468-8892.

The written report shall contain the following:

- Description of discharge and location
- Whether discharge reached state waters; if so, name of affected waterbody
- Cause of discharge
- Date of discharge
- Duration of discharge
- Volume of discharge
- Whether the discharge is continuing; if so, how long it is expected to continue
- Expected total volume of discharge
- Steps planned or taken to reduce, eliminate, and prevent reoccurrence of current or future discharges

The Service Authority will back-charge the Applicant for any fines, penalties, or other costs or damages incurred by the Service Authority as a result of a sewage spill occurring in connection with the work being performed by the Applicant.

5.15 Sanitary Sewer Main Easements

A. General

The Applicant shall dedicate easements and convey ownership to the Service Authority for all sanitary sewer facilities and appurtenances that are not within a public right-of-way. The Applicant shall convey ownership to the Service Authority for all sanitary sewer facilities and appurtenances that are within a public right-of-way. The Applicant shall provide the deed of easement in accordance with the template in *Appendix L: Omnibus Deed of Easement Template* and *Appendix M: Off-site Easement Acquisition Policy*. The easement plat is reviewed as part of the Project Plan review and acceptance process. After plans are accepted by the Service Authority, signed deeds and accompanying plats are to be submitted directly to the Development Department for review and signature.

1. Easements are not required for sanitary sewer laterals or low-pressure force main service lines to property line flushing stations when they fully reside on the property they serve or if they are located within a public right-of-way.
2. Applicant shall submit proof of recorded easements prior to placing utilities into service with the Full/Partial Beneficial Use process.
3. Other easement requirements are described in the Service Authority policies that

include, but not limited to, the following: *Appendix I: Service Connection Policy*, *Appendix L: Omnibus Deed of Easement Template* and *Appendix M: Off-Site Easement Acquisition Policy*.

B. Easement Widths

1. Applicant shall dedicate a minimum easement width of 15-feet for force mains and LPFM.
2. The Applicant shall dedicate a minimum easement width of 20-feet for sanitary sewer mains. For sanitary sewer mains installed deeper than 10-feet, 5-feet of additional easement width is required for each 5-feet of additional depth in accordance with Table 5-4.

Table 5-4: Required Easement Widths by Sanitary Sewer Depth

Depth to Bottom of Sewer (ft)	Easement Width (ft)
Up to 10	20
10.5–15	25
15.5–20	30
20.5–25 ^a	35
25.5–30 ^a	40

^a Sanitary sewer mains must have written approval from the Director or designee for installation at depths greater than 25 feet.

3. The Applicant shall center sanitary sewer mains, force mains, and LPFMs in the easement unless the Development Manager or designee permits an offset within the easement.
4. Increased easement area may be required as deemed necessary by the Director or designee.

C. Easement Exclusions and Offsets

1. The Applicant shall not place trees, fences, monuments, signs, entrance features, sheds, decks, overhanging canopies, light poles, or permanent structures in easements dedicated for sanitary sewer utilities without the written approval of the Director or designee.
2. All structures (e.g., walls, piers, piling, columns, buildings, footings, foundational elements, storm structures, structural embankments and/or dams) shall be offset a minimum of 10 feet from a sanitary sewer facility when located in the right-of-way or a non-easement area (e.g., Service Authority’s own property). The Director, or designee, may require additional offset from the sanitary sewer facility if the means and methods to install the structure puts Service Authority sanitary sewer facility at risk or impedes the Service Authority’s ability to maintain its facilities.
3. The Applicant shall offset Service Authority utilities and their easements to avoid undermining structural foundations or requiring the use of shoring to support

structural foundations when utility re-excavation is needed.

4. Project Plans that cannot provide the required easement area shall require a variance and is subject to additional mitigation as directed by the Director or designee.

D. Easement Access

1. The Applicant shall provide all necessary easements to the Service Authority for adjacent property access and/or extension of the sanitary sewer system. Easements shall extend to the property line as directed by the Development Manager or designee.
2. As deemed necessary by the Development Manager or designee, and to ensure routine and emergency maintenance access, Applicant shall provide permanent access (ingress/egress) easements to utility easements and facilities to be owned, operated, and maintained by the Service Authority. The Applicant is responsible for maintaining all easements serving the development site until final acceptance and bond release by the Service Authority. Maintenance shall include, but not limited to, cutting vegetation, removing trees, controlling erosion, maintaining access to all utilities, and grading sufficiently to allow maintenance vehicles to traverse the easement for routine and emergency maintenance.
3. Access to public sanitary sewer facilities and easements located on private properties is to be provided at all times. Properties with security measures need to insure prompt and efficient access can be provided to Service Authority personnel as required in the Customer Handbook and the deed of easement. In addition, the Service Authority may require property owners of secured sites to enter into an appropriate separate access agreement detailing the obligations and means of access for both parties.

E. Overlap with Other Easements

1. Easements of other entities can overlap Service Authority easements, but the physical location of non-Service Authority underground utilities shall remain outside the Service Authority's defined easement; however, crossings are permitted. The Applicant shall confirm the location of such underground utilities to ensure that excavations shall pose no danger of undermining the Service Authority's utilities.
2. Although Service Authority easements are non-exclusive, the location and separation requirements of underground utilities shall comply with Virginia State Code 20VAC5-309-140.
3. Buffers, tree-save, conservation, resource protection areas, or other land use-restricting easements shall not overlap Service Authority easements. The Applicant shall not restrict the Service Authority's prescribed easement and access rights.

5.16 Sanitary Sewer Information Required in Project Plans

The Applicant shall provide a sealed, signed and dated, by a Professional Engineer licensed in the Commonwealth of Virginia, Project Plans for sanitary sewer main construction. Project Plans must be submitted to the Development Department for review. The Applicant shall provide additional information, details, and/or specifications requested by the Development

Department Manager or designee to support the review of the Project Plans. The Service Authority shall accept and permit Project Plans prior to the Applicant executing work in the field. At a minimum, Project Plans shall contain the following:

A. Cover Sheet

1. For site plan submission to PWC, the Applicant shall provide a fully completed standard cover sheet. The PWC cover sheet can be obtained at: <http://www.pwcgov.org/government/dept/publicworks/pages/site-development-forms.aspx>
 - a. The Service Authority will assign a plan number after the first review; the Applicant shall add the Service Authority plan number to the title block.
2. For Project Plan submission within an incorporated Town, the following is reported in the cover sheet:
 - a. A vicinity map and site location.
 - b. Plans shall have a unique title.
 - c. The Service Authority will assign a plan number after the first review; the Applicant shall add the Service Authority plan number to the title block.
 - d. Identify the Town where the project resides and the contact information of the Town representative managing the plan application.
 - e. Title block with the property address and GPIN, owner information, developer information, and Engineer's information.

B. Plan View

1. The Applicant shall provide plan views at 1:30 scale (1-inch to 30-feet). Other scales are only permitted with written permission from the Development Manager or designee.
2. The Applicant shall provide sanitary sewer designs in context with site grading, right-of-way limits, structures, buildings, walls, light poles, traffic controls, sidewalks, trails, walkways, concrete pads, and fences.
3. The Applicant shall place sanitary sewer main design information in either the grading and/or utility plan sheets.
4. Show and correctly identify all existing sanitary sewer mains, manholes, laterals, cleanouts, force mains, valves, flushing stations, air releases, sewage pumping stations, energy dissipation structures, and private potable wells within 100 feet of the project limits or plan sheet limits, whichever is greater.
5. Show all proposed and existing sanitary sewer mains and manholes with the designated line type and symbol per Table 5-5.

Table 5-5: Sanitary Sewer Main and Manhole Line Type and Symbol

EXISTING SANITARY SEWER	
PROPOSED SANITARY SEWER	

6. Show and label proposed sanitary sewer main segments with the pipe size, material, and direction of flow. All private sanitary sewer lines are to be labeled, "Private," in the plan view.
7. Place hatch layer, x – x – x – x, over the sanitary sewer mains that are to be removed and hatch layer, // - // - // - // - //, over the sanitary sewer mains that are to be abandoned in place.
8. Show and label all existing manholes with the Service Authority's assigned manhole number. Show and label all proposed manholes with a unique identifier that can be matched to the profile.
9. Show sanitary sewer laterals for all buildings and miscellaneous facilities connected to a sanitary sewer main.
10. Show cleanouts at the property line for residential use.
11. Show and label all multi-family, mixed use, student housing, or non-residential building's proposed sanitary sewer laterals as private. Show and label the lateral size and material. Show cleanout locations in compliance with the applicable plumbing or building code.
12. Show and label external grease traps, oil separators, and volatile liquids separators.
13. Show and label all existing and proposed sanitary sewer easements, both on-site and off-site. Provide the recordation number, with the easement identifier, for existing easement.
14. Show and label all multi-family, mixed use, student housing, or non-residential buildings. Label building use, address, square footage, height, and number of dwelling units, if applicable.

C. Profile View

1. The Applicant shall provide profile views at 1:5 vertical scale (1-inch to 5-feet) and 1:50 horizontal scale (1-inch to 50-feet). Other scales are only permitted with written permission from the Development Manager or designee.
2. Profile sanitary sewer mains separately from road, storm, and water main profiles.
3. Profile the existing and proposed grade over the center of existing and proposed sanitary sewer mains.
4. Profile interim and final grade elevations over the sanitary sewer main if grading is subject to change with a future Project Plan.

5. Show and label all existing manholes with the Service Authority's assigned manhole number. Show and label all proposed manholes with a unique identifier that can be matched to the plan view.
6. Show and label elevations of existing manhole tops. If an existing manhole top is to be adjusted, specify the new elevation for the top of manhole.
7. Show and label watertight manhole frames and covers, where applicable.
8. Show and label manhole vents, where applicable.
9. Show and label inside drop connections, where applicable.
10. Show and label existing manhole diameters and proposed manhole diameters.
11. Show and label cast-in-place or spray-on lining for manholes where the manhole is subject to the effects of a force main discharge.
12. Show and label all existing and proposed manhole invert elevations.
13. Show proposed sanitary sewer mains match the crown of a larger sanitary sewer main that enters the same manhole.
14. Show and label the pipe size, material, DR rating or pressure class, slope and length for each run of sanitary sewer main. All private sanitary sewer lines are to be labeled, "Private," in the profile view.
15. Specify polyethylene encasement and internal protective lining for DIP sanitary sewer mains, if applicable.
16. Specify the pipe size and material for each force main segment. Identify the force main profile with a unique identifier that can be matched to the plan view.
17. Show and label all proposed laterals, valves, reducers, flushing stations, air releases, and vacuum breakers with corresponding stationing in profile and plan view.
18. Show and label all utility crossings in the profile.
19. Show casing pipes graphically in the profile and label with the following: stationing of casing ends, diameter, material, and length.
20. Show and specify vertical separation from other utilities, which are less than 2-feet, in the profile.
21. Show and label limits of engineered fill graphically and include compaction requirements.
22. Show and specify false bottoms and spread footers for manholes proposed in fill areas.

D. PWCSA Information Sheet

1. A completed PWCSA Information Sheet is required for all plan submissions.

Reference the PWCSA Information Sheet at <https://www.pwcsa.org/service-authority-standard-plan-sheets>

2. Complete the sanitary sewer design table, if applicable. Refer to *Chapter 5, Section 5.3*
3. Complete the sanitary sewer lateral table, if applicable. Refer to *Chapter 5, Section 5.7.B*. Profiles of laterals for non-residential buildings may be submitted in place of a sanitary sewer lateral table.

E. Landscape Sheets

1. The Applicant shall not show trees in any existing or proposed Service Authority easement.
2. Trees are not permitted within 5-feet of a sanitary sewer lateral running in the road right-of-way or within 5-feet of a LPFM service line between the property line flushing station and the LPFM connection.
3. The Applicant shall not grant conservation areas, storm water Best Management Practice (BMP) areas, or any other land use dedication that would restrict the use of a Service Authority existing or proposed easement.

F. Unit Price Sheet

1. The Applicant shall calculate bond values for all sewer facilities using the values shown on the current PWC Unit Price Sheet.
2. The Unit Price Sheets must clearly communicate if the Schedule of Values is being posted as new bond, changing quantities of an existing bond, or adding quantities to an existing bond.

-- end of Chapter 5 --

Chapter 6: Sewage Pumping Stations

6.1 Scope

A. Intent

The sewage pumping station (SPS) design standards are intended to assist the Applicant in the development of plans and specifications. The materials, configurations, and features described here represent the minimum acceptable level of quality expected in pump station design and reflect the goal of standardizing Service Authority equipment. These standards should not be construed as being a complete description of the necessary features for a particular pump station design. The Director, or designee, shall approve all deviations from these standards and has the final authority regarding the acceptability of any particular pump station design within the financial thresholds established by the Service Authority.

B. Review and Approval

The Service Authority has established a procedure for reviewing and approving eligible sewage pumping station plans under Local Review Authority. The Applicant shall meet with the Development Manager before starting a pumping station design to discuss the Service Authority's procedures and requirements, including architecture design requirements of the community in which they are built. The sewage pumping station plans shall include all of the structural, electrical, and mechanical design information and details necessary to construct the station.

C. Regulations

The Applicant shall design sewage pumping stations to be in conformance with the Sewage Collection and Treatment (SCAT) Regulations, as published by the Commonwealth of Virginia. All sewage pumping stations within the Occoquan Watershed shall further comply with the design requirements of the Occoquan Policy, 9 VAC 25-410. The Service Authority will not approve structures that are tributary to a proposed sewage pumping station for a water meter installation until the pumping station has been placed into Beneficial Use status, for a Developer constructed pump station, or a Certificate of Substantial Completion has been issued by the Service Authority Project Manager, for a pump station constructed under the Capital Improvement Program.

6.2 Reference Standards

The Applicant shall comply with all relevant industry standards and federal, state and local regulations, including, but not limited to the following standards:

- Sewage Collection and Treatment (SCAT) Regulations, as published by the Commonwealth of Virginia
- Virginia Building Code
- Virginia Water Control Board: *Occoquan Policy*
- VDOT: *Road and Bridge Specifications*

- NFPA: 820 Standard for Fire Protection in Sanitary Sewer Treatment and Collection Facilities
- New Source Performance Standards in 40 CFR 60 Subpart IIII
- RICE MACT in 40 CFR 63 Subpart ZZZZ
- Prince William County: DCSM
- Regulations of the Occupational Safety and Health Administration (OSHA)
- Service Authority SCADA Design & Configuration Standards
- USM *Appendix C: USM Approved Products List*
- USM *Appendix D: Approved Equipment Manufacturers*
- USM *Appendix H: Service Authority Customer Handbook and Rates and Fees for New Connections (Developer Fees)*
- USM Appendix R: Development Review Process and System Improvement Policy

6.3 Suggested References

Additional standards and regulations to be considered, incorporated herein by reference are as follows:

- Hydraulic Institute Standards
- American Concrete Institute (ACI) 308-01, Guide to Curing Concrete
- ACI 318, Building Code Requirements for Structural Concrete
- ACI 530-02, Building Code Requirements for Masonry Structures and Specifications for Masonry Structures
- ACI 350, Code Requirements for Environmental Engineering Concrete Structures
- National Electric Code (NEC)
- National Electric Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- Standard Rules of American Institute of Electrical Engineers
- Environmental Protection Agency (EPA)
- International Building Code (IBC)
- American National Standards Institute (ANSI)
- American Institute for Steel Construction (AISC)
- National Association of Corrosion Engineers (NACE)

6.4 Required Meetings

The Service Authority has established a procedure for the review of the sewage pumping station plans. The Applicant shall meet with the Service Authority prior to starting the design to go over the design procedures and requirements and shall schedule the following meetings during the design phase of all sewage pumping stations:

- Initial Planning/Kickoff Meeting
- Preliminary Design Report Presentation/Comment Review Meeting
- 100 percent Design Discussion Meeting/Comment Review Meeting
- Public Outreach Meetings (as required)
- Additional meetings as requested by Development Manager or Project Manager

It is the responsibility of the Applicant to contact the Project Manager for a list of Service Authority attendees and to schedule the room. At the Initial Planning/Kickoff Meeting, the

Project Manager shall deliver to the Applicant the Service Authority's current start-up check list from the WWF Manager and SCADA specifications SCADA Manager to incorporate in the design documents.

6.5 General Requirements

Prior to final sewage pumping station plan approval and issuance of a Certificate to Construct (CTC) by the Service Authority, the Applicant shall submit a construction schedule for review and acceptance. The schedule shall establish a start and completion date for the construction of the station. Prior to acceptance of the station by the Service Authority, the Applicant shall demonstrate through startup and testing that the station is fully functional and operational for its intended use. Following successful start-up and testing, the Applicant shall provide the Design Engineer's certification that the station has been constructed in accordance with the approved sewage pumping station plan. As a pre-requisite to Service Authority issuance of the Certificate to Operate (CTO), the Applicant shall place the station in Beneficial Use within six (6) months of the Service Authority providing written notice of its readiness to place the station in service.

The Applicant shall provide new materials, fittings, appurtenances, and equipment, direct from the manufacturer, unused, and free of defects and shall submit proof of purchase to the Field Inspector. The Applicant shall provide a list of all materials and product technical details to be used on the project. Applicant shall provide a list of all materials and product technical details to be used on the project. Refer to *Appendix D: Approved Equipment Manufacturers*.

The Service Authority will reject any materials found to be defective, damaged, improperly stored or handled, or determined to not meet the requirements of this Manual or current Service Authority System requirements.

The Applicant is responsible for following and meeting all safety requirements as established by regulatory agencies with jurisdiction over workplace safety.

The Applicant shall design and locate a permanent sewage pumping station to serve the entire sewer shed. A permanent sewage pumping station may not be initially constructed with capacity for the entire sewer shed; however, the Applicant shall design and construct the major structures in the facility to accommodate the ultimate capacity of the station.

A. Location

The Applicant shall locate sewage pumping stations above the level of the 100-year-flood/wave action. The Applicant shall subdivide and convey the land parcel encompassing the sewage pumping station to the Service Authority as fee simple. The Applicant shall fence and screen/landscape the sewage pumping station lot as required by the DCSM and in accordance with this Manual.

B. Alarm Systems

The Applicant shall provide monitoring equipment for all pump stations in accordance with the Service Authority's SCADA Design & Configuration Standards. The Operations and Maintenance Director or designee shall establish all required alarm points that the Applicant must tie into the SCADA system.

C. Instructions and Equipment

The Operations and Maintenance Director or designee and VADEQ, as required, shall review and approve the Operations and Maintenance Manual. The Applicant shall submit two (2) copies of the approved Operations and Maintenance Manual to the Service Authority prior to completion of the station in both hard copy and electronic format (PDF). The Operations and Maintenance Manual shall contain all necessary information documenting the sewage pumping station construction, equipment, and operations and at a minimum shall contain the following:

1. Introduction
 - Purpose and Scope of the Manual
 - Project Background and Parameters for the Pump Station Design
 - Adherence to the Occoquan Policy, 9 VAC 25-410 (if applicable)
 - Permits and Waivers
 - References
2. Personnel Requirements
 - Outline of Responsibilities (e.g., Operators, Maintenance Crew, Supervisor)
 - Frequency of Personnel Station Monitoring
3. Facility Description
 - Pump Station Design
 - Design Criteria for the Pump Station, Force Main and Pumps
 - Manufacturers' Pump Curve for the Installed Pumps
 - Combined Pump and System Curve for the Pump Station
 - Description of Primary Equipment (e.g., Comminutor, Wet Well, Pumps, Controls, Check Valves, and Back-Up Power Supply)
 - Operational and Equipment Data Summary (e.g., Comminutor, Wet Well, Pumps, Controls, Flow Meter, Major Valves, Telemetry, and Generator)
4. Facility Operation
 - Unit Operations (e.g., Comminutor, Pumps, Controls, Flow Meter, Telemetry, and Generator)
 - Alarm List
 - Start-up Procedures
 - Commons Operating Problems
 - Troubleshooting Guide
 - Emergency Operations
5. Maintenance
 - Introduction
 - Maintenance Records
 - Daily Maintenance Routine
 - Spare Parts Inventory
 - Corrosion Control
 - Typical Forms
6. Records and Reporting
 - Operating Logs
 - Reporting Requirements
 - State Agencies

- Other Contacts
7. Safety
 - General
 - Sewers
 - Electrical Hazards
 - Mechanical Equipment Hazards
 - Explosion and Fire Hazards
 - Bacterial Infection
 - Oxygen Deficiency and Noxious Gases
 - Potentially Hazardous Materials
 8. Appendix A: Permits & Service Area
 - Final Preliminary Engineering Report for the Pump Station
 - Certificate to Construct
 - Map Exhibit of the Sanitary Sewer Shed for the Pump Station
 9. Appendix B: Record Drawings
 - A Reduced Set of the Pump Station Plans
 - As-built Drawings of the Pump Station and Force Main
 - As-built of Electrical and Control Schematics
 10. Appendix C: Arc Flash Study
 11. Appendix D: Manufacturer's Operation & Maintenance Manuals
 12. Appendix E: Equipment Warranties

D. Sump Pumps

In installations where sump pumps are required by the Service Authority, the Applicant shall provide Zoeller 98-0006, Model M98-B, with grating cover, or other product approved by the Products Committee, with a minimum discharge rate of 40 gpm.

E. Protective Coatings

The project specifications shall specify a paint or other protective coating for all corrodible materials not otherwise protected. The type, color, and thickness of the paint or other protective coating are subject to the Operations and Maintenance Director's or designee's approval.

6.6 Pump Station Selection Criteria

The following are two (2) basic styles of acceptable pump stations: submersible pump station and conventional wet well/dry well pump station. In cases where ultimate flows are 150,000 gpd or less, consideration may be given to alternative pump station designs, subject to the Director's or designee's approval.

A. Design Flow

The Applicant shall design pump stations for the ultimate build-out peak flow from the drainage area, which is a minimum of 2.5 times the average daily flow unless otherwise directed by the Service Authority. The Applicant shall include pump curves, flow calculations, system curves and a drainage area map in the sewage pumping station plans.

The Applicant shall design pump stations with a design flow of 1 MGD (ADF) or less as **submersible stations**. The Applicant shall design pump stations with a peak design flow of greater than 1 MGD as a **wet well/dry well** configuration.

All sewage pumping stations shall have a minimum of two (2) pumps and shall follow the SCAT regulations.

B. Design Limitations

The following design limitations should be observed for each style of station.

1. Site Configuration for Vehicle Access

- a. The pump station shall be configured to permit a 38-foot-long truck to exit the travel way and pull up to the security gate without stopping or impeding traffic.
- b. The station layout shall permit trucks with a minimum 42 foot turning radius the ability to ingress and egress the site and the ability to turn the truck around, if necessary, to re-enter the travel way.

2. Submersible Pump Stations

a. Definition:

Submersible stations are defined here as those 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. The Applicant shall provide guide rails to enable the pumps to be raised and lowered into place without requiring entry into the wet well by personnel under normal circumstances.

b. Configuration:

The Applicant shall design submersible pumping stations with an above ground control building for electrical equipment and controls near, but external to the wet well structure. When possible, the comminutor basin, wet well, and valve vault shall be separate subsurface structures connected with the necessary piping. When the site area precludes such a layout, a single subsurface structure is permitted with a common wall separating the comminutor basin from the wet well and pipe running through a common wall between the wet well and valve vault.

A sluice gate shall be provided in the comminutor basin with the operating stem extended up to grade level, to isolate flows from the wet well. Influent sewage shall flow into a channel with a hydraulically driven comminutor for grinding debris. Channels within the comminutor basin are configured to allow aluminum or stainless steel slide gates to divert the influent sewage from the comminutor to a bypass channel with a bar screen as a bypass. The comminutor basin shall have a walkway spanning the length of the chamber. Pumps shall be mounted on stainless steel guide rails inside the wet well with stainless steel lifting chains. Chains must be tagged with the lifting capacity to meet OSHA requirements.

The valve vault shall contain the pump discharge shut-off and check valves along with the flow meter. The Applicant shall provide a surge relief valve on the discharge force main before the piping leaves the station. Surge relief valves and piping shall discharge to the wet well. An emergency generator shall be provided.

Aluminum hatches shall be installed at the top the comminutor basin, wet well, and valve vault. Aluminum hatches shall be sized to remove the largest piece of equipment. The comminutor basin and valve vault shall each have grab bars from grade level to the ladder or walkway leading down into each chamber. Each grab bar shall have safety extension poles.

c. Special Conditions:

When specific site conditions limit access to the sewage pumping station for chemical deliveries, remote chemical feeds shall be provided when directed by the Development Manager or Project Manager. When site conditions prevent access of Service Authority vehicles with mobile cranes, fixed or portable jib cranes with their associated mounting base shall be provided with the comminutor basin, wet well, and valve vault.

3. Wet Well/Dry Well Configuration Pump Stations

a. Definition:

Wet Well/Dry Well configuration pump stations are defined here as pumping stations in which the wet well and dry well structures are formed and poured onsite.

b. Configuration:

The Applicant shall design the wet wells with two (2) chambers connected by a sluice gate in the divider wall, with operating stem extended up to grade level, so as to enable one of the chambers to be taken out of service for maintenance without taking the station off-line. Influent sewage should flow into an influent channel with sluice gates or slide gates to enable sewage to flow to one or both of the chambers. The Influent channel shall have a hydraulically driven comminutor for grinding debris, a bypass channel, and a trash rack. Wet wells shall have a walkway spanning the length of the wet well. Each chamber shall have grab bars from grade level to the walkway and from the walkway down into each chamber and each grab bar shall have safety extension poles.

The Applicant shall locate all electrical equipment above grade in a room above the dry well. The Applicant shall provide an access hatch, located in the floor and directly above the pumps, for pump removal. The Applicant shall provide a monorail and crane, sized to accommodate the weight of the largest pump, to facilitate removal of the pumps. The Applicant shall provide dry pit submersible

type pumps with liquid-cooled motors and design the dry well with at least one unused space for a future pump to accommodate future upgrades. The electrical/control room should be designed with extra space to accommodate future upgrades. The Applicant shall connect the pump suction piping to the dry pit sump to enable one of the pumps to be used for dewatering of the dry pit. The valve for opening this dry pit suction connection as well as the pump suction isolation valve shall have extended operator stems up to the control room floor. The Applicant shall provide a surge relief valve on the discharge force main before the piping leaves the station. Surge relief valves and piping shall discharge to the wet well. An emergency generator shall be provided along with a concrete pad for a chemical tank and associated controls.

6.7 Design Criteria for Pump Stations

A. Pump Selection

Pumping Units

All pump stations shall have at least two (2) pumps providing 100 percent reliability in accordance with SCAT regulations. The Applicant shall provide a non-prorated warranty from the pump manufacturer for all pumps against defects in workmanship and material for a period of five (5) years or 10,000 hours of operation by the Municipal Sanitary Sewer Permanent Installation Warranty Policy under normal use, operation, and service, effective from the earlier date of acceptance by the Service Authority or placement in Beneficial Use. The Applicant shall provide Flygt or ABS submersible pumps (Refer to *Appendix D: Approved Equipment Manufacturers*) and provide oversized bearings (Class B) for all submersible pumps designed with a center shaft.

Pump Openings

All pumps shall have openings and passages large enough to permit the passage of a 3-inch-diameter sphere. All pumps shall have cleanout ports.

B. Protection Against Clogging

The Applicant shall equip all pumping stations with a comminutor basin at the influent end of the station. The Applicant shall provide a JWC comminutor or another manufacturer approved by the Products Committee (Refer to *Appendix D: Approved Equipment Manufacturers*), sized for the estimated peak flow into the station (refer to Table 5-1), and designed as follows:

- To be easily removable from the flow channel without disturbing any piping connections
- To settle out grit upstream of the screening area
- For continuous operation and to automatically restart after power failures
- With a JWC Controller as the standard programmable logic controller (PLC) program type.

The Applicant shall equip the comminutor basin with a bypass channel, manual bar screen, and flow diverter so that the comminutor can be taken out of service for repair and maintenance. The clear openings on the bar screen shall not exceed 2.5-inches in any dimension.

C. Wet Well

The Applicant shall divide wet wells at stations three (3) MGD or larger into two (2) interconnected sections to facilitate repairs and cleaning. The effective capacity of the wet well should be so that one pump shall run continuously at least five (5) minutes of every 30-minute period at the minimum flow. The wet well fillets shall have a minimum slope of one-to-one to the hopper bottom and have a hopper bottom no larger than necessary for the proper installation and function of the inlet. All wet wells shall have a coating or a liner system, as determined and approved by the Operations and Maintenance Director or designee, to prevent corrosion. The Applicant shall design the wet well size and control settings to avoid heat buildup in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention times. Provide a visual gauge for the wet well level.

D. Storage

Reserved for future use.

E. Surge Analysis

In a pressurized Sanitary Sewer system, events that create pressure surges include:

- Pump power failure
- Pump shutdown/startup cycles
- Pipeline rupture.

When pumps cycle off or there is a power failure, transient surge pressures can damage piping. Reduced voltage solid state starters may be required to reduce surge pressures. As backup protection, a surge relief valve may be required at the pump station, to provide for events of power failure, or a failure of the soft start/stop equipment. The Applicant shall perform a surge analysis of the discharge force main when the velocity exceeds 3.5 fps and/or the total dynamic head (TDH) imparted by the pumping system is anticipated to exceed 150 feet when the pump station is operating at peak flow (*i.e.*, for a three-pump station using Variable Frequency Drives (VFDs), the TDH produced when two (2) pumps are operating at 100% speed and the wet well level calling for lag pump on is reached).

F. Valves and Piping

The Applicant shall provide eccentric plug valves on the suction and discharge lines of each pump to allow the pump to be isolated. The Applicant shall provide a check valve with an external arm and limit switch on each discharge line between the pump and the eccentric plug valve. The velocity in the suction line shall not exceed six (6) fps, and the velocity in the discharge line shall not exceed eight (8) fps. The Applicant shall provide pressure gauges with isolation valves on the discharge side of the check valve. The Applicant shall provide gauge taps with valves on the suction and discharge side of each pump. Where necessary, the Applicant shall provide a surge relief valve (Refer to *Appendix D: Approved Equipment Manufacturers*). The Applicant shall install the surge relief valve so that it can be taken out of service without shutting down the force main. The Applicant shall provide flexible connections for all below-grade pipe connections to concrete structures. The Applicant shall provide a tee and necessary valving on the discharge force main downstream of the valve vault to allow the force main to be drained and used as an emergency bypass connection.

G. Lighting

Light-emitting diode (LED) lighting levels shall meet minimum building and electrical code requirements or as required by the Operations and Maintenance Director or designee during plan review. The Applicant shall provide lighting fixtures rated for the environment in which they are installed. The Applicant shall provide vapor-proof, corrosion-resistant lighting mounted with stainless steel hardware/fasteners in comminutor basins, wet well/dry well configurations, and valve vaults. All lighting fixtures shall be located in an accessible areas for maintenance.

Interior lights, exterior pole lights, and lights around the control building shall be activated by an intrinsic exterior photoelectric switch. All exterior lights shall be wired to independent switches inside the control building that can manually keep the lights off. Lighting design is subject to the review and approval by the Operations and Maintenance Director or designee to account for the specific site conditions. When requested, the Applicant shall provide shrouding around exterior lights and provide a lighting analysis documenting the lighting levels.

H. Flow Measurement

The Applicant shall provide a magnetic flowmeter that has an output of four (4) to 20 milliamperes direct current (mADC), refer to *Appendix D: Approved Equipment Manufacturers*. All flowmeters shall have manufacturers' startup and calibration. The Applicant shall provide valves and couplings on each side of the flowmeter, and a bypass around the flowmeter. The Applicant shall provide a human-machine interface touch screen that is designed to trend the flow data from the pumps and has the capability to chart and totalize the flows.

The Applicant shall provide magnetic meters with grounding rings on each side of the sensor. The Applicant shall locate flow metering equipment, except for the sensor, in the control building. The Applicant shall retain the manufacturer's field service technician to seal the flowmeter termination, which shall prevent migration of groundwater through the raceway into the equipment. The flow meter shall be commissioned by the manufacturer's field service technician at the station.

I. Controls

The Applicant shall provide pumps that are controlled by two ultrasonic or a submersible level transducer in a stilling well. Primary pump control shall consist of a Modicon M340 PLC with required memory and functional capacity to perform the specific sequence of operation with scheduled input and outpoint points in accordance with a human-machine interface touchscreen for backup control, in accordance with the latest edition of the Service Authority SCADA Design & Configuration Standards. The Operations and Maintenance Director or designee shall provide control narrative and all control and monitoring points that are required for the design. The Applicant is to obtain the latest version of SCADA Design & Configuration Standards from the Service Authority.

J. SCADA Field-wired Circuits

The Operations and Maintenance Director, or designee shall approve all control narratives and PLC specifications. All desired control and monitoring points to be provided and installed by the Applicant.

K. Ventilation

The Applicant shall provide ventilation for all pump stations for those periods when the station is occupied. When pumps are installed below ground, mechanical ventilation is required and arranged to independently ventilate all of the basins, wells, and vaults at the station. (Refer to *Appendix D: Approved Equipment Manufacturers*).

The Applicant shall not use dampers on the exhaust or fresh air ducts, nor any fine screens or other obstructions in the ducts that may cause clogging. Ventilation equipment shall be a ducted style centrifugal fan, backward-curved, with the air flow path making a 90-degree turn inside the fan. The Applicant shall ensure the switches for operating the ventilation equipment are well marked and above grade near the entrance hatches. The Applicant shall provide interlocking lighting and ventilation switches on all wet wells. If three-phase service is available, the Applicant shall provide three-phase motors on the exhaust fans. The Applicant shall provide time clock switches to allow a programmed run time for the exhaust fans. The Applicant shall provide a thermostat for Control building fans. Interconnection between the ventilation systems in the wet well and dry well are not permitted.

1. In Wet Wells

Ventilation may be either continuous or intermittent. If continuous, ventilation shall provide at least 12 complete air changes per hour; if intermittent, at least 30 complete air changes per hour. The Applicant shall provide explosion-proof electrical equipment and devices for all wet well applications. The Applicant shall provide wet well ventilation fans and ducts constructed of either stainless steel or fiberglass reinforced plastic. If the motor is in direct contact with the air stream, the motor must be designed to survive the corrosive moist environment of the wet well air. (Per VADEQ SCAT Regulations)

2. In Dry Wells

Ventilation may be either continuous or intermittent. If continuous, ventilation shall provide at least six (6) complete air changes per hour; if intermittent, at least 30 complete air changes per hour.

L. Water Supply

The Applicant shall extend public water to the pumping station for wash down and cleanup operations. The Applicant shall provide water service into the station with either a 2-inch, Type K copper service pipe or a 4-inch ductile iron service pipe and have a 1.5-inch water meter, provided by the Service Authority, set in accordance with the details of this Manual. If public water is not available, the Applicant shall provide a well at the site and the Applicant is responsible for securing all required regulatory permits. The Applicant shall take appropriate cross-connection measures to ensure that no physical connection exists between any potable water supply and a sewage pumping station that, under any conditions, might contaminate the potable water supply. Applicant shall provide a hose rack at the control building and, when required by the Operations and

Maintenance Director/designee or building code, provide restroom facilities inside the sewage pumping station.

M. Structures

The Applicant shall provide a layout of the station for the Service Authority's approval to accommodate working clearances to maintain or install equipment. The Applicant shall locate access hatches in the station appropriately sized to facilitate the removal, installation and maintenance of the pumps, motor, and other equipment in the station without disrupting the operation of the facility. The Applicant shall provide aluminum hatches with stainless steel hardware/fasteners, locking hasps, and automatic hold-open arms. The Applicant shall include floor drains in the comminutor basin, valve vault, and flowmeter vault. Floor drains shall have a P-trap and shall discharge to the wet well and be installed with a check valve or flapper valve to prevent sewage from entering the structures if the wet well floods. The Applicant shall provide a 50-foot antenna pole near the control building for exclusive use by the Service Authority.

N. Odor Control

The Applicant shall provide odor control measures as part of the station design as directed by the Service Authority. Local geography and distance to residential and commercial properties shall be analyzed during pump station review to determine required odor control measures when greater than 50 yards from residential or within 50 yards of commercial properties. If the pump station is within 50 yards of residential housing, odor control measures shall be installed.

The Operations and Maintenance Director or designee shall determine required odor control measures during the review of the plans for the station that may include, but are not limited to, carbon filter odor control unit and/or an Evoqua chemical feed system. At a minimum, an appropriate structured and sized concrete pad shall be provided for a future chemical tank and associated controls for all new stations.

Stations with an average daily flow rate (1) less than one million gallons per day shall have a carbon filter unit placed in the pump station. For stations with an average daily flow rate (1) greater than one million gallons per day, plans shall include stub-outs and conduits for connection of future odor control measures to the wet well, as well as electrical panel space with an individual breaker for the possible future odor control system.

(1) Average daily flow rate is calculated as the existing and future projected daily flows that are tributary to the SPS in accordance with USM requirements. These are the flows prior to applying any peaking factors.

O. Noise Control

The Applicant shall provide noise control measures as part of the station design. The Operations and Maintenance Director/designee and/or building code requirements shall determine the required noise control measures during the review of the plans. At a minimum the hydraulic pack for the comminutor and the generator shall each be installed in a sound-attenuated enclosure.

P. Control Building

The Applicant shall provide or construct a precast or brick and block building as approved by the Development Manager or designee or other development conditions required by PWC or community association covenants. The Applicant shall provide a building that is consistent with the architectural style of the community which is sized to accommodate all proposed equipment and to provide adequate space for personnel to operate and repair the equipment in the building with the access doors closed. A standing seam metal roof shall be provided with a 35-year finish warranty. The Applicant shall provide thermostatically controlled cooling and heating equipment in the building and locate the thermostats controlling all heating, ventilation, and air conditioning (HVAC) equipment in an easily accessible area. Equipment in the control building shall be electrically grounded separately from the lightning rod and telecommunication systems.

Q. HVAC

The HVAC unit shall be size appropriately per the engineered heat load calculation and design for industrial corrosive environments. The equipment should have corrosion resistant coating on the evaporator coil & condenser coil, the coating should protect the coil from leakage and premature failure. The system shall be designed to operate and maintain ambient temperature of below 85F and humidity conditions ranging from between 30 and 60 percent.

The HVAC equipment manufacture shall be Lintern Corporation or equally engineered HVAC equipment manufacture. The HVAC systems shall be tested and certified acceptable performance before placing it into normal operation.

R. Pump Starter

Pumping units shall be equipped with two methods of starting. Acceptable methods of starting a pump unit include Variable Frequency Drives (VFD), Reduce Voltage Start (RVS) for soft start/stop controls, and across-the-line starting as approved by the Operations and Maintenance Director or designee. (Refer to *Appendix D: Approved Equipment Manufacturers.*)

S. Reliability

All sewage pump station shall be provided with a SCADA system in accordance with this Manual to permit the continuous monitoring by the Service Authority's SCADA system have a permanently mounted backup generator and automatic transfer switch as is required for all Reliability Class 1 stations

All pumping stations shall have 100 percent back-up power reliability (Class 1 reliability) provided and installed by the Applicant. The Applicant shall provide electric power to the station by distribution lines and by an emergency generator. Both power sources shall provide sufficient power to operate the pumps, lighting, and ventilation systems during maximum design flow conditions.

The distribution lines and the generator shall have a means of being disconnected before the generator switch gear. The generator shall automatically switch online in the event of a power failure. The Applicant shall provide generator switch gear that is fully automatic with the ability to sense a single-phase power condition and switch to the generator

power system with a minimum time delay. The Applicant shall protect both power sources with fuses or breakers before the transfer switch (Refer to *Appendix D: Approved Equipment Manufacturers*).

T. Pump Station Power System Design

The Applicant shall protect the station's power supply and equipment from lightning by providing a lightning protection system with a separate and isolated ground. The Applicant shall provide a final step-down transformer on each electric feed line with adequate physical separation between them to prevent a common mode failure. The Applicant shall provide a separate buss for each power source. The electric transmission line and the emergency generator shall remain separate and form separate distribution substations up to the internal buss system transfer switch to preclude a common mode failure of both sources.

The Applicant shall coordinate breaker settings or fuse ratings to effect sequential tripping so that the breaker or fuse nearest the fault shall clear the fault before the other breakers or fuses are activated. The Applicant shall pad mount all lighting transformers and shall configure the load distribution panel so it is not an internal part of the transformer. The Applicant shall provide an automatic transfer switch equipped with a manual bypass.

U. Electrical Equipment Type

The electrical equipment in the generator and control building, wet well, dry well, and valve vault shall comply with the appropriate requirements of the National Electrical Code as well as the Virginia Uniform Statewide Building Code in effect. Aluminum buss bars, wire, connectors, or lugs are not permitted.

The Applicant shall protect three-phase motors and their starters from electric overload and short circuits on all three phases. All motors shall have a low-voltage protection device that shall cause and maintain the interruption of power to the motor upon the reduction or loss of voltage. The Applicant shall provide temperature detectors in the stators and bearings of larger motors (50 hp or more) to indicate overheating.

All wires installed in underground conduits shall have moisture-resistant insulation as identified in the National Electrical Code. The Applicant shall provide thermoplastic high-heat-resistant nylon (THHN) stranded wire for all wiring installed in raceways. The Applicant shall provide all Type-SO electrical cables with sunlight and ultraviolet protection. All four (4) to 20 mADC signal cables shall have shielding properly terminated on one end of the cable run.

The Applicant shall provide control and operating equipment and safety devices constructed of corrosion-resistant materials; stainless steel, aluminum, or fiberglass. The Applicant shall paint all surfaces not otherwise protected, such as concrete, using a two-step process: primer and then paint. Approved primer is Sherwin Williams Macropoxy® 646; approved paint is Sherwin Williams ACROLON™ 218 HS. The Applicant shall include a painting schedule in the sewage pumping station plans.

The Applicant shall provide Crouse Hinds cast device boxes constructed of non-corrosive materials for all surface-mounted electrical device boxes and small junction boxes subject to moisture. All boxes shall have mounting lugs; mounting holes drilled in the

back of the box are unacceptable. The Applicant shall provide covers with gaskets and stainless steel screws for all boxes and provide covers from the same manufacturer as the boxes. The Applicant shall install all boxes with stainless steel hardware/fasteners. Moisture-proof bell boxes are not acceptable.

The Applicant shall provide a stainless steel wire mesh strain relief fitting that is properly sized for the cable for any cable subject to stress or strain. The Applicant shall protect all cables from stress, crush, and abrasion. The Applicant shall provide provisions to mitigate the migration of liquids and gases into the equipment from all cables installed in raceways.

The Applicant shall size the emergency back-up power supply generators to provide 100 percent reliability to fully operate the station (Refer to *Appendix D: Approved Equipment Manufacturers*). The Applicant shall provide an adjustable time delay between all functions and transitions for the generator, which shall include the capability of holding in the “neutral” position for an adjustable time period between all transitions. The Applicant shall provide sound-attenuated enclosures for generators located outside the building. Applicant shall fill the generator’s fuel tank after all startup testing is completed.

The Applicant shall provide Cutler Hammer or Square-D for all electrical distribution equipment. The Applicant shall provide electrical equipment that is protected by a Solid State Advanced Control Phase Monitor, PLMU11 or ATC/Diversified model SLU-100-ASA and be consistent with the Service Authority SCADA Design & Configuration Standards.

The Applicant shall provide NEMA 4 for indoor electrical enclosures, NEMA 4X for electrical enclosures below grade and outside, and explosion-proof and corrosion-resistant electrical enclosures located in a wet well. The Applicant shall provide PVC coated pulling devices and junction boxes for wet well applications.

The Applicant shall provide 0.75-inch diameter or greater conduit for all wiring conduit. Galvanized rigid conduit is permitted, except in the wet well, where PVC-coated rigid conduit is required. The Applicant shall size conduits to facilitate wiring for the ultimate design conditions. The Applicant shall recoat PVC-coated rigid conduit, where the coating was removed during the installation of the conduit with PVC. The Applicant shall provide PVC coated conduit straps for wet well applications and corrosion-resistant conduit straps for all other applications. The Applicant shall provide aluminum, or other material approved by the Operations and Maintenance Director or designee, for channels used to mount electrical equipment or conduits.

The Applicant shall identify all foreign sources of electrical power entering a control cabinet or motor control cabinet and provide a means of disconnecting the power.

V. Electrical Equipment Location

The Applicant shall install electrical switch gear and controls in the building. Any equipment remotely located from the distribution panel shall have a lockable service disconnect on the line side. The Applicant shall locate the emergency back-up power supply generator on a concrete pad inside the pump station lot and provide a prefabricated sound-attenuated enclosure to protect the generator from the weather and a skid-mounted tank for storing its fuel. The Applicant shall provide skid-mounted tanks

that are double-walled for leak containment, sized to hold adequate fuel to run the generator for 24 hours at 100 percent load and which meets all VADEQ and U.S. Environmental Protection Agency regulations. The Applicant shall provide a fuel storage level indicator in the generator and control building and point tie it to the Service Authority's SCADA system for monitoring. The Applicant shall equip the generator with a block coolant heater, battery charger, and an alarm indicator to display the cause of a generator failure. The Applicant shall provide controls for starting the emergency generator completely independent of the normal electric power source. The Applicant shall provide a starting system that is sufficient to start the generator a minimum of three times without recharging and be alarmed and instrumented to indicate a loss of readiness.

The Applicant shall protect all motors and control enclosures from moisture, weather, and water under pressure in accordance with the manufacturer's recommendations. The Applicant shall provide splash-resistant motors for indoor applications.

The Applicant shall provide all equipment in accordance with the approved sewage pumping station plans and the manufacturers' recommendations. When laying out the location of the equipment in the control and generator building, the Applicant shall consider the necessary separation between devices to provide adequate ventilation and the location of door, hatches, and panel covers to avoid conflicts among these items when they are opened and closed. The Applicant shall provide provisions for housekeeping pads to keep equipment off the floor.

The Applicant shall provide a moisture-proof, NEMA 4X enclosure constructed of non-corrosive materials for all equipment located outside the control building. For submersible sewage pumping stations, cable trays shall be provided between the pumps and outside controls to permit cables from the pumps to be unwired and removed. The Applicant is required to maintain the integrity of these enclosures.

W. Controlled Overflow Diversion

The Applicant shall provide a retention basin at all pump stations in the Occoquan Watershed unless this requirement is waived by VADEQ. The Applicant shall size the retention basin to hold the estimated 24-hour flow volume.

X. Access and Security

The Applicant shall provide a 12-foot-wide paved access road to the pump station. The minimum road section shall consist of a compacted sub-grade, 6-inches of VDOT 21-A stone, and 2-inches of compacted VDOT SM-2A bituminous concrete. The grade on the road shall not exceed 10 percent (10%). The Applicant shall provide unrestricted ingress and egress to the Service Authority from a public right-of-way to the pumping station. On long access roads, Applicant shall provide, at the entrance to the access road from the public right-of-way, a locking gate that has been reviewed and approved by the Service Authority.

An unrestricted, all-weather access road to the station is constructed and maintained by Applicant until the permanent access road is complete and accepted by the Service Authority. The Service Authority staff shall have access to the station at all times.

The Applicant shall provide an 8-foot-high brown vinyl- or black vinyl-coated chain link

security fence topped with three strands of barbed wire around the pumping station lot. The requirement to use vinyl coating applies to all fabric, posts, ties, and fittings; galvanized fencing is not permitted. Privacy slats may be required to be provided and installed by the Applicant depending upon the location and the application as determined by the Director of Operations and Maintenance or designee. The Applicant shall equip the fence with a top rail and a bottom tension wire. The Applicant shall provide access to the station with a 12-foot wide, lockable gate. The Applicant shall key all door locks and padlocks in the station to the Service Authority's standard keys as provided by the Operations and Maintenance Director or designee.

The Applicant shall provide a minimum of 3.5-foot separation between the security fencing and structures or as required for building and grounds maintenance and future equipment removal and maintenance.

6.8 Testing, Acceptance, and Warranties for Sewage Pumping Stations

A. Pre-Testing, Start-Up, and Beneficial Use Inspections of Sewage Pumping Stations

For new sewage pump stations constructed for new development where there is no existing source of influent sewage, the Applicant shall successfully complete the following testing and inspections requirements. Prior to beginning testing, the Applicant must complete the following:

- Substantially complete all construction.
 - Pass all building trade inspections and acquire all related permits from the governing authorities.
 - Achieve Beneficial Use status for the sewage pumping station force main.
 - Ensure all sanitary sewer mains receiving the force main discharge are placed in Beneficial Use status or are in a status of being owned and operated by the Service Authority.
1. Pre-testing to prepare for start-up:
 - a. Independently verify complete operation of the sewage pump station.
 - b. Conduct successful pretesting of the SCADA system with the SCADA Manager or designee.
 - c. Acquire a start-up check list from the WWF Manager and SCADA Manager for reference.
 - d. Conduct required testing necessary for the Engineer to certify the station was built in conformance with substantial completion and operates as designed.
 2. Start-up testing and inspection:
 - a. Schedule and facilitate training of Service Authority staff by the equipment manufacturers.

- b. Successfully tests all major pieces of equipment including pumps, generator, automatic transfer switch, comminutor, flow meter, check valves, control system, and SCADA system to the satisfaction of the WWF Manager, SCADA Manager, and Inspection Manager, or their designee.
- c. Verifies all sensors, alarms, SCADA, and start-up of equipment operate as designed for various operational scenarios.

If the sewage pumping station is not placed into Beneficial Use within 90 days of successful start-up testing, the Applicant must go through start-up procedures again before being placed into Beneficial Use.

3. Beneficial Use inspections to place the sewage pumping station into service:
 - a. Pass all Service Authority inspections for Beneficial Use (see Chapter 2, Section 2.9).
 - b. Provide written certification by the Engineer that sewage pumping station was built in substantial conformance with the plans and specifications.
 - c. Acquire a CTO for the sewage pumping station (see Chapter 3, Section 3.5).
 - d. Submit a temporary flushing plan for the sewage pumping station to exercise the pumps and minimize the retention time in the force main.
 - e. Deliver Operations and Maintenance Manuals for the sewage pump station (see Chapter 6, Section 6.5).
 - f. Transfer property and access rights for the sewage pumping station to the Service Authority (see Chapter 6, Section 6.5).
 - g. Submit information for the sewage pumping station's electrical account to the Service Authority's Project Engineer or Project Manager so that the account can be assigned to the Service Authority.
 - h. Provide the Development Manager a schedule of values for the sewage pumping station in accordance with Service Authority Finance Division reporting requirements.

The Applicant has six (6) months to address all punch list items and to place sewage pumping station into Beneficial Use. If all punch list items are not addressed or the station is not placed into Beneficial Use within the six (6) months, a new and full inspection is required.

The Service Authority will only permit a sewage pumping station to go into Beneficial Use status if tributary flows are to be delivered to the station within 60 days of Beneficial Use. The Service Authority will not place a station into service via Beneficial Use nor commence the start of warranties until flows are delivered to the station and operations by the Service Authority are necessary.

Sewage pumping stations are not eligible for Partial Beneficial Use status

B. Five (5)-Day Acceptance Testing of Sewage Pumping Stations

When a new sewage pumping station is replacing an existing station or is to receive flow

from an existing source of sewage, the Applicant shall conduct a five (5)-day acceptance test prior to Beneficial Use inspections. Existing sewage flows are temporarily diverted to the new station to conduct testing by a controlled method.

The purpose of the five (5)-day acceptance test is to operate the sewage pumping station in an operational mode for five (5) days. The intent is to test all pumping station components, control systems, and SCADA system (including alarm notifications) under conditions as close as possible to normal operating conditions.

1. Following the successful completion of the start-up testing and inspection, the Applicant shall submit a detailed plan for the five (5)-day acceptance test and obtain the Engineer's and Service Authority's approval of the detailed plan. After the testing plan is accepted by the Engineer and the Service Authority's Project Engineer or Program Manager, the Applicant shall schedule a five (5)-day acceptance test for the sewage pumping station in coordination with the Engineer and the Service Authority.
 - a. The Applicant shall not schedule the five (5)-day acceptance test during any observed Federal Holiday, weekend day, or during scheduled manufacturer training.
 - b. The cost for the five (5)-day acceptance test is at the Applicant's expense.
 - c. All major pieces of equipment shall be tested including pumps, generator, automatic transfer switch, comminutor, flow meter, check valves, control system, and SCADA system.
2. A successful five (5)-day acceptance test, performed by the Applicant, certified by the Engineer, and accepted by the Service Authority's Project Engineer or Program Manager, is required prior to placing the project into Beneficial Use status. A successful five (5)-day test shall include a detailed report indicating that:
 - a. All the major equipment worked, as specified, for the duration of the five (5)-day acceptance test.
 - b. The control systems worked, as specified, for the duration of the five (5)-day acceptance test.
 - c. The SCADA systems worked, as specified, for the duration of the five (5)-day acceptance test.

C. Final Acceptance & Project Closeout

1. The conditions of final acceptance and project closeout shall include the following:
 - a. Bond release shall not be requested until 6 months after Beneficial Use acceptance.
 - b. Pump station functions as designed and no longer requires flushing.
2. The Applicant must request and pass a final inspection for final acceptance by the Service Authority.
 - a. The Applicant has six (6) months to address all punch list items from a final inspection. If all punch list items are not addressed within six (6) months, a new and full inspection is required prior to final acceptance.

- b. The Applicant shall request re-inspection from the Service Authority after addressing all punch list items.
- c. The Service Authority's Project Engineer or Project Manager shall issue a formal letter of acceptance on behalf of the Service Authority once all punch list items have been satisfactorily addressed.

D. Sewage Pumping Station Warranty

1. The Applicant shall warranty the pump station for a period of one year for all materials, equipment, and workmanship, effective at the date of Beneficial Use acceptance.
 - a. The Applicant shall repair or replace defective materials, equipment, or workmanship within 60 days of written notice by the Service Authority at the cost of the Applicant.
 - b. New materials shall be used to repair or replace defects or equipment the by original equipment manufacturer or Service Authority approved qualified contractor.
 - c. If the Service Authority must immediately repair or replace defects or equipment to maintain operation of the sewage pump stations, the Applicant shall pay all associated Service Authority expenses.
 - d. Final acceptance of the sewage pumping station by the Service Authority, does not relieve the Applicant of the one-year warranty responsibilities.
2. The Applicant shall provide a five (5) year warranty for the pumps and the generator from the manufacturer. The Applicant shall purchase an extended warranty from the manufacturer, as necessary, to provide a five (5) year warranty coverage from the date of Beneficial Use acceptance.
3. All written warranties from the equipment manufacturers shall be provided with the equipment manuals delivered with the Operation and Maintenance Manual.

6.9 Spare Parts, Supplies and Special Tools

The Applicant shall supply all spare parts for all major equipment, as indicated on the spare parts list created by the Operations and Maintenance Director or designee after its review of the equipment submittals for the pump station. The Applicant shall provide all special tools required for a given station that uses special (non-standard) equipment. The Operations and Maintenance Director or designee shall specify such special tools during its review of the pump station plans. The Applicant shall provide the following list of supplies with the pump station:

- Brooms (one push, one regular) and dustpan
- 36-inch curved squeegees with 55-inch handle (two)
- mop and mop bucket with wringer
- 50-feet of 5/8-inch heavy duty hose with fire hose type nozzle (two), with hose reel (outside near hose bib) and hose hanger (inside near hose bib)
- step ladder (sized to reach interior light fixtures)
- extension ladder (sized to access wet well with three (3) feet of ladder above top of slab, stored on wall hangers on outside of building – mounted out of view of the general public)

- industrial grade storage cabinet (general purpose, 48-inches wide by 78-inches high by 24- inches deep or equivalent)
- fire proof cabinet (30-gallon or equivalent)
- single pedestal desk with chair; two-drawer file cabinet; cordless phone with answering machine; bulletin board (combo: 1/2 dry-erase, 1/2 cork)
- 55-gallon trash can with lid and dolly
- 50-feet of 12-gauge electrical extension cord
- paper towel dispenser and soap dispenser (near sink)
- face shields (ratchet headgear with crown extension and clear polycarbonate lens)
- fire extinguishers (suitable for electrical fires in control panels; include minimum of one extinguisher per floor level)
- First Aid Kit, OSHA approved (one per floor level)
- ear muff hearing protectors (two per generator room with storage cabinet mounted outside generator room door)

-- end of Chapter 6 --

Appendix A: List of Water Distribution System Details

Refer to the Service Authority's Water Details
by using Control + Click to follow the link

[Water Details](#)

<u>Detail No.</u>	<u>Detail Title</u>
W-1	5/8-inch by 3/4-inch Residential Meter
W-2	1-inch Meter in 1-inch Residential Service for Fire Suppression
W-3	5/8-inch by 3/4-inch Meter in 2-inch Copper Setter for Commercial Use (Only)
W-4	1-inch, 1 1/2-inch and 2-inch Meter in 2-inch Copper Setter for Residential Fire Protection
W-5	1-inch Meter in 2-inch Copper Setter for Commercial Use (Only)
W-6	Water Distribution System 1 1/2-inch Meter in 2-inch Copper Service
W-7	Water Distribution System 1 1/2-inch and 2-inch Meter in D.I.P. Service
W-8	3-inch or 4-inch Master Meter Vault
W-9	6-inch, 8-inch, or 10-inch Main Line Meter Vault
W-10	5/8-inch by 3/4-inch and 1-inch Water Meter and Monitor Frame and Cover Detail
W-11	3/4-inch Water Service Connection Detail
W-12	4-inch D.I.P. Service Connection Detail
W-13	Temporary Blow-off Assembly
W-14	Permanent Blow-off Assembly
W-15	Typical Valve and Valve Box
W-16	Water Distribution System Air Release Valve
W-17	Joint Restraint Device
W-18	Buttresses for 22 1/2° Horizontal Bend
W-19	Buttresses for 45° Horizontal Bend
W-20	Buttresses for 90° Horizontal Bend
W-21	Buttresses for Tees, Plugs, and Caps
W-22	Buttress for 11 1/4°, 22 1/2° and 45° Lower Vertical Bends
W-23	Anchorage for 11 1/4°, 22 1/2° and 45° Upper Vertical Bends
W-24	Dead End Anchor Detail
W-25	Typical Fire Hydrant Installation for Depths Between 3.5 to 5.0 Feet
W-25A	Typical Fire Hydrant Installation for Depths Between 5.1 to 10.0 Feet
W-26	Typical Fire Hydrant Location with Curb and Gutter or Ditch Line

<u>Detail No.</u>	<u>Detail Title</u>
W-27	Typical Fire Hydrant Location in Island and Parking Area
W-28	Typical Fire Hydrant Location on Street
W-29	Typical Fire Hydrant Post Protection
W-30	Tapping Sleeve and Valve Detail
W-31	$\frac{5}{8}$ -inch by $\frac{3}{4}$ -inch and 1-inch Sub-meter Detail
W-32	Lowering Water Main or New Installation
W-33	Trace Wire Test Station
W-34	Water Line Bedding and Backfill
W-35	Access Gate Details
W-36	Electronics at Magnetic Meter
W-37	T-Bolts and Nuts

Appendix B: List of Sewer Collection System Details

Refer to the Service Authority's Sewer Collection System Details
by using Control + Click to follow the link

[Sewer Details](#)

<u>Detail No.</u>	<u>Detail Title</u>
S-1	Sewer Service Connection Plan View for Non-Public Right-of-Way
S-2	Sewer Service Connection Termination
S-3	Sewer Service Connection/Replacement Plan View for Public Right-Of-Way
S-4	Sewer Service Connection/Replacement Profile View for Non-Public Right-Of-Way
S-5	Sewer Service Connection/Replacement Profile View for Public Right-Of-Way
S-6	Cleanout Cover for Paved Areas
S-7	Grinder Pump Connection to Gravity Sewer Main
S-8	Insert-a-Tee
S-9	Precast Concrete 4-foot-Diameter Manhole
S-10	Precast Concrete 5-foot- and 6-foot-diameter Manhole
S-11	Precast Concrete Cut-in Manhole
S-12	Construction of Manhole over Existing Sewer
S-13	Abandonment of Manhole
S-14	Precast Concrete Manhole Cone Section
S-15	Standard Manhole Frame and Cover
S-16	Watertight Manhole Frame and Cover
S-17	Pro Ring, Ladtech Ring, or Other
S-18	Waterproof Manhole Insert
S-19	Precast Concrete Manhole Flat Top
S-20	Precast Concrete Manhole Reducer
S-21	Precast Concrete Manhole Conical Reducer—5 Feet to 4 Feet
S-22	Inside Drop Manhole Detail
S-23	4-foot Manhole with Outside Drop Connection
S-24	Manhole Vent
S-25	Flushing Station and Grinder Pump Connection to Low Pressure Force Main
S-26	Sewage Force Main Air or Vacuum Release Assembly
S-27	Grease Trap
S-28	Concrete Cradle and Encasement
S-29	Steel Casing
S-30	Clay Dam Detail
S-31	PWCSA Logo
S-32	Low Pressure Force Main Valve Cluster Detail
S-33	Sewer Only Meter for Process Water

<u>Detail No.</u>	<u>Detail Title</u>
S-34	Sanitary Sewer Lateral Replacement
S-35	Termination of Sanitary Sewer Lateral
S-36	Sanitary Sewer Line Bedding and Backfill
S-37	Chain Link Fence Detail
S-38	Hatch Safety Features
S-39	Advance Blasting
S-40	Warning Water/Sewer Pipe Crossing

Appendix C: USM Approved Products List

Refer to the Service Authority's USM Approved Products List
by using Control + Click to follow the link

[Products List](#)

Appendix D: Approved Equipment Manufacturers

Refer to the Service Authority's Approved Equipment Manufacturers
by using Control + Click to follow the link

[Equipment Manufacturers](#)

Appendix E: Partial/Full Beneficial Use Developer Request Template

Refer to the Service Authority's Partial/Full Beneficial Use Developer Request Template
by using Control + Click to follow the link

[Full and Partial Beneficial Use Request and Certification Form](#)

Appendix F: USM Waiver Form

Refer to the Service Authority's USM Waiver Form
by using Control + Click to follow the link

[Waiver Form](#)

Appendix G: Community Notification & Outreach for Development and Service Authority Projects Creating Impacts to Existing Communities

Refer to the Service Authority's Community Notification & Outreach for Development and Service Authority Projects Creating Impacts to Existing Communities
by using Control + Click to follow the link

[Community Notification & Outreach for Development and Service Authority Projects Creating Impacts to Existing Customers](#)

Appendix H: Service Authority Customer Handbook/ Developer Fees

Refer to the *Service Authority Customer Handbook Rates and Fees for New Connections (Developer Fees)*

by using Control + Click to follow the link

[Customer Handbook](#)

[Developer Fees](#)

Appendix I: Service Connection Policy

Refer to the Service Authority's Service Connection Policy
by using Control + Click to follow the link

[Service Connection Policy](#)

Appendix J: Low Pressure Force Main and Grinder Pump Policy

Refer to the Service Authority's Low Pressure Force Main Policy
by using Control + Click to follow the link
[Low Pressure Force Main](#)

Appendix K: Reserved for Future Use

Appendix L: Deed of Easement Template

Refer to the Service Authority's Omnibus Deed of Easement Template
by using Control + Click to follow the link

[Easement Template](#)

Appendix M: Off-Site Easement Acquisition Policy

Refer to the Service Authority's Off-Site Easement Acquisition Policy

by using Control + Click to follow the link

[Off-Site Easement Acquisition](#)

Appendix N: Pre-Construction Packet

Refer to the Service Authority's Pre-Construction Packet
by using Control + Click to follow the link

[Pre-Construction Packet](#)

Appendix O: New Construction Meter & Final Inspection Guidelines

Refer to the Service Authority's New Construction Meter and Final Inspection Guidelines

by using Control + Click to follow the link

[New Construction Meter & Final Inspection Guidelines](#)

Appendix P: Sub-Meter Policy

Refer to the Service Authority's Sub-Meter Policy
by using Control + Click to follow the link

[Sub-Meter Policy](#)

Appendix Q: Facilities Access Agreement

Refer to the Service Authority's Facility Access Agreement

by using Control + Click to follow the link

[Facilities Access Agreement](#)

Appendix R: Development Review Process and System Improvement Policy

Refer to the Service Authority's Development Review Process and System Improvement Policy
by using Control + Click to follow the link

[Development Review Process and System Improvement Policy](#)

APPENDIX S: Sewage Bypass Pumping Plan Template