HRSD

DESIGN & CONSTRUCTION STANDARDS

2026

Major Revisions in the June 2026 Edition of the HRSD Design and Construction Standards

Section	Title	Revision Summary
4	Monthly Project Status Reporting	An invoice template was added as Attachment A and a Diversity Procurement statement template was added as Attachment B.
5	Capital Project Cost, Schedule, and Risk Reporting	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.
8	PER, Design, and Construction Submittal Requirements	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.
11	Public Communication Program	Additional Notices: The requirement to provide notices 24 hours prior, the morning of work, and once completed, as directed by HRSD has been deleted. Traffic Advisories/Media Releases: Traffic advisories for larger traffic detours will be distributed seven days ahead. Several attachments were added, deleted, or revised – please review this section carefully at the start of each project.
12	Preconstruction Assessment and Damage Mitigation Procedures	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.

Section	Title	Revision Summary
18	CA and CI Expectations	Several CA/CI expectations have been added: • CA: Prepare emergency contact list for all involved parties • CA: Send any submitted "or equal" equipment/manufacturers to HRSD for review. • CA: Provide a final submittal list from the Contractor to HRSD to determine what submittals must be reviewed by HRSD. • CA: Davis Bacon wage classification verification by the FIRM will not be required on all **FUTURE** VCWRLF projects – FIRM shall check with the HRSD Project Manager or the Engineering Compliance Manager when scoping CA/CI services for any active projects to verify if these services are needed. • CA/CI: Work change directors, change orders, etc., must be approved by the Project Manager and uploaded to and approved in Unifier before any related work is performed in the field. • CA/CI: Enhance vendor-provided equipment training that is unique to the design and coordinate comprehensive system training for information/functionality covered in the functional description. • CI: NACE Level 2 certification is required for all inspectors overseeing coating and lining work at treatment plants and pump stations when a manufacturer dictates a specific profile is needed for proper adhesion. • CI: Inspectors will have NASSCO ITCP for CIPP rehabilitation project work.

Section	Title	Revision Summary
24	Pipelines and Appurtenances	III.B – Updated to indicate X,Y,Z coordinates spreadsheet shall be updated monthly and attached to each contractor payment application. A new as built X,Y,Z template was provided in Attachment B. IV.A.10.a – Force main valve spacing shall be as approved by HRSD Operations. IV.A.22 – Beads on HDPE pipe shall only be removed in gravity sewer applications. V. B - Design Submittals – At the 90% design submittal or before, the designer of the line stop and bypass system shall request the dry weather minimum, dry weather maximum, and wet weather maximum flow values from HRSD. The designer shall provide an estimated duration of bypass operations and headloss calculations for the various bypass pipe size considerations under the three flow scenarios provided (dry weather minimum, dry weather maximum, and wet weather maximum). IX.A and B – This section, related to the disposition of inline and branch valves to be taken out of service, was rewritten. X.D – For manholes on lines 12-inch and larger, at force main discharge manholes, and at heavily traversed or difficult operating locations, manholes shall be made of corrosion-proof materials for manholes, frames and covers.
27	Trenchless Crossing Installations	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.
32	Treatment Plants	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.
33	Electrical and Instrumentation	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.
34	IT Infrastructure Hardware and Third-Party System Integration	This section has been renamed and reorganized to guide FIRMs via the attached IT Division guidelines.
37	Standard Details	Note that the new HRSD logo has been inserted into the standard details.
39	Front End Documents	Approved plans and technical specifications will be provided by the FIRM to the HRSD Project Manager, instead of the Contract Specialist, for incorporation into the front end documents. For lump sum bids, mobilization shall be an incidental item and not included as a line item.
41	Master Specifications	Multiple master specifications have been updated extensively and thus all warrant a careful review for new, changed, and deleted requirements.

Section	Title	Revision Summary
42	VDEQ Project Funding	This section has been updated extensively and warrants a careful review for new, changed, and deleted requirements.

Table of Contents

Section No.	Subject	Page No.
Forward	Chief Engineer's Viewpoint	Forward
1.	Introduction	1-0
	I. Purpose	
	II. Expectations, Outcomes and Sustainability	
	III. Project Management	
	IV. Project Delivery Methods	
	V. Distribution	
	VI. Preparation of Design Documents	
	VII. Common Historical Issues in the Design and Construction Phase	
	VIII. Use of Autonomous Vehicles (AV)	
2.	Architectural and Landscaping Design and Review Process	2-0
	I. Introduction	
	II. Attachments	
	Attachment A – HRSD Facilities Architectural Guidelines.	A
	Attachment B – Aesthetics Consideration Log	B
	Attachment C – Address Sign Specification	C
	Attachment D – Safety Sign Specification for Buildings	D
	Attachment E – Landscaping Planting Plan Sample	E
3.	Use of Technical Memorandum for CIP Projects	3-0
	I. Introduction	
	II. Circumstances for Use	
	III. Approval for Use	
4.	Monthly Project Status Reporting	4-0
	I. Introduction	
	II. Content and Format for Engineering Service Invoice	
	III. Content and Format for Project Status Report	
	IV. Content and Format for Project Expenditure Tracking	
	V. Content and Format for Diversity Procurement Statement	
	VI. Attachments	
	Attachment A – Invoice Template	A
	Attachment B – HRSD Firm Progress Report Template	B
	Attachment C – Example Design Phase Expenditure Graph	C
	Attachment D – Diversity Procurement Statement Template (for use on non-capital project invoices)	D

Section No.	Subject	Page No.
5.	Capital Project Cost, Schedule, and Risk Reporting	5-0
	I. Introduction	
	II. FIRM's Responsibilities	
	III. Attachments	
	Attachment A – Project Budget and Schedule Estimate Report and OPCC Classification	A
	Attachment B – Project Risk Table	B
	Attachment C – Schedule Data Template	C
	Attachment D – Project Budget Estimating Template	D
6.	Drawings, Record Drawings, and Valve Guides	6-0
	I. Introduction	
	II. Drawings	
	III. Record Drawings	
	IV. Bid Documents	
	V. Valve Guides	
	VI. Standard Symbols	
7.	HRSD Building Information Model (BIM) Requirements	7-0
	I. Introduction	
	II. Level of Development (LOD) Tables	
	III. BIM Execution Plan	
	IV. Model File Creation	
	V. Shared Coordinates	
	VI. Family Creation	
	VII. Shared Parameter File	
	VIII. Contract Drawings	
8.	PER, Design, and Construction Submittal Requirements	8-0
	I. Introduction	
	II. Requirements for Submittals	
	III. Attachments	
	Attachment A – Major Submittals List	A
	Attachment B – Equipment Record Template (Excel)	B
	Attachment C – XYZ Spreadsheet	C
	Attachment D – Soil Corrosivity DB Template	D
	Attachment E – PER Minimum Required Table of Contents Chapters	E
	Attachment F – Interceptor Project GIS Deliverables Flow Chart	F
9.	Real Estate Acquisition and Plat Guidelines	9-0
	I. Introduction	

Section No.	Subject	Page No.
	II. Real Estate Schedule vs. Project Schedule	
	III. Acquisitions and Plats	
	IV. Design Engineer's Estimate	
	V. Justification Memorandum	
	VI. Phase 1, Environmental Site Assessment (ESA)	
	VII. Location Map	
	VIII. Demolition of Structures	
	IX. Attachment	
	Attachment A – Plat Template	A
	Attachment B – Project Acquisition Tracking Log	B
	Attachment C – Engineer's Estimate Template	C
	Attachment D - Sample – Justification Memo – Design Firm	D
	Attachment E – Sample – Justification Memo – Real Estate Firm	E
	Attachment F – ESA Scope and Fee Template	F
	Attachment G – Sample – Phase 1 ESA	G
	Attachment H – Sample – Location Map	H
10.	Flood Elevation Requirements	10-0
	I. Introduction	
	II. Definitions	
	III. Locality Code Requirement	
	IV. Asset Protection Requirements	
	V. Locality Freeboard Requirements	
11.	Public Communication Program	11-0
	I. Introduction	
	II. Engage with Locality Staff	
	III. Alert Public Officials	
	IV. Identity Project Stakeholders	
	V. Participate in Public Open House/Community Meetings	
	VI. Virtual Presentation for Open House	
	VII. Establish a Project Webpage	
	VIII. Website Updates	
	IX. Stakeholder Updates	
	X. Distribute Project Introductory Notice to Neighbors	
	XI. Post Project Signs (If Applicable)	
	XII. Construction Updates Notices	
	XIII. Additional Notices	
	XIV. Post Variable Message Boards (VMB)	
	XV. Traffic Advisories/Media Releases	
	XVI. Response to Public and Media Inquiries	

Section No.	Subject	Page No.
	XVII.Attachments	
	Attachment A – Public Communication Program Checklist	A
	Attachment B – Stakeholders List Template	B
	Attachment C – Willingness to Hold Advertisement – Example	C
	Attachment D – Informational Open House Advertisement – Example	D
	Attachment E – Open House Notice to Public – Template	E
	Attachment F – Open House Requirements/Guidelines	F
	Attachment G – Open House Sign-In Sheet	G
	Attachment H – Open House Comment Card	H
	Attachment I – Open House Advertisement Submission Schedule	I
	Attachment J – Website- Project Webpage – Template	J
	Attachment K – Website- Project FAQs – Template	K
	Attachment L – Website Project Map – Template	L
	Attachment M – Stakeholders Notification Update – Template	M
	Attachment N – Project Introductory Notice – Template	N
	Attachment O – Project Sign – Template	O
	Attachment P – HRSD Project Site-Sign Specifications	P
	Attachment Q – HRSD Sign & Base Specifications – Product Sheet	Q
	Attachment R – Construction Update Notices – Template	R
	Attachment S – Emergency Repair Work Notice – Template	S
	Attachment T – Emergency Work-Pump and Haul Notice – Template	T
	Attachment U – CCTV Inspection Notice – Template	U
	Attachment V – CCTV Notice with Cleaning and Inspection – Template	V
	Attachment W – Initial Smoke Testing Notice – Template	W
	Attachment X – Reminder Smoke Testing Notice – Door Hanger – Template	X
	Attachment Y – Survey Notice – Template	Y
	Attachment Z – Survey Notices – Mailing and Tracking Log	Z
	Attachment AA – Lateral Work Notice – Template	AA
	Attachment BB – Boring Notice – Property Adjacent – Template	BB
	Attachment CC – Boring Notice – Property Access – Template	CC

Section No.	Subject	Page No.
	Attachment DD – Unplanned Power Interruption Notice – Template	DD
	Attachment EE – Unplanned Water/Sewer Service Interruption Notice – Template	EE
	Attachment FF – Project Closeout Notice – Template	FF
	Attachment GG – Media Release – Traffic Advisory Example	GG
12.	Preconstruction Assessments and Damage Mitigation Procedures	12-0
	I. Chief Engineer's Introduction	
	II. Purpose and Process	
	III. Deliverables and Timing	
	IV. Stage 1 – Construction Impact Research and Evaluation	
	V. Stage 2 – Risk Mitigation Analysis and Recommendations	
	VI. Stage 3 – Pre-Construction Assessments, Construction Monitoring, Determination of Responsible Parties, and Bid Document Development	
	VII. Attachments	
	Attachment A – Sample - Noise and Vibration Generation and Impacts	A
	Attachment B – Sample - Noise and Vibration Generation and Impacts by Phase	B
	Attachment C – Sample – Dewatering Impacts	C
	Attachment D – Pre-Construction Conditions Assessment Communications and Contact Tracking Log	D
	Attachment E – Assessment of Pre-Existing Conditions – Right to Access Property Form	E
	Attachment F – Letter to Property Owner Template for Pre-Existing Conditions Assessment	F
	Attachment G – Preexisting Condition Assessment – Reporting Form – Template	G
	Attachment H – Sample – Precondition Assessment and Damage Mitigation Report	H
	Attachment I – Sample – Precondition Assessment Field Survey Report (excerpts)	I
	Attachment J – Template Waiver Request	J
	Attachment K – Precondition Assessment and Damage Mitigation Report Cover Sheet	K
	Attachment L – Precondition Assessment and Damage Mitigation Report – Table of Contents	L
	Attachment M – Excerpt Federal Transit Administration Vibration Impact Assessment 2018	M

Section No.	Subject	Page No.
	Attachment N – Excerpt Federal Transit Administration Noise Impact Assessment 2018	N
	Attachment O – Excerpt Federal Transit Administration Vibration Mitigation Assessment 2018	O
	Attachment P – Excerpt Federal Transit Administration Noise Mitigation Assessment 2018	P
	Attachment Q – Sample – Vibration Monitoring Program	Q
	Attachment R – Sample – Summary Assessment Memo for Public Use	R
13.	Coordination with Virginia DEQ for Certificate to Construction and Certificate to Operate	13-0
	I. Introduction	
	II. Approval CTC Process for State Water Quality Improvement Fund (WQIF) Projects	
	III. Abbreviated Administrative Process for Non-WQIF Projects	
	IV. Approval Process for Non-WQIF Projects that Involve Greater than 25% Capacity Increase or Decrease	
	V. Online Resources within DEQ for Approval Process	
	VI. Attachments	
	Attachment A – Sample Letter – Pressure Reducing Pumping Stations	A
	Attachment B – Sample Letter – Pumping Station Replacement	B
	Attachment C – Sample Letter – New or Replacement Pipeline	C
14.	Coordination of Preconstruction Phase Item	14-0
	I. Introduction	
	II. Coordination with Engineering Contract Specialist	
	III. Coordination with the Design and Construction Director and Project Manager	
	IV. Attachments	
	Attachment A – Sample Bid Recommendation Letter	A
15.	Preparation of and Format for Construction Addenda	15-0
	I. Introduction	
	II. Guidelines and Specific Requirements	
	III. Attachments	
	Attachment A – Addendum Template	A
16.	Preparation of and Format for Conformed Documents	16-0
	I. Introduction	

Section No.	Subject	Page No.
	II. Specifications	
	III. Drawings	
	IV. Format and Number of Conformed Documents	
17.	Tracking of Construction Phase Milestones and Performance Metrics	17-0
	I. Introduction	
	II. Completion and Submittal of Construction Milestones Tracking Form	
	III. Performance Metrics	
	IV. Attachments	
	Attachment A – Milestone Tracking Form	A
18.	Expectations for Construction Administration and Construction Inspection	18-0
	I. Introduction	
	II. Organization of This Section	
	III. General Expectations	
	IV. Preconstruction	
	V. General Procedures	
	VI. Tie-In, Shutdown and Diversion Procedures	
	VII. Line Stop Procedures	
	VIII. Trenchless Crossing Procedures	
	IX. Damage Assessment and Claims Procedures	
	X. Training	
	XI. Record Keeping	
	XII. Staffing	
	XIII. Verification	
19.	Use of Air Vent Proving Tool (“Whammy Rod”)	19-0
	I. Introduction	
	II. FIRM Responsibilities and Procedures	
20.	Condition Assessment Protocol	20-0
	I. Introduction	
	II. Pre-Planning Phase	
	III. PER and Design Phase	
	IV. Pipe Coupon Data Collection Form	
	V. Technical Specifications	
	VI. Condition Assessment Guidelines	
	VII. Attachments	
	Attachment A – Coupon Data Collection Form	A

Section No.	Subject	Page No.
21.	Regulatory Reporting Requirements for Spills	21-0
	I. Introduction	
	II. Procedures	
	III. Contact Information	
22.	HRSD Safety Programs	22-0
	I. Introduction	
	II. Safety Programs	
	III. Attachments	
	Attachment A – Asbestos Checklist	A
23.	VDOT 2026 Work Area Protection Manual (WAPM) 11.0 Requirements	23-0
	I. Introduction	
	II. Training Requirements for Construction Inspectors	
	III. Personal Protective Equipment (PPE) Requirements	
	IV. Attachments	A
	Attachment A – Personal Protective Equipment Requirements for Work Zone Operations	
24.	Pipelines and Appurtenances	24-0
	I. Introduction	
	II. General	
	III. Force Main	
	IV. Line Stops	
	V. Valves	
	VI. For exposed service applications	
	VII. For buried service applications	
	VIII. Gravity Interceptors and Manholes	
	IX. Attachments	
	Attachment A – Report of Hydrostatic Pressure Test	A
	Attachment B – As Built Asset Locations X, Y, Z Template	B
25.	Checklist for Line Stop Installations	25-0
	I. Introduction	
	II. Completion and Submittal of Checklist for Line Stop Installations	
	III. Attachments	
	Attachment A – Checklist for Line Stop	A
26.	Checklist for Tie-Ins to Existing Interceptor Force Mains	26-0
	I. Introduction	

Section No.	Subject	Page No.
	II. Completion and Submittal of "HRSD Checklist for Tie-Ins to Existing Interceptor Force Mains"	
	III. Attachments	
	Attachment A – Checklist for Tie-Ins	A
27.	Trenchless Crossing Installations	27-0
	I. Introduction	
	II. General Evaluation Criteria	
	III. Trenchless Pipe Installations	
	IV. Subsurface Investigations	
28.	Checklist for Trenchless Crossing Operations	28-0
	I. Introduction	
	II. Completion and Submittal of Checklist for Trenchless Crossing Operations	
	III. Attachments	
	Attachment A – HRSD Checklist for Trenchless Crossing Operations	A
29.	Rehabilitation of Sanitary Sewer Systems	29-0
	I. Introduction	
	II. General Evaluation Criteria	
	III. Sanitary Sewer System Rehabilitation	
30.	Deep Excavation Support Systems	30-0
	I. Introduction	
	II. Technical Codes, Standards, and Regulations	
	III. Excavation Support System Design	
	IV. Miscellaneous	
31.	Pump Stations	31-0
	I. Introduction	
	II. Description of Operations	
	III. General	
	IV. Site Issues and Layout	
	V. Masonry	
	VI. Equipment	
	VII. Conveying Systems	
	VIII. Mechanical	
	IX. Electrical & Instrumentation	
	X. Attachments	
	Attachment A – PS Substantial Completion Checklist	A
	Attachment B – Temporary Portable Pump Alarms	B

Section No.	Subject	Page No.
32.	Treatment Plants	32-0
	I. Purpose	
	II. Abbreviations	
	III. Sewage Treatment Design & Operation	
	IV. SWIFT Facilities Design & Operation	
	V. Solids Handling Design & Operation	
	VI. Access to Unit Processes and Equipment	
	VII. Sampling	
	VIII. Chemical Containment	
	IX. Chemical Feed Systems	
	X. Drain Systems	
	XI. Emergency Eyewash and Showers	
	XII. Equipment Numbering Sequences	
	XIII. Equipment Spare Parts	
	XIV. Miscellaneous Pump Items	
	XV. Noise Abatement for Installed Stationary Equipment	
	XVI. Non-Potable Water Systems	
	XVII. Odor Control and Room Ventilation	
	XVIII. Pipe Insulation & Heat Tracing	
	XIX. Primary and Secondary Clarifiers	
	XX. Process Air Piping	
	XXI. Process Flow Splitting	
	XXII. Scum Handling, Piping and Pumping	
	XXIII. Grit, Septage and Grease, and Biosolids	
	XXIV. Site Lighting	
	XXV. Slide and Sluice Gates	
	XXVI. Solids Piping	
	XXVII. Travel Path (Walkway) Alignment	
	XXVIII. Yard Piping	
	XXIX. Functional Descriptions	
	XXX. Operational Technical Information System (OTIS)	
	XXXI. Equipment Startup, Training, and Turnover	
	XXXII. Flow Metering	
33.	Electrical and Instrumentation	33-0
	I. Introduction	
	II. General	
	III. Pump Station and Interceptor Systems	
	IV. Treatment Plant	
	V. Quick Manufacturers Reference Guide	
	VI. Attachments	
	Attachment A – Arch Flash Mitigation & Power Study Specifications	A

Section No.	Subject	Page No.
	Attachment B – Load Bank Connections	B
	Attachment C – Variable Frequency Drive Specs.	C
	Attachment D – Lighting Policy	D
	Attachment E – HRSD Electric Motor Specifications	E
	Attachment F – Temporary Portable Pump Alarms & Setup Standards	F
	Attachment G – SCADA Site Drawings	G
	Attachment H – SWIFT Requirements	H
	Attachment I – Ductbank Directions	I
	Attachment J – Dominion Energy Coordination	J
	Attachment K – SCADA Flowchart	K
	Attachment L – Remote Switch Operator	L
	Attachment M – Remote Open-Close Operator Panel	M
	Attachment N – Ultrasonics Technical Information	N
	Attachment O – Limitorque	O
	Attachment P – Waterpilot FMX-21 Technical Information	P
	Attachment Q – Strategic Automation Configuration Guide	Q
	Attachment R – Controlwave & Telog Wiring Details	R
	Attachment S – Solids Treatment Processes	S
	Attachment T – Wet Well Pump Wiring Electrical Backboard Detail	T
	Attachment U – Antenna Installation Detail	U
	Attachment V – Intrinsic Safety Panel Details	V
	Attachment W – Actuator Vault Electrical Backboard Detail	W
	Attachment X – Wet Well Instrumentation Installation Detail	X
	Attachment Y – Collections Systems	Y
	Attachment Z – Liquid Streaming	Z
	Attachment AA – Hydrogen Sulfide Mitigation for Electrical Room	AA
	Attachment BB – Backup Battery Systems	BB
	Attachment CC – Cable Routing Disconnect	CC
	Attachment DD – Manufacturers List	DD
	Attachment EE – Conductors Colors	EE
34.	IT Infrastructure Hardware and Third-Party System Integration	34-0
	I. Introduction	
	II. General	
	III. OT Cybersecurity Requirements	
	IV. Attachments	
	Attachment A – IT Infrastructure Hardware Guidelines	A

Section No.	Subject	Page No.
	Attachment B – Third-Party Control Network Integration Guidelines	B
	Attachment C – Operational Technology (OT) Cybersecurity Standards	C
	Attachment D – Operational Technology (OT) Cybersecurity Standards Supporting Guidance	D
	Attachment E – Physical Security Infrastructure Standards	E
35.	Miscellaneous	35-0
	I. Introduction	
	II. Site	
	III. Concrete	
	IV. Masonry	
	V. Metals and Plastics	
	VI. Thermal and Moisture Protection	
	VII. Doors and Hardware	
	VIII. Painting and Coatings	
	IX. Architectural / Structural	
	X. Interior Finishes	
	XI. Miscellaneous Accessories	
	XII. Attachments	
	Attachment A – Door Typical Drawings	
36.	Standard for Capital Improvement Projects that Involve Construction Dewatering Activities	36-0
	I. Introduction	
	II. Background	
	III. Requirements	
	IV. Receiving Sewer System	
	V. Contacts	
	VI. Attachments	
	Attachment A – Anticipated Schedule from Initial Investigation to General Permit Acquisition	A
	Attachment B – Contaminated Identification Table	B
37.	Standard Details	37-0
	I. Introduction	
	II. Listing of Standard Details	
	Attachment A – 100 Series	A
	Attachment B – 200 Series	B
	Attachment C – 300 Series	C
	Attachment D – 400 Series	D

Section No.	Subject	Page No.
	Attachment E – 500 Series	E
	Attachment F – 600 Series	F
	Attachment G – 700 Series	G
38.	Suggested Division 1 Items	38-0
	I. Introduction	
	II. Table of Division 1 Items for FIRM Consideration	
39.	Front End Documents	39-0
	I. Introduction	
	II. Responsibilities of the FIRM	
	III. Standard Front-End Documents	
	IV. Specific Documents Requiring FIRM Input	
	V. Attachments	
	Attachment A – EJCDC 2018 Front End Documents	A
	Attachment B – Table of Contents	B
	Attachment C – Tax Exemption Procedure for Pollution Control Equipment	C
40.	Construction Administration Forms/Format	40-0
	I. Introduction	
	II. Contract Administration Forms	
41.	Master Specification Sections Overview	41-0
	I. Introduction	
	II. Listing of Master Specification Sections	
42.	VDEQ Project Funding	42-0
	I. Introduction	
	II. Program Compliance	
	III. DEQ Final Inspection/Evaluation Items	
	IV. Checklists	
	Checklist A – Categorical Exclusion Checklist: HRSD Project Manager and/or Engineer	
	Checklist B – Preliminary Engineering Report for Conveyance Projects	
	Checklist C – Preliminary Engineering Report for Treatment Projects	
	Checklist D – Plans and Specifications: HRSD Contract Specialist	
	Checklist E – Map to Closing: HRSD Project Manager	
	Checklist F – Checklist for Project Completion and Final Disbursement	

Section No.	Subject	Page No.
	V. Attachments	
	Attachment A – Overview Procedures	A
	Attachment B – Procurement Requirements for Small Purchases	B
	Attachment C – Davis Bacon Certified Payroll Form-WHD 347	C
	Attachment D – Request for Authorization of Additional Classification and Rate-SF-1444	D
	Attachment E – American Iron and Steel Initial Certification	E
	Attachment F – American Iron and Steel Waiver Request	F
	Attachment G – American Iron and Steel Waiver Request Checklist	G
	Attachment H – American Iron and Steel Final Certification Statement	H
	VI. Additional Resources	

Forward

Chief Engineer's Viewpoint

The HRSD Engineering Division was created in 1987 to better manage the growing infrastructure needs of the organization. Since the inception of the Engineering Division, it has been our goal to rely on both the region's consulting and contracting community to provide the support needed to complement and supplement the capabilities of HRSD staff.

As an extension of our staff, we expect consultants to work collaboratively to find the best solution to a problem or issue. We expect our consultants to be technically competent and strive for innovative solutions. However, a great project is only possible if we also have competent contractors to implement the design intent and to use best construction practices. Thus, the blending of design and construction requires a team approach and a mindset of collaboration. On large projects, we often use a formal partnering process to assure project success, which is built on the foundational areas of content, procedures, and relationships. Partnering strives to build an environment of trust and mutual respect between all parties. Although we limit our use of formal partnering, the concepts inherent in this approach are applied to all projects. An important component in any relationship is trust, and the components of trust are reliability, competence, sincerity, and care. Trust is built on a foundation of integrity, communication, and a clear understanding of the expectations and needs of all team members. These concepts are not new and can be easily forgotten when difficult challenges arise during project delivery.

We expect the project team to deliver a quality project. We define quality as consistently meeting or exceeding customer expectations. A quality project must strike a balance between budget, schedule, and cost, and open, honest, and effective communication are key ingredients to achieve this balance. We expect our staff, and therefore our consultants/contractors, to keep HRSD's Vision in mind as we plan, design, and construct projects. This Vision is: "Our communities will have clean waterways and reliable water resources for generations to come."

At the end of the day, we are a team and we win or lose together. As such, we should look to find ways to meet the goals of each respective team member while delivering on the infrastructure needs of HRSD. The ratepayers of HRSD expect that we will do these things, and we must deliver!

Section 1 - Introduction

I. Purpose – The purpose of this document is to present information to Professional Services Firms for the design, preparation of construction documents and contract administration and inspection services more efficiently while satisfying the needs and desires of HRSD. The term "FIRM" is used throughout this document to refer to the firm or individual providing professional consulting services for the design, contract administration, and inspection of HRSD facilities. HRSD expects the FIRM to bring its experience, expertise, and enthusiasm to projects while recognizing the culture and desires of HRSD. The FIRM must carefully review the information contained in this document, raise questions where appropriate, and deliver projects that incorporate HRSD standards as laid out in this document. HRSD must be specifically advised, in writing, of any case when these standards that make up this document have not been incorporated in the final plans, specifications, and Bid Documents or are contrary to other federal, state, or local requirements.

II. Expectations, Outcomes, and Sustainability – For an Engineered Construction Project to be successful, a number of outcomes are required. These outcomes include meeting project quality, schedule, and cost objectives. Projects must meet all regulatory, environmental, safety, and other needs of HRSD and the citizens we serve. Each project results in the delivery of infrastructure assets to HRSD. These assets must provide the required level of service within an acceptable level of risk at the lowest life-cycle cost. As such, FIRMs should consider the full life cycle of assets when planning, designing, and constructing HRSD projects. Life cycle cost accounting should include capital, operating, maintenance, rehabilitation, and decommissioning costs of the asset. FIRMs should compare asset alternatives based on Net Present Value (NPV) per anticipated years of service (NPV/anticipated years of service). HRSD strives to deliver projects sustainably. To be consistent and develop a common understanding of what sustainability means, FIRMs shall utilize the Institute for Sustainable Infrastructure (ISI) Envision checklist when evaluating and designing projects. The Envision checklist will assist the project team in identifying and engaging stakeholders, identifying project risks and opportunities, and evaluating the project from multiple perspectives. Because project adjustments can be most economically incorporated early in a project's life, the first use of the Envision checklist should occur sometime between the start of preliminary engineering and the start of project design. The primary goal of utilizing ISI Envision is to plan, design, and construct better infrastructure projects for HRSD, our ratepayers, and our local partners; not to receive accreditation or an award. In some instances, pursuing project accreditation and award may be justified. Better infrastructure projects are the result of evaluating the project from economic, social, and environmental perspectives (the triple bottom line or TBL) and evaluating project alternatives and project components based on their life cycle costs. For certain small, fast-track or

specialized projects, use of the Envision Checklist may not be required. Elimination of this requirement should be discussed and approved by the HRSD Project Manager.

III. Project Management – FIRMs are typically hired to provide both design and construction support services throughout the life of a project. HRSD has limited internal inspection staff; thus, we largely rely on the FIRMs to manage projects from start to finish. The "cradle to the grave" approach has served HRSD well over the years to assure continuity throughout the project. HRSD has the expectation that FIRMs have the capability to effectively manage the design and oversee the construction efforts. HRSD's standards provide specific expectations and information for all aspects of project management. The FIRMs are expected to provide knowledgeable and experienced staff to manage projects. FIRMs act as an extension of HRSD's Engineering Division and must use best practices when managing all aspects of projects, including technical, interpersonal, and professional responsibilities.

IV. Project Delivery Methods – As a political subdivision of the Commonwealth of Virginia, HRSD follows the requirements of the Virginia Public Procurement Act. In addition, HRSD has developed the HRSD Procurement Policy to more specifically define our efforts to meet specific procurement related matters. Engineered construction projects are typically delivered using a Design-Bid-Build method; however, HRSD has the authority to use alternative forms of project delivery if certain procedures and requirements are followed. Alternative (or Collaborative) delivery methods including Construction Management, Job Ordering Contracting, and Design-Build are evaluated on a case-by-case basis and must be approved by HRSD Commission for each project prior to starting an Alternative Delivery method.

These Design and Construction Standards were first developed when the traditional Design-Bid-Build project delivery was the recognized means of accomplishing HRSD's capital program. Although HRSD has adopted forms of alternate or collaborative project delivery, these Standards are still primarily to provide FIRMs guidance on preparation of Bid Documents for Design-Bid-Build project delivery and to provide expectations for the FIRM throughout the life of these delivered projects. Sections of these Standards may be appropriate for Design-Build (DB) project delivery and Construction Management (CM) project delivery with permission from the responsible HRSD Project Manager. FIRMs must exercise caution when using these Standards and providing or referencing these Standards for DB and CM project delivery to properly balance between prescriptive, performance, and preference elements.

V. Distribution - This document is incorporated by reference into all HRSD Professional Services Agreements for the design and construction of HRSD facilities. This document is posted on the HRSD website at www.hrsd.com.

VI. Preparation of Design Documents – HRSD employs numerous FIRMs for technical assistance in the preparation of design documents. Each of these FIRMs bring unique expertise to the design effort. These differences result in new ideas and methods for both the design and implementation of HRSD's Capital Improvement Program. Although HRSD has some specific preferences for certain aspects of the design, much of the procedures, details and technical information required for the project should be determined by the FIRM. The following information is an overview of some of the general requirements required by HRSD for the preparation of design documents.

A. General Requirements

1. Vertical construction projects (pump stations, pressure reducing stations, treatment plants, wet weather storage tanks, and administrative buildings) are to be designed in a 3-D CADD format as approved by HRSD Project Manager, which can be viewed and reviewed by HRSD staff with non-licensed viewer software packages and are compatible with BIM use. HRSD may additionally request that these 3-D models support both virtual reality (VR) and augmented reality (AR) for design reviews. The FIRM shall incorporate approved changes proposed by the Contractor during submittal reviews and Change Proposals to confirm that alternate equipment, materials, and changes from the FIRM's developed Bid Documents will not create further conflicts. The final 3-D design files are also to be delivered to HRSD in their native software format unless otherwise requested.

2. Total project cost estimates should be provided, listing design, construction, land acquisition, wetlands mitigation, and all other anticipated project costs. Costs should also include necessary contingencies, and these contingencies should be clearly defined. Along with each developed and published project or construction cost estimate by the FIRM, the ENR Construction Index of the month during which the estimate was prepared shall be documented in the footnote of the published cost estimate.

B. Study and Preliminary Engineering Report (PER)

1. Studies and PERs should clearly state the purpose, goals, and assumptions used in preparation of the document.

2. The PER should include an Executive Summary at the beginning of the document. The Executive Summary should include a brief overview of the project, recommendations, all project costs (design, construction, property acquisition, etc.), and schedule to implement

the work. The Executive Summary should be limited to approximately five (5) pages and should include a cost summary for the project in accordance with the Standards. The PER should consider alternatives for the various systems, processes, and equipment to be included in the final design. Materials of construction for the significant items of construction should also be included. A thoughtful method of comparing various alternatives is needed with specific recommendations.

3. Large amounts of data or other technical information should be included in an appendix with a summary of the information included in the text of the document.

4. Studies and PERs must be provided in an electronic PDF format for ease of use by HRSD. Paper copies may also be required, and their quantity is project-specific.

5. Specific requirements for the technical aspects of the study or PER will be included in the Professional Services Agreement.

6. PERs should be prepared in compliance with the Commonwealth's Sewage Collection and Treatment (SCAT) Regulations.

7. Depending on the type of project, HRSD has an expectation and process for incorporating architectural features and landscaping into site rehabilitation and both new and rehabilitation of vertical projects (pumping stations, pressure reducing stations, wet weather storage tanks, administration buildings, and certain treatment plant facilities). Specifics regarding these architectural guidelines and HRSD's Architectural Review Committee's role in the PER and Design phases are included in Section 2 – Architectural and Landscaping Design and Review Process.

8. Section 8 - PER, Design, and Construction Submittal Requirements details the minimum required table of contents chapters.

C. Project Manual (Contract Requirements, Technical Specifications, and Construction Drawings)

1. The FIRM should prepare the Project Manual in accordance with this document and all state and local regulatory requirements. The Project Manual should generally be organized as follows:

a. Volume 1: Construction Contract Requirements and Technical Specifications

b. Volume 2: Construction Drawings

c. Volume 3: Other documents as required

2. The documents used for regulatory approval and for construction bidding must be sealed and signed by a Professional Engineer or Architect licensed in the Commonwealth of Virginia.

3. The type of media and method used for the distribution of the Project Manual shall be agreed upon by HRSD and the FIRM prior to finalization of the design documents.

4. Specific requirements for the technical aspects of the Project Manual are described further in this document and will be included in the Professional Services Agreement.

5. Project and construction cost estimates during plan development shall be as described in Section 5 of the Standards.

VII. Common Historical Issues in the Design and Construction Phase - HRSD has routinely encountered a number of recurring issues in both the design and construction phases of projects. Some of these relate to HRSD preferences that may differ from the FIRM's or industry's normal practices. These are summarized below by design and construction phase.

A. Design Phase

1. Specification sections were included in the Bid Documents that are not applicable to the specific project.

2. Plans and specifications were not well coordinated.

3. The general intent is that existing HRSD drawings are to be reviewed, and all pertinent information from existing drawings should be included on the current project drawings so that these drawings represent the complete picture of the HRSD facility in the areas covered.

4. Suggested sequences of construction to ensure maintenance of plant operations (MOPO) and maintenance of service (MOS) for pipelines and pump stations were not prepared or carefully considered.

5. Technical specifications were not coordinated with HRSD standard front-end documents. Do not repeat in the technical specifications items that are covered in the front-end documents.

6. A consistent format (font, page numbering, paragraph numbering, etc.) was not used throughout the technical specifications.

7. Existing field conditions were not verified at the final design stage, resulting in conflicts.

8. Locations of piping and appurtenances, such as air release valves and isolation valves in busy intersections, need to be considered for maintenance and operation access.

9. Access for sampling or maintenance of equipment needs to be considered at treatment plants, pump stations, covered tanks, and other facilities.

10. Lack of consideration for how the project will negatively impact the public (noise, odors, vibration, access, etc.)

11. Easements, both temporary and permanent, and other property needs are not identified early enough in the project lifecycle, which causes the property acquisition timeline to become the critical path. Refer to Section 9 – Real Estate Acquisition and Plat Guidelines for the typical timeline.

B. Construction Phase

1. FIRMs were not carefully checking that Contractor submittals were in full compliance with the Bid Documents and HRSD Standards, and that the approved products and materials do not result in conflicts with other aspects of the physical space or other aspects of the Contract Documents.

2. FIRM not coordinating a list of submittals to be reviewed by HRSD prior to the start of construction.

3. FIRM not allowing HRSD to review all “or equal” equipment submissions by the Contractor prior to approval.

4. Field personnel (FIRM’s representative) did not have a copy of and were not familiar with the plans, specifications, and approved shop drawings/submittals.

5. Field personnel did not check materials received against approved shop drawings/submittals.

6. Field personnel used personal experience, not plans and specifications, when considering changes, answering questions, etc.

7. Field personnel relied on Locality / VDOT or other agency inspectors for contract item compliance when the Locality or VDOT was administering the construction contract that included impacts on HRSD facilities.

8. Field personnel relied on Contractor's record drawing keeping and failed to monitor progress and field changes closely. Field personnel should keep their own record of drawing information and frequently review the Contractor's record drawings.

9. FIRM failed to prepare independent cost estimates for use in verifying/negotiating changes with Contractor.

10. Field personnel were unaware of special features for the project. Design personnel should brief field personnel on special features and participate in startup to ensure compliance with the specifications.

11. Field and design personnel did not receive copies of all change documents, i.e., addenda, change orders, field orders, work change directives, etc.

12. Consideration was not given to final site restoration, including work best performed by certified landscape contractors.

13. Field personnel were not monitoring, documenting, or enforcing when the Contractor was outside of rights of way and easements that they were limited to work within.

14. Field personnel were not monitoring, documenting, or enforcing when the Contractor was violating locality maintenance of traffic restrictions.

VIII. Use of Autonomous Vehicles (AVs) – Due to potential issues with the use of prohibited airspace, privacy concerns, the changing regulatory environment, and the risk of injury and damages that could result from the use of AVs, HRSD requires that the use of AVs must comply with all relevant regulations, insurance requirements and policies. The use of AVs should be limited to circumstances when the AV provides HRSD with a financial, safety, or functionality benefit over

other reasonably available options. When the use of the AV involves a Consultant, Contractor, or other individual, written permission from the HRSD Chief Engineer and the HRSD General Manager will be required. The request submitted must clearly state the need and benefit afforded by using the AV, the name of the individual controlling the AV, and insurance coverages. The request should include the Remote Pilot Certification number of the responsible individuals controlling the UAS (Unmanned Aircraft Systems) and should note that they will fully meet all federal, state, and local regulations relating to the use of AVs.

End of Section

Section 2 – Architectural and Landscaping Design and Review Process

I. Introduction – This section provides information and guidelines for architectural and aesthetic features to be incorporated into highly visible HRSD projects in the communities. There is a need for a high level of review and buy-in at early stages of concept development for all vertical structures that HRSD will construct in the communities that we serve. HRSD's Architectural Review Committee (ARC) will provide direction to the project team and FIRM (design engineers and architects) at the earliest possible stage to help ensure our designers, architects, and staff verify the proper land requirements and secure stakeholder buy-in for both form and function of these facilities, such that these facilities can be efficiently brought to completion. Attached to this section are guidelines, forms, and templates to assist the FIRM and project team with incorporating architectural and landscaping concepts.

A. HRSD Architectural Review Committee (ARC) - The following steps are to be followed for vertical construction projects:

1. FIRM to research the current zoning and building styles (e.g., residential, public, business) in the surrounding neighborhoods or areas within the proposed construction site. This research should influence the design of the structure in a way that will allow it to blend in with the surrounding community.

2. FIRM to review the current HRSD Pump Station Architectural Guidelines (Attachment A) and Aesthetics Considerations Log (Attachment B) to this section for best fit and desired styles/considerations to blend into the surrounding areas where the facility is to be constructed or renovated.

3. FIRM to provide varying conceptual architectural renderings (minimum of three for new construction and two for beautification initiatives) along with associated Opinion of Probable Construction Costs (OPCC) at AACE Class 4 estimate, as defined in Section 5 - Capital Project Cost, Schedule and Risk Reporting, for each option at the draft Preliminary Engineering Report (PER) stage for the ARC's review. These architectural renderings shall be at a level of development to envision how the structure would blend into the surrounding area, what the facility would look like from all sides, and include all known above-ground external appurtenances, including but not limited to fixtures, yard piping, generators, bypass pumps, odor control system, emergency connections, and panels.

4. FIRM to provide conceptual landscape design appropriate to the style of the new or renovated structure for blending with the surrounding community. HRSD's preference is to use evergreen, low-maintenance, and native to the area (Hampton Roads)

vegetation whenever possible, if compatible with the locality's landscaping requirements. The FIRM will research the area of planting (e.g., soil type, flood zone type, dry soils) for proper selection and successful planting/growth. Once the landscaping design is approved, the FIRM shall also provide a Landscaping Planting Plan. An example is provided in Attachment E to this section.

5. FIRM to provide conceptual fencing design appropriate to the style of the new or renovated structure or blending with the surrounding community. HRSD's preference is not to utilize hardscape fencing on a property if landscaping can be utilized to the same effect. Fencing may be used if deemed necessary for the safety of the general or motoring public or HRSD's infrastructure. If hardscape fencing has been deemed mandatory, HRSD's preference is not to use privacy or panel fencing.

6. HRSD Project Manager will coordinate with their Director to receive early feedback and concurrence on the architectural and landscaping concepts to be presented to the ARC.
7. HRSD Project Manager will submit the architectural/ landscaping/ fencing rendering options to the HRSD ARC for comment and direction. This committee is generally comprised of the following HRSD members: General Manager, Deputy General Manager, Chief of Communications, and the division Director for whom the facility is being constructed.
8. The HRSD Project Manager will schedule a meeting with the ARC within approximately two weeks of the submittal of the renderings to discuss their comments and guidance for moving forward. Title the appointment/meeting: Architectural Review Committee Meeting – PROJECT or INITIATIVE NAME.

    a. During this meeting, the HRSD Project Manager should provide:

        (1) A brief and high-level review of the project including why this initiative is needed, how old the existing infrastructure is or the reason for the new structure, current budget for this CIP/Beautification Initiative, where we are in the process to-date, as well as any external architectural steps taken to this point such as meetings with the city/county to obtain requirements).

        (2) Provide a 'live' Google Earth street view 'walk through' of the surrounding area and buildings - allowing the ARC to view the existing structures in the community for comparison.

(3) Provide the preliminary design rendering options developed by the architectural/design firm for the HRSD ARC to consider as described above. The ARC will determine if these renderings align with their desired vision and will provide further guidance.

b. The FIRM (and/or the Architect) may be allowed to attend a portion of this meeting to hear direct comments from the ARC, after ARC internal discussion.

c. HRSD Project Manager to inquire if the ARC believes there is a need for a full meeting to discuss this project or if the ARC can submit their comments via an email discussion. The ARC has opted for this email response method for past beautification initiatives or cases where the ARC is satisfied with the originally presented and discussed concept.

d. If a response is required by a specific date, please note that date for the ARC.

9. The FIRM shall modify the renderings according to the direction given by the ARC and prepare a sample board of color and material selections (if desired by the ARC) and resubmit to the ARC for final concurrence within two weeks of the first meeting with the ARC.

10. The accepted architectural concept by the ARC will be incorporated into the final PER by the FIRM.

11. The FIRM shall base its scope of services and fee proposal for the design phase upon the final PER recommendations.

12. Depending on the locality's review and approval process regarding architectural style and landscaping, the FIRM will need to accommodate the additional submittals and reviews by governing bodies within their proposed completion schedule.

13. FIRM shall submit additions to the Aesthetics Considerations Log to the Project Manager using the template provided in Attachment B.

14. HRSD Project Manager shall ensure the approved safety and address signage are ordered and installed on the structure, as directed by the ARC.

II. Attachments – the following information is provided for guidance:

1. Attachment A - HRSD Facilities Architectural Guidelines.

2. Attachment B - Aesthetics Consideration Log

3. Attachment C - Address Sign Specification
4. Attachment D - Safety Sign Specification for Buildings
5. Attachment E - Landscaping Planting Plan Sample

End of Section

Section 3 - Use of Technical Memorandum for CIP Projects

I. Introduction - HRSD and FIRMs have used technical memorandums to summarize design criteria and equipment recommendations on many of our past projects. A technical memorandum is typically more limited in scope than a Preliminary Engineering Report (PER). It is generally used to document project decisions rather than review numerous aspects of a conceptual design.

II. Circumstances for Use - A technical memorandum can be used instead of a PER in the following circumstances:

A. When the project is of a relatively small size (<$500K).

B. When the project involves a relocation of an existing HRSD pipeline as part of a VDOT or locality-administered project that impacts HRSD's facilities.

C. When an immediate decision is required due to a documented time constraint by HRSD.

D. When a series of technical memoranda will be used and ultimately grouped in a PER.

E. When the project has already gone through some level of conceptual design via one of the on-call Engineering contracts before the initial appropriation.

III. Approval for Use - The use of a technical memorandum instead of a PER shall only be used with approval by the responsible Director of Design and Construction.

End of Section

Section 4 – Monthly Project Status Reporting

I. Introduction - FIRMs who are contracted for project design and construction-related services are required to generate and submit a project status report along with their monthly payment request for services rendered, in addition to other required forms. This Section contains specific guidelines for FIRMs to follow related to the content and format of these project invoices and status reports.

II. Content and Format for Engineering Services Invoice

A. The template in Attachment A shall be used by each FIRM for any capital or non-capital project to document authorized, billed to date, and the total amount invoiced for each 30-day billing period and submitted as part of each monthly invoice.

III. Content and Format for Project Status Report

A. The template in Attachment B shall be used by each FIRM for any capital and/or non-capital funded project unless otherwise agreed to by the HRSD Project Manager in writing as part of the Record of Negotiation.

B. The Project Status Report shall be updated monthly and submitted along with the payment request. Accurate and up-to-date project status reports are necessary so that HRSD Project Managers can update their project status in the Enterprise Project Management (Unifier) system. This information is especially important as projects enter the construction phase for construction website updates viewed by the public, the HRSD Communications Division, and other stakeholders.

1. For Capital Projects – submit with pay application via Unifier.

2. For non-Capital Projects – submit with pay application via HRSD's Enterprise Resource Planning (ERP) system.

IV. Content and Format for Project Expenditure Tracking

A. The example graph in Attachment C shall be generated by each FIRM for any capital and/or non-capital funded project unless otherwise agreed to by the HRSD Project Manager in writing as part of the Record of Negotiation. For each assigned phase of a project, the graph will reflect the following:

1. Originally forecast project spending based upon the negotiated services fee for the duration of the phase of the project.

2. Actual expenditures by the FIRM, tracked monthly.

3. Adjustment of fee and scope of services via an approved amendment to the negotiated services for the active phase of work.

V. Content and Format for Diversity Procurement Statement

B. For Capital Projects - The involvement of small, women-owned, and minority-owned (SWaM) businesses, service-disabled veteran-owned business (SDVOB), or disadvantaged business enterprises (DBE) is to be provided on the diversity data tab in Unifier while creating a payment request

A. For non-Capital Projects - The template in Attachment D shall be used by each FIRM, unless otherwise agreed to by the HRSD Project Manager in writing as part of the Record of Negotiation, to indicate the involvement of small, women-owned, and minority-owned (SWaM) businesses, service-disabled veteran-owned business (SDVOB), or disadvantaged business enterprises (DBE).

VI. Attachments:

A. Invoice Template

B. HRSD Firm Progress Report Template

C. Example Design Phase Expenditure Graph

D. Diversity Procurement Statement Template (for use on non-capital project invoices)

End of Section

Section 5 - Capital Project Cost, Schedule, and Risk Reporting

I. Introduction - Project cost, schedule, and other risk factors must be carefully considered while delivering CIP projects. Without a careful understanding of these factors, poor decisions related to project value can result. A thoughtful process is required to manage each factor from project inception through project closeout. HRSD has adopted the Association for the Advancement of Cost Engineering (AACE) construction cost estimate classification philosophy for the various stages of study and plan development, with a few modifications to meet the needs of HRSD. HRSD expects that each FIRM will provide the effort necessary to provide cost information to the level of accuracy defined below. The following classifications are to be used at these described milestones for reporting to HRSD the Opinion of Probable Construction Costs (OPCC) along with the upper and lower range of the class estimate, unless otherwise approved by the responsible HRSD Project Manager.

- Class 10: Future Need/Order of Magnitude Risk
- Class 5: Up to 2% project definition (Initial Budget Development stage) with expected accuracy range of -20% to +100% above calculated cost.
- Class 4: Project definition 1 to 15% (Study or PER stage) with an expected accuracy range of -15% to +50% above calculated cost.
- Class 3: Project definition 10 to 40% (Preliminary Design stage) with expected accuracy range of -10% to +30% above calculated cost.
- Class 2: Project definition 30 to 75% (Pre-Final Design stage) with expected accuracy range of -5% to +20% above calculated cost.
- Class 1: Project definition 65 to 100% (Bid Advertisement or Preconstruction stage) with expected accuracy range of -3% to +15% above calculated cost.

A letter from the FIRM, signed by the FIRM's principal in charge, shall be included with all OPCCs and shall document conformance with all of the requirements herein.

Construction cost estimates will carefully consider:

- The project scope, complexity, and risks
- Input from the local contracting community
- Input from significant suppliers/vendors
- Local market conditions
- Similar, recent project costs, including a review of HRSD’s construction cost database

Construction cost estimates will include the following specific items (at a minimum):

- Materials
- Labor
- General conditions
- Owner-furnished items

- Bonds/Insurance
- Profit
- Contingencies
- Market adjustment factors

All OPCCs with a total value of >$50M shall also include a secondary estimate from an independent team not directly involved in the project. Prior to the use of the independent team, the FIRM shall review, for approval, the qualifications of this team, the timing of their involvement during the project lifecycle, and their scope of work with the HRSD Project Manager.

This Section identifies tracking total project costs, OPCC, schedule, and risks to cost/schedule against the CIP baseline during each project's life. HRSD desires to learn what is happening on individual projects and, if possible, have an opportunity to make changes to compress the budget or schedule at earlier stages. Cost estimates should include design, construction, land acquisition, and all other project-related costs.

II. FIRM's Responsibilities - The FIRM shall provide the following reports to HRSD's Project Manager as indicated below for each project.

A. An example **Project Budget and Schedule Estimate, and OPCC classification report** is included as Attachment A. This table is to be modified and updated so that all information throughout the project's life will be contained in a single document. The document will be in a format approved by the HRSD Project Manager and will accompany the monthly payment reimbursement request unless otherwise approved by the HRSD Project Manager.

B. An example **Project Risk Table** is included as Attachment B. The document will be in a format approved by the HRSD Project Manager and will accompany the monthly payment reimbursement request unless otherwise approved by the HRSD Project Manager. HRSD expects FIRM to submit the risk management framework for the project being planned, designed, or constructed to the HRSD Project Manager at the beginning of the project and to continue updating it during the project life cycle. The risk management framework, including a clear description of consequence types, likelihood ranges, risk tolerance, and risk treatment approach, is expected as a submittal throughout the project life cycle.

C. A **template schedule primarily used for internal stakeholder coordination** is included in Attachment C for PER, Design, Preconstruction, and Construction phases, showing example key involvement milestones and dates for HRSD personnel (other than the HRSD Project Manager). Examples of HRSD personnel include Real Estate Manager(s) for property matters; Engineering Compliance Manager for review of preconstruction assessment and damage mitigation plan;

Electrical and Instrumentation staff involved with submittal reviews during PER/Design and various field verifications during construction and start-ups; and Operations staff for maintenance of plant/piping/pumping operations and verifications and activities associated with construction Substantial Completion and Final Completion milestones.

Each prepared and updated project phase schedule will include dates that require HRSD personnel involvement, such that HRSD can plan when various staff will need to be available.

The appropriate project stage schedule table for each CIP project is to be created, updated, and to accompany the monthly payment reimbursement request. At a minimum, the dates from the most recently published CIP (https://www.hrsd.com/cip) will be incorporated by the FIRM into the schedule, so that the entire expected duration of the project can be captured. As the project progresses from PER through Construction, additional or more accurate dates for each phase shall be included by the FIRM. The project schedule will be in Excel format.

D. An **Excel template for estimating total Project Budget** is included in Attachment D. This template is to be used and submitted at each project phase milestone, either as a stand-alone table or included in a Study, PER, or similar report as directed by the HRSD Project Manager. The FIRM shall provide an updated budget form to the HRSD Project Manager for each active CIP project no later than the first week of January of each calendar year to assist HRSD in the annual CIP update cycle.

III. Attachments:

A. Project Budget and Schedule Estimate Report and OPCC Classification

B. Project Risk Table

C. Schedule Data Template

D. Project Budget Estimating Template

End of Section

Section 6 - Drawings, Record Drawings, and Valve Guides

I. Introduction – HRSD has in excess of 40,000 Record Drawings in an electronic form, which are archived in a records management system. Many older drawings are in scanned (raster) format. Most of the recent drawings and all valve guides are in AutoCAD format. Some drawings are hybrid, containing both CAD and images. HRSD accepts Record Drawings only in AutoCAD format unless otherwise approved by the HRSD GIS Manager. Record Drawings must be provided in full-scale paper copy, Adobe Acrobat (PDF), and AutoCAD format up to the latest release used by HRSD at the time Record Drawings are received. The latest release is provided in each Request For Proposal (RFP). To provide some uniformity and to assist HRSD with its records management system, certain criteria have been established as described in the Section. The FIRM must submit an electronic copy of the conformed plans in PDF to HRSD at the time of the pre-construction meeting. This will allow HRSD to enter the plans into the records management system, verify compliance with HRSD standards, and print copies for internal use during the construction phase of the project. HRSD has not adopted a mandatory layering system for contract drawings. However, the FIRM must submit a listing of the proposed layering system to HRSD for review prior to beginning drawing preparation. Layers containing new or improved HRSD infrastructure must only contain such infrastructure and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD_ for layers representing new or improved HRSD infrastructure). Due to the frequent need to modify valve guides, the layering system listed in the Valve Guide section below must be used in the preparation of valve guides. The FIRM must submit an electronic copy of the final record drawings in .DWG and .PDF at the final project completion stage. Once Record Drawings are received, approved, and inputted, the advertised set will be deleted from the records management system.

II. Drawings

A. Size - Use 24-inch x 36-inch sheets. Prefer to limit actual area used to 22 inches x 34 inches to allow for true scale half-size printing on an 11-inch x 17-inch page.

B. Scale - Use a scale for the plan view of gravity sewers and force mains, one-inch equals 20 feet for urban areas and one-inch equals 40 feet for rural areas, or as appropriate. Indicate vertical scale on each profile view.

1. Pipelines

a. 1 inch = 40 feet in rural or low-development areas

b. 1 inch = 20 feet in urban or high development areas

c. Use small scale for details

2. Pump Stations and Treatment Plants – Site plans shall be at one inch = 20 feet

3. Fonts - Use a minimum letter size of one-tenth (1/10) inch to allow for good resolution when viewing drawings and for drawing use at half-size.

4. Units - Drawings shall be prepared using English units (non-metric).

C. Title Block

1. Locate across the bottom or right-hand margin with the sheet number in the extreme lower right-hand corner.

2. Information – Include:

a. Project title

b. Drawing title

c. Sheet number

d. FIRM's name

e. Scale and graphical scale reference for one inch

f. Revision block

D. Required Sheets - Provide required sheets in the order listed as follows:

1. Cover Sheet – Refer to Standard Details section in this manual.

2. Location and Vicinity Map Sheet – Include datum and coordinate system used for design.

3. Drawing Index Sheet – Index may be placed on cover or location sheet if the project includes fewer than 20 drawings. The Index Sheet must include the drawing number (ex: C-1), sheet number (a consecutive numbering scheme beginning with 1), and a drawing description (ex: “Yard Piping – Demolition Plan”).

4. Hydraulic Profile – For treatment plant projects, plot the hydraulic grade line for each condition considered during design.

5. Legend Sheet – Include all abbreviations and symbols used for design. Refer to Section 29 Treatment Plant in this manual for required plant process abbreviations.

6. Schedule Sheets – Compile equipment schedules, door schedules, hardware schedules, cable and conduit schedules, panel board schedules etc., and place schedule sheets at front of respective sections of work.

7. Electrical point-to-point diagrams – refer to Section 33 Electrical and Instrumentation in this manual.

8. Detail Sheets – Compile civil details, electrical details, mechanical details, structural details, etc., and place detail sheets at end of respective sections of work.

E. Electronic Drawing Format

1. All design drawings shall be prepared in an electronic format using AutoCAD (.DWG) format. The .DWG file must capture the proposed HRSD infrastructure at its true State Plane Coordinates (as specified herein). Horizontal datum, including the realization (also known as the adjustment) used, should be referenced on the cover sheet. (e.g. NAD83(CORS96)). The software release number is identified in the Request for Proposals (RFP). The FIRM shall review with HRSD any proposed deviation in the version of AutoCAD to be used and any other third-party or proprietary software programs that will be used to prepare the design drawings. HRSD reserves the right to reject any variation in the version of AutoCAD to be used, non-standard AutoCAD format, or specialty software program proposed by the FIRM.

   Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

2. HRSD does not require the use of a standard layering scheme for the preparation of electronic Record Drawings. The FIRM shall provide a file listing each layer name, description, and color (pen weight) with each electronic file provided. Layers containing new or improved HRSD infrastructure must only contain such infrastructure and must be clearly identified in the layer listing (the FIRM is encouraged to use a prefix of HRSD_ for layers representing new or improved HRSD infrastructure). Line widths shall be designated by layer and not by color. Provide the associated .CTB file with each project/drawing.

   Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

3. The use of x-referencing when preparing electronic drawings is acceptable. Prior to the submission of any electronic drawing to HRSD, each x-referenced dwg file associated with a drawing shall be bound to that file. Referenced images (TIFF, JPEG, etc.) within the electronic drawing must also be embedded. Unbound electronic drawings will be returned to the FIRM for revision. The final delivered bound AutoCAD files must be of a manageable size for use in Adept (files should not exceed 20MB). Also refer to section C.1.j. for clarification regarding the file size for individual sheets.

4. The use of stick-on maps, diagrams, or sketches shall not be allowed. All information shown on the paper copy drawing should correspond to the electronic file provided as part of the Record Drawing submission.

5. The FIRM shall provide to HRSD all font files used within the electronic drawings. The use of non-standard AutoCAD fonts is strongly discouraged.

6. For pipeline projects, at the conformed stage, the FIRM shall provide to HRSD a single AutoCAD file (.DWG) containing the proposed HRSD infrastructure (also referred to as a “seamless file”); the .DWG file must capture the proposed HRSD infrastructure at its true State Plane Coordinates (as specified herein). Proposed Valve Guide locations should also be shown in this single AutoCAD file; the proposed Valve Guide locations should be represented as squares/rectangles in their true coordinate location, estimating the extent of the areas to be represented by the Valve Guide. This AutoCAD file will serve as an early coordination tool to determine eventual line number(s) and Valve Guide number(s).

F. Drawing and Electronic File Naming

1. Each drawing shall be provided with both a sheet number and a drawing number. A sheet number is a consecutive numbering scheme beginning with 1. A drawing number is an alphanumeric numbering scheme beginning with the discipline designation and a consecutive number (i.e., C-1, M-12, S-93, etc.)

2. Each electronic drawing file shall be named as follows:

   a. Index sheet – Index.dwg

   b. All other sheets – SHEETNUMBER.dwg (i.e., Sheet 05 of 35.dwg)

3. In the case of Adept ‘hybrid’ drawings, each referenced file shall be named in correspondence to the drawing within which it is

referenced. (i.e., a referenced image file would be named “Sheet 05 of 35 A.tiff” if it is x-referenced in Sheet 05 of 35.dwg)

G. Miscellaneous

1. Labels and Symbols

a. Identify and label all existing facilities and underground utilities.

b. Use standard symbols and terminology consistently throughout drawings.

c. Shading, stippling, or cross-hatching is acceptable only if drawing clarity on half-size prints is approved by HRSD. The use of solid fills for shading is not sufficient.

2. Drawing Orientation

a. North arrow orientation should be up or to the right on each drawing.

b. Pipeline stationing should be left to right on each drawing.

3. Piping and Hydraulic Structures

a. Indicate pipe sizes and materials at transitions between different pipe sizes and materials.

b. Indicate elevations and grades of gravity sewers including pipe inverts at manholes, manhole rims, and other key points along the gravity sewer.

c. Indicate elevations of force mains including pipe inverts at changes in grade and other key points along the force main.

d. Indicate elevations of hydraulic structures including floor elevations and water surface elevations.

e. Prepare line diagrams for process systems and isometric schematics for complicated piping systems.

f. For pipeline projects tying into existing pipelines, such as repairs or relocations, the connecting point between the new and existing pipelines must reference the stationing from the original drawings.

g. Indicate pipeline stationing based on the pipeline centerline. Stations should be indicated on both the plan and profile views.

h. For pipeline projects, a profile and related data should be shown on the bottom half of the plan sheet, indicating the pipeline stationing on accented vertical grid lines. The profile should be shown at true pipeline centerline length and projected above to the plan view in as close a relationship as possible.

i. For pipeline projects, the drawings shall show the anticipated pipe trench width on the ground surface based upon the construction and installation of new and/or rehabilitated pipelines.

4. Electrical – FIRM to confirm that these requirements are included in the Bid Documents for Contractors.

a. Process and Instrumentation Diagrams (P&IDs) – The FIRM shall prepare the P&IDs.

b. Loop Drawings – The Contractor shall be required to provide loop drawings.

c. Conduit and Cable Schedules – The FIRM shall provide on the drawings or in the specifications. Contractor shall provide as-built conduit and cable schedules.

d. Point to Point Drawings – Contractor to provide.

5. Underground Utilities – FIRM to indicate the location of all underground utilities installed or encountered during the project.

6. The record drawings must indicate the location of any non-sewer utilities installed, relocated, or encountered while installing the HRSD facilities.

H. Horizontal and Vertical Controls

a. For all outfalls provide the following:

(1) Longitude and latitude for the beginning and end of the diffuser.

(2) Longitude and latitude for the point where the outfall enters the body of water.

(3) Longitude and latitude at all pipe deflections.

(4) Distance in feet from the end of the diffuser to the shoreline.

b. Provide layout information tied to the Virginia State Plane coordinate system. For pipeline projects, a minimum of two Virginia State Plane coordinates should be indicated on the drawing. Horizontal datum including the realization (also known as the adjustment) used should be referenced on the cover sheet. (e.g. NAD83(CORS96)).

(1) Indicate location of benchmarks and use elevations based on the NAVD88 vertical datum, unless otherwise approved. Vertical datum reference should be indicated on each profile view.

(2) Provide Virginia State Plane horizontal coordinates and NAVD88 elevations for all appurtenances such as valve boxes, air vents, manholes, pipeline bends, and other critical items.

I. Drawing Designations – The following drawing designations shall be used:

1. General

2. Index

3. Civil

4. Structural

5. Architectural

6. Electrical

7. I & C

8. Mechanical

9. HVAC – Plumbing

III. <u>Record Drawings</u>

A. General

1. Indicate revised dimensions, annotations, coordinates, and elevations as specified in this section. Only dimensions, coordinates, and elevations depicting as-built conditions to appear on the final

Record Drawings. Record Drawings are not to contain “mark-ups”, text strikethrough, etc. (only final as-built conditions).

2. Indicate added and/or revised construction details. Only the final version of construction details is to be included in the Record Drawings.

3. Indicate location of easements and label to include each acquisition’s recorded instrument number.

4. Remove wording and annotations on drawings that do not relate to the as-built conditions (such as "Proposed") as appropriate.

5. Revise all drawings to reflect as built conditions of all equipment or other schedules.

6. Label drawings as "Record Drawings" and indicate last revision date.

7. Prepare and submit a full-scale set of black line drawings.

8. Submit CAD drawing files (including the listing of all layer names as specified herein, and font files) compatible with AutoCAD Release (as specified in the RFP) software. Later editions cannot be accepted without prior written agreement from HRSD.

9. Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

10. Submit PDF format file copies of the CAD drawing files.

11. An engineer’s seal is not required on the Record Drawings.

12. A single drawing file shall be provided for each sheet of the Record Drawings. Delete all extraneous parts of the project from the drawing file except what pertains to the immediate sheet. This reduces the file size and works better in HRSD’s records management system. No individual file should exceed 20MB.

13. Exceptions to this requirement will be considered for projects where 3D modeling has been approved in accordance with Section 7 – “HRSD Building Information Model (BIM) Requirements”.

B. Construction Information

1. List Contractor name, address, telephone number and point of contact on the cover sheet.

2. For pipeline projects list suppliers and model numbers/designations of all major items of construction.

IV. Bid Documents

A. Provide final Bid Documents with all incorporated addenda in a PDF format file for incorporation into Adept Software.

V. Valve Guides

A. Introduction

1. HRSD uses Valve Guides to locate critical facilities in the interceptor system. The goal of each Valve Guide is to provide a location diagram and valve information for operations, maintenance and emergency shutdowns.

2. Valve Guides are prepared for valves, air vents, leak detectors, meter installations, cathodic protection test stations, and other corrosion control equipment. Manholes used in sanitary sewer systems do not require the preparation of a Valve Guide.

3. Valve Guides are prepared in an electronic drawing format for records management and internal use by HRSD.

B. Specific Instructions

1. Valve Guides shall be prepared at 8.5-inch x 11-inch size drawings with the drawing limits set to 8.5-inch x 11-inch (See Attachment A in this section for examples). All elements are to be drawn in model space. A Valve Guide Template file, including the appropriate paper space layout, is to be provided by HRSD.

2. Pipeline size and material to be annotated. Abandoned pipelines/valves/etc. that remain in place to be indicated as abandoned.

3. Provide only enough information to locate the valve(s) and/or air vent(s). Additional information should not be provided.

4. Provide a minimum of two (2) and preferably three (3) tie-down dimensions, from the valve or air vent to an adjacent, permanent fixture.

5. Valve Guides are identified using a sequential numbering system. The FIRM must coordinate with HRSD's GIS Section to determine the interim and final Valve Guide numbers. Each valve, air vent, etc., is also numbered using a sequential numbering system within each

Valve Guide. In cases where an existing Valve Guide is being updated, the FIRM must coordinate with HRSD to determine the interim and final valve numbers.

6. Valve Guide drawings shall be prepared in an AutoCAD (.DWG) format (release as referenced in the RFP). Any associated files (font, compression, etc.) should be included with the drawings.

7. A single drawing file shall be provided with each individual Valve Guide.

C. CAD Standards

1. 0 Layer - Information appearing on the 0 layer shall conform to the following established standards:

   a. Layer Color - White (No. 7)

   b. Valve Guide Drawing Sheet/Information Block

   c. North Arrow (North Arrow HRSD Standard)

   d. Pen Width = 0.012 inches

2. Text Layer - Information appearing on the Text Layer shall conform to the following established standards:

   a. Layer Color - Cyan (No. 4)

   b. Valve Guide Information

      (1) VG Number

      - Height - .20
      - Font - Romant

      (2) Location (General area of valve)

      - Height - .10
      - Font - Romand

      (3) Drawing (Line no., contract title and sheet no.)

      - Height - .10
      - Font - Romand

(4) Line Number Symbol (Place in or near Drawing Title)

c. General

(1) Dimensions are considered to be text and shall be drawn on the text layer.

(2) Text font and height for valve information (Valve No., Size, Turns, etc.) is established in information block and operator shall be prompted for insertion of data.

(3) Street Names

- Height - .20
- Font - Romand

(4) Stations Number (0+00)

- Height - Minimum .08
- Font - Romand

(5) Notes

- Height - Minimum .08
- Font - Romand

(6) Distance Table (If required on VG)

- Height - Minimum .08
- Font - Simplex

(7) Dimension Text

- Height - Minimum .08
- Font - Simplex
- Location - (Place dimension text on top if space allows; otherwise use a break.)

3. Topo Layer - Information appearing on the Topo Layer shall conform to the following established standards:

a. Layer Color - Dark Gray (No. 8)

b. General – Information drawn on the Topo Layer shall include the following:

(1) Power Poles (Include identifying numbers)

(2) Fire Hydrants

(3) Other utilities only if they are relevant to the location of the valve or air vents, such as gravity manholes when used as a measurement marker.

(4) Pavement limits, edge of pavement symbols, sidewalks, residences when such use will assist in location, trees and shrubbery, fences, HRSD easements, property lines if at PS locations, cross streets, dirt roads, and other pertinent data which will aid the locating of valve or air vent. A minimum number of symbols should be used where trees or shrubbery lines exist.

(5) Text

- Height - Minimum .08
- Font - Simplex

(6) Line Types

- Continuous - Pavement limits, sidewalks, cross street roadway limits, building limits.
- Hidden 2 - Dirt Roads
- Phantom - Property and Easements
- -··· - ··· - Ditch
- -x - x - Fences

c. Pen Width = 0.002 inches

4. FM Layer - Information appearing on the FM Layer shall conform to the following established standards:

a. Layer Color – Green (No. 3)

b. General – Information drawn on the FM Layer shall include the following.

(1) HRSD force mains, HRSD gravity mains, air vents, valves, other force mains which connect directly to valved outlets or tapping saddles, valve vaults, pipe encasements, leak detectors, cathodic protection symbols, locator boxes and check valves.

(2) Line type

- HRSD FM - Continuous Polyline
- Other FM and Gravity Mains - Dashed 2

(3) Line width

- HRSD FM - .047" (for largest diameter on VG sheet. Vary width where FM reduces in size.)
- Others - Size smaller than HRSD according to the difference in diameter.

(4) Symbols - Standard HRSD symbols for valves, air vents, leak detectors, line stops, test stations, etc. Size valves relevant to the diameter of the force main.

c. Pen Width = 0.016 inches

5. Detail Layer - Information appearing on the Detail Layer will conform to the following established standards:

a. Layer Color - White (No. 7)

b. General

(1) Information drawn on the Detail Layer should include:

- If required, a more detailed drawing of the connection to the HRSD force main showing fittings, changes in elevation, and any special related conditions.
- Text related to the detail shall be drawn on the detail layer. Text shall be a minimum of .08".

(2) Line Types as indicated in the above CAD Standards.

(3) Font - Romand (Use Simplex if contrast in style is necessary.)

c. Pen Width = 0.012 inches

D. Abbreviation, Fonts and Standard Symbols

1. Abbreviations - The following list of abbreviations are required for use on all HRSD Valve Guides.

Item Description	Abbreviation
Air Vent	AV
Asbestos Cement Pipe	AC
Bulkhead	Bhd
Building	Bldg
Boulevard	Blvd
Bypass	BP
Cast Iron	CI
Cast Iron Mechanical Joint	CIMJ
Cable Antenna Television	CATV
Cathodic Protection	CP
Chemical	Chem
Center	Ctr
Clockwise	CW
Concrete	Conc
Concrete Pipe	CP
Corner	Cor
Corporation	Corp
Counterclockwise	CCW
Department	Dept
Department of Public Works	DPW
Diameter	Diam
Drive	Dr
Ductile Iron	DI
Ductile Iron Mechanical Joint	DIMJ
Fire Hydrant	FH
Elevation	Elev
Electric	Elec
Flanged	Flg
Force Main	FM

Item Description	Abbreviation
Interceptor Force Main	IFM
Foot	Ft
Gallon	Gal
Government	Govt
Gate Valve	GV
Gravity	Grav
Height	Hgt
High Density Polyethylene Pipe	HPDE
Highway	Hwy
High School	HS
Horizontal	Horz
Horizontal Gate Valve	HGV
Inch	In
Invert	Inv
Leak Detector	LD
Light Pole	LP
Limit	Lim
Linestop	LS
Maximum	Max
Mechanical	Mech
Mechanical Joint	MJ
Mile	Mi
Minimum	Min
Outside Diameter	O.D.
Overhead Electric	OHE
Plug Valve	PV
Polyvinyl Chloride	PVC
Power	Pwr
Power Pole	PP
Private	Priv
Property	Prop
Reinforced Concrete	RC

Item Description	Abbreviation
Reinforced Concrete Cylinder Pipe	RCCP
Restrained Joint	RJ
River	Riv
Residence	Res
Right Of Way	ROW
Railway	Rwy
Railroad	RR
School	Sch
Sheet	Sht
Station	Sta
Steel Pipe	SP
Test Station	TS
Tracer Locator Box	TLB
Tracer Wire Box	TWB
Welded Steel Pipe	WSP
Surface	Sur
Valve Guide	VG
Vertical	Vert
Vertical Gate Valve	VGV
Underground	U/G
Underground Electrical	UGE
Without	W/O

2. Fonts – In accordance with the CAD Standards and included in the template file.

VI. Standard Symbols – Included in the template file.

A. VALVE GUIDE FORMAT AND EXAMPLES

1. Valve Guide Example – AT-1019

2. Valve Guide Example – NA-4001

3. Valve Guide Example – W-5510

End of Section

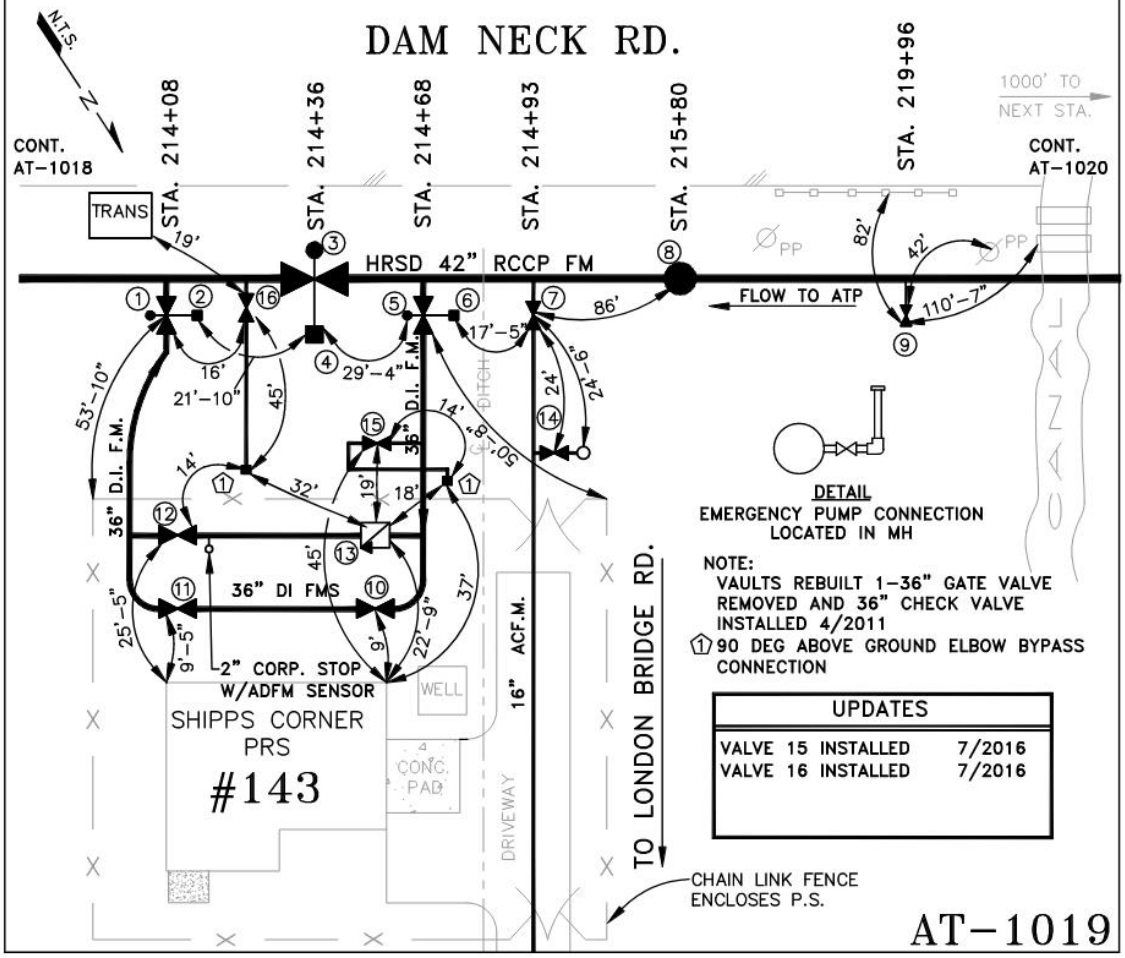
HAMPTON ROADS SANITATION DISTRICT
INTERCEPTOR SYSTEMS DEPARTMENT
VALVE GUIDE

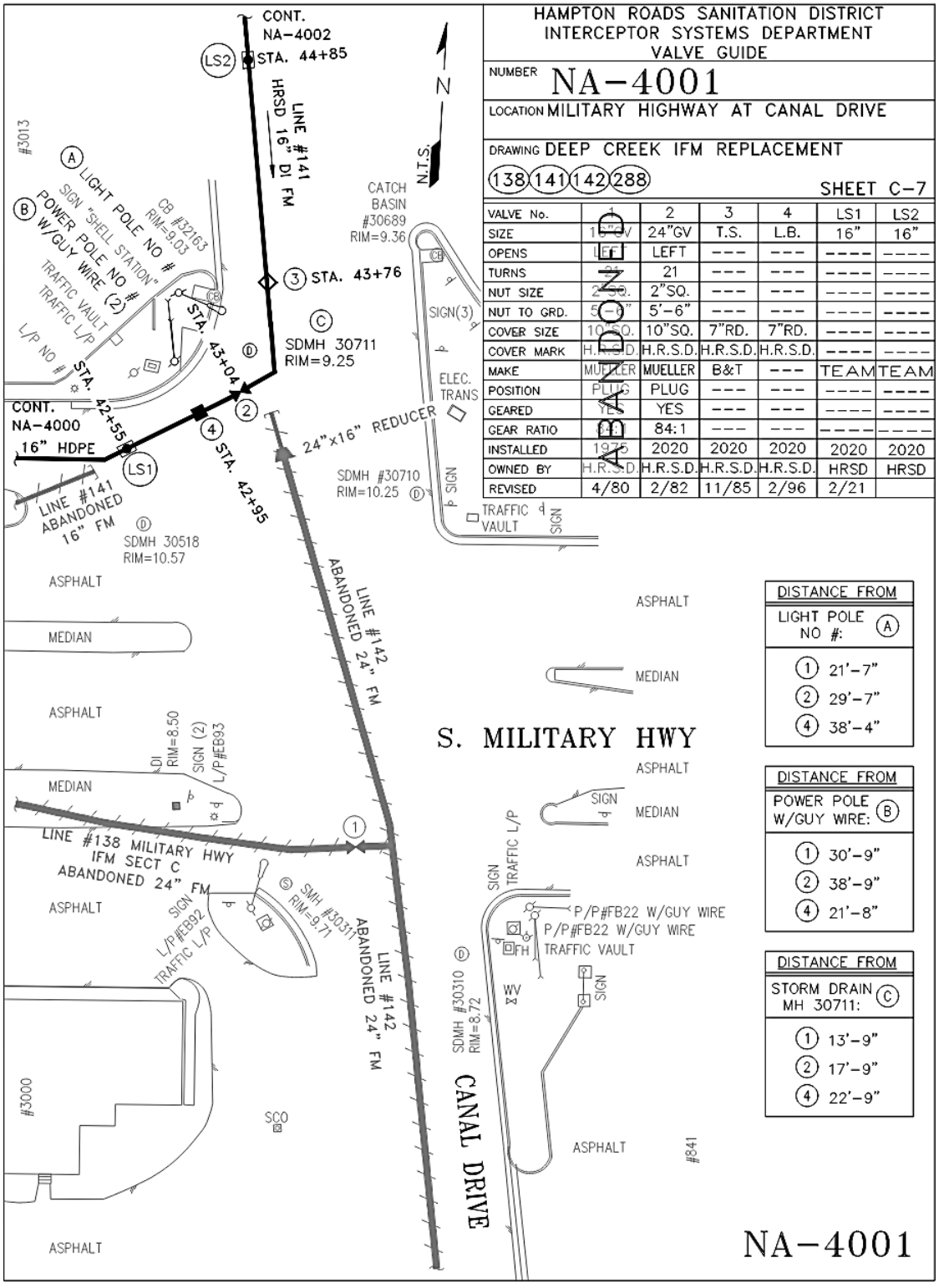
NUMBER **AT−1019**

LOCATION SHIPPS CORNER PRS 143 (171)

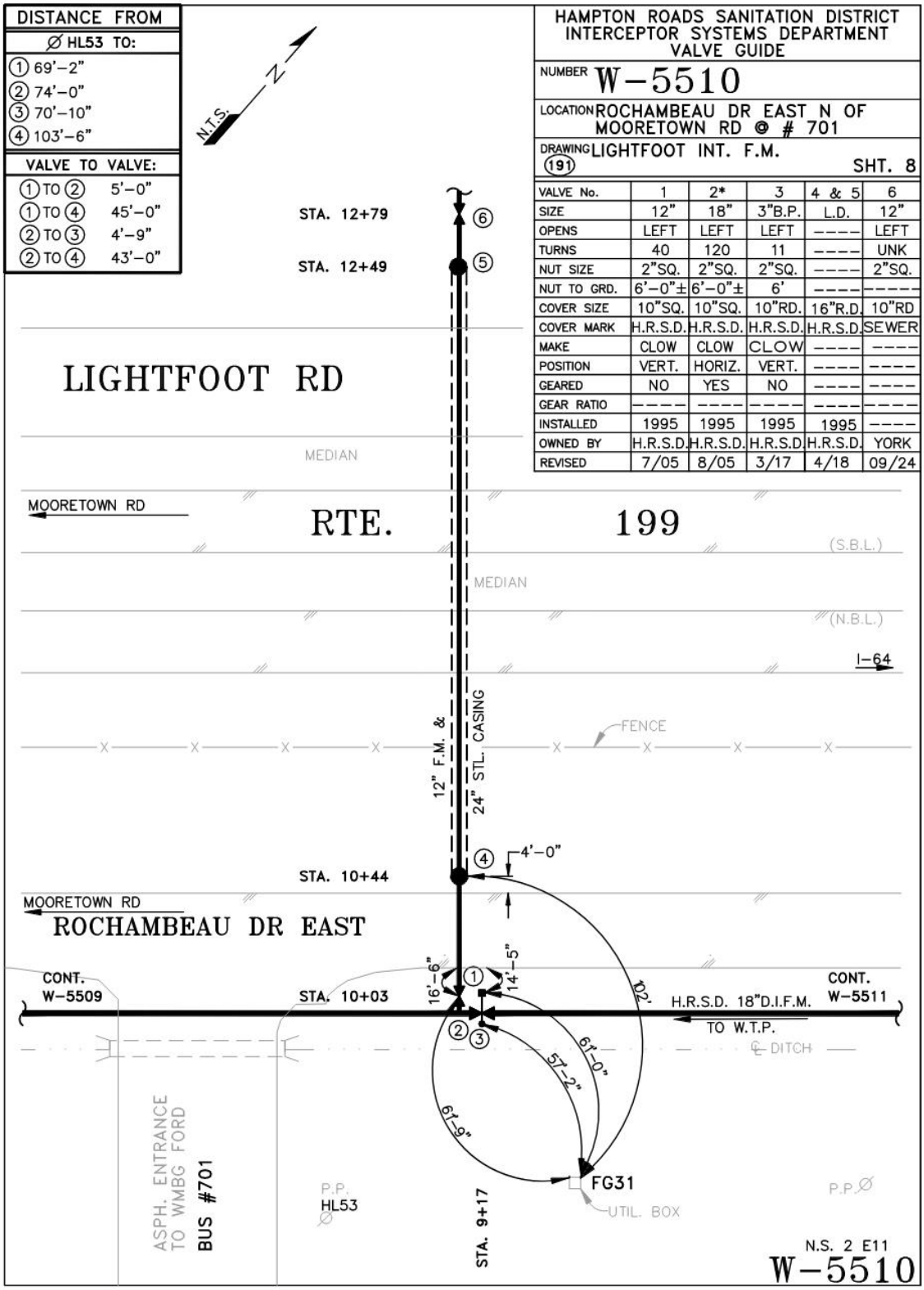
DRAWING DAM NECK TO SHIPPS CORNER F.M.−SHT 5 OF 8/SHIPPS CORNER B.P.S.−SHT 2 OF 10
INT. SYSTEM METERING, PH IV, MMPS−171, CONTRACT M

VALVE No.	1,3,5	2,6	4	7	8	9	10,11	12	13	13	14	15	16		
SIZE	6"BP	36"GV	42"GV	16"GV	2"A.V.	12"GV	36"GV	36"GV	36"GV	36"CV	6"	24"GV	24"GV		
OPENS	LEFT	LEFT	LEFT	LEFT	LEFT	LEFT	LEFT	LEFT	LEFT	----	LEFT	LEFT	LEFT		
TURNS	19	223	348	51	----	38	223?	222	222	----	21	229.25	228		
NUT SIZE	2"SQ.	2"SQ.	2"SQ.	2"SQ.	----	2"SQ.	2"SQ.	2"SQ.	2"SQ.	----	2"SQ.	2"SQ.	2"SQ.		
NUT TO GRD.	5'	5'−6"	5'−6"	4'−6"	----	4'−6"	5'−6"	6"	6"	----	----	8'−4"	6'−5"		
COVER SIZE	10"SQ.	10"SQ.	10"SQ	10"SQ.	16"RD.	10"SQ.	10"SQ.	10"SQ.	10"SQ.	----	10"	10"SQ	10"SQ		
COVER MARK	H.R.S.D.	H.R.S.D.	HRSD	HRSD	H.R.S.D.	HRSD	H.R.S.D.	IN VAULT	HRSD	IN VAULT	H.R.S.D.	H.R.S.D.	H.R.S.D.		
MAKE	M&H	M&H	M&H	M&H	----	M&H	M&H	DARL	DARL	MUELLER	MUELLER	MUELLER	MUELLER		
POSITION	HOR.	HOR.	HOR.	HOR.	VERT.	HOR.	HOR.	---	---	HOR.	VERT	HOR.	HOR.		
GEARED	NO	YES	YES	NO	----	NO	YES	---	---	NO	NO	----	----		
GEAR RATIO	----	3−1	3−1	----	----	----	3−1	---	---	---	---	----	----		
INSTALLED	1974	1974	1974	1974	1974	1974	1974	8/90	8/90	4/11	4/11	2016	2016		
OWNED BY	HRSD	HRSD	HRSD	HRSD	H.R.S.D.	HRSD	HRSD	HRSD	HRSD	HRSD	HRSD	HRSD	HRSD		
REVISED	1/95	11/95	2/96	12/10	7/16										





VALVE No.	1	2	3	4	LS1	LS2
SIZE	16"GV	24"GV	T.S.	L.B.	16"	16"
OPENS	LEFT	LEFT	---	---	-----	-----
TURNS	21	21	---	---	-----	-----
NUT SIZE	2"SQ.	2"SQ.	---	---	-----	-----
NUT TO GRD.	5'-6"	5'-6"	---	---	-----	-----
COVER SIZE	10"SQ.	10"SQ.	7"RD.	7"RD.	-----	-----
COVER MARK	H.R.S.D.	H.R.S.D.	H.R.S.D.	H.R.S.D.	-----	-----
MAKE	MUELLER	MUELLER	B&T	---	TEAM	TEAM
POSITION	PLUG	PLUG	---	---	-----	-----
GEARED	YES	YES	---	---	-----	-----
GEAR RATIO	84:1	84:1	---	---	-----	-----
INSTALLED	1975	2020	2020	2020	2020	2020
OWNED BY	H.R.S.D.	H.R.S.D.	H.R.S.D.	H.R.S.D.	HRSD	HRSD
REVISED	4/80	2/82	11/85	2/96	2/21	


DISTANCE FROM
Ø HL53 TO:
① 69'–2"
② 74'–0"
③ 70'–10"
④ 103'–6"
VALVE TO VALVE:
① TO ② 5'–0"
① TO ④ 45'–0"
② TO ③ 4'–9"
② TO ④ 43'–0"
N.T.S.
N
HAMPTON ROADS SANITATION DISTRICT
INTERCEPTOR SYSTEMS DEPARTMENT
VALVE GUIDE
NUMBER W–5510
LOCATION ROCHAMBEAU DR EAST N OF MOORETOWN RD @ # 701
DRAWING (191) LIGHTFOOT INT. F.M. SHT. 8
VALVE No. | 1 | 2* | 3 | 4 & 5 | 6
SIZE | 12" | 18" | 3"B.P. | L.D. | 12"
OPENS | LEFT | LEFT | LEFT | ---- | LEFT
TURNS | 40 | 120 | 11 | ---- | UNK
NUT SIZE | 2"SQ. | 2"SQ. | 2"SQ. | ---- | 2"SQ.
NUT TO GRD. | 6'–0"± | 6'–0"± | 6' | ---- | ----
COVER SIZE | 10"SQ. | 10"SQ. | 10"RD. | 16"R.D. | 10"RD
COVER MARK | H.R.S.D. | H.R.S.D. | H.R.S.D. | H.R.S.D. | SEWER
MAKE | CLOW | CLOW | CLOW | ---- | ----
POSITION | VERT. | HORIZ. | VERT. | ---- | ----
GEARED | NO | YES | NO | ---- | ----
GEAR RATIO | ---- | ---- | ---- | ---- | ----
INSTALLED | 1995 | 1995 | 1995 | 1995 | ----
OWNED BY | H.R.S.D. | H.R.S.D. | H.R.S.D. | H.R.S.D. | YORK
REVISED | 7/05 | 8/05 | 3/17 | 4/18 | 09/24
STA. 12+79
STA. 12+49
LIGHTFOOT RD
MEDIAN
MOORETOWN RD
RTE. 199
(S.B.L.)
MEDIAN
(N.B.L.)
I–64
FENCE
12" F.M. &
24" STL. CASING
4'–0"
STA. 10+44
MOORETOWN RD
ROCHAMBEAU DR EAST
CONT. W–5509
STA. 10+03
16'–6"
14'–5"
10'
H.R.S.D. 18"D.I.F.M.
TO W.T.P.
CONT. W–5511
DITCH
61'–0"
57'–2"
61'–9"
FG31
UTIL. BOX
P.P. HL53
P.P.
STA. 9+17
ASPH. ENTRANCE TO WMBG FORD
BUS #701
N.S. 2 E11
W–5510

Section 7 - HRSD Building Information Model (BIM) Requirements

I. Introduction

A. Preface

This document presents HRSD's BIM Requirements with a focus on Revit. These requirements and associated Revit template set a minimum standard to establish consistency throughout projects. This document provides guidance on setting up and executing a project using Revit.

These requirements shall be used in conjunction with each project-specific BIM Execution Plan. The BIM Execution Plan includes project-specific planning, such as team members and roles, software and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project-specific LOD requirements, etc. It shall be set up by the project BIM lead in close coordination with the HRSD project manager and consultant project manager.

B. Overview

This manual will serve as an HRSD style guide for the use of Revit BIM software and define the practice common to all drawings produced for HRSD projects. This manual is intended to be used alongside HRSD, the project template, and the shared parameter file.

II. Level of Development (LOD) Tables

The following LOD (Level of Development) tables are based on the AIA Level of Development definitions. These tables shall be used in conjunction with the project BIM Execution Plan to coordinate BIM model development with individual project goals and milestones. These tables provide general LOD outlines and may not fully represent individual project requirements or specific mentions of required components. The designer shall use his/her best judgment, based on these tables and coordination with the project team, to meet project goals and/or milestones outlined in the Project BIM Execution Plan. All components in a specific discipline model shall be represented at similar LOD, and special care must be taken when importing models from third parties (vendor websites). These models are often detailed to a much higher level than content created by the modeling standards established in this document. Refer to Family Creation Requirements - Paragraph VII for more information.

The LOD definitions below are written to dictate the production of individual model elements (mechanical equipment, walls, framing, etc.) represented within discipline project model files. These definitions contribute the project file as a whole but are not an indication of project milestones. Refer to Paragraph II, Section A for information about the level of development of project model files at various project milestones.

Basic LOD Definitions	
LOD 100	LOD 100 elements are schematic representations (linework and/or basic masses) of large equipment and structure elements. LOD 100 elements represent the approximate maximum size, quantity, orientation, and relative location to other elements, but not necessarily their actual shape. LOD 100 elements are generally used to develop preliminary layouts. Any information gathered from LOD 100 model elements must be considered approximate.
LOD 200	Model element satisfies LOD 100 requirements. Model element is recognizable as the component it represents. Models may be represented as volumes or space reservations for component appurtenances, such as piping, conduit, cable tray, fastening, or support devices, etc. Non-graphical information (data parameters) may be attached to model element. LOD 200 models are generally used to refine layouts further. Any information gathered from LOD 200 model elements must be considered approximate.
LOD 300	Model element satisfies LOD 200 and lower requirements. Model element represents accurate size, location, orientation, and count of specified/proposed equipment. This information can be obtained directly from the element without the need to refer to non-model elements such as annotations, dimensions, or notes. <u>LOD 300 model requirements as it pertains to the creation of HRSD contract drawings:</u> • The model element should be easily identifiable from any view when placed on a contract drawing at a scale of 1/4”=1’-0” and printed half size (11”x17”). • No part of the model should print as an unidentifiable black mass. • No part of the real-world object, represented by the model, that does not contribute to the easy identification of the model should be represented, i.e., nuts, bolts, heat sinks, dials, etc. • Model contains IFC data parameters established in HRSD template when applicable. • Model includes non-graphical information required for the population of tags, tables, and other annotation elements.
LOD 350	Model element satisfies LOD 300 and lower requirements. Model element contains elements necessary for connections and coordination with other attached or nearby model elements. <u>LOD 350 model requirements as it pertains to the creation of HRSD contract drawings:</u> • All LOD 300 requirements and elements necessary for connection to other objects. Pipe, duct, electrical connectors, etc.

LOD 400	Model element satisfies LOD 350 and lower requirements. Model element contains detailed components sufficient for fabrication and assembly. <u>LOD 400 model requirements as it pertains to the creation of HRSD contract drawings:</u> • These models would be used for the fabrication of equipment and building components and would contain more information than necessary to produce contract drawings. • Models developed to this LOD are beyond the scope of HRSD project work.
LOD 500	Model satisfies LOD 400 requirements. Model incorporates field verified measurements. <u>LOD 500 model requirements as it pertains to the creation of HRSD contract drawings:</u> • Models developed to this LOD are beyond the scope of HRSD project work.

A. Model and Contract Drawing Content by Project Milestone

The following tables outline the content required for various project milestones. These milestones offer basic guidelines and may not address the requirements of all projects. It is the responsibility of the design team and the HRSD project manager to determine the development of project models and contract drawings to suit the needs of individual projects. Project specific LOD requirements shall be defined in the project BIM Execution Plan.

Process Mechanical

Project Milestone	**Project Milestone Requirements**

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major process mechanical equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: large containment vessels (tanks, bins, etc.), pumps, centrifuges, screens, etc.
	• Layout dimensions and equipment orientations are approximate and may change upon further model development

Process Mechanical

Project Milestone	Project Milestone Requirements

PER Final	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and processes. All process equipment represented at PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed process mechanical items.
	  o If existing process mechanical model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary process mechanical equipment:
	  o Layout of process mechanical equipment shall accurately represent size, quantity, shape, and location.
	  o Process mechanical equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed
	  ▪ When multiple manufacturers are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.
	  o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage
	  o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.
	• Preliminary process mechanical piping, fittings, and accessories:
	  o Process flow conveying piping 3” diameter and greater, valves, fittings and pipe accessories sized per process engineer’s calculations
	  o Layout of process mechanical piping equipment shall accurately represent size, quantity, shape, and location
	  o Accurate dimensional, piping system, pipe size and pipe elevation data can be pulled from the model for production of contract drawings
	
	Contract drawings include:
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections

Process Mechanical

Project Milestone	Project Milestone Requirements
	○ Refer to Paragraph IX Section F for general information about plans and sections • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. ○ Size, system abbreviation, and centerline elevation (CL) for all process flow conveying piping ○ Descriptive tags of valves and pipe accessories, i.e., “8” BUTTERFLY VALVE” ○ Descriptive text relating to process mechanical equipment, i.e., “POLYMER TRANSFER PUMP” ○ Overall dimensions of rooms and/or tank and channel dimensions ○ Elevations of all major floors
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD’s PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Further development of process mechanical piping: ○ Ancillary piping and associated valves and fittings not conveying process flow ○ Ancillary pipe accessories represented (Dismantling joints, expansion couplings, flushing connections, sample ports, etc.) ○ Small diameter piping 1” - 3” diameter and all associated fittings and valves ○ Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements • Instrumentation associated with all represented equipment: ○ This would mostly apply to instrumentation items that require power, i.e., temperature elements and transmitters, flow elements and transmitters, level sensors and transmitters, etc. ○ Instrument designation and description can be pulled from model elements • Additional process mechanical equipment not represented in PER documents • Further refinement of process mechanical equipment and piping layout representing further design • Chemical storage and distribution systems including but not limited to bulk chemical storage tanks, day tanks, metering pumps, skid mounted

Process Mechanical

Project Milestone	Project Milestone Requirements
	make-up units, major supply and distribution piping, and associated valves • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in PER documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Additional section and plan views, if additional plan views are necessary, generally at a larger scale than those present in PER drawings further detailing design • Dimensions of major pipe penetrations, pipe headers and equipment • Standard details and standard detail callouts • Additional callouts of any additional equipment, piping, or pipe accessories • Instrumentation tags for all process mechanical equipment (pumps, motor operated valves, sensors, etc.) that require power • Descriptive tags relating to instrumentation elements
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels and local control stations located and coordinated with Electrical and Instrumentation • Seal water assemblies located if applicable • Pipe supports, to the extent specified by the project BIM Execution Plan, but in particular, supports for pipe systems that experience substantial force due to expansion and contraction during operation • Further refinement of process mechanical equipment and piping layout as well as any related equipment representing further design. • Further refinement of chemical storage and distribution systems, associated piping and valves • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text • Details of unique process mechanical equipment, equipment configurations or equipment connections • Detailed notes dictating the specifics of construction that may not be clearly represented graphically

Process Mechanical

Project Milestone	Project Milestone Requirements

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Final routing of all process piping 1" diameter and greater with all necessary pipe accessories, fittings, and valves
	  o Final pipe size diameter representation requirements will vary by project. Consult with HRSD Project Manager for specific project requirements
	• Final placement of process mechanical equipment developed to LOD 350
	• All process mechanical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD process mechanical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).
	• Accurate representations of proposed process mechanical equipment, piping, valves, and pipe accessories developed to LOD 350
	• Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline
	• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping

Process Mechanical

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements modeled to as-built size, type, and location
	  ○ All elements shall be modeled to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.).
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed, which may differ from the proposed model and drawings
	• Model reflects all changes made to the proposed process mechanical design during construction
	• All Process Mechanical equipment models include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  ○ All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	• Dimensions and annotation sufficient for the construction of all process mechanical equipment and piping
	• Dimensions and annotation modified to reflect as-built conditions

Structural Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of the design, but may lack sufficient detail for anyone unfamiliar with the project to understand the design intent without a written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions, if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major structural elements represented at LOD 100 or 200
	  o Major structural elements include but are not limited to: wall, floor slabs, columns, and column grids, etc.
	
	Layout dimensions, element sizes, and orientations are approximate and may change upon further model development.

PER Final	Structural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic structural layout. All structural elements represented for the PER and beyond shall be modeled to LOD 300.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o If existing structural model exists, there is no need to remove or hide content for the sake of consistency.
	• Major load bearing walls and floors sized based standard practice
	• Major structural framing based on standard practice
	  o Any column grids associated with preliminary columns
	• Conceptual layout of access stairs and platforms with any framing that may impact accessibility to equipment or equipment areas
	  o Framing that does not meet that criteria does not need to be modeled.
	  o Input from structural engineer may be required
	• Equipment pads under all present equipment as required
	• Openings for any required equipment access
	• Grated openings and access hatches/doors
	
	Drawings include:

Structural Model

Project Milestone	Project Milestone Requirements

	Consult HRSD project manager regarding the inclusion of structural drawings for the Final PER.
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Overall, out-to-out dimensions
	• Interior-to-interior dimensions of spaces
	  o Thicknesses of walls and floors is not required at this stage
	• Dimensions between column grids and from grids to walls where applicable
	• Elevations of all major floors shown in sections with spot elevations shown in plan only when elevations cannot be called out in sections

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Major load bearing walls and floors updated to reflect structural engineer's calculations
	• Minor framing sized per design engineer's calculations
	  o Platform framing and other minor supports
	• Foundation elements:
	  o Spread footings, slab turn downs, trench and sump builddowns, etc.
	• Roof support systems:
	  o Precast panels, metal decking, metal decking with concrete, trusses, bar joists, embedded grating seats, etc.
	• Expansion joints in concrete where required
	• Inter-discipline coordination and conflict resolution (clash detection)
	
	Contract drawings include:
	
	• All requirements defined in the PER Final milestone and those defined in this section
	• Updates to any annotation present in the PER documents reflecting model changes, if applicable
	• Additional dimensions indicating thicknesses of structural elements
	• Plans and sections:
	  o Plans (overall and enlarged when required)

Structural Model

Project Milestone	Project Milestone Requirements
	○ Overall sections ○ Partial sections detailing elements not clearly detailed in overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Standard details and standard detail callouts • General structural notes
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present and modeled to LOD 300 • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings include: • Updates to any annotation present in 50% documents reflecting model changes. ○ All structural elements dimensioned or otherwise located • Structural framing elevations if applicable • Rebar sizes and spacing represented on drawings • Framing connection details • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • All structural walls, floors slabs, framing, bracing and other support members required for the construction the facility present, sized per the structural engineer's final calculations, and modeled to LOD 300 • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all structural elements reflecting the design intent of the structural engineer
Substantial Completion	Model includes: • All discipline elements modeled to as-built size, type, and location.

Structural Model

Project Milestone	Project Milestone Requirements
	○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to other structural elements. ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition. • Any changes made to the proposed structural design during construction Contract drawings include: • Dimensions and annotation sufficient for the construction of all structural elements reflecting the as-built condition of the structure ○ Dimensions and annotation modified to reflect as-built conditions

Architectural Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major architectural elements represented at LOD 100 or 200
	  o Major architectural elements include but are not limited to: masonry walls (interior and exterior), roofs, doors, etc.
	
	Layout dimensions, element sizes and orientations are approximate and may change upon further model development.

PER Final	Architectural drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for PER Final Submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand the basic architectural layout. All architectural elements represented for the PER and beyond shall be modeled to LOD 300.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o If existing architectural model exists and is developed beyond current milestone, there is no need to remove or hide content for the sake of consistency.
	• Major walls sized based on standard practice
	  o Wall construction materials can be assumed to be standard masonry or actual material where known at this milestone
	• Preliminary architectural items
	  o Basic doors representing proposed size and type
	  o Basic roofs representing shape and type
	• Rooms with associated room names
	• Egress and code requirements
	
	Drawings include:

Architectural Model

Project Milestone	Project Milestone Requirements

	Consult HRSD project manager regarding the inclusion of architectural drawings for the Final PER.
	
	• Plans, Elevations, and Sections:
	  o Plans (overall and enlarged when required)
	  o Overall Elevations
	  o Overall Building Sections
	  o Refer to Paragraph IX Section F for general information about plans, elevations and sections.
	• Overall, out-to-out dimensions
	• Interior-to-interior dimensions of spaces
	  o Thicknesses of walls and floors is not required at this stage
	• Room names
	• Simple descriptions of visible architectural items

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Walls
	  o Size and composition updated to reflect architect's input
	• Doors
	  o Type and size updated to reflect architect's input
	• Ceiling Systems
	• Casework and built-in items
	• Finish and Opening Schedules
	• Life safety data including maximum travel distances, adequate exits, fire rated walls, and appropriate fire warning systems per local building code
	• Door properties entered as BIM data
	• Window and louver properties entered as BIM data
	
	Contract drawings include:
	
	• Updates to any annotation present in PER documents reflecting model changes, if applicable
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Partial sections detailing elements not clearly detailed in overall sections

Architectural Model

Project Milestone	Project Milestone Requirements
	○ Refer to Paragraph IX Section F for general information about plans and sections. • Casework and built-in items identified and detailed on drawings • Standard details and standard detail callouts • Room and opening schedules to define all finishes and materials
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • All exterior and interior wall materials updated to reflect architect's design intent • Ceiling systems updated • Roof drainage system • Toilet accessories • Furniture • ADA compliant building components • Room finish data updated • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings include: • Updates to any annotation present in 50% documents reflecting model changes • Schedules for architectural components populated by BIM data • Wall sections • Ceiling system identified and detailed • Roof, wall, and other architectural details • Interior elevations • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • All walls, ceilings, and roofs modeled to LOD 300 • All doors, windows, casework, and additional architectural items modeled to LOD 350 • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer

Architectural Model

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements shall be modeled to as-built size, type, and location.
	  ○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½".
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Any changes made to the proposed architectural design during construction
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all architectural elements reflecting the design intent of the structural engineer
	• Dimensions and annotation modified to reflect as-built conditions

HVAC Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major HVAC equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: condensing units, VAV boxes, air handling units, etc.
	
	Layout dimensions and equipment orientations are approximate and may change upon further model development.

PER Final	HVAC drawings may not be required at this project milestone. Coordinate HRSD project manager about the production of drawings and modeling effort for the PER Final submittal.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All HVAC equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed HVAC items.
	• If existing HVAC model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary HVAC equipment:
	  o Large HVAC equipment:
	  ▪ Air Handling units, Condensers, VAV Boxes, etc.
	  ▪ Pumps
	  o Layout of HVAC equipment shall accurately represent size, quantity, shape, and location.
	  o HVAC equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed.
	  ▪ When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.

HVAC Model

Project Milestone	Project Milestone Requirements
	○ Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage ○ Space allocations for small diameter piping and content related to other disciplines not shown: process mechanical piping, control panels, structural framing, etc. • Areas reserved for the future locations/routing of ductwork and HVAC equipment not shown in the HVAC model Drawings include: Consult HRSD project manager regarding the inclusion of HVAC drawings for the Final PER. • Plans and sections: ○ Plans (overall and enlarged when required) ○ Overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. ○ Basic descriptions of all HVAC equipment present in the model • Dimensions locating HVAC equipment relative to major structural or architectural walls
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Ductwork for supply and exhaust/return air • HVAC related piping 1" diameter and greater • Additional HVAC equipment: ○ Fans, unit heaters • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Plans and sections: ○ Plans (overall and enlarged when required) ○ Overall sections

HVAC Model

Project Milestone	Project Milestone Requirements
	○ Partial sections detailing elements not clearly detailed in overall sections ○ Refer to Paragraph IX Section F for general information about plans and sections. • Updates to any annotation present in PER documents reflecting model changes, if applicable • Descriptive tags of HVAC equipment and control equipment • Descriptive tags of HVAC ductwork including size and elevation • Size, system abbreviation and centerline elevation (CL) for all major piping • Standard details and standard detail callouts
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels located and coordinated with Electrical and Instrumentation • Duct and Pipe supports, to the extent specified by the project BIM Execution Plan, but, supports for pipe systems that experience substantial expansion and contraction during normal process, including Chilled and Hot Water • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes ○ Much of this should be automated if tags are used in lieu of simple text. • Details of unique HVAC equipment, equipment configurations or equipment connections • Detailed notes dictating the specifics of construction that may not be clearly represented graphically
100% Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review. Model includes: • Final routing of all ductworks with all necessary fittings, control and distribution devices • Final placement of HVAC equipment modeled to LOD 350 • All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD ○ All equipment operations and maintenance data parameters are preloaded into the HRSD HVAC Revit template and will

HVAC Model

Project Milestone	Project Milestone Requirements
	automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly. o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt). • Appropriate maintenance and access/code clearance requirements accounted for with specific care to ensure no encroachment of these areas by any discipline • Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all HVAC equipment, ductwork, and piping
Substantial Completion	Model includes: • All discipline elements modeled to as-built size, type, and location. o All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.). o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition. • Model reflects specific equipment installed which may differ from the proposed model and drawings • Model reflects all changes made to proposed HVAC design during construction • All HVAC equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD. o All operations and maintenance data parameters are populated with correct data as provided by contractor Contract drawings include: • Dimensions and annotation sufficient for the construction of HVAC equipment, ductwork, and piping o Dimensions and annotation modified to reflect as-built conditions

Plumbing Model

Project Milestone	Project Milestone Requirements
PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.

Plumbing Model

Project Milestone	Project Milestone Requirements

	Model includes:
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major plumbing equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: water heaters, sinks toilets, safety showers, etc.
	• Layout dimensions and equipment orientations are approximate and may change upon further model development

PER Final	Plumbing drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort at PER Final.
	
	The PER model and contract drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All plumbing fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed plumbing items.
	  o If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary plumbing fixtures and equipment:
	  o Large plumbing fixtures and equipment:
	  ▪ Sinks, toilets, safety showers, water heaters, etc.
	  o Layout of plumbing equipment shall accurately represent size, quantity, shape, and location
	  o Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage
	  o Space allocations for small diameter piping and content related to other disciplines not shown: HVAC ductwork, control panels, structural framing, etc.
	
	Drawings include:
	
	Consult HRSD project manager regarding the inclusion of plumbing drawings for the Final PER.

Plumbing Model

Project Milestone	Project Milestone Requirements

	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible.
	  o Descriptive tags of plumbing fixtures and equipment

50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review.
	
	A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan.
	
	Model includes:
	
	• Further development of plumbing fixtures, equipment, and piping:
	  o Piping 1/2" and greater diameter and all associated fittings and valves
	  o Final pipe size diameter representation requirements will vary by project. Consult with HRSD project manager for specific project requirements
	• Additional plumbing fixtures not represented in PER drawings
	• Inter-discipline coordination and conflict resolution (clash detection)
	
	Drawings Include:
	
	• Plans and sections:
	  o Plans (overall and enlarged when required)
	  o Overall sections
	  o Partial sections detailing elements not clearly detailed in overall sections
	  o Refer to Paragraph IX Section F for general information about plans and sections.
	• Updates to any annotation present in PER documents reflecting model changes, if applicable
	  o Much of this should be automated if tags are used in lieu of simple text.
	• Dimensions of major pipe penetrations and locations of fixtures
	• Standard details and standard detail callouts
	• Additional callouts of any additional fixtures and equipment, piping, or pipe accessories
	• Instrumentation tags for all plumbing equipment that require power

Plumbing Model

Project Milestone	Project Milestone Requirements
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Further refinement of plumbing fixtures, equipment, and piping layout as well as any related equipment representing further design • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Details of unique plumbing fixtures and equipment configurations or equipment connections. • Piping system riser diagrams • Detailed notes dictating the specifics of construction that may not be clearly represented graphically

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Final locations of plumbing fixtures and equipment
	• All process plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD plumbing Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).
	• Final routing of plumbing piping
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment, and piping

Plumbing Model

Project Milestone	Project Milestone Requirements

Substantial Completion	Model includes:
	• All discipline elements modeled to as-built size, type and location.
	  ○ All elements shall be model to correct dimensions and positional accuracy to the nearest ½" relative to major structural components (walls, column lines, etc.).
	  ○ It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed which may differ from the proposed model and drawings
	• Model reflects all changes made to proposed plumbing design during construction
	• All plumbing equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  ○ All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	• Dimensions and annotation sufficient for the construction of all plumbing fixtures, equipment, and piping.
	  ○ Dimensions and annotation modified to reflect as-built conditions

Electrical Model

Project Milestone	Project Milestone Requirements

PER Draft	The preliminary model should reflect the basic intent of design but may lack detail sufficient for anyone unfamiliar with the project to understand the design intent without written or verbal description.
	
	Model includes:
	
	• Schematic representation of existing conditions if applicable.
	  o If an existing model is available, it should be used as a background/starting point.
	• Schematic layout of major electrical equipment represented at LOD 100 or 200
	  o Major equipment includes but is not limited to: generators and service entrance equipment, switchgear, switchboards, motor control centers and/or large motor controllers, etc.
	
	Layout dimensions and equipment orientations are approximate and may change upon further model development.

Final PER	Electrical model and drawings may not be required at this project milestone. Coordinate with HRSD project manager about the production of drawings and modeling effort for the Final PER.
	
	The PER model and drawings should represent the basic design intent of the facility to a sufficient level that someone unfamiliar with it could understand its basic function and process. All electrical fixtures and equipment represented for the PER and beyond shall be modeled to LOD 350.
	
	Model includes:
	
	• Existing conditions if applicable
	  o Existing conditions shall be modeled to the same level as proposed items at every project milestone.
	  o Additional equipment may need to be modeled to represent interactions with proposed electrical items.
	  o If existing plumbing model exists, there is no need to remove or hide content for the sake of consistency.
	• Preliminary electrical equipment:
	  o Layout of electrical equipment shall accurately represent size, quantity, shape, and location.
	  o Electrical equipment models (families) represent possible selection of proposed/specified equipment but may not represent equipment that will ultimately be installed.
	  ▪ When multiple manufactures are specified for any given equipment, the largest and/or most challenging to install of the possible selections should be represented.

Electrical Model

Project Milestone	Project Milestone Requirements
	• Appropriate maintenance and access/code clearance requirements represented as well as considerations for placement of items relating to other disciplines which may not be present at this stage • Space considerations for placement of conduit and/or cable tray Drawings include: Consult HRSD project manager regarding the inclusion of electrical drawings for the Final PER. • Plans: o Plans (overall and enlarged when required) o Refer to Paragraph IX Section F for general information about plans • Basic annotation: Tags representing information pulled directly from model elements should be used whenever possible. o Descriptive tags of electrical equipment
50%	The 50% model and contract drawings should represent further development of design, from the PER, and incorporate any design comments from HRSD's PER design review. A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier per the directions specified in the Project BIM Execution Plan. Model includes: • Instrumentation and electrical equipment associated with electrical not included in PER model • Additional electrical equipment not in the PER • Inter-discipline coordination and conflict resolution (clash detection) Contract drawings Include: • Plans and sections: o Plans (overall and enlarged when required) o Overall sections o Partial sections detailing elements not clearly detailed in overall sections o Refer to Paragraph IX Section F for general information about plans and sections. • Updates to any annotation present in PER documents reflecting model changes, if applicable o Much of this should be automated if tags are used in lieu of simple text.

Electrical Model

Project Milestone	Project Milestone Requirements
	• Standard details and standard detail callouts • Additional callouts of any additional equipment • Instrumentation tags for all equipment (pumps, motor operated valves, sensors, etc.) that require power
90%	The 90% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 50% design review. Model includes: • Equipment control panels and local control stations located and coordinated with all other required disciplines • Further refinement of electrical equipment layout as well as any related equipment representing further design • Lighting and other electrical fixtures • Inter-discipline coordination and conflict resolution (clash detection). • Conduit embedded in slabs and walls. Contract drawings Include: • Updates to any annotation present in 50% documents reflecting model changes o Much of this should be automated if tags are used in lieu of simple text. • Details of unique electrical equipment, equipment configurations or equipment connections. • Single line diagrams, panel schedules, riser diagrams, conduit and wire schedules lighting plans and other electrical equipment single lines

100% - Issued for Construction	The 100% model and contract drawings should represent further development of design and incorporate any design comments from HRSD's 90% design review.
	
	Model includes:
	
	• Accurate representations of proposed electrical equipment developed to LOD 350
	• All applicable electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All equipment operations and maintenance data parameters are preloaded into the HRSD electrical Revit template and will automatically be applied into any appropriate families loaded into projects created from this template, provided they are categorized correctly.
	  o All equipment operations and maintenance data parameters can also be found in the HRSD shared parameter file (HRSD-Shared Parameter File.txt).

Electrical Model

Project Milestone	Project Milestone Requirements
	• Inter-discipline coordination and conflict resolution (clash detection) completed with all conflicts resolved Contract drawings include: • Dimensions and annotation sufficient for the construction of all electrical equipment.

Substantial Completion	Model includes:
	
	• All discipline elements modeled to as-built size, type, and location.
	  o All elements shall be model to correct dimensions and positional accuracy to the nearest ½".
	  o It is not acceptable to modify dimensions to represent the accurate location of model elements. These elements must be relocated/remodeled to represent the as-built condition.
	• Model reflects specific equipment installed which may differ from the proposed model and drawings
	• Model reflects all changes made to proposed electrical design during construction
	• All electrical equipment models (families) include all operations and maintenance data parameters (IFC parameters) as required by HRSD.
	  o All operations and maintenance data parameters are populated with correct data as provided by contractor
	
	Contract drawings include:
	
	• Dimensions and annotation sufficient for the construction of all electrical equipment
	• Dimensions and annotation modified to reflect as-built conditions

III. BIM Execution Plan

These requirements shall be used in conjunction with the project specific BIM Execution Plan. The BIM Execution Plan includes project specific planning including: team members and roles, software and releases to be used, file hosting location, model sharing methods, deliverable dates, client presentation methods, project LOD requirements, etc. and shall be set up by the project BIM lead in close coordination with the HRSD project manager.

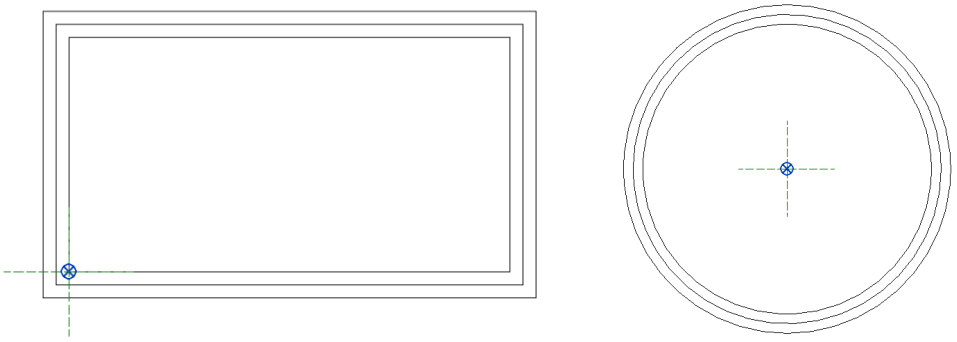
IV. Model File Creation

A. Project Templates

All HRSD project model files shall be created using HRSD's project template. Reference the BIM Execution Plan for software version requirements.

B. Orientation and Project Base Point

Project files should be modeled in the same orientation as they will be shown on contract drawing plan views. Refer to Paragraph IX Section F for more information on plan views. All project files shall be modeled such that the project base point is at the inside bottom left corner or the center of a round structure. The project base point shall be located at the finished floor elevation of the structure. The project base point must never be moved unclipped and should always be located at the project origin.



C. Revit Model Linking

All Revit models shall be linked origin to origin or by shared coordinates once shared coordinates have been established.

D. Level and Grids

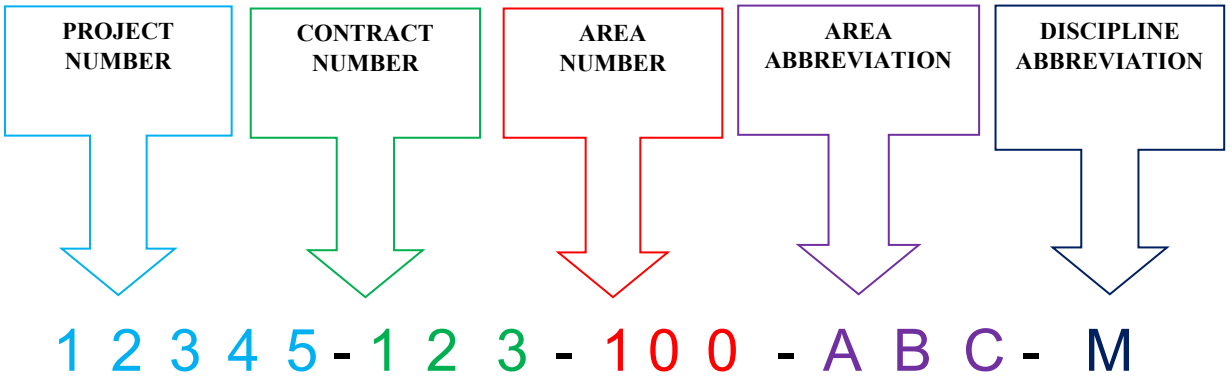
All column grids and levels associated with main floors shall be copy-monitored from the structural model.

E. Model Naming Convention

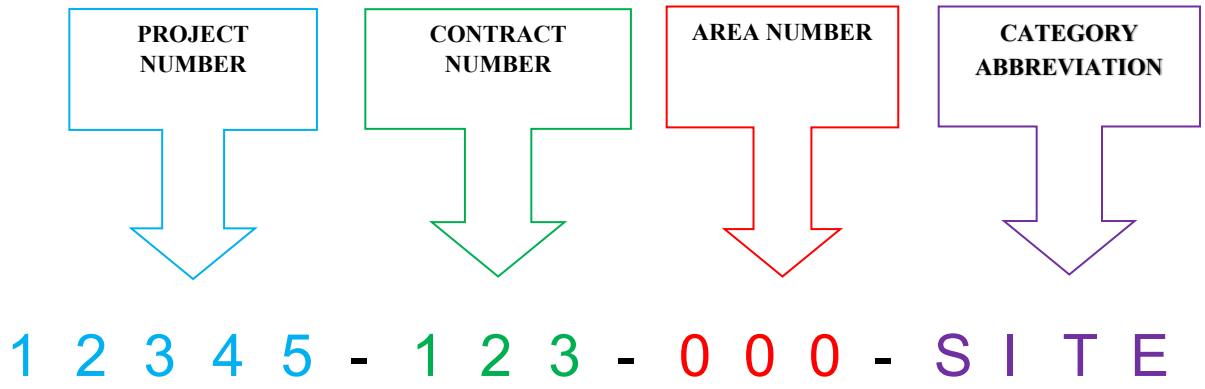
Project files names shall contain the project number, contract number, area number and category abbreviation. The “Area Number” and “Area Abbreviation” shall correspond area numbers established in the BIM Execution Plan. The following is an example of a project file name: 12345-123-100-ABC-M.rvt. In this example, the project number is “12345-123,” the area number is 100, the structure (area abbreviation) is a “ABC” and it is a Mechanical file “M” (See discipline abbreviation table below). Most Revit files should fall into one of the categories below.

Discipline Abbreviation Table	
Discipline Abbreviation	**Discipline**
C	Civil/Site
M	Process Mechanical
S	Structural
A	Architectural
H	HVAC
P	Plumbing
FP	Fire Protection
E	Electrical
I	Instrumentation

SINGLE DISCIPLINE MODEL



SITE PLANS



V. Shared Coordinates

A shared coordinate system must be established and common amongst all models no later than the 50% submittal. A shared coordinate system can be created earlier in the project life cycle per the directions specified in the Project BIM Execution Plan.

Care should be taken to ensure that all model geometry is within a 20-mile radius of the model's internal origin to ensure model accuracy. It should be noted that this requirement does not hold the location of a shared coordinate system to that 20-mile limit, as this is related to the Virginia State Plane Coordinate System and is not model geometry.

A. State Plan Coordinate System

All project shared coordinates shall be based on North American Vertical Datum of 1988 (NAVD 88) and State Plane Coordinate System: VIRGINIA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NORTH AMERICAN DATUM 1983 (NAD 83) (1993) (U.S. FEET).

B. Federated Site Model

A federated site model (a single model containing all discipline models for all areas within the scope of the project linked as references) shall be created before the 50% submittal unless specified otherwise in the BIM Execution Plan. The federated site model shall include all linked files of all structures/processes for all disciplines. All discipline models shall be located per the established shared coordinate system.

VI. Family Creation

The HRSD template files contain general annotation and tags, but do not contain equipment models. Equipment models created for project needs shall meet the criteria defined in this document and any criteria detailed in the Project BIM Execution Plan. All equipment families shall be created as the appropriate category type. Equipment families should never be categorized as "Generic Models" but rather as what they represent: "Mechanical Equipment", "Pipe Accessories", "Electrical Equipment", etc.

Families representing maintainable assets must be modeled in such a way that all independently maintainable assets within the family are also independently addressable. For example, a progressive cavity pump may have maintenance data requirements that differ from the electric motor attached to it. In such a case, the pump and attached motor would each need to be unique elements capable of hosting independent and different data. This is most easily accomplished by making individual maintainable assets within a family separate nested and "Shared" families.

A. Family Naming Convention

All families will be named using the following requirements:

1. Keep file names as short as possible.

2. All family names must be unique.

3. File names will use ‘title casing’.

4. When adding descriptors (e.g., “Plug Valve Flanged 4-12in”), consider the order of the descriptors and the order they will appear in the project browser. Descriptors that would appear in several similar families should be the first of the descriptors if there are more than one.

5. All family names shall adhere to the following format:

Functional Type-Subtype-Manufacturer-Descriptor1-Descriptor 2

Name Format Descriptions		
Component	**Required or optional**	**Description**
Functional Type	Required	Names the element that the part will represent. For example, MCC or Door.
Subtype	As needed	Names the part type, for example, “Flanged” on a flanged valve.
Manufacturer	As needed	Manufacturer information not necessary when dimensions are governed by an industry standard (ANSI) or when the family is a generic component.
Descriptor	As needed	Examples: Size ranges (4-12in), Material (PVC, Steel, etc.)

B. Family Level of Detail

To maintain consistency and drawing clarity families must be created using the following requirements:

1. Families shall be drawn with sufficient detail to clearly visually identify them from any view and will accurately represent overall size and key features of an object (LOD 300). Items too fine to be clearly represented when printed at a given drawing scale should not be included in a family. These items include but are not limited to bolts, buttons, hinges, etc. The inclusion of such items increases the time required to model a family without adding any needed clarity.

a. Simply put, a progressing cavity pump family should look like a progressing cavity pump when printed but should not print as an indistinct black blob on contract drawings.

2. Families should feature enough visual information to convey features that impact the design of the project. For example, access hatches or manways on equipment that must be clear from obstruction or lifting hooks that must align with a monorail.

3. Dimensions taken from manufacturers' literature should be rounded to the nearest minimum unit of measurement. See table below:

Minimum Units*	Examples
1/16"	Annotation symbols
1/4"	Small diameter pipe accessories (1" to 6"), Small equipment (occupying less than 2'-0"^{3})
1/2"	Pipe accessories greater than 6" diameter, medium size equipment (small pumps, small control panels...)
1"	Large equipment (large pumps, large equipment...)

Flanged pipe connections or any other connection size dictated by an industry standard should be drawn to the nearest .01" per the standard. This includes any connectors associated with a family of any size. Pipe fittings that adhere to an industry standard, ANSI, should be drawn to those dimensions.

VII. Shared Parameter File

The HRSD Shared Parameter file is provided as a repository for the IFC parameters present in the template as well as other standard parameters. It is not necessary for all parameters to be present in all families. The shared parameter file is provided simply to facilitate adding parameters to families as needed.

A. Shared Parameters in Models

Project needs may require the addition of shared parameters. Any project specific shared parameter file shall always start with the provided HRSD Shared Parameter file and all parameters unique to that project will be added to that file. The Project Shared Parameter file contains all family and project parameters as well as all standard HRSD parameters.

B. Shared Parameters, Equipment Data and Asset ID

The provided HRSD Shared Parameter file contains parameters relating to HRSD equipment record standards. These parameters must be included in all project files. These parameters are present in the HRSD template files

as well as the HRSD Shared Parameter.txt file. The parameters shall be applied to all equipment requiring regular maintenance. This will occur automatically, provided equipment is categorized properly and the appropriate HRSD template was used to create the project file. See paragraph VIII for more information.

All equipment requiring regular maintenance shall be assigned a unique asset ID. This asset ID shall match the asset ID found on the corresponding equipment data sheet. All data sheet information shall be applied to the corresponding equipment in the BIM model. Equipment data shall be applied to the completed as-built model prior to it being turned over to HRSD.

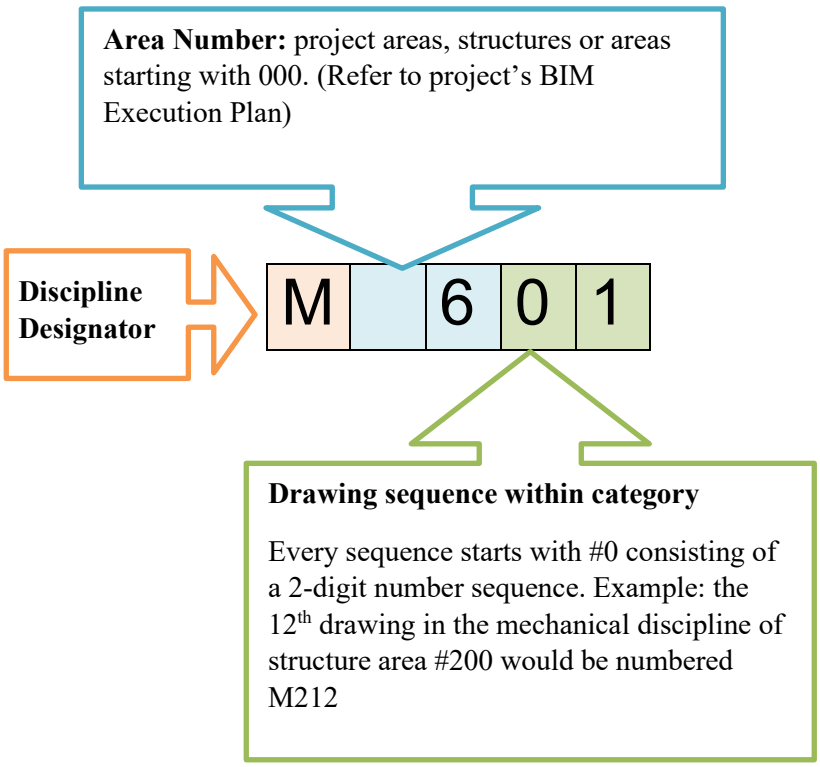
VIII. Contract Drawings

A. Sheet Size

All sheets created for HRSD shall be produced on ANSI D 22”x34” when printed full size.

B. Sheet Numbering

Sheets numbers shall consist of a discipline designator, an area number and a sequential individual sheet number as shown in the example below.



C. View Templates and Filters

View templates are predefined templates with view overrides in HRSD templates. View templates will be used in plans, section tables, and detail views, to show consistency in all project drawings. With that in mind, understand that view templates will not do all the work for every element in every model; a good understanding of the graphic overrides that need to take place is a must. View templates should be used in all views. Presentation changes should be made in view templates, never in individual Visibility/Graphics Overrides on individual views.

A key portion of view templates are filters. Filters allow graphic overrides for elements that differ from the category in which it's modeled. Filters override elements based on different parameters, such as type name, family name, comments, etc. It is critical that all users familiarize themselves with information filters that are required to model elements properly. It is imperative that all modeling be consistent with the information that view filters require. When additional filters are required, filter names will use the following requirements:

1. All filter names must be unique.

2. Filter names will be case sensitive and use 'title casing'.

3. Keep filter names as short as possible.

D. Text and Labels

HRSD project template files contain all text styles needed to annotate drawings. All annotation shall be created using the text styles provided in the template. See the table below for text style names and uses:

HRSD Text Styles			
Text Style Name	**Actual Text Height**	**Text Font**	**Drawing Use**
HRSD-06pt	1/16"	Arial	Annotation on figures
HRSD-08pt	5/64"	Arial	Annotation on figures
HRSD-10pt	3/32"	Arial	General contract drawing text
HRSD-14pt	9/64"	Arial	Titles, room names…
HRSD-18pt	3/16"	Arial	Label text
HRSD-20pt	13/64"	Arial	Titles, tables…

All annotations shall be placed per the following requirements:

1. All leaders shall use a 15 Degree Filled Arrow

2. All text with leaders shall be left-aligned with leaders coming from the top left or bottom right of text strings.

3. Labels shall be used wherever possible. “Dumb” text should only be used when the presented information cannot be pulled from the model element itself with the use of a label.

4. All labels shall adhere to the same requirements and properties as regular text.

E. Schedules

Schedules shall be created per the following requirements:

1. All tables or schedules shall use the HRSD-Schedule View Template.

2. All schedule or table data shall be generated from project BIM data when possible.

3. Unique parameters can be added for scheduling purposes. Refer to Paragraph VIII.

F. Plans, Sections, and Details

Plan views presented on contract drawings shall be at a preferred scale of 1/4” = 1’-0” or 3/16” = 1’-0” if necessary. Larger structures may need to be displayed at larger scales to fit on standard ANSI D sheets. In this case, enlarged plans should be used in conjunction with overall plans. Overall plans may be displayed at the minimum scale necessary for them to fit on sheets. Plan views shall be oriented such that the plan or true north point up or to the left. It is acceptable for plant or true north to point to the right when necessary. Plan views should never be oriented such that plan or true north point down the page. Use the HRSD Plan Viewport callout option when placing plan views on sheets.

All sections and details in the same project or drawing series (i.e. 100, 200, etc.) shall have unique letters (sections) or numbers (details). In other words, the mechanical drawing series for area 200 may contain sections: A, B, C, etc. and details: 1, 2, 3, etc. and the mechanical drawing series for area 300 may also contain sections: A, B, C, etc. and details: 1, 2, 3, etc., but these letters and numbers shall not repeat within a series. This rule only applies to a single discipline. For example, Architectural, Structural and Mechanical can all have a section “A” and a Detail “1” within the same drawing series. The sections and details only need to be unique per discipline and drawings series. Section letters “I” and “O” shall not be used because of their similar appearance to numbers “1” and “0.” If a drawing series exceeds the number of available letters for sections, it is correct to number sections “AA,” “BB,” etc. When sections are cut in a detail view, they are considered minor sections. Minor Sections shall be Section A-A, B-B, etc. The numbering is sheet dependent, meaning you can have a minor

section A-A on more than one sheet, but there cannot be two minor sections A-A on the same sheet.

Sections should be cut to the right or, when necessary, left. Sections should be cut looking up a page on a plan view. Sections should only be cut looking down a page only when required.

G. Drawing Submittal Format

All drawings shall be provided to HRSD as vector pdfs, printed directly to pdf, and not scanned. Drawings shall be printed full size (22x34in). Drawings shall be signed and sealed in accordance with the Commonwealth of Virginia DPOR requirements.

End of Section

Section 8 - PER, Design, and Construction Submittal Requirements

I. Introduction - To reduce paper and to further implement the Enterprise Project Management (Unifier) system, the Engineering Division has implemented standards for storage of plans, Bid Documents, Operations and Maintenance (O&M) manuals, and shop drawings. Engineering's Project archival systems must maintain the official records of shop drawings, O&M manuals, and all other project-related correspondence until the project is closed out. Paper submittals from the FIRM will only be required when requested by HRSD staff or as otherwise detailed in the Professional Services Agreement/Amendment.

II. Requirements for Submittals – The FIRM shall follow the requirements detailed in the listed paragraphs. Attachment A to this section is a tabular summary of the following submittal requirements.

A. Provide all stages of PER, plan, specification submittals, and supporting analysis in Portable Document Format (PDF). PDF files shall be formatted with bookmarks, and each submittal shall be a single PDF as opposed to a collection of PDF files for individual chapters, plan sheets, etc.

B. For pipeline projects, seamless AutoCAD files (a seamless file is an individual file containing the entire proposed pipeline improvements) are to be prepared and submitted to HRSD for the purpose of populating the GIS with new / relocated / rehabilitated pipelines. Show locations of pipeline alignment, pump stations, metering valves, gate/plug valves, air vents, etc., in support of establishing a numbering scheme for Valve Guides. The timing and content of submittals are as follows:

1. Prepare and submit a "seamless" AutoCAD file showing the proposed improvement limits at the 50% design stage. This information will be used to show the overall limits and alignment of the project.

2. Prepare and submit a "seamless" AutoCAD file with the proposed improvements and delineations for proposed Valve Guides at the Conformed Drawing submittal stage. The GIS /CAD group will review the proposed Valve Guide locations and layouts and will assign numbers for Interim and Final Valve Guides. The HRSD Project Manager will coordinate with the FIRM to incorporate these assigned asset numbers into the generated Valve Guides.

3. Submit to the HRSD Project Manager, unless otherwise detailed in the Professional Services Agreement / Amendment, the following:

a. One (1) AutoCAD seamless file of the project limits at the 50% design stage.

b. One (1) AutoCAD seamless file of proposed improvements and proposed Valve Guide delineations at the Conformed Documents stage.

c. The Project Manager shall submit to the FIRM the assigned Valve Guide numbering scheme for the production of Interim and Final Valve Guides.

C. Interim Record Drawing submittals must be submitted to the HRSD Project Manager a minimum of 5 business days in advance of the scheduled tie-in for the force main project or HRSD taking operational possession of the constructed facility. The FIRM will incorporate this requirement into the Construction Bid Documents.

1. Interim Record Drawings shall be prepared by the FIRM and transmitted to the HRSD Project Manager along with the tie-in plan. The Project Manager will review the Interim Record Drawings for accuracy and completeness. Any required revisions will be coordinated with the FIRM and the corrected version resubmitted back to the HRSD Project Manager.

2. Interim Record Drawings shall be in the following format: PDF scan of the Interim Record Drawings.

3. Refer to Section 6 - Drawings, Record Drawings, and Valve Guides in this manual for the latest information to be included with Record Drawings.

4. Submit to the HRSD Project Manager, unless otherwise detailed in the Professional Services Agreement / Amendment, the following:

a. One (1) PDF scan of the Interim Record Drawings in Unifier.

D. The Interim Valve Guide submittal must be a minimum of 5 business days in advance of the scheduled tie-in for force main project or HRSD taking operational possession of the constructed facility. The FIRM shall incorporate this requirement into the Construction Bid Documents.

1. Interim Valve Guides shall be prepared by the FIRM and transmitted to the HRSD Project Manager along with the tie-in plan. The Project Manager will review the Interim Valve Guides for accuracy and completeness. Any required revisions will be coordinated with the FIRM, and the corrected version shall be resubmitted back to the HRSD Project Manager.

Interim Valve Guides shall be the following formats (a) AutoCAD “dwg”, and (b) PDF.

2. Submit to the HRSD Project Manager unless, otherwise detailed in the Professional Services Agreement / Amendment, the following:

    a. One (1) AutoCAD dwg file of each Interim Valve Guide in Unifier.

    b. One (1) PDF file of each Interim Valve Guide in Unifier.

E. Final Record Drawings submittal at project Final Completion stage. Refer to Section 6 – "Drawings, Record Drawings, and Valve Guides" in this manual for the latest information to be included with Record Drawings.

1. Final Record Drawings to be prepared by the FIRM and transmitted to the HRSD Project Manager. The Project Manager will review the Final Record Drawings for accuracy and completeness. Any required revisions will be coordinated with the FIRM, and the corrected version shall be resubmitted to the HRSD Project Manager.

2. Final Record Drawings shall be in the following formats:

    a. AutoCAD dwg for each plan sheet,

    b. A single PDF file for each volume of Record Drawings,

    c. Full-size paper prints *(HRSD Project Manager to determine the need)*.

3. Submit to the HRSD Project Manager, unless otherwise detailed in the Professional Services Agreement / Amendment, the following:

    a. Four (4) 24" x 36" full-size paper copies of Final Record Drawings (*HRSD Project Manager to determine the need).*

    b. One (1) PDF file of each volume of Final Record Drawings in Unifier.

    c. One (1) AutoCAD dwg file of each Final Record Drawing sheet in Unifier.

F. Final Valve Guides shall be prepared by the FIRM and submitted at the Final Completion stage. Refer to Section 6 – "Drawings, Record Drawings, and Valve Guides" in this manual for the latest information to be included with Valve Guides.

1. Final Valve Guides to be transmitted to the HRSD Project Manager. The HRSD Project Manager will review the Final Valve Guides for correct numbering assignment as determined by the HRSD

GIS/CAD group and for completeness. Any required revisions will be coordinated with the FIRM and the corrected version shall be resubmitted back to the HRSD Project Manager.

2. Final Valve Guides shall be in the following formats (a) AutoCAD “dwg” and (b) PDF.

3. Submit to the HRSD Project Manager, unless otherwise detailed in the Professional Services Agreement / Amendment, the following:

   a. Four (4) 8½” x 11” paper copies of each Final Valve Guide *(HRSD Project Manager to determine the need).*

   b. One (1) AutoCAD dwg file of each Final Valve Guide in Unifier.

   c. One (1) PDF file of each Final Valve Guide in Unifier.

G. Shop Drawings for each project shall be submitted to HRSD’s Project Manager. Refer to Master Specification 01340 Submittals in Section 41 in this manual for further information. The following is in addition to Unifier submittals. Contractor Submittals shall be initially submitted by email from the Contractor to the FIRM for review, and only the final version of the submittals shall be submitted in Unifier. Before the start of construction, the FIRM, Contractor, and HRSD shall determine which submittals will also be reviewed by HRSD staff before submission in Unifier. HRSD must review any “or equal” submissions by the Contractor. The format for Shop Drawings is to be PDF and distributed by the Project Manager as follows:

1. For force mains and gravity sewers – portable media containing PDF files at Substantial Completion stage to the appropriate Director of Interceptor Operations or in Unifier.

2. For pump stations, PRS, flow meters, pressure sensors, and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Substantial Completion stage to the appropriate Director of Interceptor Operations, Operations Support Systems Manager, and Director of Electrical and Instrumentation, or in Unifier.

3. For treatment plants and outfalls – portable media containing PDF files prior to Substantial Completion or before taking operational ownership of a process or component to the Operations Support Systems Manager, the Director of Electrical and Instrumentation, and to the appropriate Director of Treatment, or in Unifier.

H. Operations and Maintenance (O&M) Manuals for each project shall be submitted to HRSD’s Project Manager. Refer to Master Specification 01340

Submittals in Section 41 in this manual for further information. The Operation & Maintenance Manual Equipment List is included in Attachment B. The sheet in this spreadsheet labeled as “O&M Manual Equipment List” shall be prepared and submitted in Excel format to HRSD at the 100% design stage. HRSD Asset Management and Operations will review and approve the proposed list of equipment that would require O&M Manual submittal. This form will provide HRSD with the data to populate the Computerized Maintenance Management System (CMMS) and establish the system and process hierarchy. This form along with the “Equipment Record” in this spreadsheet shall be submitted in Excel format prior to substantial completion in accordance with Master Specification 01340 Submittals. The following is in addition to Unifier submittals.

I. The format for O&M manuals is to be PDF and distributed by the Project Manager as follows:

1. For pump stations, PRS, flow meters, pressure sensors and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Contractor / FIRM component training or operational ownership to appropriate Director of Interceptor Operations, Operations Support Systems Manager, and Director of Electrical and Instrumentation.

2. For treatment plants – portable media containing PDF files prior to Contractor/FIRM component training or operational ownership to Operations Support Systems Manager, Director of Electrical and Instrumentation, and to the appropriate Director of Treatment.

J. Conformed Documents specifics are defined in Section 16 – “Preparation of and Format for Conformed Documents”. The following is in addition to Unifier submittals. HRSD’s Project Manager shall make the necessary copies of the received PDF version of Conformed Documents for each project and distribute as follows:

1. For force mains and gravity sewers – portable media containing PDF files prior to Pre-Construction Meeting to the appropriate Director of Interceptor Operations.

2. For pump stations, PRS, flow meters, pressure sensors and other mechanical systems for Interceptor Systems – portable media containing PDF files prior to Pre-Construction Meeting to the appropriate Director of Interceptor Operations, Operations Support Systems Manager, and Director of Electrical and Instrumentation.

3. For treatment plants and outfalls – portable media containing PDF files prior to Pre-Construction Meeting to Operations Support

Systems Manager, and the appropriate Director of Electrical and Instrumentation and Director of Treatment.

K. X, Y, Z Coordinates of Installed Pipelines

1. Per Section 01323 of the Master Specifications, X, Y, Z coordinates shall be collected in a digital spreadsheet by the Contractor containing top-of-pipe elevations at each joint, fitting, valve, air vent, and connection point. Accuracy must be sub-foot for horizontal (X, Y) and 0.1-ft for vertical (Z). An updated spreadsheet must be reviewed by the FIRM monthly and provided with each Contractor pay application. The digital spreadsheet shall be directly compatible with ArcGIS software without requiring any additional re-formatting, such as a Shapefile, File Geodatabase, or properly formatted Excel or CSV files. A sample spreadsheet is included in Attachment C.

L. Soil Resistivity/Corrosivity Analyses, when performed to support project design, must be submitted in accordance with the following requirements:

1. One (1) PDF file of each soil resistivity/corrosivity report, separate from the Conformed Specifications package, uploaded to Unifier under Professional Services Deliverable

2. HRSD standard soil data spreadsheet (1) populated with analysis and result values. A blank template is included as Attachment D of Section 8 Key required attributes include:

a. Date of field measurement or soil sample collection

b. Name of soil corrosivity analysis firm

c. Soil sample and field resistivity measurement locations as Virginia State Plane coordinates to an accuracy of ± 5 ft.

d. Various soil resistivity and chemistry attributes.

M. Plats, when required for fee simple acquisitions or easements, must be submitted per the requirements of Section 9 of the Design and Construction Standards

N. Precondition Assessment and Damage Mitigation Reports must be completed as per the requirements of Section 12 of the Design and Construction Standards. Deliverables will be:

1. Stage 1 and 2 Reports: One (1) PDF file uploaded to Unifier under Professional Services Deliverables

2. Stage 3 Documentation: Provided to HRSD Project Manager via a secure file transfer mechanism.

III. Attachments

A. Major Submittals List

B. Equipment Record Template

C. XYZ Spreadsheet

D. Soil Corrosivity DB Template

E. PER Minimum Required Table of Contents Chapters

F. Interceptor Project GIS Deliverables Flow Chart

End of Section

Section 9 - Real Estate Acquisition and Plat Guidelines

I. Introduction - Professional Services firms (FIRM) and staff involved with design and construction projects often must obtain permanent and temporary easements or land acquisition to accommodate new pipelines, new or rehabilitated pump stations, storage tanks, and treatment plant expansions. This guideline outlines the steps and timing for coordinating with HRSD's Real Estate Manager during a typical project. It is important for FIRM and staff to properly account for the duration of time that a typical land acquisition process will take when preparing for bid advertisement of construction projects.

II. Real Estate Schedule vs. Project Schedule

A. Exhibit A in this Section shall be used as a template for the timing and stage for submitting real estate-related matters to HRSD's Real Estate Manager.

B. The FIRM is to build sufficient time into the project schedules to account for standard real estate acquisition efforts, as well as additional locality/jurisdictional requirements causing additional time to be added to the acquisition schedule (e.g., rezoning, subdivisions, public hearings, conditional use permits, special use permits, etc.) prior to advertising a project for construction bids.

III. Acquisition and Plats

A. Plat – Refer to the Standard Details section in this manual and Attachment A in this section for sample plats showing critical information required to meet HRSD needs.

B. The FIRM shall prepare all plats required for the project, to include subdivision, resubdivision, easements, permanent, temporary, and access ingress/egress in a manner to meet the needs of HRSD and to be in accordance with Virginia State Library and Archives Standards for Plats and be recordable in the appropriate jurisdiction.

C. The FIRM shall provide an editable list by project parcel number (e.g., 1,2,3,4) of the names, addresses (mailing and physical site), contact numbers, GPIN, Tax Map number, desired use of parcel (Fee Simple, Permanent, Temporary, Access Ingress/Egress) and size, of the current property owners for each plat utilizing the HRSD Project Acquisition Tracking log, which may be found in Attachment B.

D. Plat shall not exceed 8-½ inch x 14 inch without prior approval from the HRSD Real Estate Manager.

E. FIRM shall coordinate with HRSD's Real Estate Manager as necessary to resolve any issues uncovered in the title search or other phases of the process.

F. For plats, the minimum permanent easement width shall be 30 feet with the centerline of the pipe at the one-third point. For pipelines in easements along the right of way, permanent easement shall provide a minimum of ten feet from centerline of pipe to the edge of easement away from the right of way. Provide temporary easement widths as required for construction purposes. Access Ingress/Egress easement widths shall be determined per project and future operation and maintenance requirements.

G. FIRM shall provide HRSD with an electronic copy in pdf format and three paper copies of the final plats.

H. An electronic copy of the plats shall be provided in AutoCAD (.DWG) format or otherwise approved format. A minimum of two sets of northing and eastings, as well as two Virginia State Plane Coordinates, shall be provided to tie the easement and/or property boundary to the Virginia State Plane grid. A reference to the horizontal datum including the realization (e.g. NAD83(1986), NAD83(HARN), NAD83(CORS96)) shall be included on the plat.

IV. Design Engineer's Estimate – When requested, the FIRM shall produce a replacement cost estimate to be used in procuring a title insurance policy for a parcel and structure. A sample including the required information to be included, may be found in Attachment C.

V. Justification Memorandum – When requested, the FIRM shall produce a justification memorandum to support the acquisition cost for a property or easement. The justification memorandum should consider, at a minimum, the impact of the acquisition or easement(s) on design, permitting, maintenance of traffic, construction costs, project schedule and regulatory deadlines, community and social justice, as well as the impacts to the property owner. The memorandum should include the FIRM's recommendation statement. A sample of both Design Firm and Real Estate Firm memos may be found in Attachments D and E.

VI. Phase I, Environmental Site Assessment (ESA) – For each fee simple acquisition and when requested, easements, the FIRM shall prepare a Phase I, ESA to the current ASTM 1527 Standard. The initial Phase I, ESA should be performed during the site evaluation stage of the project. Phase I, ESAs expire 180 days from the commencement of the investigation. Therefore, the Phase I, ESA may need to be updated to ensure a valid Phase I, ESA is available at the time of acquisition. This requirement can only be waived by the Chief Engineer on the recommendation of the Real Estate Manager. A sample Phase I, ESA may be

found in Attachment F and an ESA scope and fee template may be found in Attachment G

VII. Location Map – When requested, the FIRM shall produce a Location Map for the fee simple or easement acquisition. A sample Location Map may be found in Attachment H.

VIII. Demolition of Structures – For a typical project with an assigned HRSD Project Manager, that Project Manager will be responsible for the complete demolition process required for existing structures on the purchased properties. This effort will be done in coordination with the Real Estate Manager and using the demolition specification and demolition checklist. Any demolition activities not associated with a planned project will be managed by the Real Estate Manager. The demolition specification template and checklist may be found in in the HRSD Guidelines Manual.

IX. Attachments:

A. Plat Template

B. Project Acquisition Tracking Log

C. Engineer's Estimate Template

D. Sample – Justification Memo - Design Firm

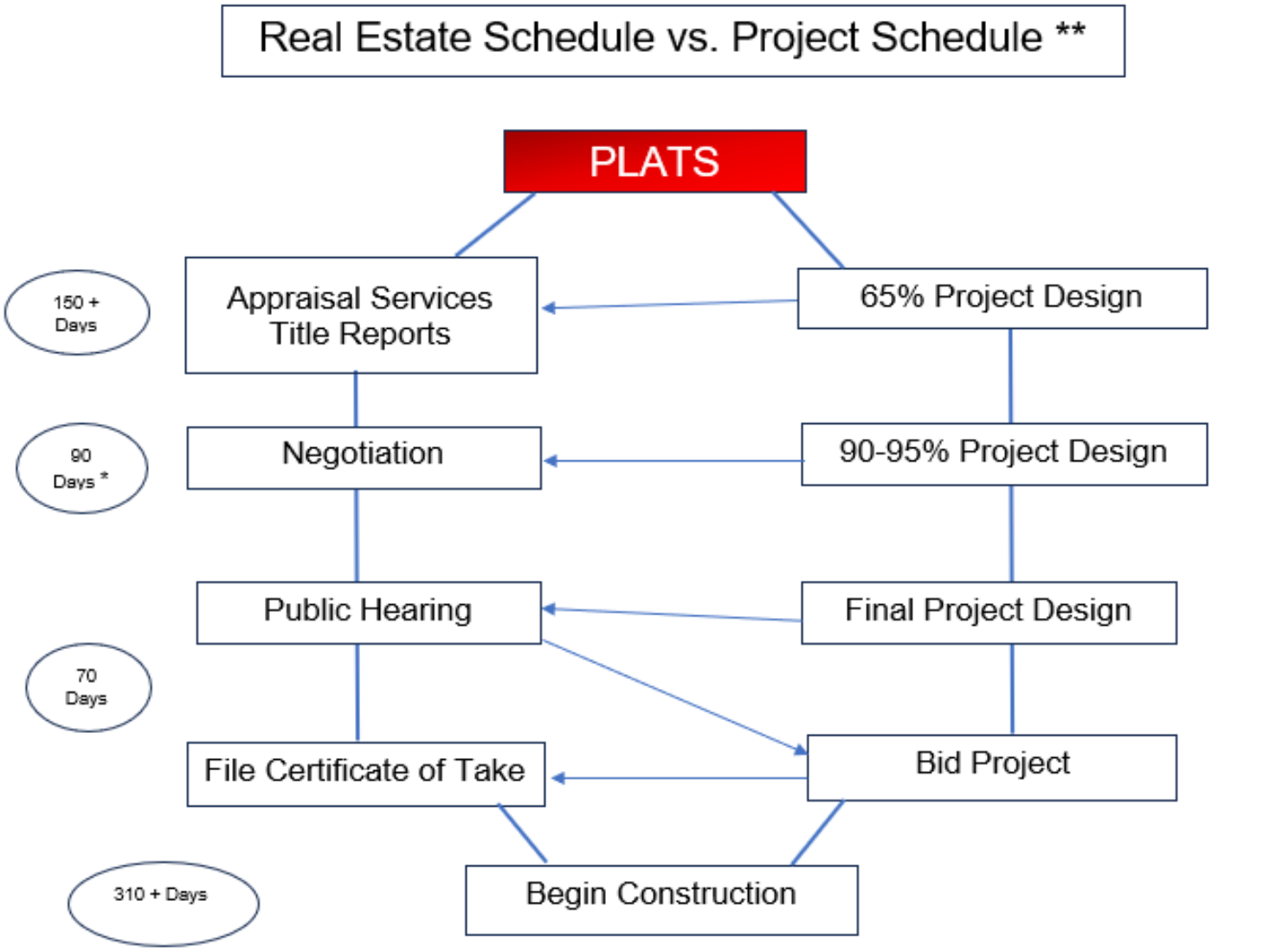
E. Sample – Justification Memo - Real Estate Firm

F. ESA Scope and Fee Template

G. Sample – Phase 1 ESA

H. Sample – Location Map

Exhibit A



Notes:

* Federal, State, Local Jurisdictions, and/or Railroads may require additional time.

** This schedule does not include additional time needed for CUPs, SUPs, rezoning, subdivisions, and other approval steps that may be required by the Localities/Jurisdictions.

End of Section

Section 10 - Flood Elevation Requirements

I. Introduction - Localities in Hampton Roads have adopted flood elevation freeboard design criteria that exceed FEMA flood elevations. The required freeboard affects finished floor elevation in these localities, including those on HRSD projects. To comply with locality requirements and consider Sea Level Rise, this standard will outline the process for determining the climate change protection level for HRSD projects.

II. Definitions

- Freeboard - the calculated difference between the finished floor elevation and the FEMA Base Flood Elevation for the 100-year storm
- BFE - Base Flood Elevation
- EWL (100yr) - Extreme Water Level for the 100-year storm event

Flood Zone definitions can be found on the FEMA website, https://www.fema.gov, under “Flood Zones.”

III. Locality Code Requirements

The freeboard and finished floor elevation requirements should be verified with the locality in question for each project when initiated. Localized drainage conditions should also be considered for each project when setting the elevation for new buildings or structures.

The following example is for the freeboard construction requirement in the City of Hampton at the HRSD Bridge St. PS Location. Note that it may not represent the current construction standards for the example Locality.

Hampton Freeboard, Zone AE: FEMA Base Flood + 3'

IV. Asset Protection Requirements

Any new structure shall be constructed in a resilient manner with the ability to add mitigation measures at an appropriate future date. For facilities that need a maximum protection level of 4 feet above the finished floor, building walls can be constructed from reinforced CMU. For structures that require protection levels beyond the 4-foot, building walls should be constructed from reinforced concrete.

V. All new facilities shall build the first floor in accordance with the Locality Freeboard requirements. Additional construction measures shall be in accordance with Section D. of this standard. Please contact Engineering Planning and Analysis Division for additional information on the flood elevations by sending in a request to the **ModelingRequest@hrsd.com** email with a project description and location map.

End of Section

PLEASE NOTE: *The Public Information Specialists do not use the Enterprise Project Management (Unifier) system. If Public Relations-related information is required to be entered into Unifier, please also email the information to the corresponding Public Information Specialist (Lisa Bolen for South Shore, Surry, and Eastern Shore; Shawn Maxfield for North Shore and Small Communities). When using any HRSD letterhead documents,* ***ensure you have the most up-to-date letterhead****. If mailing any documents, use the main office's address on envelopes.*

Section 11 – Public Communication Program

I. Introduction - HRSD's Public Communication Program is intended to develop public awareness of planned projects and define the roles of project partners in engaging the community. This program includes standards; however, parts of this program may not be implemented if the HRSD Communication Department's staff determines a project will have minor public impact.

The following forms/formats shall be used in the administration of the project. The Project Manager (PM) and FIRM will provide a detailed project briefing to HRSD's Chief Communication Officer (CCO) and HRSD's Public Information Specialist and, utilizing the **Public Communication Program Checklist**, will determine the extent of the program's implementation and customize the forms/formats for each project. The FIRM may be requested to assist with additional documentation or public outreach needs deemed appropriate for a project or locality.

- Attachment A: Public Communication Program Checklist
    - Please complete the first section in grey prior to meeting with the CCO and Public Information Specialist.

II. Engage with Locality Staff - HRSD representatives (staff and/or FIRM) shall meet with representatives of the locality in which a project will occur to discuss the project. The PM shall ensure appropriate information is forwarded to and received from a single point of contact throughout the project's life. This individual will be known as our locality partner (LP) or their designee. The FIRM shall attend these meetings throughout the design and construction phases.

III. Alert Public Officials – HRSD's PM or their designee will be responsible for ensuring project information is provided to our assigned LP. The FIRM may be requested to provide additional information and or respond by phone or in person for this effort throughout the design and construction phases.

IV. Identify Project Stakeholders – The FIRM shall compile a list of all parties that may be affected by construction activities located along the project route requiring

outreach/coordination during the project. This list shall include, but is not limited to, civic leagues, residents, businesses, schools, school bus routes, churches, trash collection, road detours/closures, and mass transportation routes. The list shall include the following: contact information, full address (including both physical and mailing addresses, if different), project impact, and operating hours. This initial list shall be provided to the Public Information Specialist during the first design submittal (e.g., 30% design) for review and comment. The FIRM shall then log this list into the Unifier Stakeholders List, located under Reports.

- Attachment B: Stakeholder List-Template

V. Participate in Public Open House/Community Meetings – In a cooperative effort, HRSD will assist each locality in fulfilling its public communication guidelines. If the locality requires an informational open house, HRSD will request that the locality establish a date and time and secure a location for the meeting. Utilizing the advertisement submission schedule, ensure the specific advertisement deadlines outlined in the submission schedule will be met, allowing time for public response. HRSD's Public Information Specialist or the CCO, in the Specialist's absence, will help draft a **Willingness to Hold** an Informational Open House for a project when a locality requests it. The Engineering Admin Assistant will advertise it. If an additional notification is to be mailed, at the request of the locality, the expectation will be that the locality will print and mail the open house notice provided by HRSD to the addresses identified by the locality and in the locality's records (as resident and property owner, if different). HRSD's staff and the FIRM will attend and present the project information in an Open House format. If needed, HRSD representatives (staff and/or FIRM) will also meet with civic leagues or business associations at their request to discuss the project.

- Attachment C: Willingness to Hold Advertisement-Example
- Attachment D: Informational Open House Advertisement-Example
- Attachment E: Open House Notice to the Public – Template
- Attachment F: Open House Requirements/Guidelines
- Attachment G: Open House Sign-In Sheet
- Attachment H: Open House Comment Card
- Attachment I: Open House Advertisement Submission Schedule
- Project Display Board – ask Public Information Specialist for sample boards

VI. Virtual Presentation for Open House – The virtual presentation will be used in addition to an in-person Open House to allow the public to view the information and provide feedback if they cannot attend the in-person event. Please refer to Open House Requirements/Guidelines (Attachment F) for virtual presentation requirements. For an example of a Virtual PowerPoint Presentation, ask the Public Information Specialist.

VII. Establish a Project Webpage – HRSD will create a dedicated webpage on its website for each project of specific public interest. The FIRM shall be responsible for compiling the information needed using the HRSD-provided templates. The information provided should include an overview, schedule, the project team, contact information, a list of roads affected and separately, a list of project-specific frequently asked questions and a project map. HRSD's Public Information Specialist and PM will review the information before it is uploaded to the website. **The FIRM shall submit these documents to the Public Information Specialist the month prior to, and no later than the month of, the project being taken to the HRSD Commission for approval.**

- Attachment J: Website- Project Webpage – Template
- Attachment K: Website- Project FAQs – Template
- Attachment L: Website Project Map - Template

VIII. Website Updates – Updates to the project webpage are expected at the end of each month once staging/construction has begun. **In the last week or two of the month (depending on holidays), the Public Information Specialist will send an email to each Project Manager/Consultant who has projects that are currently on the website, along with the project schedule and the most recent project update for their revision. The PM/Consultant will reply to the email with the updates to those projects for that month and include any updated project maps.**

IX. Stakeholder Updates – The website has a button allowing stakeholders to sign up to receive notifications when a project webpage is updated. Once the project page is added to the website, the FIRM shall send an email to the stakeholders notifying them of how to sign up to receive project update notifications. This activity should occur within two business days of being notified by HRSD staff that the project has been placed on the website. The FIRM shall log these email notifications using Unifier – PR Notifications located under Reports.

- Attachment M: Stakeholders Notification Update-Template

X. Distribute Project Introductory Notice to Neighbors – HRSD's Public Information Specialist, PM, and FIRM will work collectively to draft project notices to be distributed to businesses and residences affected by a project. **The FIRM is responsible for the distribution of the HRSD Communication Department's approved notice a minimum of thirty (30) days prior to mobilization or any construction activities. Work shall not be permitted to begin prior to the 30-**

day notice. The FIRM shall log this distribution into Unifier - PR Notifications located under Reports.

- Attachment N: Project Introductory Notice – Template

XI. Post Project Signs (If Applicable) – When working on City assets and when required by the locality, standard signs shall be placed at strategic locations in a neighborhood to notify the public that an HRSD project is underway and to provide contact information. The Public Information Specialist will approve the sign display, and the contractor shall be responsible for procuring and installing the signage at the site(s) as defined by the locality prior to the start of construction.

- Attachment O: Project Sign-Template
- Attachment P: HRSD Project Site-Sign Specifications
- Attachment Q: HRSD Sign & Base Specifications-Product Sheet

XII. Construction Update Notices – Notices are developed by the FIRM, utilizing HRSD's approved templates, and provided to the Communications Department for review ten to fourteen days prior to any work commencing in the affected area**. The FIRM shall ensure the distribution of notices by the contractor to all affected residents and businesses at least seven days prior to any work occurring in the affected work area. Work shall not be permitted to begin until the distribution of these notices has been confirmed** and logged into Unifier – PR Notifications located under Reports. Coordination of this effort will take place with the Public Information Specialist and requires HRSD Communication Department approval.

- Attachment R: Construction Update Notices – Template

XIII. Additional Notices – Notices advising affected properties of disruptive activities shall be distributed seven (7) days before the work begins by the FIRM. The FIRM shall be responsible for drafting the notices, utilizing HRSD's approved templates, and providing them to the Communications Department for review ten to fourteen days prior to work beginning.

The contractor will be responsible for distribution of the notices to the public. **The FIRM shall ensure work will not begin until these notices have been distributed**, confirmed by HRSD, and logged into Unifier – PR Notifications located under Reports.

- Attachment S: Emergency Repair Work Notice-Template

- Attachment T: Emergency Work-Pump and Haul Notice-Template
- Attachment U: CCTV Inspection Notice-Template
- Attachment V: CCTV Notice with Cleaning and Inspection-Template
- Attachment W: Initial Smoke Testing Notice-Template
- Attachment X: Reminder Smoke Testing Notice-Door Hanger-Template
- Attachment Y: Survey Notice-Template
- Attachment Z: Survey Notices – Mailing and Tracking Log
- Attachment AA: Lateral Work Notice-Template
- Attachment BB: Boring Notice-Property Adjacent-Template
- Attachment CC: Boring Notice-Property Access-Template
- Attachment DD: Unplanned Power Interruption Notice-Template
- Attachment EE: Unplanned Water/Sewer Service Interruption Notice-Template
- Attachment FF: Project Closeout Notice-Template

XIV. Post Variable Message Boards (VMB) – VMB's shall be utilized in areas with high traffic counts, main thoroughfares, cut-throughs, or when deemed necessary to reach a larger audience. The VMBs shall be set up one to two weeks before any work and located in a manner that will advise affected traffic in all directions. In most cases, an accepted three-screen message would detail: [1] the type of work to begin (e.g. road work, utility work, overnight work, milling and paving), [2] the expected date range of the work, and [3] additional information if identified (e.g. flaggers, lane shift, lane closed). The use of, timing, and messaging of VMBs will be coordinated with the Public Information Specialist and PM.

XV. Traffic Advisories/Media Releases – HRSD's CCO or the Public Information Specialist, in the CCO's absence, will draft media releases and traffic advisories when needed. These will be coordinated with and forwarded to the locality's media contact or designee for their internal distribution and use. **Traffic advisories must be distributed 24 hours ahead of any detours occurring. Larger detours will be distributed up to 7 days ahead. Please ensure the Public Information Specialist has the date range of the detour and the approved traffic control map to aid in the creation of the traffic advisory. Allow five business days for creation and review of the advisory prior to distribution. If the planned detours are delayed, the PM or FIRM must inform the Communications Department of any date changes ahead of the advisory distribution.**

- Attachment GG: Media Release – Traffic Advisory Example

XVI. Response to Public and Media Inquiries – All media inquiries received shall be directed to contact HRSD's CCO or Public Information Specialist, in the CCO's absence. The FIRM shall address any public inquiry with courtesy and then forward

to the Public Information Specialist. HRSD and the FIRM will strive for same-day response during business hours and reply no later than the next business day to after-hours inquiries. The FIRM will be requested to provide information and/or respond to the inquiring party and to track and log these inquiries using Unifier – Citizen Inquiry Log located under Reports. The FIRM shall verify that all inquiries or concerns have been resolved, recorded, and marked as closed in Unifier before closing out the project.

Media guidance will be provided to the project team by the CCO at the beginning of each project or as requested by the project team. HRSD wallet-size media/project inquiry cards can be provided for the field staff to carry and provide to the media or any public inquiry beyond their expertise.

XVII. Attachments –

- Attachment A: Public Communication Program Checklist
- Attachment B: Stakeholder List-Template
- Attachment C: Willingness to Hold Advertisement-Example
- Attachment D: Informational Open House Advertisement-Example
- Attachment E: Open House Notice to the Public – Template
- Attachment F: Open House Requirements/Guidelines
- Attachment G: Open House Sign-In Sheet
- Attachment H: Open House Comment Card
- Attachment I: Open House Advertisement Submission Schedule
- Attachment J: Website- Project Webpage – Template
- Attachment K: Website- Project FAQs – Template
- Attachment L: Website Project Map - Template
- Attachment M: Stakeholders Notification Update-Template
- Attachment N: Project Introductory Notice – Template
- Attachment O: Project Sign-Template
- Attachment P: HRSD Project Site-Sign Specifications
- Attachment Q: HRSD Sign & Base Specifications-Product Sheet
- Attachment R: Construction Update Notices – Template
- Attachment S: Emergency Repair Work Notice-Template
- Attachment T: Emergency Work-Pump and Haul Notice-Template
- Attachment U: CCTV Inspection Notice-Template
- Attachment V: CCTV Notice with Cleaning and Inspection-Template
- Attachment W: Initial Smoke Testing Notice-Template
- Attachment X: Reminder Smoke Testing Notice-Door Hanger-Template
- Attachment Y: Survey Notice-Template
- Attachment Z: Survey Notices – Mailing and Tracking Log
- Attachment AA: Lateral Work Notice-Template
- Attachment BB: Boring Notice-Property Adjacent-Template

- Attachment CC: Boring Notice-Property Access-Template
- Attachment DD: Unplanned Power Interruption Notice-Template
- Attachment EE: Unplanned Water/Sewer Service Interruption Notice-Template
- Attachment FF: Project Closeout Notice-Template
- Attachment GG: Media Release – Traffic Advisory Example

End of Section

Section 12 – Preconstruction Assessment and Damage Mitigation Procedures

I. Chief Engineer's Introduction - In past years, HRSD received complaints from private property owners, the public, and locality staff regarding the condition of roads, sidewalks, drainage ditches, private property, damage to buildings, etc., within and along pipeline construction corridors and in close proximity to pumping station construction projects. For many of these construction projects, the captured preconstruction photography and/or video coverage was inadequate to resolve claims or complaints. This section provides evaluation processes and expectations for varying levels of preconstruction surveys and active impact monitoring during construction related to the potential construction noise, vibration, ground settlement, building damage, water ponding, and restoration complaints. Numerous publications have been authored on the matter of construction-related noise and vibration impacts to individuals and structures. Included in this section are excerpts from some of these publications to assist the FIRM in determining the appropriate level of preconstruction survey/assessment and active construction impacts monitoring to be performed for a planned construction project for the purpose of protecting all parties.

II. Purpose and Process – The purpose of this section is to deliver a project that focuses on minimizing risk and impacts to adjacent infrastructure and the community and also protects HRSD's reputation. The preconstruction assessment and damage mitigation report will document the efforts to accomplish this goal. The report should include a summary of all items discussed below, as well as any others evaluated or considered by the FIRM:

a. Evaluate the impacts and identify risks associated with the construction of the project.

b. Provide recommendations and modifications to the design to avoid the identified risks and impacts and consider mitigation or avoidance measures.

c. Utilize the reports produced and recommendations provided by the FIRM. The FIRM and HRSD team will determine appropriate mitigation efforts for the project through collaborative workshops with HRSD staff.

d. This report shall be considered a living document and should be reviewed and updated throughout the design and construction phases of the project as new risks are identified and conditions change (e.g., design changes, change of field conditions, or Contractors' means and methods).

e. Modify the Bid Documents to reflect all design changes and the recommendations resulting from this evaluation.

III. Deliverables and Timing – This section is divided into three Stages. Each stage

corresponds to evaluations and decision points related to types of construction-related impacts. Figure III-1 is a decision flow chart that is included to assist the FIRM in navigating these stages and actions. The FIRM shall produce a Stage 1 report for every project. If warranted, Stage 2 and 3 efforts will be authorized by the HRSD Project Manager and funded through the additional services budget.

The FIRM shall submit the detailed Stage 1 and Stage 2 reports within the Enterprise Project Management (Unifier) system under Transmittal-Deliverable-Turnover BP Logs, Professional Services Deliverables, and an electronic copy to the HRSD Engineering Compliance Manager. The Stage 3 deliverable shall not be submitted through Unifier, but the delivery method and format shall be coordinated with the HRSD Engineering Compliance Manager, with a copy to the HRSD Project Manager. An example of a Stage 1 and 2 report is included in Attachment H.

The FIRM shall use the template Cover Sheet provided in Attachment K and the Sample Table of Contents provided in Attachment L during the development of the report.

Workshops shall be facilitated by the FIRM corresponding to each Stage as indicated in Figure III-1. The FIRM shall then modify the report and obtain HRSD acceptance before moving on to the next Stage. As these reports are deemed a living document, additional workshops may be necessary throughout the project's life. Attendees at these workshops will include the HRSD Project Manager, Engineering Compliance Manager, Director of Design and Construction, and other key HRSD stakeholders (e.g., Communications, Operations staff), as needed.

Below are the deliverable timings:

- Stage 1 – Shall be submitted after the 50/60% design review with HRSD staff
- Stage 2 – Shall be submitted and accepted by HRSD before the 90% Design
- Stage 3 – Shall be completed before construction

Waiver Requests - On rare occasions, a project may not require the application of all parts of this section of the standards. An example of such a project might be one located on an existing HRSD property, such as on a treatment plant or in an isolated area, that does not present a perceived or material risk of damage to any or all of the following: HRSD's existing facilities or structures, any private property, roadways or the motoring public. In most cases, however, a Stage 1 analysis will be required to justify a waiver. Approval of any waiver request must be obtained, in writing, from the HRSD Engineering Compliance Manager, the responsible Director of Design and Construction, and with the Chief Engineer's acknowledgment. A template waiver request is provided in Attachment J.

The following pages and attachments provide a more detailed understanding of

the required research, information, and breakdown of efforts within each Stage to be included in the FIRM's report and workshops.

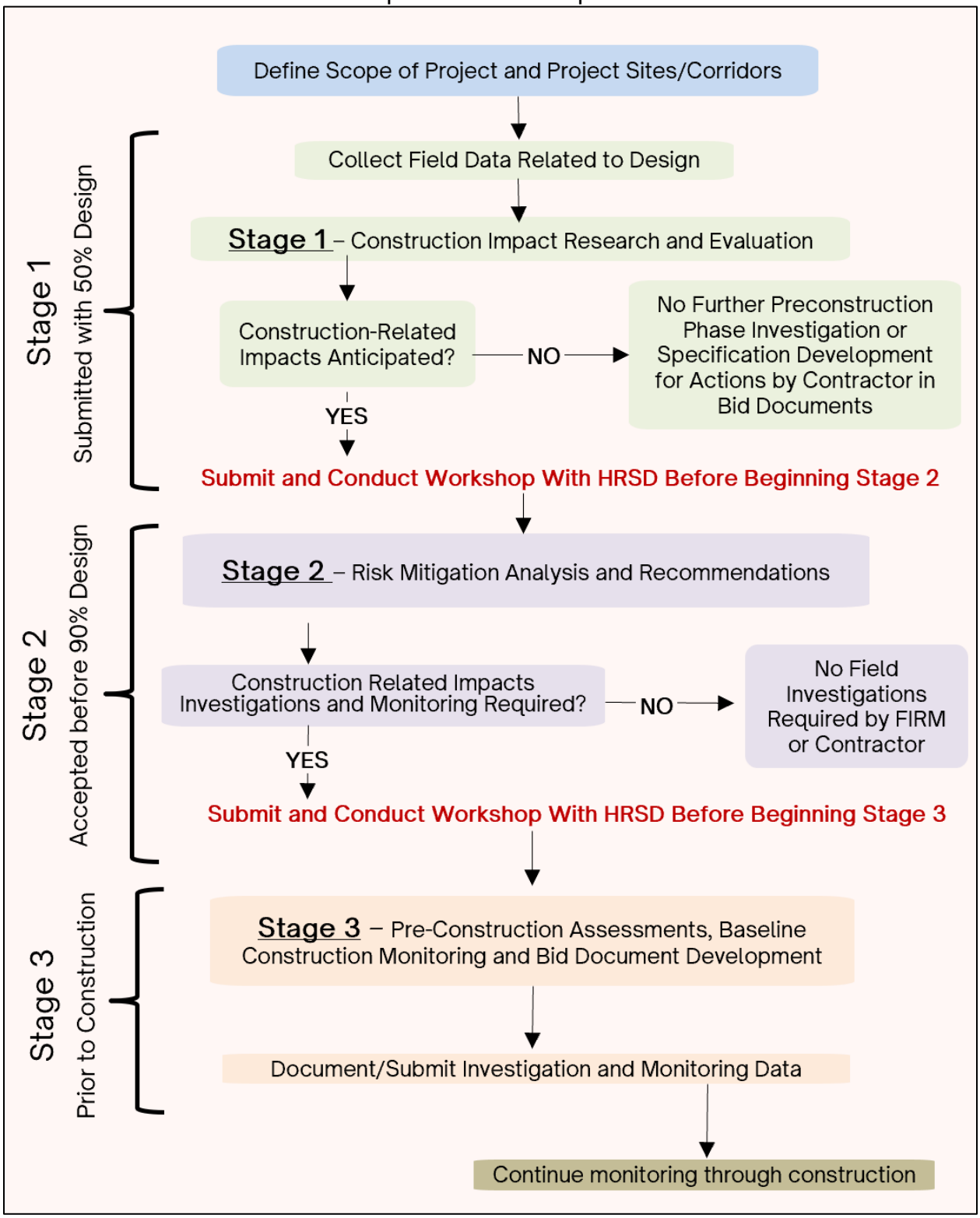


Figure III-1: Flow Chart for Preconstruction Assessment Decisions and Actions

IV. Stage 1 – Construction Impact Research and Evaluation

1. The FIRM shall perform, at a minimum, the following research and investigations (developing graphs and tables for each) to determine the possible construction-related impacts of the designed project:

   a) Determination of the various zones of influence throughout the entire project area

   b) Presence of historically significant buildings, structures, monuments, and/or sites. Resource: NPS National Register of Historic Places

   c) Determination of the types of buildings/structures (e.g., residential, business, religious, educational, daycare, etc.)

   d) Determination of age, materials of construction, presence of basements for buildings/structures and properties with pools

   e) Identify potentially sensitive structures that may exist in the area, including but not limited to, schools, crosswalks, bus stops or routes (public and private), churches, historical buildings or monuments

   f) Distance from the closest point of construction to each building, structure, and/or site

   g) Determination of other projects in the general vicinity that may be under construction at the same time, have recently been completed, or will be commencing soon

   h) Determination of soil conditions, types, and strata from soil borings

   i) Determination of groundwater levels and seasonal variations within the construction site and/or corridor

   j) Determination of topography and known or likely stormwater drainage issues

   k) Determination of dust, odor, and other emissions

   l) Additional items as identified by the FIRM

2. The FIRM shall determine and include in the report the likely construction means and methods for the designed project.

3. The FIRM shall consider the findings from the research and evaluations from

Section 12.IV-1, in combination with the likely construction means from Section 12.IV-2 above. The FIRM shall then determine the possible construction-related impacts to the surrounding areas as noted below.

a) Ranges of depth of construction (e.g., bottom of pipe trench, pump station wet well, vault, etc.).

b) Noise generation and impacts.

c) Vibration generation and impacts.

d) Anticipated heavy construction equipment for specific areas (noise and vibration impacts).

e) Construction methods and materials for trench or excavation pit stabilization and foundation support (e.g., driven temporary or permanent sheet piling, auger foundation piles, driven foundation piles).

f) Dewatering methods and likely impacts on ground settlement and/or structural impacts within the cone of depression zone, including but not limited to pools and other subsurface structures.

g) Pavement type and thickness where construction equipment will travel, or equipment/materials will be staged.

h) Determination of day versus night construction noise requirements.

i) Determination of prevailing winds in areas of construction and fugitive emissions from the construction zone.

j) Construction impacts on existing topography, hydrology, and construction travel routes and traffic counts (e.g., neighborhoods/businesses, detours, parking, buses).

k) Dust, odor, and other emissions in and beyond the construction zone.

l) Determination of Locality limitations, requirements, or Ordinances.

m) Any additional category of findings by the FIRM.

4. Construction Zone of Influence (ZOI) - The FIRM shall identify and document each potential construction-related impact, including both perceived impacts and those with the potential to cause damage. Provide a table and diagram of each impacted site within each ZOI detailing distances from the source of the impact. The FIRM shall tailor each ZOI determination to the specific construction activities proposed in that area (e.g., dewatering, vibration, and noise impacts) and by phase, if different (e.g., site clearing, demolition,

excavation). Note that a 5-foot deep open-cut pipeline excavation would be vastly different than a 40-foot-deep excavation for a pump station; thus, this effort will likely generate multiple graphics and tables. Samples of ZOI analyses can be found as Attachments A-C.

5. Additional Impact Considerations – As Stage 1 evaluations are performed, the FIRM will also consider the items below for each potential construction-related impact.

   a. Noise Generation and Impacts. Noise influences from construction activities may vary depending on the duration, equipment used, sound frequencies, environmental conditions, among other factors that need to be evaluated and possibly abated depending upon the anticipated impact of noise.

      The following diagram provides a visual relationship between common indoor and outdoor sound generators and their accompanying decibel levels. This type of graphic can be used to compare expected construction-related noise levels to more commonly experienced sounds.

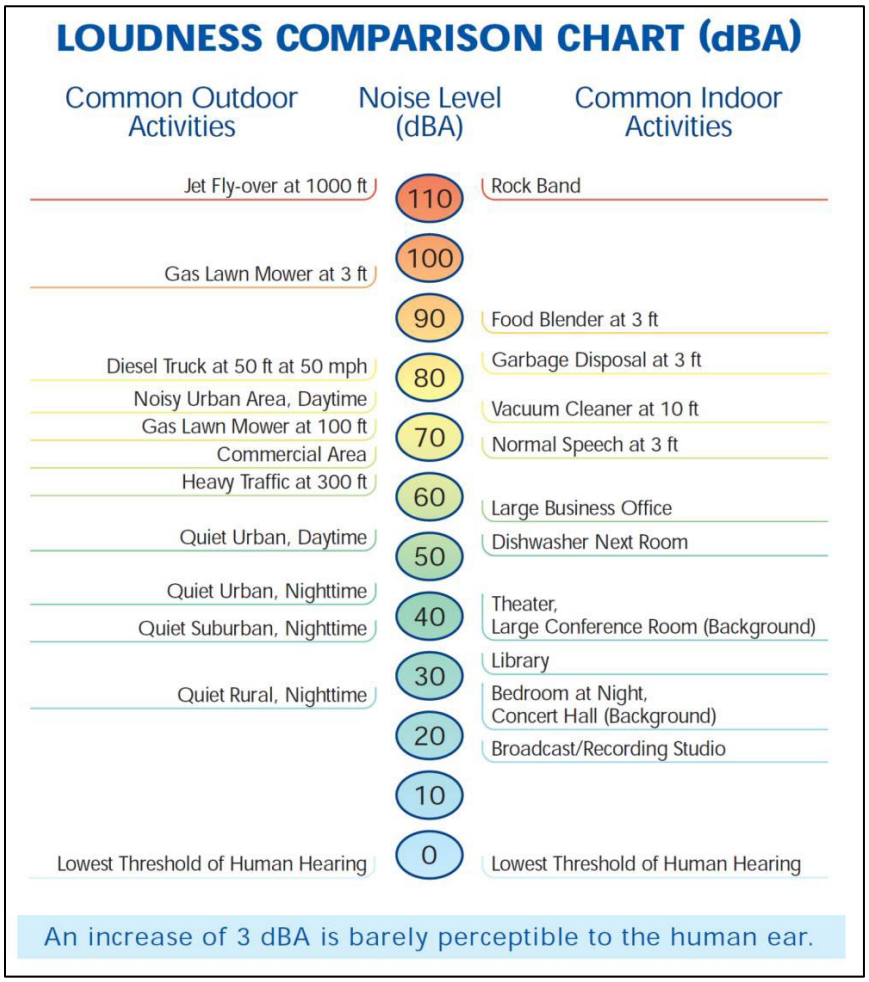
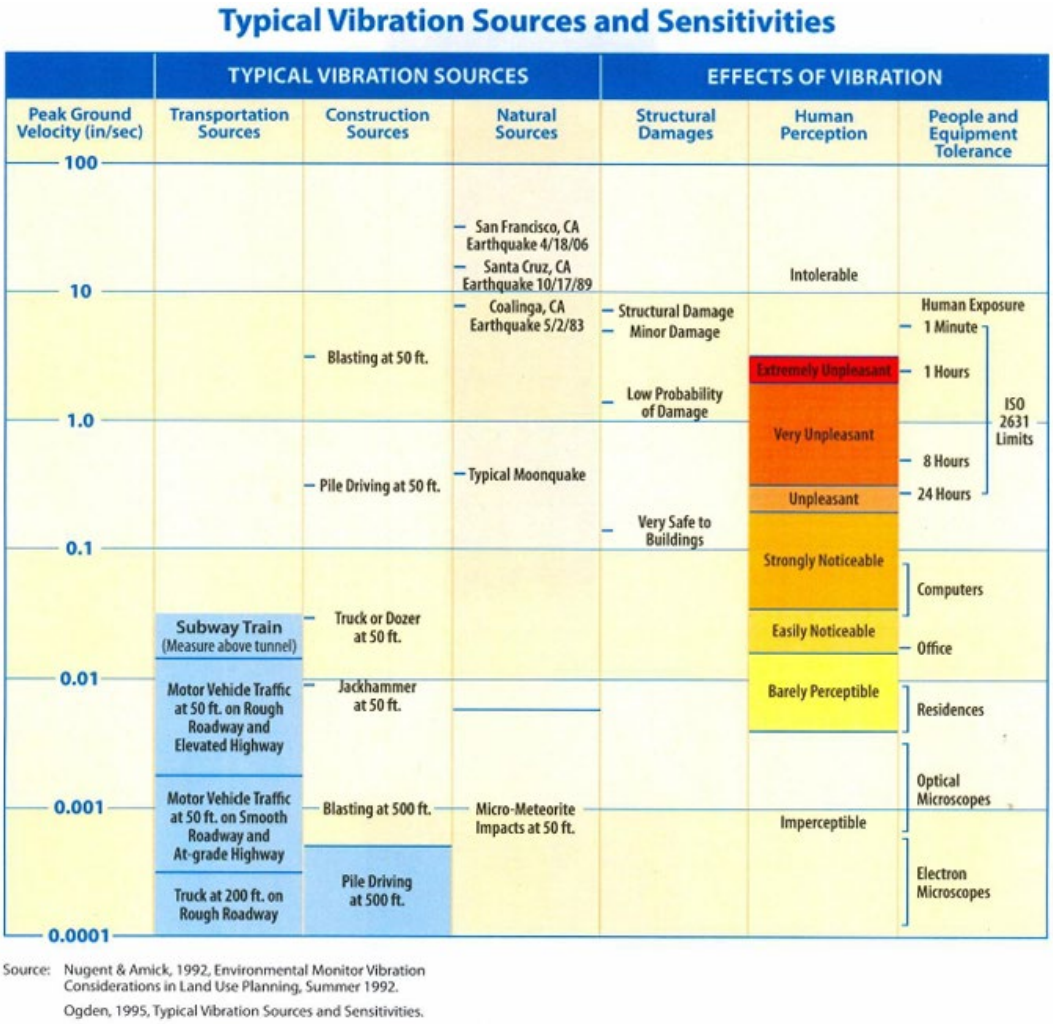


Figure IV-1: Decibel Levels for Common Sound Sources

b. Vibration Impacts. Ground vibration impacts from construction activities may vary depending on the duration, equipment used, soil types, groundwater level, vibration frequencies, construction methods among other factors that need to be evaluated and monitored depending on the anticipated impact of vibration.

The following diagram provides a relationship between vibration sources and likely impacts from the vibrations they generate.



Source: Nugent & Amick, 1992, Environmental Monitor Vibration Considerations in Land Use Planning, Summer 1992.
Ogden, 1995, Typical Vibration Sources and Sensitivities.

Figure IV-2: Typical Vibration Sources and Sensitivities

Dewatering Impacts on Ground and Structures Settlement. Dewatering deep construction trenches and excavations is a common practice for HRSD construction projects. The cone of depression for groundwater removal with well point dewatering systems needs to be evaluated for possible settling impacts on paved surfaces, buried utilities, buildings, and

other structures near the construction zone. Common occurrences with groundwater dewatering are compaction of soils as water is removed, resulting in soil movement and removal of fine soil particles along with the groundwater, resulting in voids in the soil. The FIRM is to evaluate settlement abatement methods and materials, create action plans, and identify the zone of influence specific to each project. The following figure shows the results of groundwater modeling for a calculated withdrawal rate.

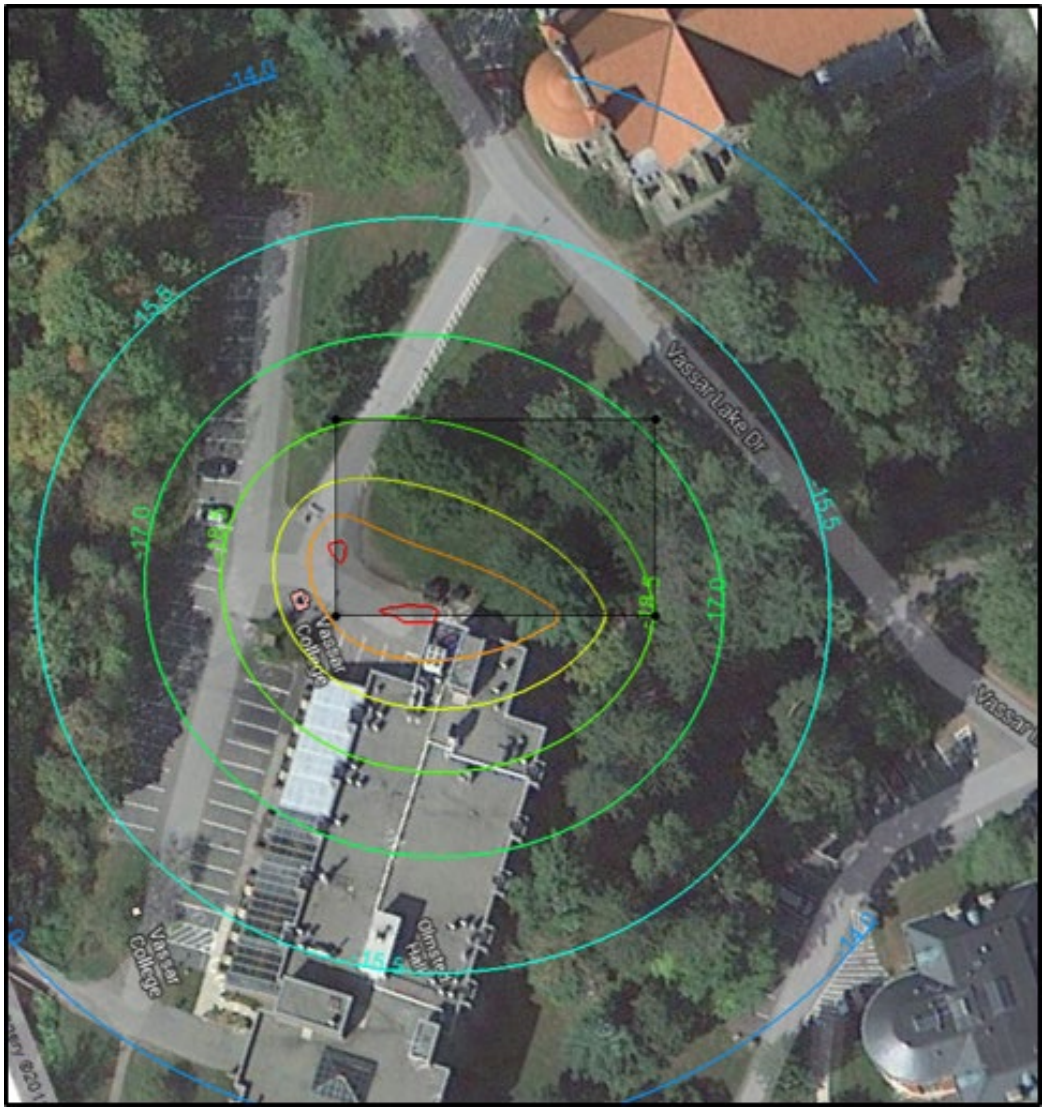


Figure IV-3: Impact Zone and Groundwater Elevations During Withdrawal

d. Construction Impacts on Existing Topography, Hard Surfaces, Hydrology, and Construction Travel Routes. The FIRM will document existing conditions and evaluate likely impacts on stormwater drainage, unpaved

surfaces, paved surfaces, concrete driveways/sidewalks, vegetation/plantings from construction equipment and material storage within the construction zones. The FIRM will consider how the Contractor(s) will deliver materials to the construction area and storage sites and movement of construction equipment across paved and unpaved surfaces. The FIRM shall create action plans and identify the zone of influence specific to each project. Consideration should be given to preventative and protective measures, as practical, to be incorporated into the construction Bid Documents.

e. Dust, Odor, and Other Emissions beyond Construction Zone**.** Construction projects have the potential to generate numerous types and quantities of fugitive emissions. Some examples of emission generating activities include site clearing; excavation and earthwork; stockpiles and storage mounds; demolition activities; spray painting; power washing; operating equipment exhausts; and site vehicular entrances and exits. The FIRM is to consider the types of construction equipment and activities within the construction zone and the potential for fugitive emissions from these sources and nuisance of these emissions. Determination of prevailing wind direction and proximity of buildings and/or sensitive receptors are to be made by the FIRM as part of this evaluation. Upon completion of these evaluations, if nuisance emissions are determined to likely extend beyond the construction zone, then further investigations and abatement efforts are warranted. The FIRM shall create action plans and identify the zone of influence specific to each project.

f. Excerpts from the *Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual September 2018* should be reviewed by the FIRM. The FIRM shall use the most recent version of this Manual for their assessment and provide acknowledgement within the submitted report which version was used and the date on which it was verified by the FIRM. The excerpts are included as Attachments M and N within this Section.

g. The referenced information and procedures provided in this Section are not all-inclusive, and therefore, the FIRM shall also apply its own experience and evaluation to supplement the information in this Section to minimize risks related to construction impacts.

STOP HERE - SUBMIT YOUR REPORT
AND SCHEDULE A REVIEW WORKSHOP, INCLUDING A VIRTUAL WALK THROUGH OF THE PROJECT LOCATION

V. Stage 2 – Risk Mitigation Analysis and Recommendations

When managing risk, HRSD uses three primary strategies: Avoidance, Mitigation, and Monitoring.

During this Stage, the FIRM shall develop mitigation and avoidance strategies for the risks and impacts identified during Stage 1. This may require the specification of Contractor activities (e.g., installation of hay bales to reduce noise; work hour restrictions) or means and methods (e.g., use of Silent Piler or trenchless technologies), or the modification of the design of the project (e.g., realignment of the pipeline; selection of a different pump station location). If the risks and impacts cannot be mitigated or avoided, then Stage 3 assessment and monitoring will be required to manage risks that cannot be mitigated or avoided.

Once the Stage 2 recommendations are accepted by HRSD, the Stage 1 report will be updated, as appropriate. For example, if the pipeline alignment was modified because of the Stage 2 recommendation, then the associated risks may have been avoided. An electronic copy of the revised Stage 1 report and the Stage 2 report will be submitted in Unifier and provided to the HRSD Engineering Compliance Manager. Stage 2 activities shall be completed before submission of the 90% design package so that Contractor-specific requirements can be included in the Bid Documents.

Stage 2 mitigation and recommendations will address, at a minimum, the following:

- Noise Impacts
- Vibration Impacts
- Dewatering, Topography, and Hydrology Impacts
- Dust, Odor, and Fugitive Emissions Controls
- Proposed Pre-Construction Surveys and Assessments
- Any other findings by the FIRM

The FIRM shall also consider the construction impacts on existing drainage, trees/vegetation, and locality and/or private roads. The FIRM will take appropriate steps to mitigate these potential impacts and incorporate appropriate requirements for the Contractor within the Bid Documents. The FIRM will collaborate with HRSD to identify and determine the appropriate level of preconstruction surveys.

As a resource, excerpts from the *Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual, September 2018* publication should be reviewed by the FIRM to mitigate vibration and noise influences and action plans as recommended. The FIRM shall use the most recent version of this Manual for their assessment and provide acknowledgement within the submitted report of which version was used and the date on which the FIRM verified it. The FIRM is to collaborate with HRSD to identify and determine the level of preconstruction surveys/monitoring efforts of properties, buildings, and structures with the potential to be impacted by construction vibrations. The excerpts are included as Attachments O and P within this Section.

The referenced information above and these procedures are not all inclusive, and therefore, the FIRM shall also apply its own experience and evaluation to supplement the information in this Section to minimize risks related to construction impacts.

STOP HERE - SUBMIT YOUR REPORT
AND SCHEDULE A REVIEW WORKSHOP

VI. Stage 3 - Pre-Construction Assessments, Construction Monitoring, Determination of Responsible Parties and Bid Document Development

I. General Discussion – The following paragraphs discuss pre-construction condition assessments for HRSD, public and private property, and facilities, as well as construction activity monitoring in areas where a level of damage or nuisance is possible, as determined by the Stage 2 assessment. These activities are intended to follow best practices for protecting all parties from damage and nuisance-related claims.

In this Stage, the responsibility for these assessments and monitoring activities will be determined collaboratively by the FIRM and HRSD, as each project is unique. Collaborative delivery projects will also require discussions with the Builder or Construction Manager. If determined to be the responsibility of the Contractor/Builder/Construction Manager, the FIRM will incorporate the items below into the technical requirements of the Bid Documents.

The following activities will be performed during the Pre-Construction Phase of the project:

1. A pre-construction condition assessment after award of the construction contract but before the start of any construction activities. The purpose of this assessment is to determine vibration and noise baselines and document the existing conditions of infrastructure and structures that may be impacted by the work, as contemplated in Stages 1 and 2 above and coordinated through the HRSD Engineering Compliance Manager. The FIRM shall document the exterior and interior (if possible) of residences, commercial, and industrial properties after obtaining the signed approval of the property owner (or their authorized agent). Documentation should include detailed and identifiable videos, images, and surveys to capture **ALL** existing conditions, with an emphasis on detailing damages or deficiencies (e.g., cracks and settlement). The documentation shall also provide detailed comments to describe the documented area or item (e.g., 1st floor, living room) and any observations (e.g., right wall, step crack 4mm

wide and 36 inches long, no other deficiencies found, or unable to visualize left wall due to furniture blocking). These assessments shall be completed and submitted to the HRSD Engineering Compliance Manager at least 30 days before Contractor mobilization. Once approved by HRSD, the FIRM will forward a copy to the Contractor for their use. An example report is included in Attachment I.

2. A post-rain event field reconnaissance immediately following a rain event. At a minimum, take photographs at each roadway intersection, all driveways, and a minimum of two pictures at the front of each property. Photograph all standing water areas within the construction limits. Digital photographs are to be labeled with the time and date taken, project stationing, cardinal direction, street address, or other identifying features. Capture video recordings along the construction limits, including roadway intersections, all driveways, and each property and structure. Recorded audio on the video recordings shall describe observations and identify the property address and construction stationing. Provide digital images and videos to the HRSD Engineering Compliance Manager for review and approval at least 30 days before Contractor mobilization.

The following are procedures associated with the pre-construction condition assessment of private property buildings and facilities described above. Note that all documentation sent out to the public must be approved by HRSD's Communications Division before distribution or use. Coordinate this effort with the HRSD Public Information Specialist and the HRSD Engineering Compliance Manager.

1. Maintain the HRSD Communications and Contact Tracking Log (Attachment D) to document each verified property owner and renter/lessee, their address, method of contact, and dates of contact attempts to gain access permission. At a minimum, three (3) certified return receipt attempts for each property are required before the property owner may be classified as "unable to contact."

2. Use the HRSD Assessment Request Letter Template (Attachment E) to gain permission to enter the property for this assessment

3. Use the HRSD Right to Access Property Form (Attachment F) and have the property owner (or authorized agent) sign. Provide a copy to the property owner (or authorized agent) for their records before entering private property.

4. Provide video and still photographs, and details as noted above in sub-section C.1. HRSD has the sole right to determine the

acceptability of these items. Provide a sample to the HRSD Engineering Compliance Manager for review and approval.

a. Photographs shall be a minimum 24-megapixel and videos shall be a minimum 1080p (Full HD), 60 frames per second that capture details effectively, with focus and stability, and clear audio. Images and videos shall be in “Exchangeable Image File Format” (EXIF). A date and time stamp shall be present in all files.

b. A ruler or other measurement device should be included in the photograph and video, for scale, next to the observed crack or defect.

5. Log the conditions using the HRSD Pre-Existing Condition Assessment Reporting Form (Attachment G). Upon completion, have the property owner (or authorized agent) sign this form.

6. Provide a sketch of each room inspected, documenting the location of each identified existing defect.

7. Prepare an overall summary report of these assessments. All items described above will be submitted in a single report, organized by each property or structure. This report will be submitted to the HRSD Engineering Compliance Manager for review and approval at least 30 days before the start of construction.

The following procedures are associated with a vibration monitoring program to be performed during the construction phase of the project. An example vibration monitoring plan from the Minnesota Department of Transportation is included as Attachment Q to provide insight for establishing various responsibilities and accountabilities for a construction-related vibration program. The FIRM is to collaborate with HRSD to establish a vibration control and monitoring program specific to the construction project's needs.

1. Duration of the monitoring, including:

   i. A minimum of 15 days of pre-construction, baseline vibration monitoring.

   ii. During the entire extent of the construction activities.

2. Specific locations throughout the project extents for vibration monitors, including the use of vibration monitors in tandem, placed a designated distance apart, for properties to be monitored. Stationary and rolling vibrations monitor placements should be considered.

3. Peak particle velocity (PPV) thresholds.

4. The amount of memory needed for each vibration monitor to capture data in the monitoring log for the date ranges required.

5. The calibration requirements for vibration monitors.

6. The minimum experience and qualification requirements for the technician and the company performing the vibration monitoring program.

7. The FIRM will verify that vibration monitors are properly installed at the correct locations.

8. Develop and implement a monitoring program for any pre-existing cracks identified during the pre-construction assessments, to allow quantification of changes to these cracks during construction.

   The FIRM, when requested, will produce a document intended for educational use with the public detailing the zone of influence, distance attenuation of ground vibrations and how it was determined, the levels of vibration (maximum peak velocity) recorded during the project, and examples of what those levels equate to for the public. This document will be submitted to the HRSD Engineering Compliance Manager upon request and updated as necessary to include the most recent property-specific vibration data. The FIRM may be required to join HRSD in a meeting with the public/property owner to relay technical information. A sample of this document can be found in Attachment R.

VII. Attachments

A. Sample – Noise and Vibration Generation and Impacts (combined diagram and impact table)

B. Sample – Noise and Vibration Generation and Impacts by Phase (diagram and impact table)

C. Sample – Dewatering Impacts

D. Pre-Construction Conditions Assessment Communications and Contact Tracking Log

E. Assessment of Pre-Existing Conditions - Right to Access Property Form

F. Letter to Property Owner Template for Pre-Existing Conditions Assessment

G. Pre-Existing Condition Assessment – Reporting Form – Template

H. Sample – Precondition Assessment and Damage Mitigation Report

I. Sample – Precondition Assessment Field Survey Report (excerpts)

J. Template - Waiver Request

K. Precondition Assessment and Damage Mitigation Report – Cover sheet

L. Precondition Assessment and Damage Mitigation Report – Table of Contents

M. Excerpt Federal Transit Administration Vibration Impact Assessment 2018

N. Excerpt Federal Transit Administration Noise Impact Assessment 2018

O. Excerpt Federal Transit Administration Vibration Mitigation 2018

P. Excerpt Federal Transit Administration Noise Mitigation 2018

Q. Sample - Vibration Monitoring Program

R. Sample – Summary Assessment Memo for Public Use

End of Section

Section 13 - Coordination with Virginia Department of Environmental Quality (DEQ) for Certificate to Construct and Certificate to Operate

I. Introduction - As a result of significant staffing reduction within the Virginia Department of Environmental Quality (DEQ) in 2008, requirements by DEQ were implemented in an attempt to streamline their approval process for applications of Certificates to Construct (CTC) and Certificates to Operate (CTO). DEQ also identified a variance procedure for those projects that are non-capacity related or maintenance related work. Projects that have been identified by DEQ as requiring a CTC and CTO include new sewage treatment works, new sewage pump stations and force mains in excess of 2,000 gallons per day (gpd), new sanitary gravity sewers in excess of 40,000 gpd, any project that increases or decreases capacity and major modifications to sewage works. In addition, water reuse related projects that require CTC and CTO under the Water Reclamation and Reuse Regulations (9 VAC 25-740.120.B.1.) include new industrial or municipal reclamation systems, new municipal satellite reclamation systems and reuse water storage. This Section describes when to use each of the four listed approaches to obtain either a CTC or a CTO.

A. FIRMs shall have HRSD (Chief Technical Officer and Chief of Water Quality) review and approve prior to submitting CTC and CTO to DEQ.

II. Approval CTC Process for State Water Quality Improvement Fund (WQIF) Projects - This involves DEQ's full engineering review process. Approval steps and specifics follow:

A. Submission of Preliminary Engineering Report (PER) or Final Engineering Report (FER).

1. Specifics for PER as listed below.

a. Suggested outline in 9 VAC 25-940.

b. Must address any additional items required by WQIF.

c. One hard copy initially to Office of Wastewater Engineering (OWE), WQIF, and Virginia Clean Water Revolving Loan Fund (VCWRLF) if needed plus one Portable Document Format (PDF) copy of final to OWE.

d. Review time 30-60 days per submittal

2. Specifics for FER as listed below:

a. Details in GM 07-2011

b. All calculations, site plan, hydraulic profile, etc.

c. Geared toward design build project

d. One hard copy to WQIF, OWE, and VCWRLF (if needed) initially

e. One PDF and one hardcopy of final plans and specifications to OWE

f. Review time 30-60 days per submittal

g. Conditional CTC issued on FER

h. Submit plans and specifications prior to the issuance of a CTC

i. Deficiencies found in plans and specifications must be corrected regardless of status

B. Other submissions to include:

1. Plans and Specifications

2. Design calculations with explanatory text as needed

3. Certification statement for non-WQIF funded components

4. One hard copy to OWE, WQIF, and VCWRLF (if needed) initially (half size preferred)

5. One PDF and one hardcopy of final plans and specifications to OWE

6. Review time 30-60 days per submittal

C. Submission of a Statement of Completion for CTO.

1. FIRM should contact DEQ 30-60 days prior to issuing Statement of Completion to coordinate inspection.

2. The inspection will be scheduled as close to the Statement of Completion issuance date as possible

3. Upon confirmation of the project's compliance with the CTC and after Statement of Completion is received, a CTO is issued by DEQ.

D. DEQ recommendations for full approval process:

1. Use proven technology or have design basis well established

2. Provide complete submittal packages

3. Provide complete contact information

4. Bring up potentially controversial issues early

5. Provide background and goal of project

6. Provide separate calculations

7. QA/QC all work

III. Abbreviated Administrative Process for Non-WQIF Projects_- Projects that fall into this category include Municipal Sewage Treatment Works, Sewage Collection Systems, Reclamation Systems and Satellite Reclamation Systems.

A. Approval process involves:

1. Submission of an Application

2. Attachments (if applicable)

a. Project Description

b. Pump Stations – Reliability Class Worksheet

c. Downstream owner acceptance

d. Justification for variances from SCAT Regulations

3. Apply after Plans and Specifications Complete

4. Apply after VPDES permit obtained

5. For Sewage Treatment Plants (STPs), design flow must match permitted flow

6. FIRM must provide signature and seal on certification statement

7. FIRM assumes responsibility for compliance with design regulations

B. CTO for Projects NOT receiving WQIF funds:

1. Submission of an Application

2. Application contains a Statement of Completion

3. FIRM signs Statement of Completion to certify construction complete in substantial compliance with CTC

4. Provide original to DEQ Regional Office

5. Processed by Water Permit Staff

6. Application is signed by DEQ and becomes the CTC or the CTO

7. Turnaround time about 2 weeks

8. If needed, the CTO will trigger issuance of a new DMR

IV. Approval Process for Non-WQIF Project That Involve Greater Than a 25% Capacity Increase or Decrease - Projects that fall under this process include new, replacement, or relocated sanitary sewer mains and force mains that are to be larger or smaller in diameter than the original pipelines; and new or rehabilitated sanitary sewage pumping stations with capacity increase/decrease. This process follows the steps of the Abbreviated Administrative Process for Non-WQIF projects as detailed above with the addition of the following requirements:

A. Demonstrate that the Project meets/exceeds the HRSD Regional Sewage Flow Projection Table or was designed to another standard to be described in the CTC request letter.

B. HRSD has adequate downstream capacity to convey and treat the flows.

C. HRSD has consulted with the affected Locality and there are no detrimental impacts.

D. In order to satisfy these additional requirements, a letter shall be submitted to DEQ that contains the elements in the template letter. The Chief Engineerfor HRSD will sign the letter that is to be submitted to DEQ.

1. Pressure reducing pumping stations (PRS);

2. Pumping station replacement;

3. New or replacement pipeline.

V. On-line Resources within DEQ for Approval Process - Visit DEQ homepage (https://www.deq.virginia.gov/home) for information on Administrative Approval and status of a project submitted for CTC or CTO.

VI. Attachments:

A. Sample Letter – Pressure Reducing Pumping Stations

B. Sample Letter – Pumping Station Replacement

C. Sample Letter – New or Replacement Pipeline

Section 14 - Coordination of Preconstruction Phase Items

I. Introduction – The following clarifications are presented for submittals and procedures during the preconstruction (bid advertisement / pre-award) phase of projects managed by the Design and Construction Departments. HRSD uses electronic business processes and systems, as well as online construction bid advertisement and bid receipt. This Section does not address specific means of interfacing with HRSD's Enterprise Project Management (Unifier) system and HRSD's Online Oracle Enterprise Resource Planning (ERP) system, but rather general requirements. This section should be cross-referenced with Section 39.

II. Coordination with Engineering Contract Specialist - The following are to be provided to the Contract Specialist prior to construction bid advertisement:

A. Updated Opinion of Probable Construction Cost (OPCC) as prepared by the FIRM [*to be provided a minimum of 10-14 business days prior to the bid release date as agreed to by the HRSD Contract Specialist*]. *(HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval).*

B. Justification (letter or memorandum) for established liquidated damages [*to be provided a minimum of 10-14 business days prior to the bid release date as agreed to by the HRSD Contract Specialist*]. *(HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval).*

C. Redline markups of the EJCDC front end sections to the Bid Documents *to be provided a minimum of 10-14 business days prior to the bid release date as agreed to by the HRSD Contract Specialist*. Note that the *HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval and ensure all sections are completed accordingly to minimize bid delay.*

1. The FIRM shall request the current version from the HRSD Project Manager.

2. The Contract Specialist will make appropriate revisions to the referenced sections.

D. Word Document of the Table of Contents including Technical Specifications and Drawings List [*to be provided a minimum of 10-14 business days prior to the bid release date as agreed to by the HRSD Contract Specialist*]. *(HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval).*

E. Bid form (or suggested bid items) matching the OPCC and Technical Specifications. For Unit Price Bids, the bid must have a Measurement and

Payment technical specification, and for Lump Sum Bids, it will have a Schedule of Values or a Measurement and Payment technical specification section (quantities must match on the bid form and OPCC). [*to be provided a minimum of 10-14 business days prior to the bid release date as agreed to by the HRSD Contract Specialist*]. *(HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval.)*

F. PDF version of Bid Documents (all volumes) [*to be provided a minimum of 7-10 business days prior to the bid advertisement date as agreed to by the HRSD Contract Specialist]. (HRSD Project Manager needs these items for review in order to submit in Unifier for Director approval).*

G. Copies of all addenda to be provided to the Contract Specialist as soon as available by the FIRM for distribution to Plan Holders via HRSD's Online Oracle ERP system [*to be provided no later than two, but preferably five, business days prior the scheduled Bid opening to the HRSD Contract Specialist*] *(approved by the HRSD Project Manager).*

1. Any addenda issued less than two business days prior to the bid opening will be to extend the bid date as approved by the Chief Engineer.

H. Prior to the bid opening date, the FIRM shall create a response to the solicitation in ERP and shall enter the most recent OPCC, providing each bid item on the online bid form.

III. <u>Coordination with the Design and Construction Director and Project Manager</u> - The following is to be provided to the Director and Project Manager prior to contract award.

A. A bid recommendation letter.

IV. Attachments:

A. Sample Bid Recommendation Letter

End of Section

Section 15 - Preparation of and Format for Construction Addenda

I. Introduction - The Design and Construction Departments contract with a wide variety and significant number of FIRMs for design and construction oversight responsibilities for both capital and non-capital projects. FIRMs are responsible for preparing Addenda if necessary. The definition for "*Addenda*" in the C-700 Standard General Condition Section of the EJCDC documents is: "*Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents*". This Section establishes a protocol for Addenda preparation for projects managed by and through the Engineering Division. The following requirements will lead to consistency on information within an addendum and enhance the FIRM's ability to prepare consistent Conformed Documents as detailed in Section 16 in this manual.

II. Guidelines and Specific Requirements

A. Per Article 7 "Interpretations and Addenda" in the Instructions To Bidders Section 00200 of the EJCDC documents, the following apply:

1. All questions about the meaning or intent of the Bidding Documents are to be submitted to the HRSD Contract Specialist via HRSD's Online Oracle Enterprise Resources Planning (ERP) System.

2. Interpretations or clarifications considered necessary by FIRM in response to such questions will be issued by Addenda coordinated with the Project Manager and HRSD Contract Specialist and delivered via HRSD's Online Oracle ERP to all registered Suppliers invited to the Bid.

3. Questions received less than 7 calendar days prior to the date for opening of Bids may not be answered.

4. Only questions answered by Addenda will be binding.

5. Oral and other interpretations or clarifications will be without legal effect.

6. Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable and approved by the HRSD Project Manager.

B. The Pre-Bid meetings are typically not mandatory so what is discussed in these meetings could provide an unfair bidding advantage for someone in attendance. If items were addressed in the Pre-Bid meeting that could be interpreted as clarifying, correcting, or changing the Bidding Requirements or the proposed Contract Documents, then these items must be prepared

in the provided Addendum format by the FIRM and provided to the responsible HRSD Contract Specialist for distribution via HRSD's Online Oracle ERP. The Pre-Bid meeting presentation material, summary of discussion, attendance list, and the like will be provided to the responsible HRSD Contract Specialist to be disseminated via the ERP online discussion portal.

C. An Addendum should not be prepared for communication with potential bidders or manufacturers' representatives, unless an issue related to potential change to contract price or time is mentioned. The attached Addenda template shall be used if an addendum is deemed necessary by the HRSD Project Manager and/or FIRM.

D. Any Addenda issued less than two business days prior to the Bid Opening will be to extend the Bid Opening date. All Addenda are issued within HRSD's Online Oracle ERP system.

E. Descriptive terms in the Addendum shall be limited to the following:

- ADD
- CLARIFY
- DELETE
- INSERT
- REPLACE
- REVISE

F. Copies of all Addenda developed by the FIRM are to be transmitted to the Contract Specialist for distribution to Plan Holders via HRSD's ERP.

G. Confirmation by the Contract Specialist will be made via HRSD's ERP that all Addenda have been received and acknowledged by the Plan Holders.

H. All Addenda are to be acknowledged by the Bidder(s) submitting a Bid.

I. All items included in the issued Addenda are to be incorporated into the Conformed Documents detailed in Section 16 in this manual.

III. <u>Attachments:</u>

A. Addendum Template

End of Section

Section 16 - Preparation of and format for Conformed Documents

I. Introduction - The Design and Construction Departments contract with a wide variety and significant number of FIRMs for design and construction oversight responsibilities for both capital and non-capital projects. As a part of the Bid Phase services, FIRMs are responsible to prepare Addenda as necessary, assist HRSD with determining if the apparent low Bidder is both responsive and responsible, and making a recommendation for award of a construction project. Following the recommendation for award of a construction contract and prior to the pre-construction meeting with the successful Contractor, the FIRM is to prepare "Conformed Documents". The Conformed Document includes revisions to the Bid Documents that are referenced in the Addenda, Agreement and Questionnaire from the Contractor, and any other changes from the original Bid Documents. These Conformed Documents (Drawings and Specifications) are intended to allow HRSD, the FIRM, Inspectors, the Contractor, the subcontractors, and product vendors to easily identify any of the changes made on the plan sheets or specification pages that were modified via Addenda. This section establishes a protocol for Conformed Document preparation for those projects managed by and through the Engineering Department. No changes other than those described within this section shall be made with the Conformed Documents.

II. Specifications - The Conformed Specifications shall include the following:

A. Specification Cover – the phrase "CONFORMED DOCUMENT" and the DATE shall be added adjacent to the Engineer's or Architect's Seal.

B. Revised TABLE OF CONTENTS with the heading "ADDENDA" and a listing of all Addenda generated for the Project. The new ADDENDA heading shall be added immediately prior to the BIDDING REQUIREMENTS heading on Page 1 of x.

C. An ADDENDA title page and all generated Addenda shall be included following the TABLE OF CONTENTS.

D. The electronic version of the "Front-End" documents, as modified by and furnished by the HRSD Contract Specialist shall be included.

E. The Contractor completed QUESTIONNAIRE, minus financial information, shall be included to replace the original Questionnaire provided with the Front-End documents.

F. The Contractor completed VIRGINIA BID BOND (these are not required for Emergency Declaration Projects) shall be included to replace the original Virginia Bid Bond provided with the Front-End documents.

G. The Contractor and HRSD completed AGREEMENT shall be included to replace the original Agreement provided with the Front-End documents. HRSD uses the C-520 Agreement of the EJCDC documents for typical Design-Bid-Build project delivery.

H. The Contractor completed VIRGINIA PERFORMANCE BOND shall be included to replace the original Virginia Performance Bond provided with the Front-End documents.

I. The Contractor completed VIRGINIA PAYMENT BOND shall be included to replace the original Virginia Payment Bond provided with the Front-End documents.

J. Annotations in the Technical Specifications sections and paragraphs referenced in the Addenda shall be included. The annotations shall be in a "Track Changes" mode with new or replaced text being bold underlined and a line thru any changed or deleted text. The Addendum responsible for the revision shall be noted in {} at the end of the sentence where the Track Change is made. An example would be {*Addenda No. 1*}.

III. Drawings - The Conformed Drawings shall include the following:

A. Drawing Cover Sheet – the phrase "CONFORMED DOCUMENT" and the DATE shall be added adjacent to the Engineer's or Architect's Seal.

B. Annotations on the Drawings as referenced in the Addenda shall be made to the original DWG sheets and regenerated. Changes as a result of Addenda shall be either "clouded" along with the Addendum reference or leader lines pointing to the revision along with the Addendum reference in {}. An example would be {*Addenda No. 1*}.

C. Update the title block on all modified Drawing sheets to reflect "Conformed Drawings".

D. If additional drawing sheets are needed due to additional notes or details, the Drawing sheet number shall be the number of the preceding sheet (at the proper insertion point) with the addition of a ".1". An example would be if a new sheet to follow C-9 is required as per Addenda No. 2, the new sheet would be "C-9.1" and inserted immediately following sheet C-9.

E. Any additional Drawing sheets inserted as a result of an Addendum will necessitate renumbering the total number of sheets and an updated Drawing Sheet Index.

IV. Format and Number of Conformed Documents - Electronic and paper submittals (*if requested*) to be delivered at the same time.

A. Electronic Format for Conformed Specifications Manual - A single Portable Document Format (PDF) format file of the Conformed Bid Documents (Project Manual) shall be prepared and delivered to HRSD. The following numbers of copies shall be delivered to the HRSD Project Manager prior to the Pre-Construction meeting with the Contractor for distribution:

1. For projects that are managed in HRSD's Enterprise Project Management (Unifier) system, the PDF file shall be uploaded to the proper project and Business Process in Unifier.

2. For all other projects that are not set up in Unifier, FIRM to supply PDF versions via portable media to both HRSD and Contractor.

B. Electronic Format for Conformed Drawings - A single PDF format file of the Conformed Drawings shall be prepared and delivered to HRSD. The following numbers of copies shall be delivered to HRSD's Project Manager at the same time as the Conformed Specification PDF for distribution:

1. For Capital Projects that are managed in Unifier, the PDF file shall be uploaded to the proper project and Business Process in Unifier.

2. For all other projects that are not set up in Unifier, FIRM to supply PDF versions via portable media to both HRSD and Contractor.

C. Paper Format - Refer to specifics in Attachment A of Section 8 "PER, Design, and Construction Submittal Requirements" or as otherwise negotiated for number of and specifics of paper copies.

End of Section

Section 17 - Tracking of Construction Phase Milestones and Performance Metrics

I. Introduction - The Project Managers administering and coordinating engineered projects are required to track numerous items during the construction phase of a project to verify HRSD's project archives are complete prior to closing out a project. The purpose of this Section is to gain assistance in tracking these milestones from the FIRM responsible for the construction administration of HRSD's projects. A template form (Attachment A) is provided for this use.

II. Completion and Submittal of Construction Milestone Tracking Form

A. The FIRM shall use the attached template form to create and input dates of the listed milestones for each project the FIRM is managing during the construction phase. Use "N/A" for any items that do not apply to the project.

B. The FIRM shall update and submit a copy of the construction milestone tracking form along with each monthly status report / payment request to HRSD upon start of the preconstruction phase.

C. The Project Manager shall provide a copy of each received construction milestone tracking form, if not included in HRSD's Enterprise Project Management (Unifier) System, to the appropriate Director of Design and Construction.

D. These tracking forms will assist the Project Manager in properly confirming the Project Stage Gate in Unifier for CIP projects.

III. Performance Metrics

A. Regular updates, scheduled submittals, and overall timely completion of the construction milestone tracking forms will be used as a Performance Metric for Project Managers and also for the FIRM.

B. The Director of Design and Construction will discuss on a regular basis with the Project Managers whether the goals of submitting monthly updated construction milestone tracking forms to the Directors are being met.

C. Goals for completion of the Contractor's evaluation by a joint effort by the Project Manager and the FIRM shall be within 60 calendar days of the Contractor's final payment request.

D. Goals for completion of the FIRM's evaluation by the Project Manager shall be within 60 calendar days of the FIRM's final payment request.

IV. Attachments:

A. Milestone Tracking Form

End of Section

Section 18 - Expectations for Construction Administration and Construction Inspection

I. Introduction - HRSD has for many years relied upon FIRMs to provide construction administration and inspection as a natural extension of design and preconstruction phase services for all types of HRSD infrastructure. To document and disseminate our expectations for construction inspectors and/or resident engineers, this Section was developed and intended to be followed. This document provides minimum expectations and is therefore not comprehensive with listing all the skills, knowledge, and abilities that inspectors or resident architects/engineers (RA/RE) must possess to be successful.

Typically, the agreement between HRSD and the FIRM for construction phase services including project management, technical consultation and resident inspection during construction through either the Construction Administration Services or the Field Engineering and Inspection Services as mutually agreed by HRSD and the FIRM will refer to this section of the *HRSD Design and Construction Standards* for clarification between services covered under Construction Administration and Construction Inspection. HRSD expects the FIRM to perform these tasks as required as the prime administrator and inspector on the construction project with HRSD providing only general oversight and coordination.

The expectations in this Section are coded based on HRSD's general experience to indicate whether the individual tasks are a primary responsibility (P) or secondary responsibility (S) as appropriate under the Lump Sum Construction Administration Services (CA) or the Unit Price Field Engineering and Inspection Services (CI). The FIRM may propose different primary and/or secondary responsibilities during negotiations based on their organization and qualifications of staff.

II. Organization of this Section - This document has been divided into main categories as follows:

A. General Expectations

B. Preconstruction

C. General Procedures

D. Tie-In, Shutdown, and Diversion Procedures

E. Line Stop Procedures

F. Trenchless Crossing Procedures

G. Damage Assessment and Claims Procedures

H. Training

I. Record Keeping

J. Staffing

K. Verifications

III. General Expectations

CA	CI	EXPECTATION / TASK
	P	Inspectors should understand the importance of their role in achieving the highest quality construction outcomes and have the technical knowledge, tact, and good judgment to effectively perform observation duties.
	P	Inspectors to fully understand the extent of responsibilities; accepts responsibility; does not overlook potential problems; does not overstep authority; understands supervisor's expectations; and records all verbal instructions in daily reports.
	P	Inspectors' extent of responsibilities includes requiring work in accordance with plans and specifications; points out issues but does not direct work; reviews with supervisor policies and authority to stop Contractor's operations for safety violations or construction deficiencies.
	P	Inspectors to review and be familiar with HRSD, FIRM and Contractor's organization, chain of command and team members.
	P	Inspectors to review and be familiar with administrative and reporting procedures. These procedures should be discussed between the FIRM, Inspectors, Contractor, HRSD, and other stakeholders at the preconstruction meeting.
	P	Inspectors to review and be familiar with contract documents, addenda, changes and other revisions.
	P	Inspectors to review and be familiar with the Bid Documents (drawings and specifications) related to required work, materials and equipment, omissions, discrepancies in and/or between plans and specifications and existing site conditions, common details, trouble areas, and overlooked items.
	P	Inspectors to review and be familiar with shop drawings related to layout, material and equipment, omissions, discrepancies, and conformance with actual work performed and equipment installed.
	P	Inspectors to review and be familiar with contract schedule to anticipate work activities and to review time-sensitive submittals and shop drawings.
	P	Inspectors to review and be familiar with permits, approvals, and other rights of entry documents issued by private entities, federal, state, and railroad or city/county agencies.
	P	Inspectors to interact with Contractor's personnel in business-like, cooperative, and personal manner, with understanding and without prejudice; while protecting interests of HRSD, FIRM and the Public, Inspector and Resident Architect / Resident Engineer (RA/RE) to be "firm yet fair" with Contractor.

CA	CI	EXPECTATION / TASK
	P	Inspectors to always be courteous and helpful to the public. If representatives from the Media or other interested parties ask questions or enter the work zone, inform HRSD Project Manager, HRSD Public Information Specialist and/or Chief Communication Officer as soon as possible. Inspectors are not to represent HRSD with the Media or other similar groups/individuals.
	P	Inspectors to always avoid the following: dictating directions to Contractor's personnel unless specified in the Contract documents; discussing issues directly with Contractor's crew unless the Contractor's designated supervisor is present; taking part in any workforce dispute; and giving specific safety related directions to Contractor unless imminent danger conditions are observed.
	P	Inspectors to observe Contractor's work activities for conformance with plans, specifications, and other contract documents.
	P	Inspectors to comprehend the specifications, conditions of the contract, and plans.
	P	Inspectors to be knowledgeable of HRSD definitions of a utility conflict when situations arise in construction that are not accurately shown on the plans.
	P	Inspectors to be knowledgeable of personal safety issues and informing Contractor on observed unsafe conditions and/or practices.
	P	Inspectors to follow HRSD and regulatory requirements for personal protective equipment (PPE) for the environments and conditions to be encountered.
S	P	Inspectors to understand the importance of specialized inspections, be knowledgeable of them, and possess the necessary certifications, where applicable. Types of specialized inspections include, but are not limited, to cathodic protection systems, coating systems, instrumentation and monitoring systems, and pump station and pressure reducing station start-ups.
	P	Inspectors to understand the importance of protective coatings and cathodic protection, and to be knowledgeable of their application/installation, including but not limited to, knowing the proper methods for application/installation and repairs and how to test/inspect the systems to ensure proper application/installation and repair.
S	P	Inspectors to be knowledgeable of how to address issues with inquiring residents, regulators, jurisdictional inspectors, fire marshal, and OSHA.
	P	Inspectors to exercise good judgment and know when to call for assistance. Inspectors should be very cautious and should avoid making "deals" in the field affecting cost, time, and/or quality.
S	P	Inspectors to assist FIRM and HRSD staff as requested.

CA	CI	EXPECTATION / TASK
	P	Inspectors to be able to enter trenches, manholes, tanks, and other facilities they are responsible to inspect with proper entry and safety equipment and following HRSD safety procedures, their own safety protocols / procedures, and other agency safety procedures per the job site. Inspector shall communicate needs with Contractor and FIRM, as appropriate, to perform inspections, including, but not limited, trench shoring, ladder, confined space gear and certification.
P	S	FIRM is responsible to provide all tools, equipment, and training, necessary to perform inspections to include PPE and safety equipment/gear.

IV. Preconstruction

CA	CI	EXPECTATION / TASK
P	S	FIRM and Inspector(s) to conduct pre-construction conference.
P	S	FIRM and Inspector(s) to coordinate with Contractor to establish survey reference points for horizontal and vertical control.
	P	Inspector(s) and Contractor to jointly conduct the preconstruction field survey including the capture of dry day and post rain event photos and video prior to mobilization to the site. Inspectors shall inform HRSD Project Manager when this is planned, as HRSD personnel may desire to be present.
S	P	Inspector(s) and FIRM to review requirements of preconstruction surveys and vibration baseline.
P		FIRM to prepare conformed sets of contract documents by date of preconstruction meeting for distribution to HRSD staff. FIRM to ensure the "Conformed Documents" properly incorporates all addenda. The "Conformed Documents" needs to be checked prior to distribution.
	P	Inspector(s) to be in possession of and use the Conformed Documents
P	S	The FIRM to schedule a meeting between the RA/RE, Field Staff, and HRSD at commencement of construction to discuss expectations and roles of the individuals involved.
P		FIRM to prepare emergency contact list for all involved parties.

V. General Procedures

CA	CI	EXPECTATION / TASK
P		FIRM to issue Notice to Proceed (NTP) to Contractor.
P		FIRM to conduct correspondence with Contractor as required to facilitate the project, and forward one (1) copy of all project correspondence to HRSD.
P		FIRM to review and approve schedule of values submitted by Contractor.
P		FIRM to review and approve shop drawings, equipment submittals, construction drawings and erection drawings submitted by Contractor for compliance with the construction plans and specifications.

CA	CI	EXPECTATION / TASK
P		FIRM to send any submitted “or equal” submission for equipment/manufacturers to HRSD for review.
P		FIRM to provide a final submittal list from the Contractor to HRSD to determine what submittals must be reviewed by HRSD.
P		For Virginia Clean Water Revolving Loan Fund (VCWRLF) projects, FIRM to review and approve Contractor submittals related to the American Iron & Steel requirement as well as maintain documents, certifications and tracking system for VDEQ audits if requested.
P		FIRM to review and approve laboratory, mill and shop tests reports of equipment and materials submitted by Contractor.
P	S	FIRM to prepare proposals, work change directives and change orders as required, prepare independent estimates of cost and time impacts, negotiate acceptable agreements with Contractor for HRSD approval, and document all time and material work orders on a daily basis. Note that these items must be approved by the HRSD Project manager and uploaded to and approved in Unifier prior to any related work is performed in the field.
P	S	FIRM and Inspector(s) to review progress schedule submitted by Contractor, monitor actual progress, and prepare as built progress schedule as required.
P	S	FIRM and Inspector(s) to conduct shop and field tests for pipe, machinery, equipment, and materials including any off-site witness tests as required by Contract Documents.
P	S	FIRM to contract for and administer outside testing services procured by HRSD for concrete, soils and specialty testing as specified.
S	P	Inspector(s) to assist FIRM with field testing efforts and specialty inspections as required.
P	S	FIRM and Inspector(s) to respond to requests for information, inquiries, proposals, and suggestions submitted by Contractor.
P	S	FIRM and Inspector(s) to resolve changed site conditions and design conflicts and prepare supplemental drawings and sketches to resolve conflicts as required.
P	S	FIRM and Inspector(s) to review and approve requests for progress payments submitted by Contractor for compliance with the work performed.
P	S	FIRM and Inspector(s) to conduct periodic on-site job meetings with Contractor to discuss schedule, progress, problems, coordination of activities with existing HRSD facilities, etc.
P	S	FIRM to provide specialized inspection for mechanical, electrical, instrumentation and control, etc. as required.
P	S	FIRM and Inspector(s) to reject unsatisfactory work performed and equipment and materials submitted by Contractor.
P	S	FIRM and Inspector(s) to notify HRSD of project status and potential problems.
P	S	FIRM and Inspector(s) to review operation and maintenance manuals submitted by Contractor.

CA	CI	EXPECTATION / TASK
P	S	FIRM and Inspector(s) to review performance tests for equipment and processes.
P	S	FIRM and Inspector(s) to conduct substantial completion and final inspections, prepare punch lists and establish warranty period.
P	S	FIRM and Inspector(s) to assist in resolving warranty issues.
P	S	FIRM and Inspector(s) to assist in startup of new facilities and troubleshooting.
	P	Inspector(s) to coordinate activities of Contractor with other consultants and/or contractors working on the site.
	P	Inspector(s) to coordinate activities of Contractor with HRSD to prevent interference or interruption of safe and reliable operation of existing HRSD facilities.
	P	Inspector(s) to coordinate preparation of spare parts lists and turnover of spare parts to HRSD by Contractor.
P	S	FIRM and Inspector(s) to enhance vendor-provided equipment training by providing specific information that is unique to the design and to coordinate comprehensive systems training for information/functionality covered in the functional description.
	P	Inspector(s) to attend daily, weekly, and monthly progress meetings as appropriate.
	P	Inspector(s) to inform supervisor promptly of observed deficiencies in materials, equipment, workmanship, or other adverse conditions; slowdowns, delays and slippages in progress or ability to meet schedules and deadlines; any situation or condition that may result in a dispute or claim; safety related concerns; and concerns raised by the Public, locality inspectors or other individuals at the site.
	P	Inspector(s) to coordinate with Contractor to ensure site is clean, organized and picked-up daily.
	P	Inspector(s) to inspect materials and equipment for conformance with approved shop drawings, plans, specifications, and any change orders, potential change orders, Request for Information (RFI) etc. This must be performed immediately after materials or equipment is delivered. Any discrepancies need to be brought to the attention of the RA/RE immediately.
	P	Inspector(s) to have copies of all approved shop drawings in the field for review and to understand the purpose of materials and equipment.
	P	Inspector(s) to observe installation of all buried pipe, valves, fittings and other buried assets. Inspector(s) to staff up accordingly to match Contractor's work crews.
	P	Inspector(s) to advise HRSD Safety Department and HRSD Project Manager of uncorrected unsafe conditions immediately.
S	P	Inspector(s) and FIRM to carefully review Contractor payment claims and reject / return to Contractor if supporting material is not complete (e.g., diversity statement, X-Y-Z coordinate table for installed pipe and appurtenances, and other contract requirements).
S	P	Inspector(s) to confirm stored material prior to payment approval.

CA	CI	EXPECTATION / TASK
S	P	Inspector(s) and FIRM to review monthly with Contractor status of "As-Built" record keeping and tie approval of monthly pay request from Contractor to meeting these requirements.
P	S	Inspector(s) shall coordinate with Contractor and FIRM on changes to contract drawings to facilitate the FIRM's development of accurate record drawings, including changes resulting from addenda, requests for information, field orders, change orders, and equipment and material substitutions.
S	P	Inspector(s), FIRM and Contractor to coordinate work schedule, sequence of construction, and timely notifications to residents in affected areas in advance of work commencing. Efforts may involve door hangers. Advanced notification efforts are intended to minimize complaints from residents and businesses about lack of awareness of project schedules and impacts.
	P	Inspector(s) to have a copy of the Contractor's Emergency Action Plan (EAP) and must be thoroughly familiar with its content.
	P	Inspector(s) shall be in possession of the most up to-date emergency contact information for all involved parties and key individuals.
	P	Inspector(s) to attend and actively participate in regularly scheduled construction progress meetings per requirements of Contract Documents.
S	P	RA/RE / Inspector(s) and FIRM to be knowledgeable of Work Change Directives, field orders, Contractor proposed alternate products and when to use these.
S	P	Inspector(s) and FIRM to be knowledgeable of individuals responsible for construction activities and authority of each.
	P	RA/RE / Inspector(s) need to respond promptly to RFIs and Change Proposals.
	P	Inspector(s) need to receive field copies of all RFIs, Change Orders, Field Orders etc. This information should be marked up on their plans and specifications as required.
	P	RA/RE / Inspector(s) to coordinate with Contractor on providing proper notification of shutdowns to affected parties including HRSD Operations and Locality field crews to be involved.
	P	RA/RE / Inspector(s) to notify HRSD if Contractor attempts to operate a HRSD, Locality, or Private main line valve or air vent.
	P	Inspector(s) may be interviewed by HRSD staff if a specific incident or accident occurs on the site (may include, but not limited to, HRSD Project Manager, HRSD Safety Manager - safety / injury issues; HRSD Water Quality Division - spills / SSO; HRSD Engineering Compliance & Risk Manager - insurance / damage claim by resident or motorist).
S	P	Inspector(s) to report any accidents or interruptions of existing HRSD facility operations to HRSD.
S	P	Inspector(s) and FIRM to request pump station keys back from Contractor / subcontractors following Final Completion being achieved for a project involving access to a HRSD pump station.

CA	CI	EXPECTATION / TASK
S	P	Inspector(s) and FIRM to be knowledgeable of definition and procedures to achieve Substantial Completion. Warranty period commences after Substantial Completion is achieved.
S	P	Inspector(s) and FIRM to be knowledge of definition and procedures to achieve Final Completion following Substantial Completion.
S	P	Inspector(s) to coordinate with Contractor on force main projects to complete condition assessment activities on HRSD assets (pipelines, valves, etc.) as required in Contract Documents.
S	P	Inspector(s) to notify HRSD and FIRM when any previously unknown utility or obstruction that causes a vertical or horizontal change to the intended buried pipe alignment to obtain an approvable resolution. Inspector shall verify these changes are recorded on the Interim and Final Record Drawings along with the utility or obstruction that resulted in the change if the utility or obstruction remains following pipe installation.
	P	Inspector(s) to be aware of all work performed for others by Contractor outside the limits of the project when and only if prior approval granted by HRSD's Project Manager for Contractor to perform this work.
	P	Inspector(s) to track the listed required inspections related to ductile iron pipe: proper storage and handling to include checking for ovality after pipe is stored for a long period of time; interior coatings; cutting or tapping lined pipe in accordance with proper procedures in manufacturer's installation guide; proper reapplication of coatings after cutting/tapping per manufacturer's recommendation; proper installation of restraint system or restrained joints per manufacturer's recommendations; proper cadwelding directly onto pipe to avoid damage of interior coating; and proper wire connection to bonding plates.
	P	Inspector(s) to track the listed required inspections related to PVC pipe: proper storage on and off-site to include checking for signs of UV degradation; proper handling of pipe; proper bedding and backfill in accordance with the contract documents for PVC pipe; proper installation to include looking out for over insertion of spigot into bell, over deflection of joints beyond manufacturer recommendations, and proper fusing procedures; installation of tracer systems (such as wire, tape, balls) in accordance with the specifications; use proper tapping saddles for field taps to prevent pipe fractures; proper handling to prevent cracks; proper restraint system per manufacturer recommendations.

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to track the listed required inspections related to HDPE pipe: proper storage and handling to include inspecting for excessive gouges in pipe; proper installation to include looking out for expansion and contraction per manufacturer recommendations, proper fusing of pipe per manufacturer's guidelines (environment and cooling time); monitoring (fusing) and testing is performed and recorded as recommended by the manufacturer or specified by Contract Documents; and installation of tracer systems (such as wire, tape, balls) in accordance with the specifications.
	P	Inspector(s) to track the listed required inspection on delivery and installation of valves: proper storage and handling of valve to include exercising the valve prior to installation to ensure operability; proper location for valve replacement/installation to include coordinating with HRSD prior to installation and coordinating with FIRM to revise HRSD valve guide; valve is one specified in Contract Documents to include verifying gear ratio and capture legible photo of nameplate on both valve and actuator (if they exist) and provide to HRSD; valve coating intact and not damaged; operating nut or actuator if remotely controlled are intact and not damaged; proper installation per manufacturer's guidelines and Contract Documents to include checking the valve is installed in the proper flow direction, and the valve and valve box are properly aligned (vertically plumb); confirm valve opens and closes in correct direction as indicated on plans; and record number of turns required to open/close (perform twice).
	P	Inspector(s) to track the listed required inspection for ball valves and corporation stops: inspect valves for barbs which may prevent HRSD Air Vent Verification Rod from passing through; install corporation stops fully opened; verify proper height/clearance in air vent housing; verify alignment of ball valve; and verify frame and cover set correctly for final restoration.
	P	Inspector(s) to use HRSD Air Vent Verification Rod and check-out / check-in procedure.
	P	Inspector(s) to track the listed required inspection for check valves: confirm operation of swing arm/lever and verify proper flow direction (i.e., arrow on valve).
	P	Inspector(s) to track the listed required inspection for sanitary sewer manholes: proper storage and handling of manholes to include checking manhole is not damaged; confirm manufactured or field installed openings/penetrations are in correct location (vertical and horizontal); inspect for proper channel and benching; inspect correct height; inspect concrete and joint material; inspect drop connections into manhole; riser ring installation for frame and cover set properly for final pavement or restoration; coatings are intact and not damaged when applied prior to delivery; and coatings applied per manufacturer's guidelines and tested when applied on site.

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to track the listed issues related to pipe trench: measurement and payment in accordance with the contract requirements; use of proper trench box along with necessary steel sheeting; proper trench width for pipe installation; proper dewatering of the pipe trench; excavation for pipe bells; proper installation of tracer wire and pipe warning tape during backfilling operations; trench safety issues.
	P	Inspector(s) to track the listed issues related to pipe joints: Inspector shall have pocket guide for pipe installation as published by pipe manufacturer; use feeler gage to confirm proper gasket installation; review manufacturer's "stab" joint limit marking on the pipe spigot; proper gasket lubrication practices; dispose of damaged gaskets. (Feeler gauge to be documented on daily reports)
	P	Inspector(s) to track the listed required inspections for external pipeline corrosion prevention: proper wire type and insulation colors being installed per Contract Documents; bond cables properly across joints and bonding pads are factory installed prior to the application of the interior lining for pipes to be bonded; proper affixing of wires to pipe to included weld/brazing is done properly to make a strong attachment (test) and not damage the pipeline interior coating; check for proper system isolation (designed cathodic protection (CP) system is providing protection for only area/assets it is designed to protect) to include verifying system is properly isolated and the isolation is working (check for electrical continuity at isolation); periodically check for electrical continuity along CP system; placement of sacrificial anodes in accordance with design and manufacturer's recommendations; verify proper installation of polyethylene encasement bags in accordance with the manufacturer recommendations; tape wrap products to be heat shrunk to fit properly; properly apply field coatings to steel pipe field welds for horizontal directional drill (HDD) pipe in accordance with the manufacturer's recommendations; and pipeline appurtenances are properly protected from external corrosion to include verifying what, if any, corrosion protection should be applied to the appurtenances and fasteners.
	P	Inspector(s) to track the listed required inspections for internal pipeline corrosion prevention: blisters or spalled areas are not present; proper handling of pipe; proper cutting or tapping of lined pipe in accordance with manufacturer's recommendation, Contract Documents and approved by HRSD; field applied repair coatings are in accordance with manufacturer's recommendations for applicability, temperature, environment, cure time and surface preparation.

VI. Tie-In, Shutdown and Diversion Procedures

CA	CI	EXPECTATION / TASK
S	P	RA/RE, Inspector(s), and FIRM to review / approve Contractor shutdown / diversion plan / tie-in plan for constructability. Issues for postponing a planned event include Contractor not having adequate time or resources to accomplish what has been submitted; and Contractor not complying fully with the pre-tie-in check list and not ready to accomplish tie-in.
S	P	Inspector(s) and FIRM to review the "point of no return" for a planned tie-in and engage Contractor, HRSD, and Locality in a recommendation to postpone tie-in if necessary. These conditions may be related to changed field conditions, changed weather conditions, excessive flows to handle, Contractor behind planned sequence of events schedule, or malfunctioning equipment.
	P	Inspector(s) to verify proper clear space is maintained under each assembled pipe joint for checking bolts and being able to observe leaks at all pipe joints and fittings not hydrostatically tested.
	P	Inspector(s) to visually observe and check assembled pipe sections for proper assembly, tightened bolts, and thrust restraint.
	P	Inspector(s) to verify proper remedy for any leaks noted from visual observations under line pressure.
S	P	Inspector(s) and FIRM to collect measurements, sketches, and photographs, and review X-Y-Z coordinates collected by Contractor for assembled pipe in the tie-in area.

VII. Line Stop Procedures

CA	CI	EXPECTATION / TASK
S	P	RA/RE, Inspector(s), and FIRM to review and approve Contractor's Line Stop Plan for implementation and contingencies.
	P	Inspector(s) to verify Contractor is using the most recent version of HRSD's Line Stop Checklist from ***HRSD Design and Construction Standards***, latest edition.

VIII. Trenchless Crossing Procedures

CA	CI	EXPECTATION / TASK
S	P	RA/RE, Inspector(s), and FIRM to review and approve Contractor's trenchless crossing plan for constructability and contingencies.
	P	Inspector(s) to confirm Contractor is using the most recent version of HRSD's Trenchless Crossing Checklist from ***HRSD Design and Construction Standards***, latest edition.
	P	Inspector(s) to monitor potential settlement and void formation in areas of casing and entry/exit pits.

CA	CI	EXPECTATION / TASK
S	P	Inspector(s) and FIRM to track the listed requirements related to bore and jacked casing installation: proper horizontal and vertical alignment; monitor for settlement by visual inspection; conduct pre & post ground penetrating radar (GPR) measurements for voids; upon digging pits, verify soil and groundwater conditions in the geotechnical report and identify potential issues; if conditions are extreme reconsider method of trenchless crossing; conduct soil stabilization prior to work; review Contractor's method of sealing ends; determine how to handle unknowns as undocumented obstructions prior to beginning work; determine exactly where end of casing, if unsuccessfully completed.

IX. Damage Assessment and Claims Procedures

CA	CI	EXPECTATION / TASK
S	P	Inspector(s) and FIRM to coordinate with Contractor to include an agenda item at each construction progress meeting related to damage claims and resident complaints.
S	P	Inspector(s) and FIRM to notify and compile information to report of any accidents or resident/business report of damages.
S	P	Inspector(s) and FIRM to notify HRSD Project Manager of any damage reported by residents, property owners or the traveling public.

X. Training

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to be trained for confined space entry and OSHA Standard 29 CFR Part 1926 Safety & Health Regulations for Construction, Sub-parts A thru Z. Confined space entry OSHA 29 CFR 1910.146(g)(4) and OSHA 10-hour Construction Safety & Health.
	P	Inspector(s) to complete training on VDOT Basic Work Zone Traffic Control.
	P	Inspector(s) to be knowledgeable of and in compliance with regulatory and HRSD procedures for asbestos handling and disposal.
	P	NACE Level 2 certification required for all inspector(s) overseeing coatings and lining related work at treatment plants and pump stations when a manufacturer dictates a specific profile is needed for property adhesion.
	P	Certified Electrical Inspector – Master certification required for all inspector(s) overseeing electrical related work.
	P	Inspector(s) to have NASSCO ITCP-CIPP training for CIPP rehabilitation project work and NASSCO ITCP-MR training for manhole rehabilitation.
	P	Inspector(s) to be familiar with and in compliance with HRSD Hot Work Permit requirements.
S	P	Inspector(s) and FIRM to be trained on and proficient with HRSD's Enterprise Project Management (Unifier) system.

XI. Record Keeping

CA	CI	EXPECTATION / TASK
P	S	FIRM and Inspector(s) to maintain complete set of project files at the job site as required (or full access to digital files) and provide this set of project files to HRSD at the completion of the project.
	P	Inspector(s) to prepare daily report including activities and completed tasks; difficulties; controversial issues involving questionable items or disputes; deficiencies and violations; instructions given and received; progress and delays including actions taken or contemplated to minimize delays; equipment in use by Contractor; materials and equipment delivered for installation; photographic documentation of the work; and spare parts provided by Contractor or Vendors.
	P	Inspector(s) to maintain daily records, photographs, temporary valve guides, drawing markups to compare to Contractor records for dispute resolution. These records to be incorporated into Unifier.
	P	Inspector(s) to capture sufficient photographs of utility crossings, fittings installed with GPS digital camera where appropriate.
P	S	FIRM, RA/RE, and Inspector(s) to include detailed information on monthly status report that accompanies FIRM's payment request on the activities anticipated in the next 30 days. In particular, field activities that involve HRSD Operations staff assistance.
S	P	Inspector(s) and FIRM to confirm Contractor is collecting X-Y-Z field information where required per ***HRSD Design and Construction Standards*** and in accordance with the Contract Documents.
	P	Inspector(s) to confirm turns open and close for new valves being installed and verify information correctly input on the Interim and Final Valve Guides.
S	P	Inspector(s) and FIRM to record the serial numbers on all new valves and the actuators for inclusion on records transmitted to HRSD for each valve location.
	P	Inspector(s) shall take required measurements and document these. Examples include location of building service connection tee-wye, end of service connection piping, location of valves and fittings, location of utility crossings.
	P	Inspector(s) shall prepare sketches to include pertinent buried items, end of service connections, utility crossings, other items that will be buried, and all ties taken.
	P	Inspector(s) shall take required swing ties to include measurements to two or more permanent structures.
S	P	Inspector(s) and FIRM to observe on going work by Contractor for compliance with the construction plans and specifications with emphasis on critical construction activities such as placement of reinforcing steel and concrete, items being covered up or embedded, pipe laying and testing, equipment placement and testing, etc.
S	P	RA/RE, Inspector(s), and FIRM to prepare and distribute the Substantial Completion punch list and the Final Completion punch list to Contractor and other parties.

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to document any concerns or plan deviations raised by HRSD Operations staff visiting the construction site and discuss with HRSD Project Manager for resolve.

XII. Staffing

CA	CI	EXPECTATION / TASK
P	S	FIRM to provide proper inspection coverage for multiple construction crews where work can be covered up quickly as with buried pipe installation and coatings / linings preparation work.
P	S	FIRM to provide proper inspection coverage during tie-ins and 24/7 critical construction activity periods. Contingency planning for backup personnel for exhaustive work schedule and planned or unplanned leave.

XIII. Verification

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to verify proper storage and protection of materials and equipment.
	P	Inspector(s) to verify Contractor stays within permitted easement limits (does not enter onto private property without acquiring easement) and does not park in unauthorized areas. Inspector(s) to immediately notify HRSD Project Manager if Contractor is not in compliance.
S	P	Inspector(s) and FIRM to verify traffic maintenance plan consistent with Contract Documents and locality approved permit and notify HRSD Project Manager and Contractor if Contractor is not in compliance.
S	P	Inspector(s) and FIRM to verify Contractor's efforts are meeting all environmental/erosion control requirements in the Contract Documents. Inspector(s) to notify HRSD Project Manager if Contractor is not in compliance.
	P	Inspector(s) to verify proper setup by Contractor and procedures are followed for hydrostatic testing of new pipelines. Inspectors to notify Contractor of missed steps that will delay the planned test.
	P	Inspector(s) to verify proper setup by Contractor and procedures followed for soil density testing as required for installation of new buried pipelines.
	P	Inspector(s) to verify pipe (gravity and force main) installed on proper grade to avoid sags or unplanned high point in the pipe. Inspectors to notify Contractor and HRSD Project Manager of any installation that deviates from Contract Documents or approved Work Directives / Change Orders.
	P	Inspector(s) to verify pipe handling procedures for each pipe material being used. Use of a forklift without padded forks (insert fork into fitting) is not allowed for handling fittings to protect inside linings nor chains allowed for lifting pipe or fittings with exterior coatings that may be damaged because of this action.

CA	CI	EXPECTATION / TASK
	P	Inspector(s) to verify other testing to witness and record information including vacuum testing of manholes, concrete cylinder/strength, concrete air entrainment, concrete slump.
S	P	Inspector(s) and FIRM to track the following verifications related to Asbestos Cement pipe installation: confirm pipe outside diameter (OD) and compare to manufacturer published data and shop drawings; and connect new pipe to existing Asbestos Cement pipe with proper adaptors (refer to manufacturer recommendations).
S	P	Inspector(s) and FIRM to track the following verifications related to Asbestos Cement pipe demolition: certified firm to handle Asbestos Cement pipe; break collar verses saw cutting to avoid air/friable particles; follow manufacturer and HRSD safety procedures for handling and transport; proper personal protective equipment and equipment for demolition.
S	P	Inspector(s) and FIRM to track the following required verifications related to Miss Utility coordination: record when “Miss Utility” ticket request called in; record differences marked in field vs. contract plans; review Contractor’s test pit work plan for utility location verification in advance of excavation to avoid conflicts.
S	P	Inspector(s) and FIRM to track the following required verifications related to bedding and backfill: advance written authorization/approval required for additional excavation of unsuitable materials; review of Contractor’s disposal plan for unsuitable excavated materials (dispose to approved sites and not in environmentally sensitive areas); backfill and bedding meet contract specifications (free of boulders, debris and shall be dry); proper backfill compaction in specified lifts, compaction testing where required.
S	P	Inspector(s) and FIRM to track the following verifications related to pipe rehabilitation: review Contractor’s diversion pumping systems; review Contractor’s plan to provide adequate advance notice to affected customers and to avoid or assure customer service interruptions are minimal; verify proper cure times for materials to be used; be aware of effects of temperature variation; follow manufacturer recommendations; inspect to ensure Contractor has taken accurate measurements to all connections; immediately upon pipe lining/curing reestablish service or other connections; verify that all customers are reconnected; adequate grouting between host pipe and liner pipe; ensure adequate support (water pressure if possible) of liner prior to grouting; mix shall be suitable for filling annular space; install grout holes along pipe where possible; inspect grouted pipe where possible.
	P	Inspector(s) to verify with Contractor proper grade and surface elevations intent of Contract Documents verses actual ground elevations.

End of Section

Section 19 - Use of Air Vent Proving Tool ("Whammy Rod")

I. Introduction - In recent past interceptor system force main projects, the Contractor installed air vents have not been fully opened during final inspection walk-throughs. This has led to delays in getting the force main online by the Contractor having to excavate down to the corporation stop on the air vent assembly and confirming that the corporation stop is in the fully open position, and able to pass HRSD's air vent cleaning rod through it. HRSD's Design and Construction Departments each have an Air Vent Proving Tool, otherwise known as a "Whammy Rod" by the Interceptor System field crews. HRSD Project Managers can reserve these tools for use by the FIRM's Inspector prior to final backfilling around each air vent assembly. This Section details the expectations and procedures of how this tool is to be used by the FIRM during construction.

II. FIRM Responsibilities and Procedures - The FIRM shall coordinate with HRSD's Project Manager (PM) and follow the identified steps for use of the Air Vent Proving Tool:

A. Request that HRSD's PM reserve the tool prior to final backfilling around each air vent assembly.

B. HRSD's PM will check out the tool on SharePoint and make available to the FIRM's Inspector.

C. The Inspector shall notify the Contractor immediately of any air vents where the head of the proving tool does not pass through the corporation stop.

D. Follow-up attempts to prove the air vent is passable shall be done after the Contractor has fully opened the corporation stop.

E. The Inspector will coordinate a walk-through with HRSD operations personnel only after all air vents have been proven to be fully open, properly aligned, and in full compliance with the Bid Documents.

F. The air vent proving tool shall be returned to HRSD's PM for making available for other projects.

End of Section

Section 20 - Condition Assessment Protocol

I. Introduction – One of the elements of the HRSD's Management, Operation, and Maintenance (MOM) involves collection of condition assessment information on HRSD's active and planned to be abandoned pipelines including interceptor force mains, gravity sewer mains, and treatment plant process piping. HRSD has established protocols and guidelines for condition assessment data collection activities during the following:

   A. Pre-Planning Phase

   B. PER and Design Phase

II. Pre-Planning Phase – Condition assessment during a project Pre-Planning Phase is intended to inform condition-based decisions for the following applications:

   A. Defining the extent (scope) of pipeline replacement

   B. Identifying potential connection locations

   C. Assessing pipelines to be abandoned which may provide information useful for estimating remaining useful life (RUL) of similar active pipelines in the system.

III. PER and Design Phase – Capital Improvement Projects provide opportunities to collect pipeline condition data that assists HRSD to better understand the failure risk and condition investigation needs of other pipelines of similar diameter and material in the system. The FIRM shall perform the following:

   A. Develop a project specific Condition Assessment Plan describing condition assessment goals and extents during the Planning Phase to be reviewed and coordinated with HRSD Departments:

      1. Design and Construction

      2. Asset Management

      3. Operations

   B. Incorporate the project Condition Assessment Plan into the construction documents and/or Bridging Documents for Design-Build projects, including the following:

      1. Identify condition assessment opportunities such as system diversions and/or bypass operations which may provide interior or exterior access to normally inaccessible active pipelines.

      2. State responsible parties and/or notification protocols (typically

7 days advance notice) for condition assessment data collection activities.

IV. Pipe Coupon Data Collection Form – HRSD developed a pipe coupon data collection form template **(Attachment A)** that is intended to fully document pipe coupons or samples obtained from active pipelines. The FIRM's on-site representative is to complete this form when coupons are obtained, submit the referenced form(s) in Enterprise Project Management (Unifier) system, and coordinate with the HRSD Asset Management Departments to transfer pipe coupon(s).

V. Technical Specifications – Technical specifications for the collection of condition assessment data will be assigned as follows:

A. HRSD's Asset Management Department will generally be responsible for collecting condition data that requires the deployment of internal / external condition assessment technologies.

B. If the FIRM or Contractor are made responsible for condition assessment data collection, the FIRM is to insert applicable condition assessment technical specifications into the HRSD administered construction documents.

VI. Condition Assessment Guidelines – HRSD has developed guidelines to assist internal HRSD staff (or FIRM) in planning condition assessment for the scenarios identified in Section A. These guidelines will be provided by the respective HRSD Project Manager to the FIRM based on the project specific needs. These guidelines may be utilized for interceptor system pipelines and treatment plant piping as appropriate.

VII. Attachments:

A. Coupon Data Collection Form

End of Section

Section 21 - Regulatory Reporting Requirements for Spills

I. Introduction - During the course of construction projects on the collection system, spills from manholes, force mains, etc. occur. These events need to be reported to HRSD personnel immediately.

II. Procedures – The following procedure should be followed for all spills. Failure to report a spill can lead to enforcement action by Virginia Department of Environmental Quality (DEQ) and/or US Environmental Protection Agency (EPA). Please distribute these phone numbers to the appropriate supervisors. If you have any questions, please contact Lauren Grimmer (HRSD Environmental Scientist) at (757) 460-4245 or (757) 419-8577.

III. Contact Information - The Contractor or Inspector on-site are to contact the appropriate Operations Center Coordinator. The following phone numbers are manned from 5:30 am to 4:00 pm (North Shore) Monday through Thursday and 5:30 am to 4:15 pm (South Shore) Monday through Thursday.

North Shore (Peninsula)	(757) 833-1720
South Shore	(757) 460-7072

If the Contractor has a problem outside of these business hours, then one of the following personnel should be notified. Someone should call you within 15 minutes.

North Shore Duty Supervisor Cell Phone	(757) 613-6600
North Shore Duty Foreman Cell Phone	(757) 613-6601
South Shore Duty Supervisor Cell Phone	(757) 284-8118
South Shore Duty Technician Cell Phone	(757) 284-8120

End of Section

Section 22 – HRSD Safety Program

I. Introduction - This Section addresses the various safety programs and policies of HRSD that apply to design and construction efforts. HRSD staff, as well as professional service firms (FIRM), contractors, and others involved with implementing work on HRSD facilities and on behalf of HRSD are to be in compliance with the following paragraphs. FIRMs will need to verify that appropriate edits are made to Bid Documents to capture these items.

II. Safety Programs

A. Hazard Communication Program – HRSD is required, in accordance with 29 CFR 1910.1200, to inform HRSD and contractors' personnel who work within HRSD of the hazardous chemicals on site. HRSD and contractor's personnel may be exposed to these hazardous chemicals while working at HRSD facilities. A written Hazard Communication Program, along with Response Procedures, has been developed to inform personnel about the specific hazardous chemicals present at HRSD facilities and the related safety information, including protective measures, special precautions, emergency procedures, and muster points to be observed. The Hazard Communication Program, including Safety Data Sheets (SDS) for each hazardous chemical at the HRSD facility site, will be made available to contractors. HRSD utilizes an online program for Safety Data Sheets (SDS) known as MSDSonline. Contractors will be provided with the link to MSDSonline. Contractors are responsible for communicating the information contained in the SDS to their personnel working at the HRSD facility. Contractors shall attend an *Outside Contractor Safety Briefing* conducted by the HRSD Safety Department, Plant Superintendent, or Lead Operator prior to the start of work. Contractors are responsible for informing HRSD of hazardous chemicals they bring on the plant site or to HRSD facilities. Contractors are responsible for obtaining Safety Data Sheets (SDS) for hazardous chemicals they use and store at HRSD facilities, and for providing these SDS to HRSD upon request. Contractors are responsible for using and storing the hazardous chemicals in an appropriate method while on site at an HRSD facility. Contractors are responsible for the disposal and labeling of hazardous chemicals that they use or store at HRSD facilities.

B. The HRSD Hot Work Permit Program requires that HRSD employees and/or Contractors who perform work involving electric or gas welding, cutting, brazing or similar flame producing or spark producing operations on or in close proximity to (within 25 feet or where posted) hazardous chemical process systems/equipment, within HRSD confined space, or within the fence line/property line of an HRSD Pump Station be issued a hot work permit prior to beginning work. Contractors must attend an Outside Contractor Safety Briefing conducted by the HRSD Safety Department, Plant Superintendent, or Lead Operator prior to the start of work. The

Contractor must comply with this requirement and obtain a daily hot work permit from HRSD site management before engaging in any hot work. Contractors must utilize their own Fire Watch for hot work permit operations. Note: No hot work is permitted within 50 feet of the methanol storage and feed areas.

C. Lockout/Tagout Program – Contractors are responsible for compliance with the OSHA Lock Out/Tag Out Standard. Whenever Contractors are involved in lock out/tag out activities at an HRSD facility, the equipment, process, or system shall be locked and tagged out in accordance with the HRSD Lock Out/Tag Out Program by the work center supervisor overseeing the work. The HRSD Supervisor overseeing the work will ensure that the Contractor is shown the location to apply their lock(s) and tag(s). The HRSD employee overseeing the work must be an "Authorized Employee." Only in emergency situations are equipment, processes, or systems shut down by other than an HRSD "Authorized Employee." The HRSD work center supervisor must be notified immediately if this occurs. Whenever Contractors are involved in lock out/tag out activities covered by this program, HRSD and the Contractor will inform each other of their lockout/tagout programs and procedures. The work center supervisor will inform the Contractor on the precautionary measures involved in performing lock out/tag out at the HRSD facility. All Contractors performing work at an HRSD treatment plant or pump station will receive an *Outside Contractor Briefing* prior to starting work. The briefing will be given by the Plant Superintendent, Lead Operator, or the HRSD Safety Department. Engineering Project Managers, will specify in contracts, bids, and requisitions that Contractors must comply with the Occupational Safety and Health Administration's (OSHA) 29 CFR 1910.147 standard while working at an HRSD facility.

D. Confined Space Entry Program – The HRSD Confined Space Entry Program provides HRSD employees with training and awareness of the potential hazards of entering and working in confined spaces. All tanks, manholes, vessels, as well as other areas designated by signs or otherwise instructed, are considered confined spaces HRSD's employees cannot act as "qualified person" for the Contractor, cannot complete confined space entry permits for Contractors, nor will HRSD's owned gas detection monitors or other confined space entry equipment be loaned to the Contractor. The Contractor must comply with all Federal and Virginia OSHA Confined Space Standards. Contractors can request information regarding the known hazards associated with HRSD Confined Spaces. HRSD's Safety Department, Plant Superintendent, or Lead Operator will brief the Contractor's key personnel on the confined spaces located on the project site during the *Outside Contractor Safety Briefing*.

E. Plant Access Procedures for Contractors Performing Long-Term Projects at HRSD Treatment Plants. [Note: Human Resources and/or IT staff code the

badges, and plant staff, the Project Manager, or the Safety Department provides badges to the Contractor.]

1. The Contractor will be issued a limited number of access badges for distribution among direct employees or sub-contractors. The badges will allow access through the plant gate during normal working hours. Each badge must be assigned to an individual and that individual's name logged on a form to be provided to the appropriate HRSD Plant Superintendent or Project Manager. The Contractor is responsible for periodically verifying the possession of the badges by the assigned individual. Any discrepancy in the possession or location of any badge must immediately be reported to a member of the plant supervisory staff. Any misuse of the badges will result in immediate revocation of access privileges.

2. If a Contractor badge is lost, immediate notification to the Project Manager or Human Resources is required. If necessary, a replacement card will be issued.

3. The Contractor may be issued a limited number of badges for supervisory personnel with extended access to the plant at the discretion of HRSD personnel.

4. In the event that the Department of Homeland Security raises the threat level of the country to "Red", all Contractor access badges will be disabled. Access to the plant at that time will require individual identification verification and entry only via plant staff.

5. Contractor to develop and submit an approvable plan to the HRSD Project Manager for site access procedures and protocols. This plan shall include, but not be limited to, daily login entry, current emergency contact information, management of gate openings, and daily logout procedures. Plan must be approved by HRSD Project Manager and HRSD Safety Manager. Changes to the approved plan must be submitted in writing and approved by HRSD.

6. Contractor work hours will be discussed and approved by the HRSD plant or facility.

7. Security guards shall be provided if Treatment Plant gates are to be left open during normal work hours. The following are requirements and expectations of a security guard:

    a. The Security Guard is expected to be alert and awake while guarding the open gate.

    b. The Security Guard is expected to check cars and trucks in and out of the plant site.

c. If the Security Guard is not on duty the plant gate will be closed and secured.

d. The Security Guard must turn unwanted site visitors away.

8. Perimeter fencing must be maintained during construction at HRSD Workcenters.

9. In the event of a site evacuation, the Contractor Site Supervisor will be notified by plant personnel to evacuate and instructed to report to the muster point location. Plant supervisors will be responsible for accounting for all Contractor firms are present and the Contractor Site Supervisor will be responsible for accounting for contractor personnel.

F. NFPA 70E – Contractors hired to install or modify electrical components will do so in compliance with NFPA 70E. Only qualified HRSD Electricians, Instrumentation employees, or qualified Contractors are to perform work on electrical circuits, components, and equipment. Contractors hired to perform electrical work at an HRSD plant or pump station must receive an *Outside Contractor Safety Briefing* by the HRSD Safety Department, Plant Superintendent, or Lead Operator, and the HRSD Electricians assigned to that facility. The *Outside Contractor Safety Briefing* will include information on existing electrical hazards, personal protective equipment/clothing requirements, arc flash labeling system as appropriate, and where to lock and tag out sources of power. HRSD electrical personnel and affected Operations personnel will be involved in the planning of work. Contractors are required to contact HRSD electrical personnel prior to tapping into existing HRSD electrical sources or shutting off equipment (unless an emergency exists). Warning and/or barricading are required to be used when live electrical components are exposed in areas utilized by HRSD staff.

G. Fall Protection – Contractors that are removing existing guardrails, hatch covers, deck grating, etc. in which an employee could fall four feet or greater must install temporary guardrails. Temporary guardrails include a 42-inch top rail, a 21-inch mid-rail, and a 4-inch toeboard. Temporary guardrails must sustain 200 pounds of pressure applied in any direction. When construction is complete, permanent guardrails must be installed or reinstalled, deck grating replaced and secured down, and/or hatch covers replaced. If utilizing temporary covers, temporary covers must be secured and labeled “hole.” Contractors are responsible for compliance with OSHA fall protection standards when working at heights such as on roofs, off of scaffolding, or when using mobile elevated work platforms.

H. New construction buildings and processes cannot be turned over to HRSD until all safety issues have been corrected. Contact the Safety Department for a safety walk through prior to the release of a new building or processes to HRSD.

I. Excavations and Trenching – Contractors involved in excavation work must be in compliance with OSHA Standards 1926.651 and 1926.652. Trenches 5 feet or greater in depth must have a protection system prior to employees working inside. Trenches or excavations 4 feet or greater in depth are required to have safe access and egress devices located within 25 feet of all workers. Open excavations must have adequate fall protection for personnel if greater than 4 feet and must have adequate protection (e.g., barricades) if next to areas accessed by vehicles. If an HRSD employee must enter a Contractor's excavation and is unsure about its safety, they must contact the Safety Department immediately. Contractors are responsible for evaluating their trenches or excavations for a safe atmosphere. Contractors are responsible for identifying existing utilities in areas in which they plan to dig. Contractors are responsible for not getting too close to overhead electrical lines with construction equipment.

J. Fire Protection Systems – Anytime a contractor's work may impact installed fire detection or protection systems, the HRSD work center, Safety Department, and Facilities Maintenance must be notified.

K. Housekeeping – The contractor is responsible for the overall housekeeping within their work areas.

1. All exit doors, electrical panels, fire extinguishers, emergency eyewash/showers, and first aid kits must have clear access maintained for emergencies.

2. Trash and debris must not accumulate nor impede travel on designated walkways.

3. Weeds and grass must be maintained during the project by the contractor in their designated areas so as not to create fire hazard or harborage of vermin.

L. Outside Contractor Briefing – All contractors working at an HRSD Plant or Pump Station will be given an Outside Contractor Safety Briefing by the Plant Superintendent, Lead Operator, or HRSD Safety Department prior to starting work. The briefing will cover the following:

1. HRSD Safety Rules

2. Evacuation Procedures

3. Chemicals on site

4. HRSD Safety Programs relevant to the work that is being done

5. Personal Protective Equipment (PPE) Requirements for location

M. Asbestos Awareness Program. HRSD's program objectives include employee awareness of regulations, health issues, and proper procedures for working around and handling products or materials containing asbestos. Attachment A to this Section is a checklist that should be used on each project. For existing HRSD buildings, contact the HRSD Safety Department for a list of building materials that contain asbestos.

N. Weapons Policy – Weapons, if brought onto HRSD property, must be kept locked in a personal vehicle. No weapons are permitted in HRSD buildings or vehicles.

O. Use of HRSD Equipment – Contractor must provide all equipment necessary to perform work on HRSD property. Use of HRSD equipment is prohibited. This includes:

1. Ladders
2. Forklifts
3. Telehandlers
4. Mobile Elevated Work Platforms
5. Rolling Gantry Cranes
6. Slings

P. Emergency Eyewash and Showers.

1. Emergency eyewash and shower equipment are to be provided at locations where personnel may be exposed to hazardous materials that can cause injuries to the eyes or body. The following are potential locations where emergency eyewash and showers are required:

i. Corrosive Chemicals
ii. Toxic or irritant substances
iii. Chemical Storage Tanks
iv. Battery Charging Stations
v. Fueling or chemical unloading areas

2. Emergency eyewashes and showers shall meet ANSI/ISEA Z358.1 standard.

3. Emergency eyewashes and showers shall allow for immediate flushing to minimize injury.

4. Emergency eyewashes and showers shall be located within 10 seconds of travel on the same level, without the use of stairs or ladders, and with an unobstructed path from the hazard.

5. Emergency eyewashes and showers shall be highly visible, located in well-lit areas, and identified with standard signage.

6. Performance Requirements:
    i. Equipment shall be activated in one second or less, and valves shall remain open without the use of hands.
    ii. Minimum flow rate for emergency eyewash: 0.4 gallons per minute (gpm) for 15 minutes.
    iii. Minimum flow rate for emergency shower: 20 gallons per minute (gpm) for 15 minutes.
    iv. Tepid water shall be provided between 60°F and 100°F.
    v. Emergency shower head shall be 82”- 96” above the standing surface.
    vi. The center of the shower spray pattern shall be located at least 16 inches from any obstruction.
    vii. The shower spray pattern shall be a minimum of 20” in diameter at 60” above the standing surface.
    viii. The nozzle height of the emergency eyewash shall be no less than 33” and no more than 45” above the standing surface.
    ix. Emergency eyewashes shall be capable of flushing both eyes simultaneously.
    x. Eyewash flow shall be soft and low velocity.
    xi. Protective covers shall be provided on eyewash nozzles to prevent contamination.

7. Design and Installation Requirements:

    xii. Plumbed units shall be connected to a potable water supply.
    xiii. Piping shall be designed to provide continuous flow for a minimum of 15 minutes.
    xiv. Freeze protection shall be provided for outdoor environments (ex. heat tracing, insulated enclosures)
    xv. Floor drains or other means shall be provided to safely manage discharged water.
    xvi. Materials shall be corrosion-resistant and suitable for the installation environment.

8. Inspection and Maintenance

   xvii. Emergency eyewash and shower units shall be activated weekly to verify proper operation.
   xviii. Units shall be inspected annually for compliance with ANSI/ISEA Z358.1.
   xix. Inspection and testing records shall be maintained.

Q. Noise Abatement for Installed Stationary Equipment

1. Noise abatement requirements apply to permanently installed mechanical, electrical, and process equipment and are intended to:
   a. Ensure installed equipment meets environmental and occupational noise limits.
   b. Require noise control to be addressed during design and procurement.
   c. Provide enforceable requirements for equipment suppliers and contractors.

2. All permanently installed equipment shall be selected, designed, and installed such that noise levels at the property line and within occupied areas comply with specified limits.

3. Noise abatement shall comply with OSHA 29 CFR 1910.95 for occupational noise exposure, ANSI S12 acoustics standards, and ISO 1996 for environmental noise. All applicable local noise ordinances shall be followed.

4. Noise control shall be addressed during equipment selection and design.

5. Equipment suppliers shall provide octave band sound power levels.

6. Equipment and associated systems shall be designed such that overall facility noises comply with OSHA, ANSI, and local community ordinances.

7. Equipment suppliers shall identify and provide required noise control measures, including silencers or enclosures, as part of the equipment scope of supply.

8. Acoustic enclosures shall be provided for high-noise equipment where required. The enclosures shall be fully sealed except for treated ventilation

openings. The minimum sound transmission class rating shall be 25 unless otherwise required.

9. Intake and discharge silencers shall be installed on blowers, compressors, and generators as required. Silencers shall be selected based on the frequency spectrum.

10. Barriers shall be installed where line of sight exists between equipment and receptors. The minimum surface density shall be 4 lb/ft^2.

11. All rotating equipment shall be mounted on vibration isolators. Flexible connections shall be provided on piping and ductwork.

12. Ductwork shall include acoustic lining where required. Openings shall not create direct noise paths.

13. Equipment and noise control systems shall be installed per manufacturer requirements. All gaps, seams, and penetrations shall be sealed. Improper installation resulting in increased noise levels shall be corrected.

14. Contractors shall perform post-installation noise measurements, and these measurements shall be conducted under normal operating conditions.

R. Methanol Safety Work Practices

1. HRSD personnel must be trained and instructed on the use and handling of methanol, methanol equipment, methanol detection meter(s), and methanol emergency response (refer to the Safety Data Sheet and HRSD Response Procedures for the work center).

    i. Use <u>extreme</u> care and caution when handling methanol. Never walk through spilled methanol.
    ii. There is no smoking, hot work, or open flames allowed within 50 feet of methanol storage, handling, or pump facilities.
    iii. Ensure methanol storage tanks or containers are properly labeled. The NFPA label should read as follows:

Health	1
Flammability	3
Reactivity	0

2. When handling methanol or servicing the methanol system, a calibrated, direct-reading meter for methanol must be used to monitor the atmosphere. If methanol levels are below the permissible exposure limit (PEL) for methanol of 200 ppm, the following Personal Protective Equipment (PPE) is needed: rubber boots, silver shield or disposable 0.9 mm nitrile gloves, face shield, splash-proof safety goggles, impervious rain gear, and a full face negative pressure respirator or powered air purifying respirator with organic vapor cartridges.

3. For airborne concentrations above the PEL of 200 ppm, ventilate until methanol levels are below 200 ppm. If the methanol meter is alarming due to high levels above 800 ppm and the source cannot be isolated or contained, contact a plant supervisor or local fire department (911) for emergency response.

4. Ensure that an eyewash/shower or hose with potable water is in the immediate area and operational before working on methanol system or with methanol.

5. When working around methanol or methanol systems, electronic devices that are not intrinsically safe are prohibited. Such devices include: cell phones; laptops; MP3 players; radios; flashlights; temporary lighting; IPods; Smartwatches; etc. (These electronic devices are not intrinsically safe). Intrinsically safe radios for communication will be used when around methanol or methanol systems.

6. Before working on methanol pumps or piping systems, de-energize and use non-potable water to flush methanol residual out of pumps and lines. Once system is flushed and there is no %LEL present and 0 ppm of methanol, normal tools can be used to complete work. If the methanol system cannot be flushed, non-sparking tools must be used.

   Note: If unsure about the location of valves and flush points, check process schematic in Response Procedures.

7. Before putting the methanol system into service, check to ensure that the flush valves are closed.

   Note: If unsure about the location of the above valves, check process schematic in Response Procedures.

8. When putting methanol system into service, remember that only one (1) storage tank can supply methanol to the feed pumps at any given time.

9. Flush chemical feed system for methanol if it is to be out of service for a prolonged period of time.

10. When taking the chemical feed system for methanol out of service, **NEVER** close a valve while a pump is running. Severe damage or injury could result.

11. Periodically inspect methanol chemical feed system for leaks.

    Note: If %LEL detectors or leak detectors within the methanol feed system room start to alarm, don full PPE for methanol response and use a calibrated direct-reading methanol meter to determine methanol levels using remote monitoring procedures prior to entering the room. If levels are above the PEL of 800 ppm, do not enter the room. Use intrinsically safe ventilation to lower methanol levels to below the PEL. If levels below 800 ppm cannot be obtained, notify a supervisor or call the local fire department for emergency response.
    Note: Refer to Safety Equipment: Methanol Gas Detection Equipment for meter specifications.

12. Report any problems or leaks of methanol to plant supervisors immediately.

    Note: When the leak/spill of methanol exceeds five thousand (5000) pounds, it must be reported using HRSD's Chemical Release Reporting procedure. Refer to HRSD Response Procedures.

13. Call the local fire department (911) if a person is incapacitated by methanol.

14. Perform CPR immediately on the person who has been incapacitated by methanol and is not breathing.

    Caution: Administration of mouth-to-mouth resuscitation may expose the first aid provider to the chemical within the victim's lungs or vomit – perform chest compressions only. Summon medical attention as soon as possible.

15. Place a person who does not have difficulty breathing and is contaminated with methanol into a shower immediately. Remove methanol-soaked clothing under running water and wash all portions of the body that were exposed to methanol. Get medical attention immediately.

    Caution: lethal amounts of methanol can be absorbed through intact skin.

16. Flush eyes contaminated with methanol immediately with running water for at least fifteen (15) minutes, occasionally lifting the eyelids.

17. If methanol is accidentally ingested, DO NOT VOMIT. Get medical attention immediately. Swallowing even small amounts of methanol can be life threatening. Also, the onset of symptoms may be delayed for 18 to 24 hours.

18. Methanol burns with a clear blue flame, and it is very difficult to see burning. The only indication that methanol may be burning is a shimmering heat haze or something burning nearby. Anytime the fire suppression system activates in the methanol area, call 9-1-1.
19. Methanol vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back. Therefore, use non-potable water to dilute any methanol spills that occur, if possible.

20. A foam system within the methanol building is available to reduce fire potential.

21. During methanol deliveries, the HRSD employee will stay with the driver during the delivery and will make sure that the truck is grounded. (Follow delivery procedures within the Plant's Response Procedures.)

22. Never bypass the safety features on the control system, including grounds, valves, detectors, etc.

III. Attachments:

A. Asbestos Checklist

End of Section

Section 23 - VDOT 2026 Work Area Protection Manual (WAPM) Version 11.0 Requirements

I. Introduction - HRSD's Design and Construction Departments contract with a wide variety and a significant number of Professional Services firms (FIRMs) for design and construction oversight responsibilities for both capital and non-capital projects. Typically, the FIRM providing design services will also assemble a team to perform construction administration and inspection (CA/CI) services for HRSD during construction. Many of these projects lie within state and locality road rights of way. One of HRSD's top priorities during construction activities is the safety of all staff and HRSD's field representatives. As such, it is crucial that our staff and our contracted workforce adhere to the latest federal, state, and locality safety standards.

The 2026 edition of the *Virginia Work Area Protection Manual Version 11.0*, along with updates, became effective for HRSD on January 1, 2026. Several localities have already adopted this manual and now require compliance with it. The 2026 *Virginia Work Area Protection Manual Version 11.0* and a presentation highlighting changes from the previous Work Area Protection Manual can be found at the following web link: http://www.virginiadot.org/business/trafficeng-WZS.asp

This Section establishes expectations and requirements for being in compliance with the 2026 *Virginia Work Area Protection Manual Version 11.0* for all FIRMs providing CA/CI services on behalf of HRSD.

II. Training Requirements for Construction Inspectors - All construction inspection personnel representing HRSD on any construction projects within rights of way exposed to traffic, work vehicles, and construction equipment within traffic control zones must take an approved course and become certified in Intermediate Work Zone Safety Training. HRSD will require a copy of each inspector's certification in order to represent HRSD on a construction project.

III. Personal Protective Equipment (PPE) Requirements – All workers and flaggers are required to wear ANSI/ISEA 107-2020 Class 3 High Visibility safety apparel when exposed to traffic and construction equipment. The safety apparel shall be securely fastened to maximize workers' visibility. Hard hats with 360 degrees of retroreflective material shall also be worn. For workers installing and removing temporary traffic control devices the following Personal Protective Equipment (PPE) is required at all times, both day and night:

- ANSI/ISEA 107-2020 Class 3 High Visibility Vest
- Hard Hat meeting ANSI/ISEA Z89.1-2014 standards with 360-degree retroreflective material
- Type E trousers or gaiters meeting ANSI/ISEA 107-2020 (

- Foot Protection meeting ANSI Z41, ASTM F2412 and ASTM F2413

Flaggers are required to wear the following Personal Protective Equipment (PPE) at all times:

- ANSI/ISEA 107-2020 Class 3 High Visibility Vest
- Hard Hat meeting ANSI/ISEA Z89.1-2014 standards with 360-degree retroreflective material
- Daytime: Class E trousers or gaiters meeting ANSI/ISEA 107-2020
- Nighttime: Class E trousers meeting ANSI/ISEA 107-2020
- Foot Protection meeting ANSI Z41, ASTM F2412 and ASTM F2413

Flagger stations shall be illuminated at night. Streetlights or vehicle headlights do not meet the illumination requirements for flagger stations. The light source shall produce a minimum of 50 lux (5 foot-candles) throughout the entire area. The light source needs to be higher than the flagger station and must not interfere with the flagger's or motorist’s line of sight.

IV. Attachments:

A. Personal Protective Equipment Requirements for Work Zone Operations

End of Section

Section 24 - Pipelines and Appurtenances

I. Introduction – The HRSD interceptor system conveys wastewater to the treatment plants through a network of gravity sewers, force mains, pressure-reducing stations, pressure control valves, and pump stations. This section includes specifics for the design and construction of force mains, sanitary sewer gravity mains, manholes, valves, and other appurtenances. This section also includes specifics for the design of temporary diversion and line stop systems. Designers for planned work on or near HRSD pipelines are to follow these requirements and use the appropriate details contained in Section 37 - Standard Details, appropriate technical specifications contained in Section 41 - Master Specification Sections, and other referenced checklists or forms within this manual.

II. General – The following items apply to all HRSD pipelines.

A. Design Specifics:

1. Design and construction to be in accordance with the current *Commonwealth of Virginia Sewage Collection and Treatment Regulations (SCAT)*.

2. Pipeline design flows are provided by HRSD. HRSD will provide pipe sizes for force mains and gravity mains based on the HRSD regional hydraulic model.

3. HRSD desires to bid alternative materials to increase competition wherever possible. Typical materials used are lined ductile iron, FRP, PVC, and HDPE. HRSD has more experience and operational knowledge with ductile iron for use in force mains than these other materials. Other materials should be considered as appropriate based on site-specific conditions and current technology.

4. Evaluate all utility crossings and critical tie-in points for conflicts. Conflicts shall be determined by the HRSD Project Manager and/or FIRM with concurrence from the Operations Department on a case-by-case basis. Maintain a minimum 18-inch vertical separation for all utility crossings and/or 10 feet horizontal separation from buried utilities unless otherwise approved by HRSD. Other conflicts may be identified on a project case-by-case basis for such concerns as maintenance of operation of valves and air vents, or access to buried pipelines for condition assessment programs.

5. The use of conflict structures is not permitted in the HRSD system.

6. In situations where locality gravity sanitary sewer mains are crossed over within 36-inches of vertical clearance by the newly installed gravity sewer main or force main or the HRSD force main or gravity

main is to be installed within 36-inch vertical clearance under the locality gravity sanitary sewer mains, these locality mains shall be Closed Circuit Television (CCTV) inspected preconstruction and post construction by the HRSD Contractor as a record for potential settling or misalignment issues.

7. Obtain information on existing subsurface utilities to the applicable Utility Quality Level as defined in the A.S.C.E. Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (A.S.C.E. 38-02). Locate utilities in pipeline corridor in accordance with Utility Quality Level B. Utilities crossing the proposed pipe shall be located in accordance with Utility Quality Level A.

8. Maintain a minimum of ten feet from the centerline of the pipe to the edge of the easement or right of way. Where easements are through parcels (vs. along the edge), provide minimum of 30-foot-wide easement. Refer to Section 37 - Standard Details section for standard easement plat requirements.
9. Provide bollards or agreed upon signage to protect and locate air vents, valve boxes, manholes, etc. in fields and areas where these structures are likely to be damaged or covered by vegetation or soil. Potential areas include cultivated fields or woods.

10. Do not install lined ductile iron pipe or fittings within 8 feet of chemical injection stations, as pipe, gaskets, and the ceramic epoxy lining may be damaged. Consult with the lining manufacturer in such situations.

11. When existing pipe is to be abandoned, consider the need to abandon in place and/or remove if required by the locality or governing authority. For pipe abandoned in place the following shall apply:

    a. All pipe diameters, ensure all sources of flow have been eliminated, and dewater in accordance with local, state or federal guidelines

    b. For pipe up to and including 12” diameter, seal ends using a mechanical plug or cap specifically designed for the pipe being abandoned.

    c. For pipes greater than 12” diameter, fill the pipe with lightweight cellular concrete (flowable fill). Fill shall have a minimum compressive strength of 25 lb/cu ft wet cast density yielding a minimum compressive strength of 70 psi at 28 days. Higher densities may be required by the locality or governing authority.

B. Installation records shall be kept in a digital spreadsheet containing X,Y,Z coordinates for top of pipe elevations at each joint, fitting, valve and connection points. The spreadsheet shall be updated monthly and attached to each contractor payment application. Refer to Master Specification Section 01323 - Record Documents, for X,Y,Z accuracy requirements. The "As Built Asset Locations X,Y,Z" template is found in Attachment B to this Section.

1. Evaluate the need for and, if required, design for external corrosion protection based on soil conditions or stray currents from other utilities. Provide electrical isolation at outlet valves and connections to adjacent pipeline sections if cathodic protection or bonded joints are required.

2. Evaluate the need for interior and exterior linings and coatings based on specific site conditions.

3. Where force mains discharge into gravity systems, special consideration shall be given to corrosion protection of the force main, manhole and gravity sewer. The design must also minimize turbulence**.**

C. Protective Linings:

1. Corrosion Resistant Lining for pipelines – For ductile iron pipe and fittings, the products described below have been approved and shall be specified as acceptable alternatives. Unless specifically approved by HRSD, all ductile iron pipe and ductile or cast iron fittings used for force main shall be lined. Specific requirements associated with each of these linings are contained in Master Specification 02510 – Ductile Iron Pipe within this manual.

   a. Internal Lining – The lining material for pipe and fittings shall be Permox CTF, Induron Coatings Protecto 401 or TNEMEC Series 431.

D. Bid Document Development

1. Where appropriate, utilize details, bid and payment items from the *Hampton Roads Planning District Commission (HRPDC) Regional Construction Standards* (latest edition).

2. Provide details on the drawings indicating bedding, backfill and surface restoration requirements for the project.

3. Pavement replacement details, traffic control and similar type issues must be coordinated with the appropriate municipalities, VDOT, etc.

4. Include adequate survey data, including pipeline centerline stationing. State Plane coordinates – Virginia South / NAVD 88 Datum required. Accuracy should be within 0.1 of foot in the horizontal and vertical plane. All fittings/appurtenances to be GPS surveyed. References on drawings to allow for Contractor to perform field layout of proposed work. Refer to Section 6 - Drawings, Record Drawings, and Valve Guides in this manual for specific requirements.
5. Handling of Lined Ductile Iron Pipe and Fittings – Ductile iron pipe and fittings lined with any of the standard corrosion resistant linings must be handled only from the outside of the pipe and fittings. No forks, chains, choker cables, hooks, or straps shall be placed inside the pipe or fittings for lifting, rigging, positioning, or laying. Straps will be used for lifting.

III. Force Mains

A. Design Specifics:

1. Use c=130 for force mains for all flow calculations.

2. Maintain a minimum cover of three (3) feet. Maximum cover is eight (8) feet with exceptions made on a case-by-case basis by HRSD's Project Manager.

3. Consider potential for future development in determining depth of cover.

4. Design the vertical alignment of the force main to provide a positive grade. Minimum desirable slope is 0.20%. Include the slope and elevations on the profile drawing. Provide a copy of the continuous profile for HRSD's review as soon as the majority of the crossing utilities have been identified.

5. Limit maximum pipe joint deflections to 50% of manufacturer's maximum allowable deflection.

6. When HRSD installs new pipe or replaces force mains under major roadway intersections, the project should be designed and constructed to minimize the need for HRSD to perform future maintenance, repairs, and tie-ins within the intersection. Best practices include: replacing all old piping and valves within the intersection, not leaving any active portion of existing force main within the intersection (which may be a future failure point) and configuring the terminus points of the intersection work to facilitate connection of future pipelines leading to the intersection. Design consideration should be given to enhance future worker safety and minimize future traffic disruptions associated with the operation and maintenance of the new force main.

7. Verified high points in the pipe profile shall be field tapped for insertion of a corporation stop for an air vent assembly in lieu of factory taps for the air vents based on the Bid Document drawing locations. A stainless-steel tapping saddle shall be used. Where field taps are made the protective lining shall be repaired in accordance with manufacturer recommendations.

8. Design new force mains for a minimum pressure of 100 psi at the high point in the line. Obtain anticipated range of operating pressures from the HRSD Project Manager. This may require higher design pressures, but will not be used to justify lower design pressures.

    a. HRSD will run the Interceptor System model to verify positive pressures at minimum flows or indicate the need for pressure sustaining valves.

9. Provide positive means of removing air from the ends of the lines during testing and all operating modes.

10. Isolation valve placement shall be:

    a. Force main valve placement at 2,500 to 3,000 linear feet using best engineering judgment and as approved by HRSD Operations. All mainline valves shall be restrained.
    b. All pump stations shall have a mainline valve on both sides of the emergency pump connection.

    c. All major creek crossings shall have a mainline valve, tee and branch valve on each side of the crossing.

11. Obtain locality and HRSD input on the location and size of outlet valves. Design in accordance with Section 37 - Standard Details in this manual.
12. The minimum distance between taps on an HRSD force main is 1,000 linear feet. Exceptions will be considered on a case-by-case basis by HRSD Interceptors and the HRSD Project Manager.

13. Indicate the limits of restrained pipe on the profile.

14. Specifics on pipe thrust restraint:

    a. Use manufacturer’s standard pipe restrained joints where restraint is required.

    b. Do not use thrust blocks unless absolutely necessary at tie-ins to existing facilities and only after approval from HRSD Interceptor Operations and the HRSD Project Manager.

c. Wedge type retainer glands manufactured by EBAA, Sigma, Smith-Blair Camlok and Ford Meter box are acceptable.

d. Proprietary restraint systems, such as the U.S. Pipe “HP Lok” system, shall be considered on a case-by-case basis as recommended by the FIRM and HRSD Project Manager.

e. In the case of existing unrestrained pipe at tie-in locations, on a case-by-case basis the design team shall carefully consider the application of thrust restraint to the unrestrained pipe.

15. For ductile iron pipe, specify the following:

    a. Use special Class 51 minimum wall thickness.

    b. Flanged joints, if used, shall be Class 125 per ANSI B16.1.

        (1) The use of flanged pipe in buried conditions is not preferred. Use will be considered on a case-by-case basis by HRSD Interceptor Operations and the HRSD Project Manager.

    c. Standard fittings shall be in accordance with AWWA C110 or AWWA C153.

    d. Threaded bells shall not be used.

16. Use lined eccentric reducers, match grade at top of pipe.

17. The use of Foster® mechanical joint adaptors, as manufactured by Infact Corporation, for use on ductile iron pipe 6” through 36” diameter shall be allowed on a case-by-case basis. Justification for use shall be project specific and request for approval shall be provided in writing to the HRSD Project Manager.

18. In order to facilitate ease of pipeline tie-in and to correct for minor pipeline alignment discrepancies two (2) ductile iron long body sleeves are to be designed at each tie-in. A single ductile iron long body sleeve may be used with the approval of HRSD Interceptors and the HRSD Project Manager based upon the alignment. FIRM shall also consider additional measures (e.g., matting, helical piles, or flexible joints) to eliminate post-installation settlement at the tie-in location to accommodate site or project-specific conditions.

19. Provide sequence of construction and tie-in details for connections to ensure that connections can be accomplished without spills or interruptions to service. Use the checklist in Section 26 – “Checklist for Tie-Ins to Existing Interceptor Force Mains” within this manual.

20. Install tracer wire and utility marking tape on non-ferrous pipe installations, and utility marking tape on ferrous pipe installations unless otherwise directed. Tracer wire access boxes shall be installed at a maximum distance of 400 feet. Do not use air vents or valve boxes as tracer wire access boxes. Section 36 – Standard Details, Detail No. 253 - Tracer Wire Locator Box shall be used for the tracer wire access point. There shall be adequate wire in the tracer wire access point to pull wire 24 inches outside of the box. Tracer wire to be tested for continuity as part of acceptance testing.

    a. Copper tracer wire shall be 10-gauge, solid wire with plastic coating.

    b. Subsurface utility marking tape shall be of a durable, metalized, plastic film, for identification of all sanitary sewer lines. Bright green tape imprinted with the legend “Caution-Sewer Below” shall be used. The utility marking tape shall be manufactured by Griffolyn Co. or approved equal. Tape shall be placed no less than 6 inches and no more than 12 inches below the proposed finished grade.

21. For HDPE or PVC pipe, an appropriately sized mandrel may be required to be pulled through the pipe after installation to verify that allowable deflection has not been exceeded, if there are concerns about a section of installed pipe. Proper design and installation are required related to proper bedding, backfill, and compaction to prevent pipe deflection.

22. For HDPE pipe, internal beading shall be removed only if the pipe is to be used in a gravity sewer application.

B. Hydrostatic Pressure Test Procedures:

1. Regarding use of the pressure gauge to be used for the hydrostatic test, the following options are identified. Coordinate with the HRSD Project Manager for the option to be utilized:

    a. Contractor to provide the pressure gauge for acceptance test along with a certified validation of recent calibration of this gauge. Calibration shall be within 12 months of planned hydrostatic test date. Contractor to provide a valved connection point to allow installation and removal of the test gauge without affecting line pressure.

    b. HRSD to provide the pressure gauge for acceptance test along with a certified validation of recent calibration of this gauge. Contractor to provide a valved connection point to

allow installation and removal of the test gauge without affecting line pressure.

2. Hydrostatic tests shall be a minimum duration of one hour. Test pressure at the high point in the new force main shall 100 psi.

3. Contractor shall provide the capability to add water to the line during the test and will be required to add up to the allowable leakage at the end of the test period.

4. Allowable leakage shall be in accordance with Virginia Department of Environmental Quality (DEQ) SCAT regulations and AWWA C-600 procedures.

5. Contractor shall open all outlet valves and end of line valves to allow testing of all blind flanges, plugs, etc.

6. Contractor shall install corporation stops at ends of line to remove air for testing. Plug these upon completion of testing.

7. Verify the appropriateness of the testing procedure for plastic pipe materials, if used. To account for expansion, prior to testing, HDPE pipe shall be filled to the required test pressure. The test pressure shall be maintained for a minimum of three (3) hours by adding make up water hourly as required. After three (3) hours water shall be added to reestablish test pressure and the actual test may begin.

8. The “Report of Hydrostatic Pressure Test” form to document the results is found in Attachment A to this Section.

9. Provide required pipe restraint to accomplish hydrostatic pressure test.

10. Pressure testing of new force main shall not take place against new or existing HRSD valves or extend into existing pipe or facilities without written approval from the HRSD Project Manager.

11. Hydrostatic pressure tests on taps shall be a two-part test: first on the valve fully closed against an acceptable end plug or flange, and then on the valve fully open to test the saddle installation. The tests shall be in accordance with saddle manufacturer's recommendations or to a wet pressure test of 50 psi for 30 minutes with zero leakage, whichever is the greater test. Test pressures shall be coordinated through the Interceptor Operations Manager prior to performing any pressure test.

12. The Contractor or the FIRM shall notify the HRSD Pretreatment and Pollution Prevention (P3) Department and the appropriate Treatment Process Engineer for the receiving HRSD facility prior to discharging

water used during hydrostatic testing. Notification shall be made a minimum of 24 hours in advance of the planned discharge.

IV. Line Stops

A. The Design and Construction Departments have seen the need for line stop and bypass system installations on force mains increase dramatically over the past decade. HRSD has also seen an increase in the number of line stop companies entering the wastewater market over this same period of time. The Master Specification 02531 – Line Stops on Sanitary Sewer Force Main Systems in Section 41 and the Checklist for Line Stop Installation in Section 25 of this manual are to be used for consistency for all line stop submittals and installations on HRSD force mains. This section establishes guidelines for HRSD staff and FIRMs for use and editing the HRSD Line Stop Master Specifications, including FIRM and personnel qualification requirements into the Bid Documents, and specific design submittals and considerations for line stops and bypass systems.

B. Design Submittals – At the 90% design submittal or before, the designer of the line stop and bypass system shall request the dry weather minimum, dry weather maximum, and wet weather maximum flow values from HRSD. The designer shall provide an estimated duration of bypass operations, and headloss calculations for the various bypass pipe size considerations under the three flow scenarios provided (dry weather minimum, dry weather maximum, and wet weather maximum).

C. Design Considerations - The designer of line stops and bypass systems need to evaluate the following risks associated with bypass through the line stop housing on a case-by-case basis:

1. How long will the line stop/bypass be in place? This issue needs to be discussed with HRSD Interceptor Systems and their knowledge of the force main system to determine if bypass through the line stop housing will be permitted verses a requirement to install additional tapping sleeves and valves for the bypass. The designer shall prepare head loss calculations for all bypass flows proposed through the line stop housing to compare different line stop companies and their published literature on housing design and head losses.

2. Does the interceptor system have a history of significant debris/rags at pump stations upstream and downstream of the project site? This issue is also important for a bypass design related to clogging risk and pressure spikes in the force main leading to a risk of pipeline failure and sanitary sewer overflows.

3. Can a zero or low flow (velocity 2 fps or less) situation be created to insert the line stop plug? This issue has arisen numerous times for recent past line stop installation, where the line stop field crew has requested a zero flow during insertion and removal of the stopper

unit. This issue needs to be clarified with HRSD Interceptor Systems prior to the Bid Documents being advertised for construction bids.

4. What type of response would be necessary if the line stop housing becomes clogged and what are the overflow risks? Evaluate responses to include pump and haul scenarios at impacted pumping stations (HRSD, jurisdictional, private), response time to unclog the line stop housing, additional materials on site, and other backup plans. If bypass through the line stop housing is recommended by the designer and confirmed by HRSD, then the contingency plan development, submittal and approval must be incorporated into the Bid Documents.

D. Qualifications to be incorporated into Bid Documents - The following qualifications for the line stop firm and key personnel shall be incorporated into the Instructions To Bidders (Section 00200); Article 3 – Qualification of Bidders. Any revisions to these qualifications shall be coordinated and approved by HRSD's Project Manager and the Engineering Contract Specialist.

3.01 To demonstrate needed qualifications for the Project, the apparent low Bidder and other Bidders as requested by the Owner or the Engineer shall submit a completed copy of the attached Questionnaire and documentation of experience required in Paragraphs 3.02, 3.03, and 3.04 within twenty-four (24) hours of the Bid opening. Additional information may be requested after the Questionnaires are received if, in the opinion of the Engineer, the information submitted is insufficient to complete the evaluation of the Bidder.

3.02 Bidders and sub-bidders shall be fully knowledgeable, competent, and experienced and shall meet the minimum requirements defined herein for the construction of line stops for similar projects. The Bidder and/or sub-bidder and their respective superintendents shall have successfully completed projects of similar length/size, material, diameter, and installation conditions as follows:

A. Line stop sub-bidder and the sub-bidder's on-site superintendent shall have experience with installation of at least five (5) line stops on 20-inch or larger cast iron, ductile iron, or prestressed concrete cylinder pressure pipelines over the past five (5) years. Additional line stop sub-bidder experience requirements are listed in Article 3.04 below.

B. Self-performing of line stops by the General Contractor shall not be permitted. This includes installation of "bag stops".

3.03 The Bidder shall provide required documentation for their experience, for sub-bidder's experience, and for all on-site superintendents' experience. Documentation shall include project titles, Owner's and Engineer's names, addresses and phone numbers, lengths, diameters, and materials of construction, and project values. Attach additional pages to the questionnaire as necessary to provide this information.

3.04 Qualifications of Line stop Sub-Bidder:

The line stop sub-bidder shall have a minimum of five (5) years documented, uninterrupted service with furnishing line stop equipment for sanitary sewer force mains on the type and size of pipe described in the description of work. Provide detailed reference information including:

1. Project name, location of the work, and start and completion dates.

2. Description of project including equipment provided, size of pipe, and type of force main.

3. Project owner contact information, including their contact name, address, phone and e-mail.

4. General contractor name, their contact person, address, phone and e-mail.

A. The line stop sub-bidder shall have completed five (5) successful line stop installations for sanitary sewer force main systems over the past five (5) years and shall provide the following information:

1. Project name, location of the work, and start and completion dates.

2. Description of project including services provided, size of pipe, and type of force main.

3. Project Owner contact information, including their contact name, address, phone and e-mail.

4. General contractor name, their contact person, address, phone and e-mail.

B. The line stop sub-bidder shall have a minimum of two (2) line stop superintendents currently employed with their company. Each line stop superintendent shall have a minimum of three (3) years continuous employment with the line stop company and shall provide the following information:

1. Names of a minimum of two (2) line stop superintendents currently employed with line stop sub-bidder, including number of years of employment with line stop sub-bidder's company.

C. Each line stop superintendent shall have completed three (3) successful line stop installations for sanitary sewer force main systems over the past three (3) years. Provide the following information:

1. Project names, location of the work, and start and completion dates.

2. Description of projects including services provided, size of pipe, and type of force mains.

3. Project owner contact information, including their contact name, address, phone and e-mail.

4. General contractor name, their contact person, address, phone and e-mail.

D. The line stop sub-bidder shall have an established training program for their employed line stop superintendents. Copies of the line stop sub-bidder training program shall be submitted. The line stop superintendent shall have appropriate training on the equipment that is to be used. All line stop superintendents proposed for this work must be graduates of the training program. Submit copies of the following:

1. Copies of line stop sub-bidder training program.

2. Copies of training certifications for a minimum of two (2) line stop superintendents currently employed by line stop sub-bidder's company.

E. The line stop sub-bidder shall utilize a qualified licensed professional engineer(s) to review all orders, ensure proper design, verify tolerances, and ensure that all services (standard or special) are completed in accordance with applicable AWWA, ANSI, and/or ASME codes. This engineer(s) must be capable of quantifying the range of hydraulic loss through the line stop system and have sufficient pipe design and restraint experience/knowledge with (at a minimum) the pipes specifically listed in the description of work. All submittals from the line stop sub-bidder must be stamped by the referenced licensed professional engineer(s).

E. Liquidated Damages - consideration should be given by the designer for Liquidated Damages to be included in the Agreement for Emergency Designation Projects for late delivery and installation of line stops / bypass system after an agreed upon date by HRSD and the line stop company and/or General Contractor.

V. Valves

A. Gate valves and plug valves shall be considered in the design and specified as appropriate per the particulars of each project. At present, HRSD allows both gate valves and plug valves for direct bury applications with approval by the valve manufacturer for such use with raw wastewater.

1. For large diameter valves, consider the length of bonnet and location of valve nuts (main and bypass) when determining force main alignment.

2. All valves shall be fully opened and closed for one cycle before installing to verify operation and record actual number of turns. Certified maximum operating torque on the valve shaft and the mechanical advantage of any geared actuator shall be provided by the manufacturer and shall be included on the shop drawing submittal provided to HRSD.

3. Valves shall be capable of drip-tight, bi-directional shutoff.

4. Bi-directional hydrostatic testing of valves shall be conducted by the valve manufacturer. A certificate of compliance, including test methods and results, shall be provided to HRSD for each valve and included with the shop drawing submittal to the HRSD Project Manager. Minimal acceptable test pressures shall be in accordance with applicable AWWA valve standards (C-500, C-509, C-515 and C-517) for the valve type specified.

5. Mainline plug valves to be installed on concrete pipe force mains may require special bedding. The FIRM to evaluate the loading, strain, and settlement potential of the valve and the connecting pipes and develop installation details, plan notes, and technical specification language as needed for the development of the Bid Documents and Drawings.

6. The following requirements shall be used for the specific type of valve to be installed:

a. Valves three inches and larger shall be designed for a cold working pressure of not less than 150 pounds per square inch and tested at a pressure of not less than 300 pounds per square inch. Valves 16 inch and smaller shall operate in a

vertical position and valves over 16 inches shall operate in a horizontal position. Gearing, 4:1 ratio, shall be provided on valves 16 inches and larger. Gear cases and shafts shall be the "totally enclosed type, suitable for buried service." Valves shall be furnished with a standard wrench nut (two inch), shall be of non-rising stem configurations and shall open left (counterclockwise). Valve ends shall be provided as indicated in the construction documents. Specified valves shall be in conformance with one of the following requirements.

(1) Resilient wedge Seated Gate Valve – Shall conform to AWWA C509 or C515 and be fusion bonded epoxy coated on both the interior and exterior of the valve and in accordance with AWWA C550. Resilient seated gate valves shall not be used in the horizontal position.

(2) Double Disc, Parallel Seat Gate Valve – Shall conform to AWWA C500 and shall be coated with an asphaltic varnish in compliance with NSF-61. Seats in the body shall be replaceable without removing the valve from the pipeline. Discs may be free to revolve 360 degrees. Discs shall be cast iron or ductile iron and bronze faced. Valves installed in the horizontal position shall be furnished with bronze rollers, bronze or stainless-steel tracks and bronze scrapers. Bypasses shall be provided on double disc gate valves 36 inches and larger.

(3) Eccentric Plug Valve – Shall conform to AWWA C517 and shall have an exterior and interior coating of epoxy. Valve body and plugs shall be ASTM A 126 Class B cast iron or ASTM A-536 Grade 65-45-12 ductile iron with thickness in accordance with AWWA C-517 Plugs shall be solid one piece with a cylindrical seating surface eccentrically offset from the center of the shaft. Plug facing shall be Buna-N with a minimum hardness (Shore A) of 70 durometer. Seats shall be welded in overlay of minimum 1/8" inch thick nickel raised surface. Bearings shall be permanently lubricated 316 stainless steel. Packing shall be multiple v-type or u-cup type. Washers at the top and bottom of the plug journal shall be provided to keep grit and debris out of the bearings and packing. Plug valves in the horizontal position shall be installed so that the plug rotates upward as the valve opens. The operator nut and stem shall be protected with a collar during shipping and installation.

VI. For exposed service applications plug valve shaft seals shall be externally adjustable and repackable without removing the actuator or bonnet from the valve under pressure. The actuator mounting bracket shall allow access to the packing gland and provide an air gap to visually inspect the packing.

VII. For buried service applications shaft seals shall be fully enclosed and protected from the surrounding groundwater and soil via full circumferential metal to metal contact between the bonnet and the actuator body or by other means as approved by HRSD.

A. Disposition of existing inline valves to be taken out of active service is as follows:

1. The valve and its associated connection points shall be inspected for deterioration. This includes but is not limited to the entirety of the valve, the full circumference of saddles and/or tees along the interceptor force main, and all associated hardware.
2. If HRSD, or FIRM, determines deterioration may compromise future integrity of the interceptor force main the valve shall be removed.
3. If a horizontal valve is to be abandoned in place, it shall be fully closed, the operator nut and casting removed, and the gear box removed. The gear box shall be provided to HRSD.
4. If a vertical valve is to be abandoned, it shall be removed unless otherwise approved by HRSD Project Manager.
    a. For vertically aligned valves that are not practical to remove, then develop a sequence to remove the actuator and working components and then install a gasketed flange plate.
5. All existing branch valves on the affected section of the interceptor force main shall be replaced.

A. Disposition of existing branch valves to be taken out of active service as follows:

1. The valve and its associated connection points shall be inspected for deterioration. This includes but is not limited to the entirety of the valve, the full circumference of saddles and/or tees along the interceptor force main, and all associated hardware.
2. If HRSD, or FIRM, determines deterioration may compromise future integrity of the interceptor force main the valve shall be removed.
3. If the valve is to be abandoned in place, it shall be fully closed, the operator nut and casting removed, and the upstream side of branch force main cut and mechanically capped no more than 3-ft from the valve.
4. Valves oriented vertically shall be removed unless otherwise approved by HRSD Project Manager.

a. For vertically aligned valves that are not practical to remove, then develop a sequence to remove the actuator and working components, and then install a gasketed flange plate.

5. All existing branch valves on the affected section of the interceptor force main shall be replaced.

B. Automatic air release valves may be approved for use in the HRSD system on a case-by-case basis, reviewed for use and approval by the HRSD Project Manager and with concurrence from HRSD's Operations Department.

VIII. Gravity Interceptors and Manholes

A. Use n=0.013 for gravity interceptors for all flow calculations.

B. General flow information will be provided based on HRSD's Regional Hydraulic Model. Final line sizing must consider the pump capacity of the pump stations discharging into the line.

C. Provide smooth transitions at connections, manholes and structures to minimize turbulence and release of hydrogen sulfide.

D. For manholes on lines 12-inch and larger, at force main discharge manholes, and at heavily traversed or difficult operating locations, manholes shall be made of corrosion-proof materials for manholes, frames and covers.

E. Testing

1. Perform infiltration, exfiltration or air testing in accordance with VDEQ SCAT regulations.

2. Consider pulling mandrel through completed lines to verify that the pipe is not deflected beyond the manufacturer's specified deflection limits.

IX. Attachments:

A. Report of Hydrostatic Pressure Test

B. As Built Asset Locations X,Y,Z Template

End of Section

Section 25 - Checklist for Line Stop Installations

I. Introduction - The Design and Construction Departments have seen the need for line stop and bypass system installations on force mains increase dramatically over the past decade. HRSD has also seen an increase in the number of line stop companies entering the wastewater market over this same period of time. The Line Stop Master Specification 02531, included in Section 40 of this manual, strives for consistency for all line stop submittals and installations on HRSD force mains. This section establishes procedures for use of the developed Line Stop Checklist for HRSD staff and FIRMs.

II. Completion and Submittal of "Checklist for Line Stop Installations"

A. The FIRM shall use the attached template form to coordinate with the Contractor to confirm that each step in the planning process for upcoming line stops is well thought out and resources are available.

B. The FIRM shall submit a copy of the completed checklist to the HRSD Project Manager at the completion of each line stop.

C. The Project Manager shall file a digital version of each checklist in the appropriate location.

III. Attachments:

A. Checklist for Line Stop

End of Section

Section 26 - Checklist for Tie-Ins to Existing Interceptor Force Mains

I. Introduction - FIRMs under the direction of HRSD's Engineering Division, Design and Construction Departments are required to work closely with Contractors who are preparing to connect to or work on an active force main. HRSD developed tie-in checklists based on our progressive learning throughout the years of doing and preparing for tie-ins. The attached checklist is to be used in conjunction with Specification Section 01520, Maintenance of Pipeline Operations, in this manual to properly plan and execute the plan for a successful tie-in.

II. Completion and Submittal of "HRSD Checklist for Tie-Ins to Existing Interceptor Force Mains"

A. The FIRM and Contractor shall use the attached template form to ensure each step in the planning process for upcoming tie-ins is well thought out and resources are available.

B. The Contractor shall submit a copy of the completed checklist to the HRSD Project Manager at the conclusion of a successful tie-in.

C. The Project Manager shall file a digital version of each checklist in the appropriate location.

III. Attachments:

A. Checklist for Tie-Ins

End of Section

Section 27 - Trenchless Crossing Installations

I. Introduction – In this section, information is presented on trenchless crossing techniques.

II. General Criteria

A. The FIRM shall consider and evaluate appropriate trenchless technologies, including conventional techniques, in the preliminary engineering report (PER) stage.

B. Consider space required for setup and installation equipment.

C. Locate soil borings so that they will not be over the centerline of the pipe. Borings are a potential blowout point for drilling mud. Consider grouting the boreholes with cement, if practical, to reduce soil fracturing.

D. FIRMs under the direction of HRSD's Engineering Division, Design and Construction Departments, are required to work closely with contractors who are preparing to use suitable trenchless crossing means and methods.

E. HRSD developed a checklist that has been based upon our progressive learning by doing and preparing for trenchless installation operations. This checklist is located in this standards manual in Section 28 – Checklist for Trenchless Crossing Installations and is to be used, completed, and submitted to HRSD jointly by the Inspector and Contractor.

F. Require final acceptance leakage testing as applicable (e.g., ductile iron pipe) and use of a mandrel or other approved method to verify deflection and minimum internal diameter requirements as appropriate.

G. Measurement and payment for trenchless installations shall be on a lump sum basis paid to the Contractor upon successful completion (as defined in the Bid Documents) of each crossing. Successful installation includes verification of hydrostatic and other specified testing requirements.

III. Trenchless Pipe Installations - The following technologies are commonly used by HRSD. This should not preclude the FIRM from considering and recommending alternate technologies that may provide advantages over those described below.

A. Horizontal Directional Drilling (HDD) – HRSD has used HDD primarily for river crossings and other long crossings of environmentally sensitive areas. It can be considered for new construction or pipe replacement.

1. The FIRM to consider the limitations of materials for use with HDD projects on a case-by-case basis and make a recommendation to HRSD during the preliminary engineering phase.

2. Methods to addressing internal and external corrosion are to be evaluated based on site conditions and material capabilities and limitations. Perform a corrosion analysis study and specify a cathodic protection system as necessary.

3. Require a ground grid system or other equipment to ensure accuracy of the pipe at the exit point.

4. Require the Contractor to provide a pilot hole survey alignment to be approved by the FIRM prior to commencement of the reaming operation.

5. Consider the environmental impacts of this construction method, including location of entry and exit points, depth of cover, and disposal of drilling mud and spoils.

6. Delineate a water source for drilling mud make-up in the contract documents.

7. At the conclusion of a successful HDD project and prior to connection to other pipe sections, X,Y,Z coordinates to be collected by the HDD installer and tied to project coordinates to create accurate recorded installation information to be incorporated into HRSD's record drawings and GIS. This requirement may be waived only with advance approval by HRSD's Project Manager.

B. Jack & Bore and Microtunneling - HRSD has used jack & bore and microtunneling methods in various locations where traditional open cut and HDD are not accessible and/or economically feasible. It should be considered where applicable for new construction or replacement.

1. Casing pipe materials should be evaluated considering their capabilities and limitations as well as the site conditions for which they will be installed. Materials to consider include, but are not limited to, steel and HDPE. Steel shall be in accordance with the latest edition of applicable ASTM standards unless otherwise approved in writing by HRSD's Project Manager and allowed by the permitting agency.

2. Permalok pipe joining system may be considered on a case-by-case basis as an acceptable method in lieu of butt welds for adjoining steel casing pipe sections.

3. Casing pipe design shall include casing spacers, bulkhead at each pipe end, and leak detection.

4. Carrier pipe materials should be evaluated considering capabilities and illimitations as well as the site conditions for which they will be installed. Materials to consider include, but are not limited to, HDPE, Ductile Iron (DI), and Polyvinyl Chloride (PVC).

5. FIRM shall give special consideration to the extent of the casing pipe in the design to account for future road improvements and for maintenance or repair of the installed pipeline.

6. The bored hole shall be minimally larger than the outside diameter of the casing pipe as over-cutting by the cutting head could lead to excessive soil removal and possible ground settlement.

7. The FIRM shall evaluate if corrosion protection is required on the casing pipes.

8. Consider the environmental impacts of this construction method, including location of entry and exit points, depth of cover, and disposal of drilling mud and spoils.

9. Jack & bore historically has been used for relatively short crossings or under secondary roadways. Evaluation of the appropriateness of this method by the Engineer for each installation is needed.

10. Microtunneling has historically been used for long crossings or heavily traveled roadways. Evaluation of the appropriateness of this method by the Engineer for each installation is needed.

IV. Subsurface Investigations - Implement subsurface investigations on all projects involving trenchless pipe installation. Methodologies shall include, but not be limited to, ground penetrating radar (GPR), Subsurface Utility Engineering (SUE) levels A and B, and exploratory excavating. The following criteria shall be considered when performing investigations at the various phases of the project:

1. Pre-construction to help identify near-surface voids, unknown utilities, and obstructions not identified by subsurface utility designation.

2. Following dewatering of the trenchless launching / receiving pits to the planned groundwater elevation and prior to advancing casing or pipe.

3. Post-construction to help identify any voids created as part of the trenchless pipe operation.

4. GPR testing requirements, when utilized, including the limits of testing, shall be written into the contract documents by the FIRM. When used, GPR testing shall include real-time imaging, recordable output that can be viewed on a computer screen, and printed without the use of proprietary software. The test area shall be laid out in a grid fashion over the existing plans and shall be referenced using swing ties, State Plane Coordinates, latitude/longitude, or other means to allow the contractor to reestablish the grid in order to conduct post-construction GPR testing. The FIRM shall evaluate the subsurface conditions and make recommendations as to the type of GPR required. At a minimum, 2D scans and reports shall be required, and discussion on the testing done and technology used in the final submitted reports. One of the scans to be performed following lowering of the groundwater table to the elevation necessary for preparation for the trenchless installation. Note that single-frequency GPR results are not reliable below groundwater levels.

End of Section

Section 28 - Checklist for Trenchless Crossing Installations

I. Introduction - FIRMs under the direction of HRSD's Engineering Division, Design and Construction Departments, are required to work closely with Contractors who are preparing to use approved trenchless crossing means and methods for installation of force mains or gravity sewer mains under roadways and waterways. HRSD developed a trenchless crossing checklist that has been based upon our progressive learning by doing and preparing for these installations. The attached checklist is to be used in conjunction with Section 27 – "Trenchless Crossing Installations" of this manual.

II. Completion and Submittal of "Checklist for Trenchless Crossing Installations"

A. The FIRM and the Contractor shall use the attached template form to confirm that each step in the planning process for upcoming trenchless crossings is well thought out and resources are available.

B. The Contractor shall submit a copy of the completed checklist to the HRSD Project Manager prior to the trenchless crossing attempt.

C. The Project Manager shall file a digital version of each checklist in the appropriate location.

III. Attachments:

A. Trenchless Crossing Checklist

End of Section

Section 29 - Rehabilitation of Sanitary Sewer Systems

I. Introduction – In this section, information is presented on processes for rehabilitation projects. Separate sections are also included on cleaning, closed-circuit television (CCTV), diversion pumping, and general items, which apply to most rehabilitation projects. The FIRM shall also be familiar with the *HRPDC Regional Construction Standards* latest edition for the sanitary sewer system rehabilitation means and methods.

II. General Evaluation Criteria

A. The FIRM shall consider and evaluate all appropriate technologies, including conventional techniques, in the preliminary engineering report (PER) stage.

B. When sizing new piping or bypass systems, the FIRM should seek input from the HRSD Project Manager, who will contact appropriate personnel. HRSD has numerous resources available to aid in development of design calculations including both modeled and metered data. If HRSD does not have flow monitoring data, flow monitoring data collection should be considered to determine bypass sizing.

C. Evaluate carefully the special features of existing lines to be rehabilitated (i.e. concrete pipe cradles, previous repair history, etc.) that may have a strong bearing on the techniques or processes recommended.

D. Evaluate potable water needs and availability for installation and testing.

E. Consider space required for installation equipment.

F. Require final acceptance leakage testing or other approved method to verify deflection and minimum internal diameter requirements as applicable to rehabilitation method.

G. Evaluate effect of ground water infiltration on methods proposed.

III. Sanitary Sewer System Rehabilitation

A. Cleaning – All gravity sewers must be cleaned before any rehabilitation process can be utilized. The following items should be considered and specified in cleaning.

1. Estimate the amount of material that needs to be removed from the line.

2. Outline or require the Contractor to submit a detailed procedure for removal of obstructions and capturing any loose material removed when cleaning pipe and structures such as manholes and wet wells.

3. Consider where and how the cleaned material will be disposed.

4. Consider the need to build sediment traps to capture grit or the requirement for diversion pumping during cleaning operations.

5. Require close communication with HRSD and locality stakeholders who will be impacted by cleaning or lining operations.

6. Consider structural integrity of pipe to be cleaned before choosing method of cleaning.

B. Closed-Circuit Television Video (CCTV) – CCTV inspection is required for all rehabilitation projects. HRSD generally has a pre-design CCTV of each proposed project. Require the following minimum requirements for performing CCTV.

1. Require videos immediately following cleaning and at the completion of the project. If lining is not installed immediately after cleaning, the pipe shall be inspected immediately prior to installation of liner with additional cleaning as required. Evaluate laterals and other points of concern per NASSCO requirements.

2. Specify the maximum amount of water in the pipe when CCTV is performed. Determine if diversion pumping is required or alternate water removal / inspection method.

3. Recommend that the FIRM be present during the CCTV process. Specify that Contractor shall complete the post-CCTV of each section and receive FIRM approval prior to moving to the next section.

4. NASSCO PACP, MACP and LACP shall be adhered to for the coding and reporting of any defects encountered during CCTV operations.

C. Diversion Pumping

1. HRSD will provide the maximum flows and average flows to be handled by diversion pumping. For low flow collection systems as determined by HRSD, exceptions to the requirements of master specification section 01520 – Maintenance of Pipeline and Pumping Operations will be considered.

2. Specify the maximum dB limits for the diversion pumping equipment.

3. No leaking is allowed on diversion piping or pumping equipment.

4. Maintain sewer service to all customers along the line.

5. Consider routing for diversion pipe during the PER or design phase. This should typically include approval from the locality where the work is taking place, as well as identification of private property needs.

D. Pipe Rehabilitation – The following methods have been used or considered by HRSD. Other methods may be considered as appropriate in this rapidly changing market. During the PER phase, the FIRM shall evaluate rehabilitation methods for suitability and shall perform pipeline assessment certification program (PACP), manhole assessment certification program (MACP) and/or lateral assessment certification program (LACP) inspections on the proposed sections of gravity pipeline designated for rehabilitation in accordance with National Associations of Sewer Service Companies (NASSCO) guidelines.

1. Cured In Place Pipe (CIPP)

a. The FIRM shall specify minimum liner thickness. The minimum may be different for different CIPP processes.

b. CIPP shall be designed based on the assumption the host pipe is fully deteriorated.

c. Determine if material samples are required for post-cure testing. If so, determine how samples will be obtained.

d. Provide performance specification for the liners. Require a Professional Engineer, licensed in the Commonwealth of Virginia, to seal the liner structural design.

e. Utilize existing standards such as ASTM, NASTT, NASSCO, PRC, etc. wherever applicable.

f. Require verification tickets for each liner section installed. Each ticket should include resin manufacturer and type, time and date of wet-out and other critical information.

g. Provide a watertight seal between the liner and the existing pipe at the manhole.

h. Rework the flow line through the manhole to account for the thickness of the liner.

i. Require that all water / wastewater be removed from pipe prior to and during installation of liner.

j. Require that all inflow into pipe (groundwater, laterals and side lines) shall be stopped prior to installation of liner.

k. Require that diversion pumping system be activated and flow removed from pipe during cleaning and CCTV inspection.

l. Require a detailed submittal from the contractor that provides design assumptions, calculation, material properties, and proposed installation approach.

m. Continuous temperature monitoring system (Zia Systems or approved equal) and a redundant temperature monitoring system such as thermocouples, shall be utilized as an additional QA/QC measure during the curing process.

n. Require final submittal of all temperature data.

o. Require inspection to be performed by an ITCP (Inspector Training and Certification Program) CIPP certified inspector.

p. Require submission of all relevant CIPP submittal documents listed in the NASSCO ITCP CIPP documentation (latest version).

2. Folded and Reformed Liners

a. Specify minimum thickness required.

b. Evaluate available material types.

c. Require that diversion pumping system be activated and flow removed from pipe during cleaning.

3. Formed In Place Pipe (FIPP)

a. Specify grouting procedures to be used.

b. Where man entry is possible, require tapping test with a hammer as a part of the final inspection.

c. Require that diversion pumping system be activated and flow removed from pipe during cleaning.

4. Sliplining

a. To be considered on a case-by-case basis

b. Engineer should review all pipe material available for sliplining and make recommendations

c. Require grouting of the annular space for all sliplining projects. Engineer to calculate theoretical volume of grout needed and to include in Bid Documents/Technical Specifications a means for the Contractor to measure quantity used.

d. Design and detail a watertight bulkhead between the slipliner and the host pipe at the manholes.

e. Require certified fusion welder if HDPE or fusible PVC is used. Engineer recommendation is required for proposed material and joining method.

f. Require removal of internal beads flush with pipe wall on HDPE pipe before installing the liner.

g. Specify minimum SDR or other appropriate thickness.

h. Evaluate whether diversion pumping is required for installation or if liner can be installed under flow.

5. Pipe Bursting can be considered, and Engineer should evaluate benefits and risks.

6. Structural Epoxy Linings

a. To be considered on a case-by-case basis

b. Engineer should review all pipe material available for lining and make recommendations.

E. Lateral Reinstatement – When external excavation is required, Insert–A-Tee is a good installation method which has been used on previous projects. When laterals are internally reinstated and lined, one piece mainand lateral systems as manufactured by BLD or LMK (or approved equal) are a good method of reinstating linings. The lining system should

include a method of providing a permanent seal between the host pipe and liner at both the lateral to main connection, and the upstream portion of the lateral. This is a developing area and considerable research should be performed before making recommendations.

F. Manhole Rehabilitation – This section covers rehabilitation of manholes and junction chambers.

1. Utilize diversion pumping if work below the bench is required.

2. Modify the inverts to provide a smooth flow line through the manhole.

3. Raise the bench to the top of the pipe, forming a “U” channel through the manhole and provide sufficient slope to make benches self-cleaning when benches must be modified.

4. Require a system to capture and remove cleaning material from the manhole without entry into the flow line.

5. Stop all leaks in the manhole before resurfacing, repair, or lining materials are applied.

6. Evaluate conditions of the frames and covers. The Contractor shall provide frames and covers as required.

7. Remove any steps entirely (minimum one inch recess), and do not replace. Restore surfaces before applying coatings.

8. Sanitary manholes are often exposed to environments with various degrees of aggressiveness thereby degrading the concrete and reinforcing and shortening the useful life of the structures. Choosing the appropriate protective measure should be determined during the preliminary engineering evaluation of the project. For Protective Coatings and Liners for manholes, the FIRM shall evaluate the current conditions of the structure and report findings in accordance with NASSCO MACP Guidelines. Any protective system must be applied in strict accordance with the protective system Manufacturer’s recommendations.

G. Post Construction & Rehabilitation Evaluation for Gravity Sewer Mains and Manholes

1. Existing gravity sewer mains or storm mains that are within 36” vertical clearance of the pipeline to be burst shall be CCTV inspected prior to any pipe bursting and following completion of pipe installation

by the Contractor as a record for potential future settling or misalignment issues.

2. For manhole rehabilitation projects, bonding of the coating material will be checked during the inspection and photo documentation will be provided. Special care will also be taken to inspect the bulkheads between the host pipe and the rehabilitated pipes in the manholes.

End of Section

Section 30- Deep Excavation Support Systems

I. Introduction

This section intends to provide excavation support guidance to engineers, design builders, and contractors for incorporation into projects. This section neither replaces professional design analyses nor limits innovative design where equal performance in value, safety, and maintenance economy can be demonstrated. It also does not eliminate the designer's requirement to follow applicable codes, ordinances, statutes, rules, regulations, and laws. Any conflict between this language and an applicable code, ordinance, statute, rule, regulation, and/or law shall be addressed with HRSD's Project Manager. The use and inclusion of language from this section does not alleviate the design professional from their responsibilities or legal liability for any contract documents they create. It is also recognized that this section is not universally applicable to every project.

II. Technical Codes, Standards, and Regulations

Compliance with state and federal laws, codes, and regulations is essential for the successful development and delivery of projects. The project scope and funding will determine the specific laws, codes, and regulations that must be addressed during design and construction. The following presents the most routinely applicable codes and regulations. Local government codes, ordinances, and regulations, including Site Plan approval, may be required on leased sites. This list is not comprehensive, and applicable codes should ultimately be determined by the Contractor at the time of project award. All codes, standards, and regulation references refer to the most current adopted version unless otherwise noted.

- Occupational Safety and Health Administration (OSHA) 29 CFR 1926, Subpart P, Excavations
- Portland Cement Association (PCA) standards
- USS Steel Sheet Piling Manual
- AISC Steel Construction Manual
- AASHTO LRFD Bridge Construction Specifications
- AASHTO LRFD Bridge Design Specifications
- Virginia 811
- California Trenching and Shoring Manual
- ASCE 37 Design Loads on Structures During Construction
- ASCE 7 Minimum Design Loads for Buildings and Other Structures
- ACI 318 Building Code Requirements for Structural Concrete
- Horizontal control datum – Virginia State Plane Coordinate System - South Zone, North
- American Datum of 1983 (NAD 83) (2011) in feet
- Vertical control datum – NAVD88 in feet

III. Excavation Support System Design

The following requirements are provided for general use on excavation support projects.

A. Earth Pressures. Proposed wall geometry and properties of soil materials behind and in front of the excavation support walls are to be submitted by the Contractor for review by the FIRM or HRSD's designee. If cohesive soils are present, both short-term undrained properties and long-term drained properties are to be provided by the designer or geotechnical engineer of record prior to the design of excavation support systems.

B. Calculations. Calculations for all excavation support system submittals that are deferred to the Contractor shall be submitted by the Contractor for review by the FIRM or HRSD's designee. Contractor submittals shall be sealed by a Professional Engineer registered within the Commonwealth of Virginia. The factor of safety on excavation support system designs shall be a minimum of 2.5.

C. Record Drawings. Record Drawings for excavation support systems left in place after the completion of construction shall be submitted to HRSD as part of the normal record drawing process. The Record Drawings shall be signed and sealed by a Surveyor licensed in the Commonwealth of Virginia and in accordance with the latest version of HRSD's Design and Construction Standards. The drawings shall demonstrate that the system has been accurately located (surface and subsurface) in its entirety (including but not limited to dimensions, annotations, coordinates, elevations, and reference(s) to structures visible from the surface), such that the item can be located in the future.

D. Concrete. Specific requirements for concrete within excavation support systems shall be specified by the FIRM for use by the Contractor. When concrete is placed in an excavation, provide forms for all vertical surfaces unless otherwise permitted. Where forms are provided for high, thin walls, ports shall be also be provided to permit thorough cleaning before placing concrete. Do not place forms or falsework supports on recently constructed footings or pile caps until the concrete has attained sufficient strength for the next stage of construction as approved by the FIRM. If, in the opinion of the Contractor, it is impossible or inadvisable due to prevailing conditions to dewater excavations before the placement of concrete, the Contractor shall propose alternate means that adhere to the governing regulations.

E. Tie-Back Systems:

- Design of tie-back systems shall not rely on soil strength in organic strata.
- Design of tie-back systems shall assume that the soil behind the excavation support walls is fully saturated.
- Tie-back systems that cross multiple strata shall utilize the soil properties of the weakest layer.

- Tie-back systems shall not encroach within 15 feet of property limits at any time.
- A minimum of 25% of all tie rods along each excavation face shall be tested to 200% of the design strength.
- Tie rod installation angle shall not exceed 15 degrees.
- For pump stations, tie rods shall not be installed within the first 10 feet below the top of the excavation to allow for future wet well service connections.

IV. Miscellaneous

The following guidance is provided for general use on excavation support projects.

A. Subgrade Stabilization. Subgrade stabilization will be required for soils found to be unsuitable to provide a stable subgrade for pavement construction. Unsuitable soils shall be defined based on the California Bearing Ratio (CBR) values, soil types, subgrade soil strength properties, and soil index properties. Subgrade stabilization may include over-excavation and replacement with suitable material, over-excavation and replacement with geotextile and suitable material, or in-situ subgrade stabilization. Unless previously prescribed in the contract documents, the stabilization approach shall be submitted by the Contractor for review by the FIRM before application.

B. Inspection. After each excavation is completed, the Contractor shall provide notification to HRSD. The Contractor shall not place materials therein until the depth of excavation and the character of the foundation material have been approved by HRSD or their designee. Dewater wet excavations for inspection and for construction of foundations unless otherwise provided.

C. Bedding and Backfill. HRSD or designated representative shall track the following required verifications related to bedding and backfill. The items included below are the minimum requirements that shall be specified in the Contract Documents by the FIRM:

- Advanced written authorization is required for additional excavation of unsuitable materials.
- Review of Contractor's disposal plan for unsuitable excavated materials (dispose to approved sites and not in environmentally sensitive areas).
- Documentation that any and all materials meet the contract specifications.
- Documentation of proper backfill compaction in specified lifts and compaction testing where required.

D. Well Points. The FIRM shall include requirements within the Contract Documents. At a minimum, the Contractor shall submit calculations for well points used for dewatering during construction for review by the FIRM or HRSD's designee. Piezometers shall be installed at least 1 per side, a maximum of 50 feet apart, and monitored daily. Readings shall be monitored by the Contractor and submitted to HRSD for review.

End of Section

Section 31 - Pump Stations

I. Introduction - HRSD owns and operates wet well stations and pressure reducing stations. Wet well stations are sized to receive projected flows from gravity sewers and discharge to force mains. Pressure reducing stations and/or other facilities are sized to maintain the pressure head in force mains within HRSD operating limits. Wet well stations, force mains and pressure reducing stations are all sized and operated in accordance with HRSD's Hydraulic Grade Line (HGL) policy.

A. Wet Well / Dry Well Pump Station - Flows are discharged by gravity sewers or force mains into a wet well from which they are pumped into a force main. The pumps are designed for a flooded suction condition and are in a separate dry well adjacent to the wet well with intake piping leading from the wet well to the pumps.

B. Pressure Reducing Station (PRS) - A pressure reducing station is connected directly to a force main and is used to maintain the pressure on the suction side of the pumps.

C. Submersible Pump Station – The pumps are located in a wet well. These stations are typically for small service areas. Refer to Section 36 - Standard Details, Series 400 in this standards manual for guidance.

II. Description of Operations

A. Wet Well / Dry Well Pump Station

1. Wet well stations typically use variable speed pumps to match flow fluctuations and minimize turbulence in the wet well to reduce odor, corrosion and air entrainment.

2. A proportional integral derivative (PID) level controller shall be configured in the programmable controller to control the sewage level in the wet well. The level controller shall vary the speed of the pumps as required to match the pump discharge flow rate to the wet well influent rate. The desired level to be maintained in the wet well will be programmed in the programmable controller as the set point for the level controller. The level controller will compare the actual wet well level to the set point level and output a 4-20mA speed reference signal to the variable frequency drive (VFD) for operating the sewage pumps to increase or decrease the speed of the pump or pumps as required to maintain the set point level.

3. A standby pump shall be called to operate at the high-water alarm level.

B. Pressure Reducing Station (PRS)

1. Pressure reducing stations typically use variable speed pumps to match flow fluctuations to lower the pressure on the suction side of the station. Pressure reducing stations do not typically run continuously and are not normally required to operate until the force main flow reaches approximately two-thirds of the design flow.

2. Pressure reducing stations operate by starting the lead pump when the force main discharge pressure increases to a preset high limit. The lead pump speeds up and slows down to maintain the force main suction pressure within a preset range. If the lead pump cannot maintain the force main suction pressure within the preset range, an additional pump or pumps are started and operated together to maintain the suction pressure within the preset range. As the force main discharge pressure decreases to preset lower limits, the pumps are stopped in the reverse order as needed until all pumps are stopped.

3. Provide for piping and valves inside of the pump station so that the force main flows can be pumped in either direction as appropriate with the operation of a minimum number of valves.

III. General

A. Pump stations shall meet the requirements of the Virginia Department of Environmental Quality Sewage Collection and Treatment (SCAT) Regulations.

B. Pump stations shall be designed to Hydraulic Institute (HI) Standards to the extent possible. Exceptions to the HI Standards to be discussed with HRSD and approved on a case-by-case basis.

C. Pump station shall be designed in accordance with the HRSD HGL Policy. Pump selection shall be based on the following flow and pressure conditions provided by HRSD and general requirements:

1. Operating range flows and pressures

a. Dry weather minimum

b. Dry weather maximum

c. Wet weather maximum

2. Pump stations shall be designed with provisions to accommodate future growth based on development trends.

3. Under typical operating conditions for variable speed drives (VFDs), pumps shall be capable of maintaining wet well level or pressure set point without cycling on/off.

4. Pumps shall operate within the pump's preferred operating range (POR) in accordance with the HRSD HGL Policy.

5. In the case where a bypass pumping system is required, the design and operation of the pumping system, whether portable pumps or portable pumps in conjunction with permanent station pumps, will not exceed pump station design capacity.

D. Pump station shall be capable of meeting the peak design flow condition with the largest pump out of service.

E. Pump stations shall be designed to comply with locality flood elevation construction requirements. The current locality requirements, available at the time of publication of this manual, that need to be verified for each project, are listed in Section 10 – Flood Elevation Requirements.

F. Provide a separate generator room or building with adequate space for maintenance and heat rejection from the engine block and exhaust system or isolate remaining areas from generator noise and heat.

G. Provide a slope on the pump room floor that will convey seepage from pump packing and drainage from wash down to a sump. Provide Zoeller Model 137D sump pump unless this standard model will not meet the flow or pressure condition and in this case, obtain approval for a deviation from HRSD's Project Manager.

H. Provide a toilet and sink in a separate room within the pump station. Provide a wash basin in the pump station.

I. Design shall incorporate measures to facilitate the maintenance and removal of equipment and pumps in both dry well and wet well areas.

J. Provide access to dry well and wet well by stairs.

1. Spiral stairs and ship ladders are not acceptable.

2. Stairs shall be a minimum width of 36 inches and shall include handrails on both sides.

3. Stair riser heights and tread depths shall comply with the International Building Code (IBC), latest addition.

K. Design wet well and influent piping to minimize turbulence and air entrainment in the wet well.

L. Provide minimum submergence required to eliminate vortex at pump suction intake.

M. Evaluate the need for odor control and make provisions as necessary.

N. Locate discharges for sump pump, pump air release and restroom discharge away from pump intakes in the wet well and design to minimize turbulence and air entrainment.

O. Furnish and install a removable bar screen. Channel shall be designed to accommodate a grinder system and a bar screen interchangeably. The electrical system shall be designed with the necessary capacity for the grinder system.

P. Provide wet wells that slope toward the pump suctions and do not create areas where solids can collect and build up.

Q. Concrete in the wet well shall be protected from corrosion using polymer concrete, anti-microbial additive, surface applied coating system or a thermoplastic sheet liner.

1. Thermoplastic sheet liner shall not be used on influent channels.

R. Provide smooth interior wet well surfaces. When installing thermoplastic sheet liner system, ensure that it is anchored into the new concrete and protect all interior concrete surfaces except the surfaces 1’-0” below the lowest water level in the wet well, i.e. the floor and lower walls. Use light-colored thermoplastic only, never black or other dark colors.

1. The approved thermoplastic sheet linings for new pump station wet wells are:

a. T-Lock Amerplate by Ameron International of Brea, California. (PVC Sheet Linings), or

b. GSE Studliner by GSE Lining Technology, Inc. of Houston, Texas. (High Density Polyethylene Liner), or

c. Anchor-Lok by Atlas Minerals and Chemicals, Inc. of Mertztown, Pennsylvania (High Density Polyethylene Liner).

2. The anchored thermoplastic sheet linings shall be installed in strict accordance with the manufacturer's recommendations and shall be installed to ensure a pinhole free lining system. Particular care must be taken to ensure that lining terminations and transitions at changes in direction and at metal pipe penetrations, and leading edges are properly treated.

3. Hot air welding on liners.

   a. Work on PVC liners shall be performed by certified welders trained by the selected manufacturer in strict accordance with the manufacturer's instructions. Welding shall fuse both sheets and weld strips or filler material together to provide a continuous joint equal in corrosion resistance and impermeability to the basic liner sheets.
   b. Joints on HDPE liners shall be filled using extrusion welding performed by personnel trained by the liner manufacturer.

4. Quality Control Testing

   Once the thermoplastic sheet liners have been installed, the concrete forms removed, and all welding performed, the lining shall be inspected and tested by an independent testing firm as follows:

   a. The entire lining shall be carefully visually inspected for pinholes or damage.

   b. All welds shall be probed with a blunt instrument like a putty knife to identify any weld defects.

   c. All surfaces of the sheet linings shall be tested with an approved (by the manufacturer) electrical holiday detector with the instrument set at the voltage range recommended by the manufacturer. This testing should only be performed by a certified technician trained by the manufacturer of the sheet lining or qualified previously to do so.

S. All below grade concrete structures shall have an exterior vapor barrier and /or waterproofing approved by HRSD.

T. Pump Station Substantial Completion Checklist – refer to Attachment A.

U. Physical Modeling shall be considered on all new or full replacement pump stations and a determination shall be documented in the PER regarding the decision to pursue physical modeling on an existing pump station

rehabilitation project. The decision related to whether to do physical modeling shall be coordinated with the HRSD Project Manager.

IV. Site Issues and Layout

A. Pumping station building and site shall be designed and configured to be in harmony with the surrounding setting. Architectural and landscaping designs and renderings will be submitted to and approved by HRSD at the PER stage. Refer to Section 2 – Architectural and Landscaping Design and Review Process in this standards manual.

B. Real-estate setbacks: Property shall accommodate existing and future HRSD development requirements, taking into consideration setbacks and zoning restrictions.

1. Minimum property dimensions for a Pump Station is 150 feet x 150 feet.

2. Minimum property dimensions for a Pressure Reducing Station is 200 feet x 200 feet.

C. Evaluate the need for the acquisition of additional property to accommodate future pump station replacement, off-line storage and/or other HRSD facilities.

D. Design must consider potential off-site impacts including noise, odors, excessive light, and other impacts to adjacent property owners.

E. Provide concrete entrance and a paved driveway for off-street parking, access to building and provision to turn around a crew truck. During design, use visualization tools to solicit feedback from stakeholders regarding proper access and turnaround space at site.

F. Include a site plan showing property lines, building, piping, existing & proposed utilities, valves, emergency pump connection, physical features, topography, etc. and any other requirements by the local approving authority.

G. Set a new benchmark at each new pump station or PRS and provide a data sheet to include a site map, coordinates, elevations, descriptions at a minimum. Coordinate accuracy should be within 1/100 of a foot.

1. This applies to the following if a benchmark does not exist:

a. Rehabilitation projects

b. Acquired assets (PS, PRS)

H. Refer to Section 34 – Miscellaneous in this standards manual for additional site layout information.

I. Provide a separate conditioned space to accommodate sensitive electrical equipment, such as the switchgear, motor control center, and variable frequency drives as applicable with site and space limitations.

J. Underground fuel storage tank replacement should be evaluated at existing stations when the tank age exceeds thirty years and major site work is being performed.

V. Masonry

A. Refer to Section 34 – Miscellaneous in this standards manual for additional information.

B. Building walls shall be concrete block with exterior brick veneer or as otherwise determined by HRSD's Architectural Review Committee and referenced in Section 2 – Architectural and Landscaping Design and Review Process.

C. All lintels shall be stainless steel.

VI. Equipment

A. Pumps shall be centrifugal, non-clog, solids-handling pumps, capable of passing a 3-inch solid.

B. Pump manufacturer shall certify that the pump will meet the design requirements.

C. In typical installations, pumps shall be dry-pit submersible, close-coupled or extended shaft-driven pumps. Pumps will be evaluated and recommended for use by the FIRM.

1. The FIRM shall carefully evaluate the size and dimensions of each manufacturer's product for compatibility with the space where the pump and accessories will be installed. This is especially important for rehabilitation projects where different pumps and motors are required within limited available space. Consideration must be given by the FIRM for maintenance access and removal of the pump and motor within existing spaces due to varying dimensions between manufacturers for similar products.

2. 3D modeling of the station must be completed and shared with stakeholders during the design phase to confirm maintenance access.

3. If the contractor suggests an “equal” substitution to major equipment during the bid or construction phase, the maintenance access must be reconfirmed through 3D modeling. Major equipment to be defined by Engineer in the bid documents.

D. Pump, motor, and impeller shall be balanced as a unit at the factory prior to shipment.

E. Motor shall be inverter duty rated.

F. For submersible pumps, motor shall be equipped with two (2) moisture detection sensors, one in the mechanical seal oil bath and one in the lower portion of the armature area.

G. Accommodations shall be made to properly cool all electrical equipment and motors to effectively dissipate heat.

H. Pumps shall operate at speeds below 1,000 RPM unless otherwise approved by HRSD’s Project Manager.

I. All pumps shall have a one-inch tap on the volute with a ball valve and flexible hosing so that the employee servicing the pump can monitor the air venting process while also safely directing any air or water away from the work area.

J. Spare parts to be provided by the contractor shall typically include the following. A requirement to furnish a spare volute and/or other major mechanical or electrical parts is project specific and should be discussed with HRSD.

1. For each size pump, provide the following:

a. One spare full-size impeller

b. One spare stainless-steel shaft and sleeve (shaft-driven only)

c. One spare set of wear rings

d. One spare set of mechanical seals

e. One spare set of bearings

2. For close-coupled pumps, provide the following (in addition to above):

    a. One spare coupling for each pump.

K. OSHA approved safety rails (load rated):

1. All safety railings shall be load rated, meet OSHA Safety Railing Standards, and support a vertical and horizontal load of 200 pounds.

2. Mounts for safety railings shall be designed and cast in place as part of the station.

3. Handrails, guardrails, and/or safety chains shall be 42 inches in height with a 21-inch mid-rail/chain and 4-inch toe boards.

4. All stairs, safety railings and decking within the wet well shall be fiberglass reinforced plastic (FRP). All mounting brackets and exposed metal shall be stainless steel.

L. Pumps Performance Testing – pumps shall meet all specified requirements and have measured vibrations within the acceptable limits prescribed in the HI standards.

VII. Conveying Systems

A. Provide a load rated monorail or bridge crane, trolley, and hoist with appropriate hatches and doors to directly access and remove the pumps and motors for maintenance. Use removable load rated grating to cover interior openings that are to be used for removal of equipment. Indicate the load ratings on the plans, stencil load ratings on the trolley, hoist, and rail system and provide three copies of certified load testing documentation. The monorail/trolley/hoist shall be load tested in accordance with OSHA requirements during construction by the contractor.

B. Consider the provision for electric trolley and/or hoist.

C. Provide direct access to monorail and hoist (or install separate lifting devices) for removal of sump/submersible pumps, as needed.

D. Provide rated lifting eyes to assist with equipment removal.

VIII. Mechanical

A. Interior Piping

1. Provide ductile iron flanged joint.

2. Provide a valve on the suction and discharge sides of each pump.

3. Provide a shut off valve or sluice gate on the gravity influent pipe. Preferred means of isolation is a 316 stainless steel, fabricated, heavy-duty sluice gate.

4. Gate valves shall be OS&Y or have a visual indicator, open left, and be coated with fusion- b o n d e d epoxy.

    a. Chain wheel actuators shall not be permitted.

5. All valves shall be easily and safely accessible for maintenance and operation. Provide OSHA approved fixed platform sufficient for a 2-person maintenance crew, as needed.

6. Provide a check valve on the discharge side of each pump between the discharge valve and the pump.

    a. Check valves shall not be installed in the vertical position.

    b. Sizing Check Valve: To reduce O&M requirements, the valve shall preferably be sized to match the pump discharge nozzle size. Engineer shall confirm the selected check valve and size are in accordance with the check valve manufacturer's recommendations for use and flow ranges and evaluate impact on pump selection and performance.

7. Provide check valves with iron body, bronze seat check and bronze ring on disc.

8. Check valves shall be provided with packing glands or o-rings and external lever and spring in accordance with AWWA C508.

9. Provide adequate pipe support and thrust restraint with base elbows, base pads or hangers as required. Metallic pipe supports and hardware shall be stainless steel.

10. Use eccentric reducers (match elevations at top of pipe) on the suction and discharge piping to prevent the entrapment of air.

11. Provide a manual air release on the discharge of each pump. Reduce from tap on pump volute to ½-inch pipe and ½-inch ball valve. Provide a union to transition to ¾ -inch HDPE air release

piping to wet well. All pipe valves and fittings except HDPE shall be stainless steel.

12. Exterior wall penetrations shall be accomplished with a wall sleeve. Seal between sleeve and carrier pipe with a “Link Seal” type seal with stainless steel hardware. Bolts on the link seal shall be oriented so that they are tightened from inside the station. Penetrations between the pump room and wet well for pump suction piping shall utilize wall pipe with a cast integral seep ring.

13. Provide an eyewash station near the generator batteries in accordance with the current safety requirements.

14. Provide flexible connections on suction and discharge of pump to ensure motion and vibration is absorbed.

B. Exterior Piping (Force Main)

1. Refer to Section 24 – Pipelines and Appurtenances in this standards manual for additional requirements for force mains.

2. All pump stations shall have a mainline valve on both sides of the emergency pump connection.

3. Wet Well / Dry Well Pump Station - Provide an emergency pump connection with valves and blind flange(s). Also, provide an HDPE suction leg into the well. The connection or transition from HDPE to ductile shall be outside the wet well. Size pipe for emergency connection based on pump station design flow rate.

C. Provide for space heating to prevent freezing of pump station facilities, as appropriate.

D. Ventilation of the wet well shall meet SCAT regulations. Provide for 12 air changes per hour for continuous ventilation and 30 air changes per hour for intermittent ventilation. The ventilation system shall be designed to ventilate all areas of the wet well and prevent "short circuiting" of the air.

E. Provide potable water for the restroom and hose bibs from the municipal water system or from a well if municipal water system is not available. Signage shall be placed where well water is being used.

F. Provide a Virginia Department of Health (VDH) approved reduced pressure principal backflow preventer to be installed on the main potable water line

where it enters the pump station and prior to any outlets in the pump station. Backflow preventer shall be tested and certified after installation.

G. Provide for the discharge of restroom drainage and the sump pump.

1. Pressure Reducing Station - Discharge restroom drainage to the municipal sanitary sewer system, if available, or pump discharge into the pump station suction leg utilizing a small package grinder pump. Grinder pump shall meet the maximum inlet head conditions.
2. Wet Well / Dry Well Pump Station - Discharge restroom drainage to the pump station wet well.

IX. Electrical & Instrumentation

A. Refer to Section 32 - Electrical and Instrumentation in this standards manual for additional information regarding electrical and instrumentation systems.

B. Provide a standby generator to meet Class I reliability. The generator shall be designed to meet the firm design capacity of the pump station with the primary power off.

C. Install electrical equipment and motors above the 100-year flood elevation or otherwise protect from the 100-year flood. Refer to Section 10 – Flood Elevation Requirements in this standards manual.

D. Require Contractor to install wiring for the intrusion alarm system from all required doors and their associated monitoring devices, back to the pump station control panel. The OIT on the control panel will display door entry information. Alarm points to be determined by HRSD.

E. Provide variable frequency drive controllers to control pump speed.

1. Pressure Reducing Station

a. Pump shall be controlled in response to suction pressure.

b. Provide two pressure sensors (one 0 – XX.XX psi and one 0-XX.XX psi) on the suction piping and one pressure sensor (0-XX.XX psi), on the discharge piping. Transmitter span will be provided by HRSD for the location. All transmitters to be mounted on 4- inch Red Valve Annular Seal. Refer to Section 36 – Standard Details, Series 300 in this standards manual.

2. Wet Well / Dry Well Pump Station

a. Pump speed shall be controlled in response to wet well level.

b. On the pump discharge header, provide a 4” Red Valve Annular Seal and pressure sensor or approved equal. Provide a tee with a 4” branch and install a 4” gate valve on the branch prior to the pressure sensor and install a blind flange on the outside of the pressure sensor. Provide two ¾” pipe nipples with valves for flushing and calibration purposes.

c. Wet well levels to be monitored by means of level sensors or bubbler system. If a bubbler system is used, a differential pressure transmitter should be installed. A bypass manifold around the transmitter and maintenance ports on both the low and high side of the transmitter should be incorporated into the pressure assembly.

F. Consider the inclusion of contacts to operate the pumps across the line if the variable frequency drives fail. The alarm system will notify the operators of a variable frequency drive failure and the drives must be switched to the across the line contacts manually. The pumps can be started sequentially in the across the line mode of operation. Evaluate other means of providing variable frequency drive backup when motor horsepower exceeds 200 HP. In all cases, investigate the capacity of the local power grid to accommodate the across the line motor starting.

G. Include a flow meter and pressure sensor sized based on the design flow rate for the pump station. Location of the flow meter shall be downstream of the emergency pump connection. Flow meters must be installed per manufacturers specifications or as directed by HRSD in any case where the manufacturers specifications cannot be met. For all pressure sensors installed, an elevation measurement must be taken and provided to the Project Manager prior to start-up of the facility.

H. Provide a high-level float ball and a low-level float ball in the wet well and a float ball in the pump room.

I. Provide a single four-gang lockable 20-amp, 120-volt GFCI outlet outside the station near the wet well for a portable light or other use. The need for permanent lighting in the wet well should be discussed in the preliminary engineering phase.

J. Arc Flash Requirements - refer to Section 32 - Electrical and Instrumentation in this s t a n d a r d s manual for details.

K. Load Bank Testing Requirements - refer to Section 32 - Electrical and Instrumentation in this standards manual for details.

L. All new pump stations and PRS's shall include an electrical interface located at the pump station to integrate the Advanced Prime Guard Controller used on Xylem (Godwin) pumps with the existing HRSD SCADA system. Refer to the Temporary Pump Enclosure detail in Section 36 - Standard Details, Series 700 in this standards manual for guidance.

M. Temporary Portable Pump Alarms and Setup Standards – refer to Attachment B.

N. When developing a new or modifying an existing functional description, Engineer shall follow the format of an existing and similar functional description provided by the Project Manager. The draft functional description shall be provided to the HRSD team for review in tracked changes.

O. HRSD’s sole source vendor, Emerson, shall be used for the following on new or replacement stations:

1. Furnish a new PLC control panel for installation by the General Contractor. General Contractor shall terminate wires at control cabinet and conduct loop checks.

2. Configure the existing SCADA software to operate the station remotely.

3. Configure the existing data historian, graphics, alarm screens, trend screens and reports on the SCADA system.

4. Lead site acceptance test with support from the General Contractor. General Contractor shall be responsible for testing all systems and equipment to be controlled by the PLC control panel ahead of the final site acceptance test.

5. Provide information regarding SCADA equipment that has been allocated to the project site.

P. HRSD’s preferred vendor shall conduct a Cellular Performance Survey of new property, provide instructions regarding the placement and type of cellular antenna (i.e. unidirectional or omnidirectional), and configure the wireless router and system switch. HRSD Project Manager to coordinate vendor activity through the Electrical and Instrumentation Department. General Contractor shall provide and install antenna and may be responsible for installing router and switch.

Q. Engineer to provide details in the contract documents regarding SCADA Antenna Installation and Radio Communication System Grounding. Refer to Section 36 - Standard Details, Series 700 in this standards manual for guidance.

X. Attachments:

A. PS Substantial Completion Checklist

B. Temporary Portable Pump Alarms

End of Section

Section 32 – Treatment Plant

Purpose – HRSD historically has a broad range of experience with many different types of treatment processes and equipment. This section documents best practices and criteria for the design and operation of HRSD treatment plants. This section is intended to be practical and prudent based on HRSD's history and experience. This section is to be followed wherever practical and used in conjunction with the other documents listed herein for standardization and consistency. This section is not meant to be a definitive design manual for treatment plant projects. This section provides typical standards and/or guidelines for work associated with the construction, modification, and/or rehabilitation of HRSD Treatment Plants and associated infrastructure. The information herein has been developed based on previous experience, which includes successes, failures, and lessons learned.

Section Overview

I. Purpose
II. Abbreviations
III. Sewage Treatment Design & Operation
IV. SWIFT Facilities Design & Operation
V. Solids Handling Design & Operation
VI. Access to Unit Processes and Equipment
VII. Sampling
VIII. Chemical Containment
IX. Chemical Feed Systems
X. Drain Systems
XI. Emergency Eyewash and Showers
XII. Equipment Numbering Sequences
XIII. Equipment Spare Parts
XIV. Miscellaneous Pump Items
XV. Noise Abatement for Installed Stationary Equipment
XVI. Non-Potable Water Systems
XVII. Odor Control and Room Ventilation
XVIII. Pipe Insulation & Heat Tracing
XIX. Primary and Secondary Clarifiers
XX. Process Air Piping
XXI. Process Flow Splitting
XXII. Scum Handling, Piping, and Pumping
XXIII. Grit, Septage, Grease, and Biosolids
XXIV. Site Lighting
XXV. Slide and Sluice Gates
XXVI. Solids Piping
XXVII. Travel Path (Walkway) Alignment
XXVII. Yard Piping
XXIX. Functional Descriptions
XXX. Operational Technical Information Systems

XXXI. Equipment Startup, Training, and Turnover
XXXII. Flow Metering

A. HRSD owns and operates various wastewater treatment plants. These plants consist of various unit processes, which are divided into Sewage Treatment, SWIFT Advanced Water Treatment, Solids Handling, and Sidestream Treatment.

1. Sewage Treatment: These processes typically consist of a preliminary process, a primary process, and a secondary process, which purify the liquid wastewater entering the treatment plant before it is discharged to the receiving stream, recycled for water reuse, or conveyed to SWIFT advanced treatment and aquifer recharge.

a. SWIFT Advanced Water Treatment: SWIFT advanced water treatment facilities take highly treated water from HRSD's wastewater treatment plants and treat it further to produce SWIFT tertiary effluent or SWIFT Water.

2. Solids Handling: These processes typically consist of a thickening process, a dewatering process, and a solids disposal process, which dispose of or recycle the solid residuals produced from purifying the liquid wastewater.

3. Side Stream Treatment: The processes which treat liquid recycled from the solids handling process to reduce nutrient or inhibitory compound loading at the head of the plant.

B. HRSD treatment plants are designed and operated to:

1. Meet all regulatory requirements.

2. Prevent offsite nuisance conditions.

3. Be safe and reliable.

4. Use proven equipment where applicable.

5. Use automation and technology to minimize operating cost and maximize efficiency.

6. Optimize life cycle cost.

C. Planning for new HRSD treatment plant facilities and projects is outlined in these documents:

1. Solids Management Master Plan – Provides long-term planning to evaluate solids production, solids handling capabilities and deficiencies, and required new solids handling facilities for current and future conditions.

2. Capital Improvement Program (CIP) – Provides planning to initiate new projects.

D. Design and operating criteria for HRSD treatment plants are also outlined in the following documents:

1. *HRSD Design and Construction Standards* – Provides design and construction standards for new projects.

2. Commonwealth of Virginia Sewage Collection and Treatment (SCAT) Regulations – Provides design and operating criteria for sewage systems and sewage treatment works in Virginia.

3. Hydraulic Institute Standards – Provides industry standards for the design, material, methods, performance, testing, etc. for hydraulic pumps and associated elements.

4. HRSD Functional Descriptions templates.

E. The design and operation of HRSD treatment plants shall seek balance between design based on the way treatment plants are operated and operation based on the way treatment plants are designed.

F. Design of HRSD facilities should provide for occupancy, maintenance, and storage requirements such as conference rooms, restroom and locker room facilities, lunchroom, storage area, maintenance work areas, office areas, hurricane shelters, etc.

G. Design for power failures and power failure restarts to ensure equipment fails and restarts in appropriate condition to protect personnel, facilities, and process.

II. Abbreviations

A. The following abbreviations shall be used on the construction documents for all treatment plant related projects.

Definition	Abbreviation
Acid Phase Digester	APD
Acid Phase Digester Solids	APDS
Acid Phase Influent	API
Acid Phase Recirculation Solids	APRS
Advanced Water Treatment	AWT
Aerated Effluent	ARE
Aerated Supernatant Return	ASR
Aeration Influent	AI
Aerobic	AER
Air Supply (Low Pressure Process Air)	AS
Alum Solution	ALUM
Anaerobic	ANAE
Anaerobic Effluent	ANE
Anaerobic/Anoxic Effluent	AAE
Anaerobic/Anoxic/Aerobic	AAA
Anoxic	ANOX
Anoxic Effluent	AXE
Anoxic Recycle	ARCY
Backwash Air Supply	BAS
Backwash Waste	BWW
Backwash Waste Recycle	BWWR
Backwash Water Supply	BWS
Biofilter Effluent	BAF EFF
Biofilter Influent	BAF INF
Blower	BLWR
Cake Storage Pad	CSP
Caustic Storage Tank	CST
Centrate Equalization	CNE
Centrate Treatment Influent	CTI
Centrate Treatment Process	CTP
Centrate Treatment System Effluent	CTE
Centrifuge	CENT
Centrifuge Biosolids Cake	CCK
Centrifuge Dewatering Centrate/Chlorine Contact Tank	CCT
Centrifuge Thickened Biosolids	CTS
Centrifuge Thickening Centrate	CTC
Chlorine Solution	CLS
Closed Loop Cooling Water Return	CCWR
Closed Loop Cooling Water Supply	CCWS
Decant Supernatant Return	DSR
Decant Tank Drain	DTD
Dewatering Centrate	DCE

Digested Solids	DS
Digester	DIG
Digester Gas	DGAS
Dissolved Air Flotation Thickener	DAF
Dissolved Air Flotation Thickener Solids	FTS
Dissolved Air Flotation Thickener Subnatant	FSB
Distributed Control System	DCS
Distribution Chamber	DIST CH
Drain Pump Station Discharge	DPSD
Dry Polymer	DPOLY
Ductile Iron	DI
Fats, Oils, and Grease	FOG
Ferric Chloride/Sulfate	FERRIC
Fiberglass Reinforced Plastic	FRP
Filter Aid Polymer	Filter Aid Poly
Filter to Waste	FTW
Filtrate Effluent	FE
Filtrate Influent	FI
Final Effluent	FNE
Flocculation Influent	FLOC INF
Floor Drain	FD
Fuel Oil Pump	FOP
Fuel Oil Return	FOR
Fuel Oil Supply	FOS
GAC Backwash Supply	GBWS
GAC Backwash Waste	GBWW
GAC Effluent	GAC EFF
GAC Influent	GAC INF
GAC Slurry Drain	GAC SD
GAC Slurry Fill	GAC SF
GAC to Waste	GTW
Gas Phase Digested Solids	GPDS
Gas Phase Digester	GPD
Gas Phase Effluent	GPE
Gas Phase Influent	GPI
Gas Phase Recirculation Solids	GPRS
Gaseous Oxygen	GOX
Granular Activated Carbon	GAC
Gravity Belt Filtrate	GBFL
Gravity Belt Thickened Solids	GBTS
Gravity Belt Thickener	GBT
Gravity Thickened Solids	GTS
Gravity Thickener Overflow/Supernatant	GSP

Grit	GRIT
Headworks	HW
High Density Polyethylene pipe	HDPE
Hot Potable Water	HPW
Hot Water Pump	HWP
Hot Water Return	HWR
Hot Water Supply	HWS
Hydraulic Oil	HDOIL
Hydrogen Peroxide	H2O2
Incinerator Scrubber Water	ISW
Intermediate Pump Station	IPS
Liquid Ammonium Sulfate	LAS
Liquid Oxygen	LOX
Liquid Polymer	LPOLY
Liquid Propane	LPROP
Methanol	METH
Mixed Liquor Suspended Solids	MLSS
Monitoring Well Sample	MWS
Monochloramine	NH2CL
Muriatic Acid	MURIATIC
Natural Gas	NAT GAS
Nitrified Recycle	NRCY
Non-Potable Water	NPW
Odor Control Fan	OCF
Odor Control Scrubber	OCS
Odorous Air	OA
Open Loop Cooling Water Return	OCWS
Open Loop Cooling Water Supply	OCWR
Ozonated Water Sample	O3SAMP
Ozone Destruct	OD
Ozone Gas	OZONE
Phosphoric Acid	PHOS A
Polymer	POLY
Polymer Dry Air	DA
Polymer Solution	POLYS
Potable Water	PW
Preliminary Treatment Facility	PTF
Primary Clarifier Effluent	PCE
Primary Clarifier Influent	PCI
Primary Clarifier Solids	PCS
Primary Digested Solids	PDS
Primary Digester Supernatant	PDSP
Process Drain	PD

Raw Wastewater Influent	RWI
Reaeration	REAER
Recirculation Pump/Reinforced Concrete Pipe	RCP
Reinforced Concrete Cylinder Pipe	RCCP
Return Activated Solids	RAS
Roof Drain	RD
Sample	SAMP
Sanitary Sewer	SS
Sanitary Sewer Force Main	SSFM
Scrubber Blowdown	SBD
Scrubber Recirculation Cleaning	SRC
Scrubber Recirculation Discharge	SRD
Scrubber recirculation Suction	SRS
Scum	SCUM
Scum Concentrator Subnatant	SCB
Seal Water	SW
Secondary Clarifier	SC
Secondary Clarifier Effluent	SCE
Secondary Clarifier Influent	SCI
Secondary Digested Biosolids	SDS
Secondary Digester Supernatant	SDSP
Septage	SEPT
Sequencing Batch Reactor	SBR
Service Air	SA
Settled Solids	SES
Settled Water	STW
Sewage Treatment	ST
Sidestream Treatment	ST
Sodium Bisulfite	BISULF
Sodium Hydroxide	CAUSTIC
Sodium Hypochlorite	HYPO
Softened Water	SFW
Spray Water	SPRAY
Steam	STEAM
Storm Drain	SD
Sump Pump	SP
Sump Pump Discharge	SPD
Supernatant Return	SR
Supplemental Carbon Neat/Screen	SCN
Supplemental Carbon Solution	SCS
SWIFT Non Potable Water	SWIFT NPW
SWIFT Off Spec	OFF SPEC
SWIFT Water™	SWIFT

Thickened Solids	TS
Thickened Waste Activated Solids	TWAS
Thickener Supernatant Return	TSR
Underground Injection Control	UIC
Utility Water	UW
UV Effluent	UF EFF
Vent	V
Waste Activated Solids	WAS
Welded Steel Pipe	WSP
Well Backflush	WBF

B. Nutrient Removal Abbreviations:

1. Provide consistent tank nomenclature at Biological Nutrient Removal (BNR) plants. Engineering documents and drawings should use the following nomenclature.

2. “1st Anoxic Zone” - do not use “Pre-anoxic zone”.

3. “2nd Anoxic Zone” - do not use “Post-anoxic zone”.

4. Number multiple cells within an Anoxic or Aerobic zone according to the flow direction in the tank; for example: 2nd Anoxic Zone, Cell 1; 2nd Anoxic Zone, Cell 2; 2nd Anoxic Zone, Cell 3.

5. For step feed process, use “1st Anoxic Zone”, “2nd Anoxic Zone”, “3rd Anoxic Zone”, etc. and “1st Aerobic”, “2nd Aerobic”, “3rd Aerobic”, etc.

6. For Bardenpho processes, use “Aerobic Zone” and “Reaeration Zone”.

III. Sewage Treatment Design and Operation

A. Regulations – The design and operation of sewage treatment facilities should be in accordance with all provisions of the approved SCAT Regulations.

B. Design Life – The design life of sewage treatment facilities should be greater than or equal to the following:

- Structures: 50 years
- Piping and Conveyance: 50 years
- Mechanical Equipment: 20 years
- Electrical Power Equipment: 20 years
- Instrumentation and Control Equipment: 5 to 10 years

C. Flood Elevations – Consult with the HRSD Project Manager and the Planning and Analysis Department to determine appropriate elevations for new equipment.

D. Operating Elevation – Clearly state on drawings which vertical datum is being referenced.

E. Design Flow – Consult with the Hydraulic Analysis Review Team (HART) report to determine design criteria if applicable or obtain hydraulic data from HRSD Hydraulic Analysis Managers.

F. Design Loadings – The design loadings for sewage treatment unit processes should be based on the maximum monthly wastewater flow and the maximum month mass loading for cBOD, COD, TSS, TP, and TN. The maximum month loading and projected growth should be based on historical records, field sampling or similar experience. Include the impacts of septage discharge, chemical addition, and recycle loads on the maximum monthly concentrations. Base recycle loads on historical records. If accurate data is not available, consider a minimum of a 10% recycle of cBOD, TSS, P, and N as appropriate from solids handling. Peak loadings (such as peak weekly loadings or peak hourly loadings, where typically used for process design) should be as recommended by the design engineer. Identify all flows, concentrations and loadings used for the design of unit processes in the design documents.

   Water conservation has caused a general decrease in flow and corresponding increase in concentrations of cBOD, TSS, P and N. This trend may significantly change the original design loadings at some treatment plants where sewage treatment and/or solids handling unit processes become limited by cBOD and TSS loadings before the design flow is reached unless additional aeration and/or solids handling capacity is available. Sewage treatment and solids handling unit processes should be designed to accommodate this trend by using higher influent concentrations. Recommended values for new residential neighborhoods are: BOD = 297 mg/L, TSS = 282 mg/L, TKN = 57 mg/L, and TP = 7.0 mg/L (“HRSD Rate Schedule Fiscal Year 2026).

G. Design For Initial Plant Startup – The design for initial plant startup should provide for efficient and economical operation of sewage treatment unit processes without problems caused by oversized tanks and equipment if low flows are expected during early years of operation. The design for initial plant startup may incorporate:

   1. Sufficient turndown capability

   2. Additional smaller initial equipment to be operated only at lower flows.

3. Multiple smaller initial equipment to be operated together at higher flows.

H. Outfalls And Outfall Diffusers – Consult with the (HART) report to determine design criteria if applicable or obtain hydraulic data from HRSD Hydraulic Analysis Managers.

I. Equipment Selection – The current approved list of sole-source equipment can be found on HRSD's SharePoint: Finance/Sole Source. Users without SharePoint access may request this document by contacting the HRSD Project Manager.

J. Minimum Requirements:

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Flow Measurement	1	0	Provide flow measurement with totalizer. FNE is preferred over RWI. Internal recycle streams are to be separate (after RWI measurement or prior to FNE measurement). Consider parshall flume, venturi, or magmeter. Employ only flow meter equipment that is accurate and non-ragging/self-cleaning.
Influent Pumping			
Pumps	Minimum 3 units (includes one spare) Firm capacity to be determined by HRSD Planning & Analysis of 2.5 times design flow Meet firm capacity with largest unit out of service	1	Provide for all pumps to be variable speed. The 1st pump runs continuously, the 2nd pump starts when 1st pump cannot handle all of the flow. Additional pumps run when 1st and 2nd pumps cannot handle flow or upon failure of 1st or 2nd pump.
Wet Wells/ Channels	As required	As required	Consider self-cleaning wet wells. Match size and controls to pumping requirements to prevent frequent start/stop of pumps. Consider means to remove wet wells and enclosed channels from service in the future for maintenance of concrete and coatings. Provide for personnel access into wet well. Provide protective lining or coating at linear trench style self-cleaning wet wells for RWI service.

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Automatic Actuators	-	-	Provide automatic actuators on all critical control gates and valves. Consider remote DCS control and provide at a minimum position indication.
Isolation Gates	-	-	Provide secondary means of closure at all gates. Stop Logs or Stop Gates may be considered provided they: meet the same AWWA leakage rates specified for slide gates are engineered and composed of: 316 SST for the stop log / stop gate panel is preferred but other material options can be considered if the proposed storage location will not cause deterioration. neoprene rubber for seals 316 SST for the slide frame and hardware with replaceable UHMW guide strips and neoprene guide seals. Have logs that are a minimum of 3-1/2” thick with opposing bottom-mounted dual “J” seals have surface mounted slide channel frame guides permanently installed in channel walls with a flat bottom sealing surface (no sealing keyway/grove) for the stop logs to seal against, have a mechanical galvanized lifting beam assembly to place and retrieve the stop log or stop gates are mounted in areas accessible to a portable gantry for use with the lifting beam assembly. If not, a permanent gantry or jib must be installed and positioned to accommodate log/gate installation and extraction.

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Bar Screens	2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service	1	Size to protect plant during severe storm flow conditions. Provide coarse screen bypass channel. Screenings are to be sluiced to a compactor. Dewater screenings using press or similar equipment. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.
Center Flow Band Screens and Drum Screens	2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service	1	Size to protect plant during severe flow conditions. Band screens are to have internal bypass overflows (bypass channel not required). Screenings are to be sluiced to a compactor. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.
Step Screens	2 minimum; Sized for 2.5 x annual average wastewater flow rate with largest unit out of service	1	Size to protect plant during severe flow conditions. Provide coarse screen bypass channel for emergency use. Screenings are to be sluiced to a compactor. Discharge screenings into bulk storage containers. Minimum two containers, each sized for one screen. Manifold discharge screenings to multiple containers. Locate containers inside enclosed building with odor control.
Grit Removal			

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Grit Tanks	2 minimum; Sized for2.5 x annual average wastewater flow with largest unit out of service	1	Size to protect plant during severe storm flow conditions. Consider only detritors, stacked vortex (Head Cell), or structured vortex (Grit King). Avoid aerated grit, forced vortex, and velocity channels (grit channels). Consider collection system diurnal velocities for deposition of grit and storm slug loads.
Grit Pumps	2 per tank	1	Size each unit to handle total tank loading. Do not provide interconnection between tanks. Minimum grit pipe diameter is 6-inch. Minimum grit pump suction / discharge size is 4-inch / 4-inch. Provide flushing water on suction side of pumps.
Classifiers	2 per tank	1	Size each unit to handle total tank loading.
Hopper	1	0	Discharge all classifiers into 1 hopper. Locate hopper inside enclosed building with odor control.
Pre-Aeration	-	-	Do not use.
Primary Clarifiers			
Tanks	3 sized for design loadings	1	Prefer center feed, circular units if space available due to less maintenance and better thickening. Consider separate fermenter for BNR if circular units used. For circular tanks, evaluate stainless steel rake and scum systems, FRP weirs/wells, SS center pier.

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Solids Pumps	1 dedicated pump per clarifier with 1 spare pump per 2 or 3 clarifiers	1	Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands. Provide grinder or solids screen with bypass line ahead of each pump. Pumps with internal cutting blades can be considered if grinder installation is not practical due to space limitations.
Intermediate Pumping			Refer to Pump subheading in Influent Pumping.
Aeration Tanks			
Aeration Tanks	3 minimum; accommodate 2.5 times design flow with one tank out of service	1	Provide foam re-entrainment and/or foam removal.
Blowers	3 sized for design loadings with largest unit out of service	1	Provide turndown capability or 2 smaller blowers approximating 1 larger blower for low air requirements at initial plant startup with provisions to replace smaller blowers or install additional blowers as plant expands. Provide automatic start/stop and air control. Refer to HRSD Standard Functional Descriptions for control regimes. Locate blowers near aeration tanks to minimize air piping.
Air Piping	-	-	Locate air piping above ground or in tunnels; do not bury.
Air Diffusers	-	-	Fine bubble diffused air system.
Secondary Clarifiers			

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Secondary Clarifier Tanks	3 minimum; accommodate 2.5 times design flow with one tank out of service	1	
RAS Pumps	1 dedicated pump per clarifier with provision for adequate number of spare pumps	1	Provide variable speed pumps sized for total dedicated pump capacity of 1.0 x maximum monthly wastewater flow.
WAS Pumps	2 typically pulling off RAS discharge	1	Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.
Chlorine Contact Tanks	2 sized for design flows	1	Provide 30 minutes detention time at maximum monthly wastewater flow (corresponding to SCAT terminology of average daily wastewater flow) or 20 minutes at 2.0 x maximum monthly wastewater flow (corresponding to SCAT terminology of maximum daily wastewater flow) whichever is greater with largest unit out of service. Provide scum removal system.
Effluent Pumping			
Effluent Pumps	3 sized for 2.5 x design waste-water flow with largest unit out of service	1	Provide variable speed pumps. Controls shall conform to HRSD Standard Functional Description.
Wet Well	-	-	Match size and controls to pumping requirements to prevent frequent start/stop of pumps. Locate close to chlorine contact tanks. Provide scum removal system.

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Non-Potable Pumps and Automatic Strainers	3	1	May need additional pumps for multiple purposes, wide flow range, or low flow requirements at initial plant startup. Locate suction before dechlorination. Refer to HRSD Standard Functional Descriptions for control. Ensure complete bypass capabilities for strainer maintenance.
Scum Removal			
Scum Wells and Holding Tanks	-	-	Provide for agitation to break up crusted scum and automatic pump out of scum without excessive water. Consider morning glory / tee valve to minimize water content of pumped scum.
Scum Transfer Pumps	2 per well or holding tank	1	Provide grinder ahead of each pump. Do not use air operated diaphragm pumps.
Scum Piping	-	-	Minimum 4-inch diameter. Corrosion-resistant glass lined ductile iron, HDPE, or PVC. Long radius bends, cleanouts, NPW flushing connections.
Concentrator	2	1	
Concentrated Scum Pumps	2 per concentrator	1	Do not use air operated diaphragm pumps.
Concentrated Scum Piping	-	-	Maximum 4-inch diameter. Corrosion-resistant glass lined ductile iron, PVC, or HDPE. Long radius bends, cleanouts, NPW flushing connections, and air connection at injection point to furnace.
Chemical Feed Systems Pumps	1 dedicated pump per feed point with 1 spare pump connected to manifold	-	Provide turndown capability or range of pump sizes to accommodate low flow and high flow requirements. Flow meters to read accurately at all anticipated flow ranges.
Odor Control			

Sewage Treatment Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Odor Control Enclosed Facilities and Covered Tanks	-	-	Consider on case by case basis.
Scrubbers	2 trains of 2 scrubbers each including standby train for sewage treatment	1 train	Consider 1 large odor control station versus multiple smaller odor control stations on case-by-case basis. Provide additional trains for large air flows. Consider bioscrubbers and carbon scrubbers where applicable.
	2 scrubbers including standby scrubber for solids handling where single stage scrubbing is appropriate or as above for sewage treatment where two stage scrubbing is required	1 scrubber	Provide for chemical cleaning of scrubbers.
Emergency Power			
Emergency Power Generators	1 sized on case-by-case basis	-	Satisfy Class I Reliability requirements. Provide emergency generator(s) rated to adequately power required plant loads. Provide sufficient fuel storage for a 7 consecutive day utility outage at full load. Provide equipment and provisions for portable generator connection.
UPS	-	-	Provide backup power for sufficient time at control stations for critical computer, data collection and I&C functions.

IV. SWIFT Facilities Design and Operation:

A. Regulations – The design and operation of SWIFT facilities for aquifer recharge is regulated through the EPA's Underground Injection Control (UIC) program. The Potomac Aquifer Recharge Oversight Committee is an advisory board that provides independent monitoring and oversight of the SWIFT program. The Committee consists of a 10-member advisory panel including representatives from VDH, VA DEQ, the HRPDC, and the public.

B. Design life – Design life for SWIFT facilities shall match the design life for sewage treatment facilities detailed in Section 32.III.B.

C. SWIFT treatment facilities perform two levels of treatment: SWIFT tertiary effluent and SWIFT Water.

1. SWIFT tertiary effluent is defined as effluent from the SWIFT biofiltration process that has been disinfected using ozone. SWIFT tertiary effluent is discharged to the surface water outfall.

2. SWIFT Water is defined as water that has been fully treated through the SWIFT advanced water treatment process. SWIFT Water may be discharged to the surface water outfall or used for managed aquifer recharge.

D. Treatment capacity – The treatment capacities for SWIFT tertiary effluent and SWIFT Water are determined by HRSD on a case-by-case basis.

E. SWIFT integration – Integration of SWIFT facilities shall consider impacts to plant NPW water systems, impacts to wastewater disinfection processes and associated permit requirements, nutrient removal processes, treatment plant solids handling and disposal practices, outfall infrastructure operations and maintenance, and the interface with electrical and instrumentation systems.

F. Critical control point off spec diversions – The design of SWIFT facilities shall consider off-spec diversion of process water when critical control point alarms are triggered. The treatment process shall be designed such that off-spec diversions occur automatically and in such a way to prevent the off-spec event from compromising the pathogen log removal or inactivation capability of the treatment process.

G. Design loadings – Design parameters and loadings shall be in accordance with the stipulations as defined in the EPA UIC permit.

H. Equipment selection – The current approved list of sole-source equipment can be found on HRSD's SharePoint: Finance/Sole Source Library\. Users without SharePoint access may request this document by contacting the HRSD Project Manager.

I. SWIFT residuals – SWIFT residuals (e.g., settled solids, biofilter backwash waste, etc.) shall be recycled to a suitable location within the wastewater treatment process. SWIFT residuals shall not be recycled to the SWIFT influent.

J. Minimum Requirements

SWIFT Unit Process	Minimum Number of Units Installed	Number of Units Out of Service	Comments
Rapid Mix	2	1	
Flocculation	2 sized for design residence time w/ one unit out of service	1	
Sedimentation	2 sized for design overflow rate w/ one unit out of service	1	If inclined plates are used, plate efficiency shall be 80% and plate angle shall not be less than 55°.
Ozone Generation	2	1	Selection of ozone generators shall consider maintaining economical use of power and oxygen over the expected range of operating conditions.
Ozone Contact	1 (if pipeline or serpentine contactor used) 2 (if over-under contactor used)	0 (if pipeline or serpentine contactor used) 1 (if over-under contactor used)	
Biofiltration	2 sized for design empty bed contact time w/ one unit out of service	1	Evaluation for number of biofilters should optimize the number of filters based on individual filter size, overall facility footprint, backwash flow (pumps, piping, backwash supply and waste volume requirements, and number of filters.
GAC Adsorption	2 sized for design empty bed contact time w/ one unit out of service (1 unit in backwash)	1	Evaluation for number of GAC contactors should optimize the number of contactors based on individual unit size, overall

			facility footprint, backwash flow (pumps, piping, backwash supply and waste volume requirements, and number of units. Evaluation shall consider impacts of GAC replacement activities on SWIFT AWT throughput.
UV Disinfection	2	1	
SWIFT Water Pumping	2	1	
Ion Exchange	2	1	
SWIFT Water Aeration Blowers	2	1	Size aeration system to achieve a SWIFT Water DO equivalent to 75% of saturation at 25°C when starting from zero DO.
SWIFT Recharge Wells	N/A	2 (1 well in backflush and 1 well under rehabilitation)	

V. Solids Handling Design and Operation:

A. The evaluation of new solids handling facilities should consider alternative and multiple methods and backup plans to provide for flexibility and contingencies in case of process failure or new regulatory requirements. The design and operation of solids handling facilities should be in accordance with all provisions of the approved SCAT Regulations. Solids handling design and operation should also comply with the requirements of the 40 CFR Part 503, MACT 129, and Title V regulations.

B. Design life – Design life for various elements of solids handling facilities shall match the design life for sewage treatment facilities detailed in Section 32.III.B.

C. Solids Capacity– The solids capacity for solids handling unit processes should be based on the following criteria:

1. Plant Solids Capacity – The plant solids capacity of the overall solids handling facilities should be based on solids production at maximum monthly flow and load.

2. Process Solids Capacity – The process solids capacity for individual solids handling unit processes including recycle loadings and peak loadings (such as peak weekly loadings or peak hourly loadings) should be as recommended by the design engineer.

3. Limiting Solids Capacity – The limiting solids capacity of the overall solids handling facilities should be based on the individual solids handling unit process having the lowest monthly solids capacity (i.e. the bottleneck).

   Note: Observations on loadings and capacity of solids handling unit processes based on HRSD analysis and experience are as follows:

   - Peak daily loadings are buffered (absorbed) by peak weekly loadings.

   - Incinerator capacity is related as follows:

Peak Daily Capacity	= Equipment Rated Max Capacity
Peak Weekly Capacity	~ Peak Daily Capacity due to buffering capacity = Equipment Rated Max. Capacity
Max Monthly Capacity	= 85% x Peak Weekly Capacity = 85% x Equipment Rated Max Capacity
Avg Monthly Capacity	= 85% x Max Monthly Capacity = 85% x 85% x Peak Weekly Capacity = 72% x Peak Weekly Capacity = 72% x Equipment Rated Max Capacity

D. Design Loadings – The design loadings for solids handling unit processes are to be as recommended by the design engineer. The design loadings should be based on historical records, field sampling, or similar experience. The design loadings should include the impacts of septage discharge, chemical addition, and solids from other plants.

E. Design For Initial Plant Startup – The design for initial plant startup should provide for efficient and economical operation of sewage treatment unit processes without problems caused by oversized tanks and equipment if low flows are expected during early years of operation. The design for initial plant startup may incorporate:

1. Sufficient turndown capability.

2. Additional smaller initial equipment to be operated only at lower flows.

3. Multiple smaller initial equipment to be operated together at higher flows.

F. Digester Commissioning and Decommissioning - Prior to digester commissioning or decommissioning, safety measures shall be considered

to lower the risk of explosion due to the mixing of digester gas and ambient air. Engineers shall reference the Code of Federal Regulations, section 193.2615 (isolating and purging) for guidance.

G. Intermittent Operation – The intermittent operation of solids handling unit processes should be evaluated carefully to determine the impacts on other sewage treatment and solids handling unit processes and operations at both initial plant startup and design loadings. A plan for intermittent operations, if applicable, should be developed by HRSD and forwarded to the design engineer early in the design process.

H. Impact On Sewage Treatment – The impact of solids handling unit processes on other sewage treatment unit processes and operations should be evaluated carefully at both initial plant startup and design loadings. Such impacts from solids handling may be detrimental to performance of sewage treatment unit processes or operating efficiency of facilities. The evaluation should consider factors such as:

1. Initial and design loadings

2. Size of equipment and turndown capability

3. Intermittent operation and hours of operation

4. Recycle load impact on unit processes

5. Interdependent onsite and offsite unit processes and operations

I. Reliability and Redundancy – The reliability and redundancy of solids handling unit processes should be based on operating with the largest unit out of service. The reliability and redundancy of major solids handling equipment should be based on having a spare unit of the largest size. Verify the design complies with the SCAT Regulations.

J. Equipment Selection –Sole-source equipment can be approved on a case-by-case basis. The FIRM to coordinate with HRSD Project Manager for sole source requirements.

K. Minimum Requirements:

Solids Handling Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Holding Tanks			Need to evaluate mixing requirements. Consider Confined Space Entry Permit requirements when designing access for cleaning and inspection. Provide odor scrubbing of the Holding Tanks.
Storage	2	1	
Day	2	1	
Blend	2	1	
Thickeners			
Gravity	2	1	
Flotation	2	1	Assume largest unit out of service
Gravity Belt	2	1	Assume largest unit out of service
Thickened Solids Pumps	1 dedicated pump per unit with one spare pump where applicable	1	Provide VFD/pump system turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.
Hopper	2	1	Provide useable hopper volume to match operational and process requirements. Provide hopper level monitoring to control the Thickened Solids Pumps.
Anaerobic Digesters			
Primary	2	1	Designed to meet Class B Requirements. Requires 6 months to clean and repair digester. Both primary and secondary digesters shall be dual-purpose.
Secondary	1	1	Consider alternate gas storage on a case-by-case basis. Both primary and secondary digesters shall be dual-purpose.

Solids Handling Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
2 Stage			
Acid Phase	2	1	Avoid P-traps on drawoffs due to gas/liquid binding.
Gas Phase	2	1	
Pumps	1 dedicated pump per unit with one spare pump per every two units	1	Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.
Heat Exchangers	2	1	Shell and tube.
Foam Control	-	-	Consider foam control measures
Dewatering			
Belt Filter Press	2	1	
Centrifuge	2	1	Provide 1 spare uninstalled rotating assembly or 1 additional installed centrifuge. Requires 6 months for outside repair of centrifuge.
Pumps	1 pump per unit	1	Provide turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands. Provide grinder ahead of each pump.
Hopper	2	1	Design system to be flexible for discharge into any / all hoppers. Provide usable hopper volume to match operational and process requirements. Account for working volume lost to angle of repose of dewatered solids.
Biosolids Receiving Facility			

Solids Handling Unit Process	Minimum # of Units Installed	# of Units Out of Service	Comments
Loading Hopper	2 sized for usable volume to hold a minimum of 60 cy each	1	Design system to be flexible for discharge into any / all hoppers. Provide usable hopper volume to match operational and process requirements at both the loading and receiving plants. Account for working volume lost to angle of repose of dewatered solids.
Receiving Hopper	2 sized for usable volume to hold a minimum of 60 cy each	1	Provide usable hopper volume to match operational and process requirements at both the loading and receiving plants. Provide for unloading from different types of trucks where possible. Account for working volume lost to angle of repose of dewatered solids.
Pumps	1 dedicated pump per unit with one spare pump	1	Provide pump range and turndown capability to match operational and process requirements at both the loading and receiving plants
Incinerators			
Fluidized Bed	2	1	Provide for MACT 129 requirements.
Polymer Systems			
Pumps	1 dedicated pump per unit with 1 spare pump	1	Provide VFD/pump system turndown capability or smaller pumps for low flow requirements at initial plant startup with provisions to replace smaller pumps as plant expands.

VI. Access to Unit Processes and Equipment

A. Provide access into enclosed and partially enclosed tanks, channels, and other structures to perform required inspection and maintenance. Design access points to minimize the impact on confined space entry through the use of gates, removable handrail sections, hatches with built in fall protection, anchor points, etc. Provide ground level access for above ground tanks.

B. Provide permanent stairs, ladders, or other assemblies to access tanks, buildings, structures, equipment, valves, components, etc. in accordance with OSHA regulations. Provide landings with handrail systems at the top and intermediate (as required) elevations of access assemblies. For ladder systems, elevate the first rung approximately 12-inches from the top-of-landing. Do not use Fiberglass Reinforced Plastic (FRP).

C. Provide elevated walkways with handrails in accordance with OSHA requirements to access multiple tanks and/or structures in close proximity to each other. The minimum width of walkways shall be four (4) feet.

D. Provide isolation valves upstream of all devices and appurtenances to allow for maintenance or removal. Provide isolation valves from other tanks that are commonly piped together. Provide manway access into the tank for maintenance and internal inspections.

E. Provide adequate clearance and access at SWIFT recharge well facilities to allow for crane access for pump and pump column removal and installation, well redevelopment and testing and lay down area for pump column pipes and shafts adjacent to recharge well facility. Consideration shall also be given for providing lay down for well construction and space for temporary chemical storage needed for rehabilitation events.

F. Submit equipment removal plan for all major process equipment at 60% and 100% submittal stages.

VII. Sampling

A. Sampling is required for process monitoring and control and regulatory reporting. Sampling must be representative and reliable.

B. Sampling hatches shall be provided at designated sampling locations. All sample points shall be provided with 120V outlet connections. Raw influent and final effluent sample points shall be provided with a flow signal.

C. Sampling points are to be planned, designed, and designated for all process flows and other samples routinely monitored. Sampling points are to provide

representative samples under all operating conditions. In general, sampling points are:

1. Located to include or exclude recycle streams as appropriate.

2. Well mixed to avoid solids separation.

3. Representative when process units are taken out of service.

4. Easily accessible for sampling or maintenance.

D. Provide automatic samplers. Provide connections and appurtenances for automatic samplers. Provide for manual sampling in the event of failure of the automatic sampling equipment.

E. Automatic Samplers:

1. Provide “composite-only” or “sequential/composite” samplers designed for outdoor/corrosive environments and manufactured with an exterior shell made of UV resistant fiberglass. Enclosures shall be refrigerated and heated to control temperatures inside the unit. Place samplers on housekeeping pads.

2. Provide for external inputs for flow pacing and local receptacles for power.

3. Coordinate with HRSD Technical Services Department to provide a bracket and pole for support of the sample tubing, where appropriate.

4. Provide for training of the plant staff for this piece of equipment. The training is to be included with the purchase price and/or construction contract.

5. Do not locate samplers in a classified or confined space.

F. Sample points for ozonated water, including sample streams for analyzers, include full enclosed drain piping systems that operate under a partial vacuum to limit safety hazards due to ozone off gassing.

G. Piping for sensors and sample outlets used for automatic process control shall be located as close as practical to the sample draw-off point in the process to minimize ozone residual decay in the sample piping.

H. Instrumentation related to SWIFT AWT shall have dedicated sample piping provided to each instrument (i.e. instruments shall not be fed from a common sample header). Flow and pressure control and measurement equipment shall be provided as required to meet the requirements for each instrument.

VIII. Chemical Containment

A. Provide a negative slope (minimum 1/8 inch per foot) on all floors to a sump or drain.

B. Select valves, piping, supports, and sump pump materials to be resistant to chemicals stored.

C. Generally, a sump and pump are preferred over a drain system. Sumps to be recessed to completely drain tank floor.

D. No equipment inside containment area – limit to piping and appurtenances. All tank instrument read-outs are to be located outside of the containment. All pump shutdown HOAs are to be located outside of the containment. If equipment must be located inside containment, locate above expected elevation of contained liquid. All piping is to be located above expected elevation of contained liquid.

E. Size containment areas to meet local building code. At a minimum, provide storage volume of 110% of the largest tank.

F. Minimize the installation of valves, electrical conduit, and heat trace systems within containment areas.

G. Provide for potable or non-potable water for cleaning of the containment areas. For hose connections, provide male polyethylene camlock connections with caps.

H. Draining chemical containment systems shall be initiated manually to ensure that chemicals are not accidentally discharged to the storm drain or plant drain system.

I. Provide suitable access into containment areas.

J. Avoid piping and conduit penetrations through containment walls and floors.

K. Locate feed pump suction piping within the containment area.

L. Conduct a hydrostatic test of the containment area to ensure that there are no leaks.

M. Provide appropriate waterstop material in all concrete joints.

N. Provide close inspection of concrete workmanship and coating systems prior to the placement of tanks and other equipment.

O. Provide local high-level alarm for containment sump that is also capable of being displayed on plant DCS.

IX. Chemical Feed Systems

A. General

1. Fill Stations – Provide adequate venting in the design of the chemical storage tanks and fill piping. Consider the impact of vent discharge points on equipment and personnel. Chemical suppliers often use compressed air to deliver the chemical into the storage tanks and to remove the contents of the supply hoses into the storage tanks. Provide male end quick disconnect at fill stations. A dry-break fitting is not required. Consider use of duplex strainers in parallel on fill line. Review the diameter of the quick disconnect with the plant staff to limit the possibility of contamination with other chemicals on the plant site. Provide containment to connections and fill stations and provide a drain to a proper discharge point. Provide suitable ground connection for truck unloading of flammable chemicals. Interlock fill valve permissive with ground connection.

2. Storage Tanks – Review sizing criteria for the tank(s) with the plant staff. Carefully consider the number of tanks by considering: days of storage, volume needed for dilution, thermal expansion, minimum delivery volumes, and the number of tanks needed to allow for inspection and maintenance. A suggested method for calculating the volume of chemical to be stored is:

    (1) 15 day peak use at plant capacity, or

    (2) 30 day average use at plant capacity (whichever is greater).

    (3) For chemicals which degrade significantly with time, such as sodium hypochlorite, use a 7 day peak/15 day average demand to calculate storage volumes.

    Consider if level indication is needed with the tank. Ultrasonic type level indicator is preferred except for flammable applications such as methanol, for which radar is preferred. Ultrasonic level indicators should be located in the top/center portion of the tank using a flanged connection. If vertical space is not available above the tank for installation or maintenance of the level indicator, consider the use of a differential pressure cell at the base of the tank. Refer to Section 33 – Electrical and Instrumentation for further details regarding level indicators. Provide sight glasses only if a redundant system is needed. If a sight glass is required, provide valves at both the top and bottom.

    Set relative elevations of tank and pumps to allow drawoff of full tank volume.

Provide storage tanks with ladders, safety cages, platforms with rails, etc. in accordance with OSHA requirements. Adjacent piping should not limit access to these ladders or critical isolation valves. Isolation valves must be connected directly to the tank. Consider consolidating piping adjacent to tanks to minimize access and maintenance problems. Proper vertical clearance is also important to access tank manways and maintain equipment located on top of these tanks.

Provide multiple manway openings for access and ventilation on tanks with volumes greater than 1,000 gallons. Consider placement of manway openings for ease of access.

Provide sloped tank bottoms to allow tanks to be completely emptied using installed drains or pumps.

Design storage tanks considering compatibility with chemicals stored and concentrations anticipated.

Permanently attach each tank's nameplate information including manufacturer, year of manufacture, working volume, empty volume, material of construction, diameter, and product designed to store.

3. Piping & Appurtenances – Manifold piping, tanks, and pumps and provide valves and check valves in appropriate locations to allow maximum operational and maintenance flexibility for any tank/pump/process train combination.

   Bolt critical valves directly to tank to simplify locating leaks.

   Provide an appropriate discharge point for pressure relief valves used for chemical feed systems. Detail or describe the ultimate discharge point if it is not adjacent to the limits of the work for the project.

   Provide ventilation lines for calibration columns plumbed to appropriate ventilation discharge points.

   Provide a permanent pressure gauge on the suction and discharge of each pump with gauge isolation valve.

   Provide flushing connections at appropriate locations in each chemical feed system. Provide a hose connection on the suction and discharge piping manifold for flushing the system.

   Design piping located under or adjacent to roadways for H-20 loading.

Overhead chemical piping should be avoided whenever possible.

Attach tracer wire to pipe and install buried utility warning tape approximately 18 inches above pipelines.

Compatible tubing with secondary containment conduit should be used for all underground chemical piping. Manholes should be located at all tubing bends and connection points. Tubing runs shall be continuous between manholes. Manholes should be watertight to contain potential leaks. Provide redundant underground tubing to allow for uninterrupted chemical feed if primary tubing needs to be replaced.

4. Feed Pumps – Provide pumps with a calibration column (manufacturer recommended or HRSD Standard). Provide pulsation dampener, elapsed-time meter, back pressure and relief valve as recommended by the Manufacturer.

5. Flow Metering – Provide a valved bypass or other method to allow for removal and maintenance of meters without spilling large amounts of chemical or shutting down critical plant processes.

6. Operations/Maintenance/Accessibility – Locate eyewash and emergency shower stations adjacent to new chemical feed systems in accordance with OSHA regulations. The location of these stations is to be designed to facilitate access with existing facilities. Review the location of existing eye wash stations to determine if these station locations are satisfactory for the new work. See the Emergency Eyewash and Showers paragraph in this Section for further information.

   Elevate pumps or other equipment which require regular maintenance at least two feet above the floor or access platform to facilitate maintenance. This preference should not take precedence over the hydraulic requirements of the pump.

   Provide duplex unit strainers accessible for maintenance when strainers are required for chemical systems.

   Provide access to items of regular use or maintenance (i.e. pump wet ends, isolation valves, etc.) without the need to enter tank containment areas whenever possible. Access to these items should also be provided with as little interference and obstructions as possible.

7. Chemical Off-Gassing – Provide storage tanks with vents larger in diameter (minimum 2 to 5 times) than the fill piping. Carefully consider vent orientation and discharge to limit impacts to worker

safety and corrosivity to adjacent facilities. Consider the use of scrubber systems if the discharge of the vent will negatively impact the adjacent area.

B. Caustic (NaOH) Systems

1. General – Caustic is primarily used by HRSD as part of the odor control process. The product is normally delivered at 50% strength and immediately diluted to a strength of 25%.

2. Storage Tanks – Provide steel tanks due to the heat released during the dilution procedure. Utilize a post-weld heat treatment procedure in tank manufacturing.

   Provide an automatic batch control system with a metered water source for dilution. Utilize non-potable water for dilution purposes. Provide strainer on the non-potable water source.

   Provide for continuous mixing of the storage tank. The pump should be an air operated diaphragm or centrifugal type. Pump to be compatible with heat generated during dilution. Heat tracing and insulation of the tank is not required since the chemical is diluted immediately upon delivery. Insulation and heat tracing of the non-potable water piping is required for outdoor applications.

3. Piping & Appurtenances – Provide Schedule 80 CPVC.

   Minimize or eliminate threaded fittings and unions whenever possible. Use flanged connections at all fittings, valves and other appurtenances. Gasket, O-rings, and pulsation dampener material shall be EPDM.

   Provide metal ball valves for diameters of less than or equal to three inches and metal or fiberglass composite ball valves for diameters over three inches. Provide backpressure valves designed to consider the caustic feed pump discharge pressure range.

   Heat trace and insulate all outside pipework.

4. Feed Pumps – Provide a minimum of two feed pumps for this application. Pumps should be positive displacement.

5. Flow Metering – Provide magnetic (Mag) type flow meters with a valved bypass for each feed point. Mag meters must be mounted so that they are measuring a full pipe and so that they do not trap gases.

C. Sodium Hypochlorite (NaOCl) Systems

1. General – Sodium hypochlorite is used in the chlorine contact tanks, in the odor control scrubbers, for filamentous control in the returned activated biosolids system, and in other locations throughout the plant. The product is normally delivered at a strength between 12 – 15%.

2. Storage Tanks – Storage tanks to be manufactured of fiberglass reinforced plastic (FRP). Material selected to be compatible with field installation of bulkhead fittings. Design flexible connection with tank piping due to expansion/flexure at connection points.

   Locate storage tanks indoors or in a covered location outdoors. For indoor locations, consider carefully room ventilation to limit the corrosive fumes common from this chemical. Provide insulation for all tanks located outdoors.

   Provide a transfer pump for this application to move product from storage tank to storage tank. Design the system to protect the transfer pump from running dry or provide a pump that is capable of running dry without causing damage to the pump.

3. Piping & Appurtenances – Design piping to feed the product in neat (undiluted) form to the final application point to eliminate scaling when mixed with non-potable water. Piping shall be rigid PVC (Schedule 80) for exposed locations. Use Weld-On 724 piping glue by IPS Corporation or approved equal. Minimize or eliminate threaded fittings and unions if possible.

   Isolation valves shall be of diaphragm type.

   Evaluate manifold venting back to storage tank.

   Locate pressure relief / venting back to storage tank.

4. Feed Pumps – Provide a redundant pump for each application. Give careful consideration to the range of flows to be handled with this system. The feed pump system must handle both nighttime low flows and peak high flow conditions. The pumps shall be positive displacement. Provide a variable frequency drive with each disinfection and odor control metering pump.

   Provide isolated vent systems back to the storage tanks, flush connections at each pump and calibration column vent piping. One calibration column can be used for multiple pumps..

   Avoid Viton seats on ball check valves used as part of the pump assembly. HRSD has found that EPDM or Teflon coated EPDM is an acceptable elastomer for this application.

5. Flow Metering – Provide magnetic type flow meters with a valved bypass for each disinfection and odor control feed point.

6. Operations/Maintenance/Accessibility – Consider the use of a submersible mixing unit at the disinfection application feed point.

Locate all exposed piping in areas that allow easy access for repair and which will not negatively affect adjacent equipment if a leak or spill occurs.

Due to the strong odors resulting from this chemical, scrubber system on all vents are required if storage tanks are located indoors. Leak/fume detection is required if storage tanks are located indoors. Consider room ventilation and the use of 2 speed fans to evacuate excess odors.

D. Sodium Bisulfite ($NaHSO_3$) Systems

1. General – Sodium bisulfite is used to dechlorinate the treated effluent prior to discharge at each plant (except for Atlantic Plant). The product is normally delivered at a strength of 38%.

2. Storage Tanks - See Sodium Hypochlorite Systems in this Section for tank requirements except for the following:

   Design shall consider locating tanks indoors in a controlled environment due to the likelihood of this chemical freezing.

   Provide a two-inch diameter fill station quick disconnect.

   Provide tanks with a recirculation pump to keep the product well mixed and limit crystallization at the air-liquid interface.

3. Piping & Appurtenances – A bisulfite feed facility located close to the chlorine contact tanks is preferred so NPW carrying water isn't necessary. If carrying water is necessary to deliver fast chemical delivery, provide pump discharge piping/tubing sized for maximum chemical feed and appropriate carrying water. Provide all piping with heat tracing and insulation. Consider providing heat panels in-lieu of heat tracing and insulation at the feed pumps.

3. Feed Pumps – See Sodium Hypochlorite Systems in this Section for pump requirements except for Viton. Viton is an acceptable material for ball check valve O-rings.

4. Flow Metering - Provide magnetic type flow metering with a valved bypass for both non-potable water and sodium bisulfite service.

5. Operations/Maintenance/Accessibility

   Due to the strong odors resulting from this chemical:

(1) Scrubber systems on all vents are required.

(2) Leak/fume detection equipment is required.

(3) Carefully consider room ventilation and the use of two speed fans to evacuate excess odors.

Due to concerns with chemical freezing (<55 degrees Fahrenheit):

(4) HRSD will provide a large face thermometer in all sodium bisulfite areas.

(5) Consider temperature control alarms in all sodium bisulfite areas.

E. Muriatic Acid (HCl) Systems – Important Note: This chemical is very dangerous and very corrosive. Pay close attention to materials and the pump/pipe arrangement for safety. Corrosion of electrical components also needs considered.

1. General – Muriatic acid is used as a process chemical in some odor control systems, to clean odor control scrubbers and for other maintenance purposes. The product is normally delivered at a strength between 25% – 30%.

2. Storage Tanks – Review the tank sizing criteria with plant staff. The tank volume sizing should include both process and cleaning requirements. It may be more economical to provide multiple tanks at multiple locations.

   Provide tanks manufactured of either FRP or HDPE. Design flexible connection with tank piping due to expansion / flexure at connection points.

   Provide tank level measurement.

   Provide a tank vent to an appropriate discharge point. One option for the discharge location of this vent is the odor control scrubber system duct.

3. Piping & Appurtenances – PVC (Schedule 80) piping is acceptable.

4. Feed Pumps – Provide redundant pumps only if the chemical is used as part of the odor control process. Provide a flushing connection at each pump.

5. Flow Metering – Provide a magnetic type flow meter with a valved bypass only if the chemical is used as part of the odor control process.

6. Operations/Maintenance/Accessibility

   Design based on a batch feed process if the chemical is used for cleaning purposes only.

   Minimize the use of metallic components within the tank containment area.

F. Ferric and Ferrous Chloride/Sulfate ($FeCl_3$, $FeCl_2$, $FeSO_4$) Systems

1. General – Ferric chloride (30-33% typical delivery concentration) solution is used to remove phosphorus through precipitation at various locations in the treatment process.

   Provide for ferric/ferrous to be fed to the primary, secondary clarifiers and sidestream treatment.

   Dilution of this chemical is normally not required. The product is normally fed neat to the application point.

   Locate proposed ferric/ferrous feed points in areas where metallic gates and/or piping will not be negatively affected.

2. Storage Tanks – Provide FRP tanks due to the corrosive nature of this chemical. Engineer should consider appropriate number of tanks for storage, delivery, and operations. Design flexible connection with tank piping due to expansion / flexure at connection points.

   Consider the need for continuous mixing of the storage tank. If a recirculation system is provided then a pumped system sized for 100% turnover each day should be used. The pump provided shall be a non-metallic type.

   Provide a level indicator for level monitoring. A sight glass on the tank is not required.

   Consider the use of a storage tank fill manifold with duplex basket strainer.

3. Piping & Appurtenances – Provide PVC piping and appurtenances. Valves shall be PVC true union ball type. Support systems for piping and appurtenances shall be non-metallic.

4. Feed Pumps – Provide units similar to the requirements for caustic systems.

5. Flow Metering – Provide magnetic type flow meters with valved bypass.

6. Operations/Maintenance/Accessibility – Provide proper ventilation of the corrosive fumes if ferric / ferrous system is located indoors. All items within the tank containment areas and exhaust fans and any associated items shall be non-metallic. All existing metallic equipment in areas where ferric / ferrous will be located must be replaced or protected from corrosive fumes.

G. Aqua-Ammonia (NH_4OH) Systems

1. General – Aqua-Ammonia (less than 20% by weight) is used as a nutrient source to enhance biological growth or is used to control chlorine demand during periods of partial nitrification. This chemical has a high pH, which results in operational problems similar to those found with caustic. The product is normally fed neat to the application point.

2. Storage Tanks – Provide steel or HDPE tanks. The tanks are normally under a small amount of internal pressure, which requires special attention to venting and gas relief systems. Special tank linings are not required. Containment of the tanks is required and an outdoor location for the tanks is acceptable. Provide tank level measurement. A sight glass is not required. Provide a tank vent to an appropriate discharge point. One option for the discharge location of this vent is the odor control scrubber system duct.

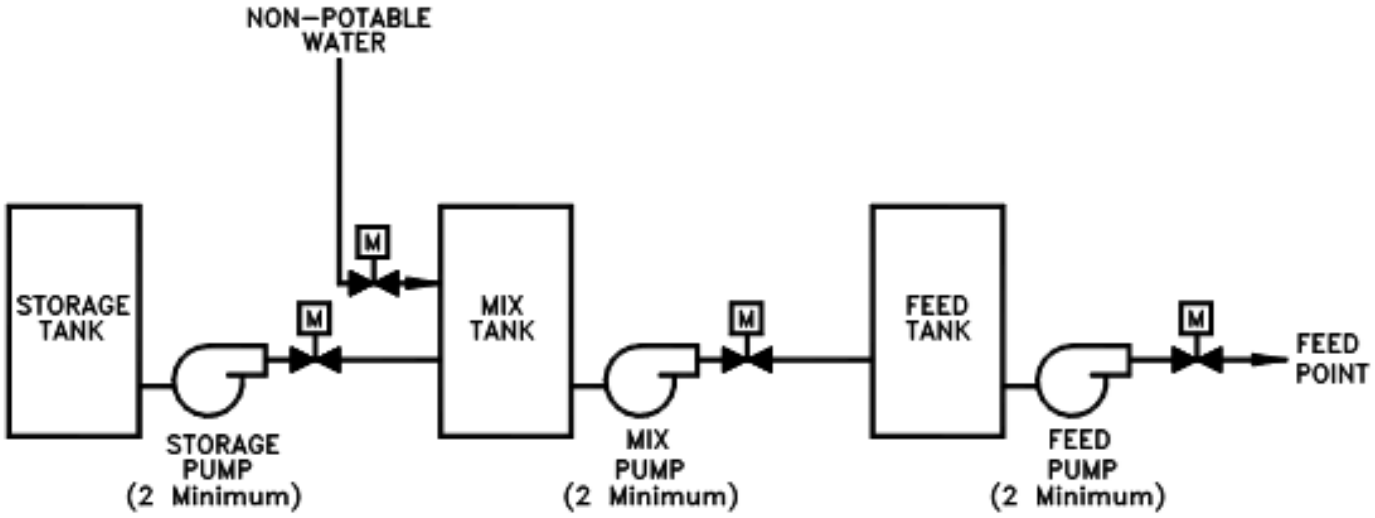
3. Piping & Appurtenances – Provide steel piping and appurtenances. The use of threaded fittings is acceptable. Valves shall be ball type, made of steel and rebuildable. Feed Pumps - Provide units similar to the requirements for caustic systems. Pumps are normally operated at a constant feed rate.

4. Flow Metering - As required.

H. Polymer Systems

1. General - Polymer systems are used by HRSD for many process applications. Polymers are commonly used to increase solids concentration at thickeners, centrifuges, and for secondary clarification. Many different types of polymers are used by HRSD. Both dry and liquid systems are used at HRSD. Dry feed systems should be located in an indoor and/or controlled environment. A typical liquid polymer system is shown in Figure 31-1.

Figure 31-1: Liquid Feed Polymer System Configuration



2. Storage Tank – Size storage tank for the larger of a 15-day peak use or a 30-day average use. The product is stored neat. Size the mix and feed tanks according to dosage requirements and acceptable age of mix.

   Provide HDPE or FRP tanks with a conical bottom if possible. Provide side manway access for cleaning. Locate tanks indoors. Heat tracing and insulation are not required if the tanks are placed in an indoor and temperature-controlled environment. Design flexible connection with tank piping due to expansion / flexure at connection points.

   Provide a level indicator for level monitoring. A sight glass on the tank is not required. For automated sequence to control, refer to the HRSD Standard Functional Descriptions.

   Provide a mechanical mixer inside the mix tank.

3. Piping & Appurtenances – Provide PVC piping and appurtenances. Some polymer products tend to cause interior chemical build-up on the piping system. Provide appropriate flanged connections and unions to allow for removal and replacement. For small diameter piping (< 2 inches) provide PVC ball valves and for large diameter piping (>2 inches) provide PVC plug or ball valves.

4. Storage, Mix and Feed Pumps – Provide rotary or gear type storage pumps for liquid feed applications and progressive cavity type mix/feed pumps.

5. Flow Metering – Provide a magnetic-type flow meter and a valved bypass on the discharge of the feed pump combination.

6. Operations/Maintenance/Accessibility – Carefully consider room ventilation. Direct tank vents to a suitable outdoor location.

I. Methanol

1. Refer to Section 22 – HRSD Safety Programs for Methanol Safe Work Practices

2. General – Methanol is used as a supplemental carbon source for the biological treatment process. Follow NFPA and building code requirements for maintaining proper distance between storage vessels and occupied buildings. Methanol is highly flammable. Proper bonding and grounding is required to reduce the potential for static discharge. Fire suppression systems shall be designed to use fluorine-free foam.

3. Storage – Provide vapor recovery connections at unloading station.

4. Piping and appurtenances – Provide 300 series stainless steel piping and appurtenances. All pipe joints shall be welded or flanged. Metered NPW carrying water shall be piped into the methanol feed so that it's at a non-flammable concentration when it leaves the containment area.

5. Operations/Maintenance/Accessibility – Ambient oxygen and methanol concentration monitoring shall be installed in indoor areas where methanol pumps or piping is present.

J. Oxygen (O_2) Systems

1. General – Oxygen is used to generate ozone gas. Oxygen is stored on site as a cryogenic liquid and is converted to gaseous oxygen using vaporizers. Follow NFPA and building code requirements for maintaining proper distance between storage vessels and occupied buildings. Oxygen is not compatible with hydrocarbons. Liquid oxygen unloading areas shall be free of asphalt or hydrocarbon-based expansion joints. Oxygen storage areas shall include ambient oxygen monitoring equipment, automatic shutdown interlocks, ventilation interlocks, and local and remote alarm notifications.

2. Storage – Provide steel storage tanks. Storage tanks shall be sized such that the anticipated typical "boil-off" of oxygen is less than or equal to the anticipated 5th percentile oxygen usage rate for the treatment facility.

3. Piping and appurtenances – Provide stainless steel piping and appurtenances. A connection shall be provided for connecting a temporary liquid oxygen storage system in the event that maintenance must be performed on the installed equipment. Relief valves shall be provided as required to prevent over-pressurization of liquid oxygen between isolation valves. Cleaning of piping and components shall be per CGA G-4.1 and ASTM G93.

4. Operations/Maintenance/Accessibility - Ambient oxygen monitoring shall be provided in ozone generator rooms and other locations where high concentrations of oxygen may be present.

K. Ozone (O_3) Generation Systems

1. General – Ozone is generated on site from oxygen gas and is applied to the water to oxidize and remove organic contaminants. Selection of ozone generators shall consider maintaining economical use of power and oxygen over the full range of expected operating conditions. Generator startup requirements shall include tuning the generator control loops (i.e. gas flow and power) to provide stable ozone output over the entire ozone generator operating range.

2. Storage – N/A

3. Piping and appurtenances – Gaseous oxygen, ozone destruct, and ozone gas piping shall be 316L stainless steel. Piping that could come into contact with ozonated water shall be 2507 stainless steel (or higher alloy)and shall not be welded in the field. Piping gaskets shall be PTFE. Cleaning of piping and components shall be per CGA G-4.1 and ASTM G93. Ozone contactors shall be fitted with a properly sized vacuum/pressure release valve to maintain nominal vacuum conditions in the contactor while protecting the structure during filling and rapid drain-down events.

4. Operations/Maintenance/Accessibility – Ambient ozone monitoring shall be provided in all facility spaces where ozone may be present (e.g., ozone generator rooms, ozone destruct rooms, sample areas). The ozone control systems shall automatically shut down interlocks, ventilation interlocks, and send local and remote alarm notifications.

L. Aluminum Chlorohydrate ($Al_2(OH)_5Cl$) Systems

1. General – Aluminum Chlorohydrate (ACH) is used as a coagulant to destabilize colloidal material and remove organic compounds in SWIFT influent water and develop a floc during the flocculation process for subsequent settling and removal in the sedimentation process. ACH storage and feed systems shall also be compatible

with aluminum sulfate (alum) and ferric (ferric sulfate or ferric chloride).

2. Storage – ACH tanks shall be FRP.

3. Piping and appurtenances – Yard piping shall be HDPE and routed through a secondary containment casing pipe. Exposed piping shall be Schedule 80 PVC pipe.

4. Flow metering – as required.

M. Phosphoric Acid (H_3PO_4) Systems

1. General – Phosphoric acid is used as a nutrient source for the SWIFT AWT biologically active filters. Phosphoric acid is normally delivered and fed as a 75% solution.

2. Storage – The storage volume required for phosphoric acid fed as a BAF nutrient source is normally small. Phosphoric acid can typically be received and stored in chemical totes. Chemical totes shall be installed on scales to allow for chemical inventory monitoring through DCS.

3. Piping and appurtenances - Yard piping shall be HDPE and routed through a secondary containment casing pipe. Exposed piping shall be Schedule 80 PVC pipe.

N. Hydrogen Peroxide (H_2O_2) Systems

1. General – Hydrogen peroxide (H_2O_2) is used in conjunction with ozone and/or UV to form hydroxyl radicals used for advanced oxidation of target compounds. Hydrogen peroxide can be delivered at a strength of 35% or 50%.

2. Storage – Hydrogen peroxide storage tanks shall be 316L stainless steel or HDPE.

3. Piping and appurtenances – Hydrogen peroxide piping shall be welded or flanged 316L stainless steel. Gaskets shall be expanded PTFE. Ball valves shall be used for isolation and shall be vented. Relief valves shall be provided as required to prevent over-pressurization of hydrogen peroxide between isolation valves.

4. Flow metering – as required.

X. Drain Systems

A. Consider plant drain system hydraulic capacity. A hydraulic grade line should be plotted with each new plant drain. Surcharging of gravity systems should be controlled. Design system to convey contents of the largest tank in less than 12 hours.

B. Gravity drain systems are preferred over pumped systems for all processes except primary and BNR process tanks. Provide valves for isolation and throttling of each tank or process. Provide regular access points (manholes) in gravity systems and cleanouts in pumped systems. Provide ability to pump out primary and BNR process tanks and return to in-service unit process/tank.

C. Grit, solids handling, and polymer process areas require special plant drain considerations due to the likelihood of plugging. Limit fittings, provide flushing connections and cleanouts, provide adequate diameter/slope of gravity drain system. Use long radius fittings.

D. Provide trench drains for pump galleries and evaluate trench drains for containment areas. Grating to be easily removable and corrosion resistant.

E. Provide flushing and cleaning locations with plant drain systems. If multiple processes are connected to the plant drain a method of isolation is needed to allow for effective cleaning operations.

F. Drain systems shall be tested as described in the Pipeline portion of this Section.

G. All concrete embedded drain inlets must be poured with a slope to the drain inlets.

H. Provide drain located under each emergency eyewash and shower.

I. All process tank drains are to be sump, trench, or negative slope floor drains.

J. All process buildings are to have either trench drains to sump or at minimum one floor drain for every 500 square feet of floor area. Floor drains are to be within three feet of process equipment.

K. Plant drains shall return upstream of influent screens.

L. Locate drain valves for ease of access, maintenance, and replacement. Avoid buried valves where possible.

XI. Emergency Eyewash and Showers

A. Refer to Section 22 - HRSD Safety Programs for specific requirements.

XII. Equipment Numbering Sequences

A. Equipment designations shall correspond to the existing Operations Department equipment identification number (EID) system and/or asset ID and plant unit process designations. All design drawings, specifications and Operations Manuals shall incorporate the plant unit process designation. The EID numbers shall be shown on the Record Drawings. The following alpha-numeric functional coding system is used to determine the EID: Plant Abbreviation/ST or SH/ Unit process – System – Subsystem – Component

1. Plant Abbreviation – Letter designation for each plant as follows:

Army Base - AB
Atlantic - AT
Boat Harbor - BH
Central Middlesex - CM
Chesapeake-Elizabeth - CE
Chincoteague - CT
James River - JR
King William - KW
Lawnes Point - LP
Middle Peninsula - MP
Nansemond – NP
Onancock – ON
Urbanna - UB
Virginia Initiative Plant - VIP
West Point - WP
Williamsburg - WB
York River - YR

2. Unit Process – Letter designation as follows:

Code		Unit Process
A		Administrative Facilities
B		Plant Utilities
C		Flow Storage/Equalization
D		Preliminary Treatment
DCS		Distributed Control System
E		Primary Treatment
F		Intermediate Treatment
G		Secondary Treatment
H		Sidestream Treatment
I		Tertiary Treatment
J		Disinfection
K		Effluent Pumping/Water Reclamation
L		Scum Disposal
M		Biosolids Thickening

Code		Unit Process
N		Biosolids Anaerobic Digestion
O		Biosolids Heat Treatment
P		Biosolids Storage
Q		Biosolids Dewatering
R		Biosolids Incineration
S		Biosolids Composting
T		Biosolids Land Application
U		Odor Control
Z		Spare
AA		SWIFT Administrative Facilities
BB		SWIFT Plant Utilities
CC		SWIFT Flow Equalization
DD		SWIFT Preliminary Treatment
EE		SWIFT Coagulation/Flocculation
FF		SWIFT Sedimentation
GG		SWIFT Ozonation
HH		SWIFT Biofiltration
II		SWIFT GAC Adsorption
JJ		SWIFT UV Disinfection
KK		SWIFT Water Distribution
LL		SWIFT Aquifer Recharge
MM		SWIFT Treatment Residuals

3. The System, Subsystem, and Component designations are assigned by the Maintenance Analyst.

B. New equipment shall be designated using a priority sequence based on original plant's existing numbering sequence. The FIRM shall review the sequence with the plant staff early in the design stage of the project.

XIII. Equipment Spare Parts

A. It is HRSD's goal to minimize the inventory of unnecessary spare parts. Review the plant's needs for spare parts and recommended special equipment/tools with HRSD prior to including these components in the contract documents.

XIV. Miscellaneous Pump Items

A. Seal Water Piping

1. Use strained NPW or potable water for this application. Potable water should only be used as a backup seal water source should the NPW

pumping system fail. Backflow preventer is required when potable water is used.

2. Provide manual bypass.

B. Sump Pumps

1. Sump pumps shall be designed to pass the product/chemicals in the area of the sump. If the materials of construction necessary to safely pass the product/chemical under consideration make the pump cost impractical, consider a lower cost, replaceable sump pump.

2. If sump pumps are being utilized to convey chemicals, an alarm system shall be included to notify operations if the pump is running.

C. Shaft Guards – Manufacturer shall provide shaft guards to comply with OSHA requirements. Refer to 29 CFR 1910 Subpart O Machinery and Machine Guarding. Select material of construction considering specific installation environment conditions.

XV. Noise Abatement for Installed Stationary Equipment

A. Refer to Section 22 - HRSD Safety Programs.

B. Consider sound attenuation in spaces that house equipment such as blowers, centrifuges, odor control fans, incinerator fans and generators.

C. Minimize location of equipment and control devices in areas with significant noise levels.

D. Design equipment installed in exterior locations such that no offsite noise nuisance will result.

XVI. Non-Potable Water Systems

A. Non-Potable Water (NPW) systems are used for certain plant treatment processes, cleaning and for flushing systems on some equipment seals. The NPW system should be designed to provide needed pressures at all locations of the plant while meeting regular water demands. A looped piping system that is isolated at each process should be provided.

B. Provide automatic cleaning strainers on the discharge of pumping systems.

C. Provide strainers at each major plant process or critical delivery point.

D. Consider how the NPW pumping system could be expanded in the future. Provide redundant NPW pump and/or an emergency pump connection.

E. NPW piping shall be ductile iron, PVC or HDPE.

F. Provide NPW hydrants at each process location. NPW hydrants shall be located to limit hose lengths to approximately 100 feet. Consider a quick disconnect, valve and drain in lieu of a hydrant at process tank locations. Provide NPW hydrants with a self-draining feature to limit freeze problems.

G. Exposed NPW systems to be painted and marked in accordance with the Miscellaneous, Painting and Coatings section of this document.

H. NPW piping systems shall be separated from SWIFT treatment areas. SWIFT treatment areas shall be provided with potable water (PW), utility water (UW), or SWIFT NPW water for washdown, process make up, or utility water demands.

I. Provide a stainless-steel hose reel and washdown station with NPW or SWIFT NPW supply at each plant process that requires regular cleaning. Discuss with plant staff to determine appropriate sizing (minimum of ¾ inch) at each unit process.

XVII. Odor Control and Room Ventilation

A. General

1. The following text lists HRSD's current standards for the design of odor control facilities with respect to Hydrogen Sulfide (H_2S). A different design approach will be required when there is a significant odor concern other than H_2S. This standard addresses odor control systems currently employed at HRSD facilities, which primarily include chemical packed towers, bio-scrubbers, and carbon units.

2. Design odor control facilities to eliminate off-site nuisance odors. Basic odor control system design and operational practices should follow the WEF Manual of Practice (MOP) 25 (Odor Emissions and Control) and WEF MOP 8 (Design of Water Resource Recovery Facilities) guidelines. Odor control facilities typically include enclosing the odorous work areas and covering odorous process areas, ducting the odorous gases to scrubbers, and eliminating the odorous gases in the odor control system.

B. Air Flow

1. Provide for sufficient air flow from enclosed work areas and covered process areas to provide adequate ventilation and odor control as appropriate. Entrance doors should be labeled with the design air changes per hour.

   NOTE: Air flow for work areas occupied by personnel should be based on ventilation requirements as appropriate and/or approved by Safety. Air flow for ventilation should not be

routed through odor control facilities wherever practical. Air flow for odor control in some situations can be substantially reduced by pressurizing work areas otherwise requiring only ventilation and drawing off only a portion of the ventilation air flow through the unit process openings for odor control. Air flow for odor control in other situations can be substantially reduced in a work area by using covers or hoods on process equipment. The minimum air change requirement indicated below shall be maintained.

Provide air flow based on the more stringent of the NFPA 820 requirements, other applicable codes, or the following design criteria.

Type of Area	Minimum Air Changes Per Hour
Enclosed work area directly exposed to wastewater or solids with normal access by personnel <u>Examples</u> Bar Screen Room Grit Classifier Room Grit or Scum Dumpster Room Solids or Scum Thickener Room (uncovered) Solids Handling Filter Room Solids Conveyor or Hopper Room Truck Drive Through Room	12 x per hour
Enclosed work area not directly exposed to wastewater or solids with normal access by personnel <u>Examples</u> Solids Handling Centrifuge Room	6 x per hour
Enclosed access, equipment or storage area not directly exposed to wastewater or solids with normal access by personnel <u>Examples</u> Electrical Rooms Stairwells	1.5 x per hour
Covered process area with extreme turbulence or H_2S levels without normal access by personnel <u>Examples</u> Screw Pumps Grit Tanks Pre-aeration Tanks	12 x per hour

Type of Area	Minimum Air Changes Per Hour
Covered process area directly exposed to relatively turbulent wastewater or solids without normal access by personnel Examples Splitter Boxes Solids Handling Tanks (based on empty)	6 x per hour
Covered process area directly exposed to relatively quiescent wastewater or solids without normal access by personnel Examples Non-Aerated Channels Primary Clarifiers (including weirs) Anaerobic/Anoxic Tanks	4 x per hour
Covered process area receiving process air without normal access by personnel Examples Aerated Channels Aeration Tanks	Max Process Air + 10%
Enclosed work area where personnel could encounter oxygen or ozone gas Examples Ozone generator room Ozone sample gallery Ozone destruct room	6 x per hour under typical operating conditions 12 x per hour if oxygen or ozone is detected above the alarm value

Face Velocity - Provide for a minimum face velocity of 100 FPM for any indoor unit process opening. Provide for higher face velocities for outdoor unit process openings to counteract wind affects as appropriate. Prevent backdraft of toxic levels into enclosed work areas. Ensure destruction of H_2S in scrubber based on past operating experience.

C. Public Acceptance, Nuisance Prevention and Odor Control – Public acceptance, nuisance prevention and odor control for treatment plants must be achieved for HRSD to provide quality service. Adverse impacts to nearby neighbors and communities from treatment plant facilities must be prevented, eliminated or minimized to the extent practical.

1. Public acceptance is critical for HRSD to build new treatment plant facilities to serve the public. Public acceptance should be paramount when siting, designing and operating facilities, and these activities should be coordinated with the public information program to promote public acceptance. Nuisance prevention is required for treatment plants to be good neighbors. HRSD's goal is to prevent offsite nuisances. Treatment plant facilities should be planned, designed and operated to mitigate offsite nuisances from odor, noise, light, traffic or other causes to the extent practical. Buffer areas should be in accordance with all provisions of the approved SCAT Regulations but in all cases should be at least 300 feet from any potentially nuisance process unit or activity to the property line for new treatment plants. The planning and design of facilities should also account for the inevitable encroachment of new residential, commercial, and industrial neighbors on any nearby developable land.

D. Scrubber Equipment

1. The odor control system shall be designed to remove 99% H_2S and 90% odor/DT.

2. Typical odor control designs include the following:

   a. Chemical scrubbers

   b. Biological scrubbers

   c. Carbon scrubbers

   d. Or a combination thereof

3. Provide for one or more individual scrubber trains connected and isolated in parallel to accommodate the required size as appropriate.

4. Provide for one additional fully equipped standby scrubber train including induced draft fan connected and isolated in parallel with the other scrubber train(s).

5. Provide for each scrubber train a discharge stack designed to discharge at sufficient height to disperse the emissions and eliminate offsite odors. Consider adding a directional stack piece on the stack discharge to direct air flow and air flow noise away from populated areas.

E. Coatings – Provide for coating protection for covered process areas to prevent corrosion due to H_2S attack per the following, and refer to Master Specification Section 09900 – Protective Coatings.

1. Provide coatings on all exposed interior surfaces of covered process areas and extend coatings to one foot below the low water surface or to an appropriate termination point.

2. Consider life cycle cost in the selection of coatings.

3. For areas which cannot be isolated and accessed for coatings maintenance using existing plant valving (i.e. splitter boxes, flow distribution chambers/channels, etc.) consider the cost of over pumping in determining life cycle costs. Stronger consideration will be given to anticipated life of the coatings in these areas.

F. Duct Work

1. All ducts shall be manufactured of fiberglass reinforced plastic (FRP). All FRP shall have UV protection. Ductwork in most cases should be elevated above ground. Consider access and maintenance of adjacent equipment when locating ductwork.

2. Odorous air is almost always very humid. Provide a drain system at low points in ductwork. Extend drain piping to existing drains or tanks. Drains must have a P-trap sufficient to overcome system vacuum.

G. Room Ventilation (As related to Odor Control)

1. See Air Flow at the beginning of this Section for air flow requirements.

2. Review with plant staff the use of timers, manual overrides and switches for the proposed ventilation system in each area.

3. Provide the maximum distance possible in each building space between intake and exhaust locations to limit short-circuiting of air flow.

4. Utilize non-corrosive hardware for all exhaust fans and vent assemblies.

5. Design screened louvers to be accessible for maintenance and to limit rainwater from entering the building space.

XVIII. Pipe Insulation and Heat Tracing

A. Provide a fiberglass, PVC jacketed insulation system.

B. Provide indicator (on/off) lights on all heat tracing systems.

C. Provide for piping insulation jacket to be color coded and/or stenciled in accordance with HRSD's Piping Identification and Color Code in Master Specification "09900 - Protective Coatings" in Section 41.

D. Provide junction boxes/plugs on heat tracing systems to allow for removal of fittings, valves, etc.

E. For new construction, provide power source with appropriate equipment. For retrofits and improvements, indicate a location for the power feed to the proposed heat tracing system and verify that the existing power panel is suited for this application.

F. Refer to Section 33 - Electrical and Instrumentation for further information regarding electrical equipment and requirements.

XIX. Primary and Secondary Clarifiers

A. Provide circular clarifiers with center feed, peripheral weir layout.

B. The following system components should also be included in new or modified secondary clarifiers:

1. Provide design which assures a watertight gearbox.

2. Provide a biosolids withdrawal system that is compatible with flow proportion RAS flow and does not require manual adjustment when flow volume or concentration changes. A suction plenum or Tow-Bro type biosolids collection system is preferred. Organ pipe drawoff systems are not acceptable.

3. All components shall be stainless steel.

4. Provide a modular drive system that can be repaired or replaced without dismantling the clarifier structure.

5. Provide fiberglass clarifier weir covers designed to allow cleaning of weir and launder channels, or provide weir covers to deter algae growth.

6. Provide a gravity drain system if possible. Consider a method to fully drain clarifier to allow for inspection and cleaning. Refer to Section X - Drain Systems for additional information.

7. Provide adequate NPW system to meet cleaning and tank filling needs.

8. Provide positive control of RAS flow from each individual clarifier.

9. Provide full diameter scum well and pump. Provide cleanouts.

XX. Process Air Piping

A. Process air piping shall be either stainless steel or welded carbon steel. Process air piping shall be placed in the following locations:

1. Above grade

2. Direct bury with a proper coating and/or cathodic protection system. Avoid buried pipe whenever possible.

B. Thermal expansion and contraction must be carefully considered with this piping system. Methods for support and/or restraint must be coordinated with the possibility of thermal expansion and contraction.

XXI. Process Flow Splitting

A. Perform a hydraulic analysis to verify that adequate flow splitting occurs for the following conditions:

1. Daily Average Flows – existing and at the rated plant capacity.

2. Diurnal Flows – average daily minimum and maximum at existing flow conditions.

3. Unit out of Service – when multiple units are included in the design, consider the impacts of the largest unit out of service.

Provide for flow balancing between multiple units using low velocity channels where feasible. If channels are not possible, provide valves designed for throttling and/or adjustable gates/weirs.

Buried valves designed for throttling shall be located in a vault and sized to allow for access and future removal of the equipment.

Review with HRSD the anticipated frequency of flow balancing and the value/cost of providing remote monitoring and control.

XXII. Scum Handling, Piping and Pumping

A. The type of scum received depends upon the grease loads of the collection system, type of screen equipment, and grease from septage receiving. Scum is any combination of water, grease, plastics, rags, floatables, and foam (from the biological process). Some general design guidelines and considerations are listed below to limit scum handling problems:

1. Design preliminary treatment to remove plastics, rags, etc that cause scum conveyance issues. Screening equipment such as band

screens and step screens are appropriate.

2. Eliminate scum pits. The use of pits results in a batch process that tends to plug pipes, pumps and appurtenances.

3. Automate the handling process to allow for a direct feed system to the scum concentrator and/or incinerator.

4. Consider the reduction or elimination of scum gravity collection systems.

5. Locate the scum concentrator to minimize piping and materials handling.

6. If the WWTP uses bar screens, expect plastics and rags at every collection source; provide grinders at each source.

B. Scum piping is to be 4 inch minimum between the collection source and a concentrator. Provide clean outs at all bends and Y's. Yard cleanouts are to be Y connections at a maximum every 50 feet.

C. Scum grinding is to be as close to the source as possible followed by scum pumping. Scum grinder must be replete with full bypassing capability to accommodate the grinder removal for maintenance.

D. Scum pumping shall be provided using screw, centrifugal or progressive cavity type units. Non-clogging pumps are not substitutes for grinders.

E. When using a well or decanting tank, consider the use of a continuously mixed system and/or heated system to limit the likelihood of the scum from separating or plugging handling equipment.

F. Provide an NPW flush system at the source of the scum collection.

G. Scum concentrators are to have a minimum retention time of 20 minutes. Scum concentrator hoppers are to be heated.

H. Scum piping after concentration is to be heat traced. Hot water, steam and NPW flushing connections are to be provided at the point of origination and destination. All downstream piping is to use sweeps with Y cleanout connections at a maximum every 50 feet.

I. Scum in the form of foam collected from the biological process is to have provisions for hypochlorite addition and NPW sprays to collapse the foam and allow conveyance.

J. Disposal: Scum may be processed to a landfill after adding an appropriate amendment for the paint filter test (sand, rags, grit, etc.), or it may be

incinerated as long as operational impacts are observed as well as adherence to 503 and MACT 129 regulations.

XXIII. Grit, Septage and Grease, and Biosolids – Grit, septage and grease, and foreign biosolids require special consideration and facilities to handle these materials effectively, minimize required labor for operations and maintenance, and prevent nuisance conditions. Inadequate facilities for handling these materials can have a significant adverse impact on overall treatment plant operations and costs.

A. Grit:

1. Grit handling facilities should be sized based on the characteristics and quantity of grit at the individual treatment plant. Examine the impact of grit on the existing WWTP.

2. Consider raw influent and plant influent grit characterization sampling to determine grit loading on the plant during dry and wet weather events.

3. Review collection system infiltration as well as velocities during dry and wet weather to determine grit slug loads. Use 1 ft/sec rule for deposition of grit and 3 – 5 ft/sec rule for re-suspension of grit. Review diurnal flow patterns for the number of grit removal units during wet weather events. Grit removal units such as detritors, head cells, and vortex are to be considered at a minimum. Consider two times the recommended number of vortex units for peak wet weather events. Grit channels are not to be considered.

4. Individual components including separators, cyclones, classifiers, pumps and piping should be sized for peak grit loadings occurring during storm flow conditions which may be significantly higher than the corresponding peak flows. Consider vertical cyclones over angled installations to minimize recycle loads on the plant.

5. Provide plug style valves fitted with grit seals. No epoxy-coated plug valves. Provide for easy flushing with NPW at all elbows and tees.

6. Grit handling facilities and grit containers should be located inside enclosed buildings with odor control. Grit containers should be designed for leveling and/or easy moving without significant operator attention. Provide plastic curtains around the dumpsters to minimize the impact of splatter. Provide 6-inch diameter at rollup doors to protect the door frames during grit container removal. Provide bollards or similar for stops upon placement of grit containers. Provide floor drains under grit containers with clean outs.

B. Septage and grease handling facilities should be designed to remove/process these materials and minimize adverse impact on sewage

treatment operations in an unattended mode. The addition of septage or FOG receiving may be based on beneficial use of these products , or by lack of other receiving options within a reasonable transport distance. Facilities shall be designed to unload a 6,000-gallon septage or grease truck within 15-to-20-minute period. Storage/equalization capacity for the facility shall be provided and based on historical data for peak week average of the total daily discharge volume. Preliminary screening, such as rock traps, grinders, package type screening systems, etc. shall be provided to prevent debris from impacting transport and pumping of discharge through pipes and pumps. Facilities shall be capable of passing grit and grease. Septage and grease handling facilities and grease and grit containers should be located inside enclosed buildings with odor control. Grease-only facilities should be designed to collect, transport, concentrate, load grease containers or otherwise dispose of the grease. Receiving stations shall be integrated with Scale Automation and DCS systems for monitoring and control.

A washdown area with containment should be provided for each discharge location. Each discharge station shall include a trench drain with a sump located below the discharge station connection.

C. Dewatered solids handling facilities shall include both receiving and loading facilities based on plants specific or HRSD solids management strategy. Dewatered solids handling facilities should be sized based on the volume/characteristics of biosolids to be handled at the individual treatment plant. The time period required to load or unload a truck or empty a receiving hopper shall be balanced to support both operational and process requirements at the loading and receiving facilities. Dewatered solids receiving facilities at incinerator plants should be designed to accept and hold multiple full truck loads and feed the incinerator in a batch process with or without blending with the treatment plant's own biosolids. Dewatered solids receiving facilities should be designed to accept various truck designs on a case-by-case basis.

XXIV. Site Lighting

A. Review the footprint of each light to ensure that the proper areas are being lit and that no off-site nuisance light will result. For all new lighting, consider use of high efficient LEDs.

B. Provide task lighting (low level) in-lieu of high mast lighting in areas where nighttime operation and maintenance efforts are required.

C. Use quick-strike capabilities when high-intensity discharge lights are used to allow for immediate access to the area being illuminated. Consider LED systems.

D. Design high-mast lights to meet minimum lighting level requirements. High-mast lights to operate on photocells. Provide on/off switches for additional lighting on and around individual process tanks.

E. Refer to Section 33 – Electrical and Instrumentation for further information regarding site lighting equipment and requirements.

XXV. Slide and Sluice Gates

A. Gates, frames, and stems to be fabricated of 316 stainless steel. Other materials may be considered on a case-by-case basis if there are concerns related to compatibility with process flow and up/downstream chemical discharge, or in cases where longevity is not a concern.

B. Gates to be provided with double-seated configuration or single seat if flow is limited to one direction.

C. Provide electric operators on gates.

D. Provide redundant gates, stop log channel or other method to isolate gate for maintenance or replacement.

E. Provide for means of access and maintenance platforms at gate actuators, if the working elevation is greater than 5 feet.

F. Gate should be installed so that they can be removed vertically without impedance of overhead structures.

G. Consider gate width and whether dual stem or single stem should be specified to prevent gate racking

XXVI. Solids Handling Piping

A. Piping should be ductile iron with internal lining systems capable of withstanding both erosive and corrosive environments and reducing headloss.

B. Provide an NPW flush system.

C. Pumps for centrifuge or thickener feed to be progressive cavity, lobe, or centrifugal with variable frequency drives. Consider the use of grinders, solids screens, or integral pump grinding as part of the pumping system design.

D. Pumps for return and waste biosolids to be centrifugal with variable frequency drives.

E. Return activated solids (RAS) systems should be designed so that multiple pumps can be used to withdraw biosolids from different clarifiers. Operating flexibility and sufficient monitoring/control is critical. The system should be designed to allow for the balancing of solids within each clarifier. An accurate and reliable metering system is critical to the proper operation of this process. Consider flow and mass metering.

XXVII. Travel Path (Walkway) Alignment

A. Provide walkways in heavily traveled locations (i.e. adjacent to Administration Buildings).

B. Locate walkways for ease of access of plant staff to daily sampling points. Provide ramps for bicycle and cart access.

C. Provide drainage pipes under walkways in lieu of lowering sidewalk elevations at drainage swales.

D. Provide elevated walkways to connect above-grade unit process tanks.

XXVIII. Yard Piping

A. Each piping system should be carefully evaluated for above ground use, buried use and the product being conveyed. Select pipe material taking into consideration the soil conditions and corrosivity. Provide pipe protection as appropriate. The following materials of construction and design features should be considered:

1. Ductile iron – Consider internal and external corrosion. Refer to Section 24 - Pipeline and Appurtenances for further information.

2. Reinforced concrete pipe (RCP) and reinforced concrete cylinder pipe (RCCP) - Provide plastic liner on piping upstream of aeration basins (T-lock by Ameron, LinaBond or approved equal).

3. Welded steel (WSP)– Consider internal and external corrosion. Refer to Section 24 – Pipeline and Appurtenances for further information.

4. High Density Polyethylene (HDPE)

5. Fiber Reinforced Plastic (FRP)

B. At locations of high flow, consider the use of concrete channels in lieu of yard piping. Provide internal coating or liner systems as required.

C. Consider the ability to access, inspect and maintain yard piping after construction is complete. Consider the use of access manways, isolation gates and valves to enter these pipelines.

XXIX. Functional Descriptions

A. HRSD's goal is to standardize the processes at the various plants as much as possible. The FIRM shall use the HRSD Standard Functional Description as a foundation for developing the P&IDs and functional descriptions for all projects. If a functional description is developed for a new process the FIRM shall follow the format of the HRSD functional descriptions.

The current functional description for the unit process being upgraded should be requested by the FIRM. The HRSD Project Manager will coordinate with the plant staff to confirm the functional to be used. The draft functional description shall be provided to HRSD for review in track changes.

XXX. Operational Technical Information System (OTIS)

A. HRSD has developed a web-based Operational Technical Information System (OTIS) that serves as a repository for plant information and is the basis for the Operational and Maintenance Manual that is submitted to the State. HRSD's goal is to standardize the OTIS structure and layout for each treatment plant as much as possible. The FIRM shall provide HRSD with requested information to populate OTIS. The FIRM shall populate template provided by HRSD for review and acceptance. OTIS is accessed through HRSD's SharePoint site.

XXXI. Equipment Startup, Training, and Turnover

A. Refer to Master Specification "01650 – Facility and System Startup" in Section 41.

XXXII. Flow Metering

A. Provide flow metering for the final effluent regulatory flow. Locate meter to read a true final effluent flowrate. There shall be no recycles to subtract.

B. Provide a Parshall flume and manual verification scale to confirm instrumentation calibration.

C. Verify downstream hydraulics do not impact meter reading at a 10-year peak hourly flow.

End of Section

Section 33 - Electrical and Instrumentation

I. Introduction – The HRSD Operations Division has an Electrical and Instrumentation Department that provides electrical and instrumentation support for all of HRSD. The Engineering Division is responsible for coordinating the electrical review of plans and specifications and coordinating with the Operations Department on design and start-up issues. Based upon HRSD's history with various products and manufacturers, we have developed requirements and needs for certain specific products. Manufacturers of equipment and products are listed in the tables that follow.

II. General – Unless otherwise agreed upon, the FIRM shall design facilities and specify equipment around the names listed in this Section. In all cases, NEMA is preferred over IEC-rated components. IEC and NEMA/IEC components are not acceptable. Place all electric/electronic equipment indoors whenever possible. The following sections provide independent tables of products and manufacturers for pump stations, interceptor system controls, and treatment plants to accommodate the different requirements of the various operating departments within HRSD.

   A. All equipment that is not NEMA rated must be approved by the Engineer or Owner.

III. Pump Station and Interceptor Systems – Refer to the following Table "Pump Station."

IV. Treatment Plant – Refer to the following Table "Treatment Plant." Equipment Numbering Sequences shall be in accordance with the Treatment Plant Section of this document.

V. HRSD's Electrical & Instrumentation Department developed a **Quick Manufacturers Reference Guide.** The quick reference guide was created for engineering design consultants/contractors to utilize as a tool so that approved manufacturers can easily be identified without having to search the entire document. These manufacturers have been vetted based upon criteria including, but not limited to, cost, application, performance, reliability, service, and support. If the manufacturer's name is not listed for a specific product, process, or application, then please contact the E&I Department for further guidance

Quick Manufacturer's Guide

Electrical and Instrumentation Requirements Index

Pump Station		
Item #	**Item Description**	**Page#**
1	Switchgear and MCC	4
2	Emergency Generators	10
3	Energy Efficient Motors	18
4	Sump Pumps	19
5	Level Sensing Systems	19
6	Variable Frequency Drives (VFDs)	21
7	Watt Hour Meter (for MCCs or individual motors)	24
8	PLCs/RTU	24
9	Exhaust Fans	25
10	Lighting	25
11	Concrete Housekeeping Pads	26
12	Conduit and Conduit Systems	27
13	Wire	29
14	Relays	30
15	Lockout/Tagout → Safety	31
16	Switches/Receptacles/Plugs	31
17	Electric Heaters	31
18	Electrical Drawings	32
19	Safety Switches (fused or unfused)	32
20	Transformers	32
21	Metering Vaults/Pits	33
22	Pressure Sustaining/Regulating Valves	33
23	Alarm Systems	34
24	Flow Meters	34
25	Antenna	35
26	Louvers/Dampers	35
27	Cathodic Protection	35
28	Junction Boxes and Misc. Enclosures	35
29	Panel Boards/Control Panels	36
30	Miscellaneous Electrical	37
31	Lightning Protection	38
32	SCADA Site Drawing	38
33	SCADA Flowchart	38
34	Dominion Energy Coordination	38
35	Analyzers/Monitors	38
36	Grounding	39
37	Building Classification	39
38	Standard Details	40
39	Air Purification	41
40	Backup Battery Systems	41
41	I&C System Subcontractors	41
42	Cable Routing/Disconnect	41

Treatment Plant		
Item #	**Item Description**	**Page#**
1	Switchgear	42
2	MCCs	51
3	Emergency Generators	55
4	Energy Efficient Motors	70
5	Sump Pumps	70
6	Level Sensing Systems	70
7	Variable Frequency Drives (VFDs)	73
8	Metering Packages for Switchgear	76
9	PLCs TP	77
10	Exhaust Fans	77
11	Lighting	78
12	Concrete Housekeeping Pads	79
13	Conduit and Conduit Systems	79
14	Wire	83
15	Relays	85
16	Lockout/Tagout → Safety	85
17	Switches/Receptacles/Plugs	85
18	Heaters	86
19	Electrical Drawings	86
20	Safety Switches (fused or unfused)	86
21	Transformers	87
22	Metering Vaults/Pits	88
23	Pressure Sustaining/Regulating Valves	89
24	Flow Meters	89
25	RTUs	90
26	Louvers/Dampers	91
27	Transfer Switches	91
28	On-Line Vibration Monitors	91
29	Panel Meters	91
30	Analyzers/Monitors	93
31	Miscellaneous Instrumentation	95
32	Miscellaneous Electrical	95
33	Heating and Cooling	97
34	Junction/Pull Boxes and Miscellaneous Enclosures	97
35	Panel Boards/Control Panels	98
36	Distributive Control System (DCS)	99
37	Lightning Protection	100
38	SWIFT	100
39	Dominion Energy Coordination	100
40	Grounding	100
41	Building Classification	101
42	Standard Details	101
43	Air Purification	102
44	Backup Battery Systems	102

Distributive Control System (DCS)

Item #	Item Description	Page#
1	Strategic Automation Configuration	103

Pump Station – Electrical & Instrumentation Requirements

I. Item No. 1

A. Switchgear and MCCs

1. Manufacturers

a. Eaton

b. Square D

c. Allen Bradley

2. Specific Criteria

a. Design to meet arc flash standard; Reduce incident energy to 12 Cal/Cm2 or lower (MCC and VFD's incident energy should be designed to meet 1.2 Cal/Cm2 if attainable); Reference HRSD Arc Flash Mitigation Document Dated July 9-10, 2013, and additional Power Study Specifications example by SKM Power Systems Analysis, Inc. *(refer to Attachment A)*

b. MCCs must be placed indoors in NEMA 12 enclosures (gasketed).

c. Switchgear must be placed indoors in NEMA 1 enclosure (gasketed).

d. MCC's providing rear access is not acceptable.

e. All horizontal / vertical bus must be accessible.

f. Everything to be face-mounted, motor controls in the MCC are to be marked, lead, 1st lag, 2nd lag selectable, (any combination) with automatic failover (This may be part of the bubbler panel).

g. Bottom entry versus Top entry routing must be evaluated for application.

h. Provide with tin-plated copper bus.

i. Provide feeder breakers with digital trip units.

j. Provide extra fasteners for door cover.

k. Provide phenolic labels with black backgrounds and white lettering.

l. Provide spare terminals for intermediate terminal blocks for controls. Provide feeder breakers with digital trip units.

m. Provide grounding for Switchgear (Ball type)

n. The size of the electrical gear is based on the ampacity of the

bus within. Typically, electrical rooms are designed to accommodate equipment layout without future considerations for growth, therefore, electrical buildings should be sized adequately to accommodate where wall space is needed for future equipment.

o. Electrical rooms should be conditioned to increase the life of sensitive electrical and electronic equipment. The thermostat should be set up to 80°F to control condensation/moisture. Also include a hydrogen sulfide (H2S) removal system if needed.

p. Wiring – internal wiring for control circuits is 16 AWG standard. In some applications, the control wiring of 14 AWG can be requested from the manufacturer, but will result in additional cost per vertical section.

q. Preferred minimum of 65 KAIC (Kilo Ampere Interrupting Current) for Switchboards, Switchgear, Panelboards, MCC's (Motor Control Centers), and ECB's (Enclosed Circuit Breakers).

r. Buss A and buss B shall be in separate compartments of MCCs and switchboards (except for the tie breaker compartment). This is to allow a physical separation between the busses so that one side can be isolated and deenergized for maintenance or modifications. This also provides a level of protection from damage should there be a fault on one busses.

B. Breakers / Solid State Breakers

1. Manufacturers

a. Eaton

b. Square D

2. Specific Criteria

a. Provide 20 amp minimum

b. Provide remote open/close operator to protect personnel from Arc Flash Incident; operator should be outside of arc flash boundary where possible (refer to Attachment M).

c. Provide ARMS "Arc Reduction Maintenance Switch" or equal, when activating downstream breakers incident energy levels will be reduced. Also, add separate pi- lot light to indicate when maintenance mode is enabled or disabled.

d. Provide LSIG digital trip unit if =/> 1000 amps and LSI if < 1000 amps

C. Provide trip units with fault indication to determine status (i.e., overloads or fault conditions) Metering Package.

1. Manufacturers

a. Schweitzer Engineering Laboratories (SEL)

b. Eaton

c. Schneider Electric (Square D)

d. GE

e. Basler

2. Specific Criteria

a. Volt Meter 3 phase & off

b. Ammeter 3 phase & off

c. kW

d. Provide 3 phase undervoltage & overcurrent protection

D. CT Cabinet

1. Manufacturers

a. Provided by Utility

2. Specific Criteria

a. Locate meter base and CT cabinet on outside of pumping station

E. Selector Switches, Push Buttons, Lighted Push Buttons (NEMA 30mm)

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Expandable contact blocks on operator IEC and NEMA/IEC rated switches are not acceptable.

b. 20mm is acceptable for specific applications if Approved by Owner/Engineer. i.e. Master Control Panel

F. Contactors

1. Manufacturers

a. Eaton

b. Square D (Contactor must be able to reclose after short power blips) - Schneider contactors size 5 or larger should not be

selected and approved during design. In addition, these contactors should not be installed in HRSD facilities.

c. Allen Bradley

2. Specific Criteria

a. Provide with expandable auxiliary contacts for 120-volt control circuits

b. IEC and NEMA/IEC rated contractors are not acceptable.

G. Fuses & Fuse Holders

1. Manufacturers

a. Bussmann

b. Shawmut

2. Specific Criteria

a. Shall be locally available

H. Transformers

1. Manufacturers

a. Square D

b. Eaton

c. ACME

2. Specific Criteria

a. Copper coils

b. Aluminum coils are unacceptable

I. Terminal Strips

1. Manufacturers

a. Phoenix Contact

b. Square D

c. Weidmuller

d. Panduit Panduct DIN Rail Wiring Duct

2. Specific Criteria

a. DIN Rail mount if possible

b. Industrial rated

c. Provide compression type screws terminals on jumpers

J. Combination Starters (buckets)

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Provide standalone combination starters in the proper enclosures (see junction/pull boxes and miscellaneous enclosures).

b. 120-volt control voltage

c. Run light – red

d. Stop light – green

e. Fault light – Amber

f. Power available light – white

g. Provide push to test indicator lights

h. Elapsed time meters (Crompton, ENB)–pump motors graduated in 1/10 hours, non- resettable

i. Externally mounted resets, operational from the front

j. Provide with adjustable thermo-magnetic breakers

k. Fused control transformer

l. MCC mounted lighting panels shall be provided with 25% spare breakers

m. Provide spare buckets (minimum 2)

n. Provide connections for motor leads directly from the motors to the starters. Do not use intermediate terminal blocks.

o. No IEC or NEMA/IEC rating (NEMA only).

K. Panel Meters

1. Analog

a. Manufacturers
(1) GE/Yokogawa
(2) Simpson

2. Digital

a. Manufacturers
(1) Yokogawa
(2) Red Lion
(3) Simpson

3. Elapsed Time

   a. Manufacturers
      (1) Crompton
      (2) ENB
      (3) Yokogawa

   b. Specific Criteria
      (1) Non resettable / resettable (plant site specific)

4. Pulse Counters

   a. Manufacturers
      (1) Acromag
      (2) Omron

5. Isolators

   a. Manufacturers
      (1) Acromag
      (2) AGMPhoenix

   b. Specific Criteria
      (1) Isolate 4-20 MA and 1-5 volt signals
      (2) Powered 4-20 MA isolator splitter
      (3) Terminal relay
      (4) Compact panel temp sensor 4-20 MA

6. Signal Converters

   a. Manufacturers
      (1) AGM
      (2) RIS
      (3) Acromag

   b. Specific Criteria
      (1) Isolate 4-20 MA and digital

7. Surge Protectors

   a. Manufacturers
      (1) Phoenix
      (2) MTL-Crouse Hinds

   b. Specific Criteria
      (1) Provide 120v AC power supply surge protectors

L. Rubber Mats (in front of gear)

1. Manufacturers

   a. Grainger

   b. Chesapeake Bay Rubber

2. Specific Criteria

a. Contractor will provide and install at substantial completion (OSHA approved electric safety rubber matting: Type II ASTM D178)

M. Pilot Lights

1. Manufacturers

a. Square D

b. Eaton

2. Specific Criteria

a. Provide LED type pilot lights

b. Provide push to test lamp

c. LED color and light cover color will be specified by HRSD

d. No IEC or NEMA/IEC Rating (NEMA Only)

e. 30mm preferred

N. Voltage Test Points

1. Manufacturer

a. Safeside- Grace Engineered Products (Load side of Main Breaker) (600 Volt or less equipment)

b. Panduit VeriSafe

II. Item No. 2

A. Emergency Generators

1. Manufacturers

a. Caterpillar

b. Cummins Onan

c. Kohler

2. Specific Criteria

a. Diesel generators

b. Propane or natural gas-powered engine generators are site specific

c. Engines to be of domestic manufacture whenever possible

d. Standby rated

e. 4-stroke

f. Parts must be available in 48 hours or less

g. Must meet current U.S. EPA and Virginia DEQ air standards

h. Low emission units

i. 48 hours of runtime/Fuel at full load

j. Remote Emergency stop pushbuttons at doorways (Pilla Model GS120 w/clear, hinged plastic cover)

B. Generator

1. Manufacturers

a. Stamford Newage

b. Caterpillar

c. KATO

d. LIMA

e. Marathon

f. Cummins

2. Specific Criteria

a. Provide permanent magnet exciters

b. The rectifier shall be a brushless, full-wave bridge

c. All stator winding leads are to be brought out to the terminal box

d. Neutrals shall be sized to full rating

e. Temperature rise shall not exceed Class B rating with 105□□C ambient rise

f. Alternator shall have a space heater that switches off when running

g. Provide for 2/3 winding pitch; 5/6 pitch is not acceptable

h. Minimum Class H insulation (epoxy) with tropicalization (anti-fungus) temperature requirements as specified by NEMA

i. Provide voltage regulation less than +/- 1%

j. Provide 150% minimum overspeed capability

k. Provide amortisseur winding

l. Provide less than 5% THD (Total Harmonic Distortion)

m. Provide less than 50 TIF (Telephone influence factor)

n. Provide Square D/Eaton main breaker of domestic manufacture

o. Provide elapsed time meter graduated in 1/10 hours (analog or digital), non-resettable

p. Voltage regulators shall be 3-phase.

q. Provide 12 leads to switch voltages

r. Provide flap at the end of exhaust to keep rain, birds, etc. out.

s. The type of bird screen is site specific.

t. Sound attenuation is site specific

u. Provide separate room for indoor generator to reduce heat and noise.

C. Diesel Engine

1. Manufacturers

a. Caterpillar

b. Cummins

c. John Deere

2. Specific Criteria

a. Heavy-duty, direct-injected, 4-stroke diesel engine.

b. Provide electronically controlled engines with an electronic control system to meet

(1) current EPA emissions regulations

c. State the control system

d. Provide isochronous frequency regulation (no load to full load)

e. Provide +/- .25% steady state frequency regulation (minimum)

f. Size air, fuel, and oil filters to provide a minimum of 250 hours of operation before servicing

g. Engine manufacturers shall provide fuel separators

h. The heavy-duty air filter is to be a dry type with a restriction indicator

i. Provide a Racor heavy duty crankcase vapor coalescer

j. Provide a battery charging alternator 12V/65 amp, 24v/35amp minimum – negative ground)

k. Skid-mounted radiator sized to prevent overheating in the most severe conditions (122°F ambient)

l. Exhaust system and muffler shall be residential grade muffler (lowest DB reductions available). All insulation must be blanket type (non-asbestos), removable for servicing of exhaust system

m. Provide 12/24-volt DC starting system

n. Provide all diagnostic equipment for complete trouble shooting and training; operational training must be included (software/technical manuals/hardware etc.)

o. Provide speed sensing to protect against accidental starter engagement into a moving flywheel. (Battery charging alternator voltage output will not be accepted for this purpose)

p. Provide an adjustable (0-15 minutes) cool down time

q. Provide a large red emergency stop push button

r. Generator Alarms and shutdowns

(1) Low oil pressure

(2) Not in auto

(3) High coolant temperature

(4) Overspeed

(5) Low fuel (Pre shutdown)

(6) Generator running and over-crank shall shut down the engine and provide indicator lights.

(7) All generator alarms/shutdowns provide indicator lights

(8) Separate alarms and shutdowns based on HRSD recommendation and not tie everything to common alarm

s. Provide analog or digital displays for coolant temperature, oil pressure, service hours, engine RPM, system DC volts and system diagnostic code

t. Provide Kim Hot-Start engine block heater (thermostatically controlled); isolation valves must be included.

u. Provide vibration isolators between generator set base and floor

v. Provide lifting eyes bolt

w. Provide break mean effective pressure (BMEP) calculations

x. Provide SCADA interface/data monitoring for HRSD generators

D. Battery Chargers

1. Manufacturers

a. LaMarche

b. Cummins

c. SENS

2. Specific Criteria

a. 12/24-volt chargers or equal

b. Automatic, solid state, provide continuous taper charging

c. UL listed, provide with under/over voltage, current failure, and loss of power acknowledgment

d. Evaluate full float charge versus trickle charge

E. Starting Batteries

1. Manufacturers

a. Exide

2. Specific Criteria

a. Use 8D series lead acid batteries (4D is not acceptable)

b. Provide 2 minimum

c. Each battery shall provide 1200 CCA each

d. Provide with insulated battery rack

e. Provide with 2-year full replacement guarantee

f. Provide as a minimum 2 cranking cycles at a minimum of 30 seconds each

g. Consult engine manufacturer for sizing

F. Sub-base Fuel Tanks

a. Provided by Generator Manufacturer

b. Must meet all UL-142 requirements for double-walled fuel tanks (Site Specific).

c. Must provide generator 48 hours of runtime at 100% load.

d. Must include high level, low level, and leak detection alarms.

e. UL 142 Compliant

f. Must include lockable fill with spill bucket.

g. Mechanical Fuel Gauge.

h. Must include Tank Dip Chart measured in ¼" increments.

i. Capacity is site specific. It must allow generators to run 48 hrs. at 100% load.

j. Subbase tanks are to be provided by the generator manufacturer.

k. Above ground tanks acceptable Manufacturer: Highland Tank and Manufacturing.

l. Must be installed according to manufacturer's requirements.

G. Day Tanks

1. Manufacturers

a. Pryco

b. Tramont

2. Specific Criteria

a. UL Listed – double wall

b. Provide with Oberndorfer bronze gear type pump. All pumps must be mounted on Day Tank.

c. Pumps with rubber or nitrile impellers will not be accepted

d. Provide with a low-level alarm and light

e. Size for 2-hour minimum running time

f. Provide a fuel level indicator on the day tank

g. Provide a 2-pump system. Each pump shall be capable of pumping 100% fuel oil throughout the entire system.

h. Provide "Not in Auto" lamp or other warning device

i. Use momentary switch for tank fill/test

H. Transfer Switches

1. Manufacturers

a. Eaton

b. ASCO

2. Specific Criteria

a. Provide with a metering package

b. Provide with an exercise cycle of 4 hours, field adjustable from 10 minutes to 4 hours

c. Provide with a utility power available light normal/emergency, phase indicator lights

d. Zenith transfer switches are not acceptable.

e. VFD compatible

f. Time delay normal to emergency

g. Time delay engine start

h. Time delay emergency to normal

i. Time delay engine cool down

j. Three phase over voltage (Source 1 & 2)

k. Phase reversal (normal)

l. Three phase under frequency (Source 2)

m. 4 NO / NC form C contacts for (Source 1 & 2)

n. Manual Push to test button which automatically returns to utility & adjustable run timer (0- 600 minutes) (Note: This is not an exercise function)

o. Time delay neutral position

p. Three phase UV protection (Source 1 & 2)

q. Normal position light

r. Emergency position light

s. Normal source available light

t. Emergency source available light

I. Underground Storage Tanks (UST) Leak Detection

1. Manufacturers

a. Veeder Root TLS450 PLUS

b. Xerxes

2. Specific Criteria

a. Provide with leak detection system

b. Provide in accordance with EPA and all applicable state and local standards

c. Provide tank monitoring system

d. Provide a graduated stick for level measuring

e. Provide for refueling and stick access

f. Provide with electronic tank level indicating system

g. Provide with 48-hour fuel tank capacity

h. Provide AMI Model 8CH-DAC 8 channel digital/analog converter (4-20ma)

J. Louvers and Dampers

1. Manufacturers

a. Greenheck

b. Ruskin

2. Specific Criteria

a. Provide gravity damper

b. Provide anodized aluminum louvers and dampers with nylon bushings or ball bearings

c. Provide with bird screens readily removable without removing louvers or dampers

d. Designed to limit rainwater in the building

e. All hardware & components must be the same material and non-corrosive.

f. Where louvers and dampers are required provide (inside) recessed damper and (outside)

g. flange mounted louvers

K. Meter or monitoring package

1. Specific Criteria

a. Provide standard metering package

b. Frequency

c. Provide a voltage adjust rheostat

d. Provide 3 phase undervoltage and over-current protection

e. Provide automatic and manual start and stop

L. Start Up and Testing - Diesel Generator Tests

1. Specific Criteria

a. Provide factory test data

b. Contractors shall verify and provide fuel prior to start up and testing

c. Simulate and test all safety equipment. Using a reactive load bank > 500kW or a resistive load bank <500kW (0.8pF) run the generator:

1. 15 minutes at idle speed

2. 30 minutes at 25% load

3. 30 minutes at 50% load

4. 60 minutes at 75% load

5. 120 minutes at 100% load

6. 15 minutes at 25% load

7. 15 minutes at 0% load

8. off-Record stator, bearing, oil, ambient, and water temperatures every 15 minutes

d. Provide load bank receptacle boxes (site specific – Refer to Attachment B)

e. Design in such that the station load is not included during load bank test.

f. Take power factor (pF) into consideration for resistive load bank test to ensure generator is not overloaded.

g. Demonstrate all warnings and shutdown alarms (simulation with laptop).

h. Record speed, voltage and amperage at 15-minute intervals as well as just prior to and after the load change

i. Hook up the generator and cycle through the light loading cycles as well as heavy loading cycles (3 each). Record same parameters every 15 minutes and before and after changing load. Tests to be witnessed by HRSD Automotive Superintendent and HRSD Electrical Engineer/Superintendent or designee

j. Create and attach to the switchgear detailed instructions. The instructions shall be laminated. The instructions shall be simple enough for anyone to pick them up and operate the diesel generator set.

k. Group A, B, and C phase cable together to cancel out EMF (Electromagnetic Field)

M. Load Bank Test Box (in Attachment B “Leviton”)

1. Fabricated Load Bank Test Box

2. Alternative Load Bank Test Box

3. Manufacturers

a. ESL Power Systems

III. <u>Item No. 3</u>

A. Energy Efficient Motors

1. Specific Criteria

a. HRSD Electric Motor Specifications in Attachment E “HRSD Electric Motor Specifications”.

b. Emergency stop push buttons

IV. Item No. 4

A. Sump Pumps

1. Manufacturers

a. Zoeller Co.

2. Specific Criteria

a. 120-volt

b. Plug into receptacle

c. Float controlled

V. Item No. 5 - Level Sensing Systems

A. Bubbler Type, Ultrasonic (Rosemount), and Submersible

1. Specific Criteria

a. Complete purged air bubbler system for sensing wetwell liquid level which generates and transmits level signals to a separate PLC which controls pump operations

b. Provide UPS for power failure

c. Power light – white

d. Provide with low pressure switch with normally closed dry contacts downstream of the regulator

e. Provide externally mounted duplex air compressors mounted on 30-gallon horizontal receiving tank (Model 3HBB-10-M300 AX) with lead/lag rotation control

f. Provide oil-less compressors with 120-volt 60 cycle, single phase motors with integral thermal overload protection

g. Provide manual purging of bubbler piping

h. Provide manual alternation of air compressors

i. Mount air compressors outside of the panel whenever possible

j. Provide high level alarm in wetwells. Provide with micro (non-mercury) switch backup (float ball)

k. Provide high wet well light and pressure switch

l. Provide overflow light and pressure switch

m. Provide high wet well and overflow push to test lights

n. All alarm contacts are closed in a normal operating state (Closed loop system)

o. Provide high level Floatball for alarms

B. Ultrasonic (site specific)

1. Manufacturers

a. Siemens

2. Specific Criteria

a. Microprocessor

b. FM approved (frequency modulation)

C. Level Transducer (site specific)

1. Refer to HRSD Standard Details 707A and 707B for Stilling Well Detail

2. Manufacturers

a. Waterpilot FMX-21 (refer to Attachment P)

D. Pressure Sensing Systems

1. Manufacturers

a. Foxboro

b. Rosemont

c. Siemens

2. Specific Criteria

a. Provide either an Ashcroft or Red Valve (series 40) brand pressure seal with Viton boot

b. Provide 0-100psi gauge (Ashcroft)

c. Provide a Foxboro IDPT 10 absolute pressure electronic transmitter

d. See Standard Detail “Pressure Reducing Station Pressure Sensor Detail”

e. Suction and discharge transmitters to be mounted in dry well area

E. Float Balls

1. Manufacturers

a. Flygt

b. Opti Float (Intrinsically Safe – Fiber Optic)

c. CSI Controls

2. Specific Criteria

a. Locate near sump pump in dry well and wet well

b. Alarm on high level

c. Support float ball cable to bottom of well; must be rigid and removable from top

VI. Item No. 6 – Variable Frequency Drives (VFDs)

A. Variable Frequency Drives (VFDs)

1. Manufacturers

a. YASKAWA

b. Allen Bradley

2. Specific Criteria

a. Provide thermal/mag breakers for the drive input power

b. Install equipment with the idea of keeping it clean and the temperature regulated

c. Provide thumbscrews for removable/washable filters or thumb screws replaced by snap in grills that are removable from the front of the cabinet (reusable)

d. Provide a programmable ramp time

e. Provide input reactors (MTE Corp) or TCI

f. Pulse Width Modulated (PWM)

g. IGBTs

h. Automatic restart on power disruption

i. Tune out a minimum of 3 frequencies

j. Hand/Off/Automatic (HOA) selector switch

k. Manual speed pot door mounted (in addition to keypad control)

l. Mount the resets and appropriate indicator lighting on the front of the drive or outside of the box to prevent employees from opening the panel

m. Tune drive to motor with a harmonics meter

n. Provide an input circuit breaker for short circuit protection (Fuses are not acceptable)

o. The controller electronics shall contain indicators of the following

conditions:

(1) Undervoltage

(2) Overvoltage

(3) Over temperature

(4) Memory failure

(5) Emergency Stop

(6) Ground fault

(7) Instantaneous overcurrent

p. Provide auxiliary run contacts wired to run command for ventilation fan

q. Provide a NEMA 12 flanged disconnect free standing enclosure

r. Mount the resets and the appropriate indicator lighting on the front of the drive or the outside of the box

s. Provide four contact outputs for run status, power failure, VFD failure, not in auto status

t. The following are site specific options:

u. VFD must be able to be isolated and bypassed (auto/manual operation) allowing the motor to operate across the line at full load speed and current

v. Provide manual isolation and bypass capability

w. Provide three contactors for bypass operation

x. 6 Pulse Drive

y. Bypass contactors are site specific; consult with Interceptor Systems & Electrical Shop

3. Additional Design Considerations

a. All electrical components must be NEMA only. IEC or NEMS/IEC is not acceptable.

b. Filters to HVAC units must be maintained and free from dust during construction phase.

c. VFD parameters must be included on as built prints (i.e., momentary power loss ride thru, energy savings, and fault reset)

d. Specify coil locks (Power Quality Solutions) on control relays for power dip ride thru capabilities.

e. Provide Bypass mode for critical VFD's. Soft start or across the line depending on application.

f. Specify main circuit breaker cable operators for breaker operation instead of standard door operating mechanisms.

g. Provide One reset button to reset VFD and control circuit faults.

h. Provide finger safe barriers for main sideline breaker lugs.

i. Provide enough fans to replace each fan within a VFD (spare parts) where several VFD's of the same size and model are specified.

j. Provide paper copies of VFD manuals.

k. To support large and heavy VFD's 60 HP and above, provide a pedestal with a flat plate mounted inside the enclosure for VFD to rest for easy removal. Also provide a lift table to remove VFD.

l. Provide external air filter for easy access on cabinets.

m. Contractor to perform static tuning for optimal performance during startup. Contractor to supply panel shop with motor data sheets including the number of poles per motor. Also, include number of motor poles on motor nameplate.

n. Provide extended warranty by VFD manufacturer where replacement cost is justified.

o. Need all switches to indicate when not in auto

p. Need indication when control power is loss in addition to VFD fault.

q. Evaluate best routing method for bottom versus top entry of wire.

r. VFD shall be sized to provide current necessary for motor to produce continuous rated horsepower and service factor horsepower at highest carrier frequency.

s. Provide VFD Cable with copper shielding, XLPE insulation manufacture by Belden or equal.

(1) Consider these factors when designing motor HP, motor voltage and motor full load current, ambient temperature, VFD cable and connector ratings, and number of cables in raceway.

t. A Harmonic Study Analysis should be performed for all VFD applications by using IEE 519 guidelines. The design engineer should evaluate the best solution to reduce

(1) Harmonic Distortion (ie. passive and active filters or active front end included as part of the VFD).

(2) Refer to Attachment C “Variable Frequency Drive” Specs

u. Provide auxiliary (AUX) to remove run command of VFD before opening contact. Refer to Disconnect – Aux Contact

v. The VFD shall have MODBUS TCP/IP communication capability

w. 3.w The following signals shall be hardwired between the VFD and the PLC:

(1) RUN Status

(2) START/RUN Command

(3) Speed Reference

(4) Speed Feedback

(5) AUTO Status

(6) General Fault/Alarm

x. VFD programmable parameters shall be provided for review and approval prior to energized field testing. Final VFD programmable parameters following substantial completion shall also be provided.

B. Eddy Current Brake Systems/DC Drives – UNACCEPTABLE

VII. Item No. 7

A. Watt Hour Meter (for MCCs or individual motors) – Meter base and meter

1. Specific Criteria

a. Provided by utility. Locate outside of pump station.

VIII. Item No. 8

A. PLC/RTU

1. Manufacturers

a. Emerson / Control Wave /OCC100

b. Allen Bradley

2. Specific Criteria

a. Provide functional descriptions, the application program, the job-specific program data and a copy of the as-built software documentation

b. Include control & alarms

c. Controls accommodate automatic purge and latch output to current state during bubbler purge

d. Program must be provided using Function Block Programming

e. Control Wave Micro

f. PLC's and RTU's shall be equipped with isolation relays for all digital inputs. Example: (Idec 5-blade – 24 VDC coils- with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay inputs. Whether a junction box is used or control panel a 24 VDC power supply with sufficient capacity to energize all of the 24 VDC relay coils

simultaneously when necessary for all PLC or RTU inputs.

g. Pump Station Control Panels shall utilize a dual 24VDC power supply and UPS configuration as shown in Standard Detail 717 – "Pump Station Control Panel Power Wiring". For stations that have a backup generator or alternate utility power, 2x 50aH batteries shall be used. For stations that do not have an alternate source of power, 2x 100aH batteries shall be used.

IX. Item No. 9

A. Exhaust Fans

1. Manufacturers

a. ILG

b. Dayton

c. Greenheck

d. Airovent

e. MK Plastics

2. Specific Criteria

a. Corrosion resistant including hardware

b. Must be explosion proof in wet wells and metering vaults

c. Direct drive

d. Belt drive not acceptable unless approved by Owner (Air detection is required if approved).

X. Item No. 10

A. Lighting

1. Manufacturers

a. Holophane

b. Hubbell

c. Thomas

d. Crouse Hinds

2. Specific Criteria

a. Provide proper levels of lighting over major equipment including switchgear, generators, pump motors, and controls. Lighting levels should conform to the IES lighting handbook as a minimum.

b. Provide exterior lighting at doorways and yard lighting required by building con- figuration.

c. Consider operation by photo electric cell.

d. Replace all light fixtures with LEDs if non-LED style fixture cannot be repaired.

(1) Refer to Attachment D - Lighting Policy

(2) HPS, LPS, and Mercury Vapor – NOT ACCEPTABLE FOR ANY APPLICATION

B. Emergency Lighting

1. Specific Criteria

a. Dual Lite GMM-EL-W2 in admin areas

b. Emerg Lite PRO-2 in corrosive areas

c. Wall-paks are provided by HRSD

(1) Note: Install dual input inverters if applicable

C. Exit Lighting

1. Specific Criteria

a. Highly visible 24 hours/day for life of material

D. LED

1. Specific Criteria

2. To reduce maintenance

3. Perform payback analysis

XI. Item No. 11

A. Concrete Housekeeping Pads

1. Specific Criteria

a. Provide a minimum of 4-inch thickness under MCCs, generators, transformers, and other general electrical equipment and around conduits at floor penetration.

b. Chamfer all edges

XII. Item No. 12

A. Conduit and Conduit Systems

1. Specific Criteria

a. Ream and chamfer all edges

b. EMT or IMC are not allowed

c. All flexible conduits shall be metallic liquidtite or equal.

d. Flexible conduit must not be installed to complete one small run between RGS.

e. Provide ¾ inch minimum size. (Where specifically approved or when the instrumentation restricts this size, ½ inch can be used)

f. Do not use plastic anchors.

g. Seal conduits with a silicone product as necessary

h. See Miscellaneous section of these standards for markings and coatings.

i. Seal conduits with OZ Gedney conduit and cable seals or with silicone where seals are not available.

j. Cable trays must be approved by Owner or Engineer.

k. Label all conduits inside of building (Engineer must provide conduit schedule)

l. Circuit # must be brought back to the panel/breaker.

m. Paint RGS conduits red if requested by owner.

B. Spare Conduit Feeder

1. Specific Criteria

a. Provide with service entrance.

b. Add appropriate spares with pull wire.

C. PVC Coated Rigid Steel (inside and out)

1. Manufacturers

a. Robroy

b. OCAL

c. Perma-Cote

d. Gafco Industries

e. Plastibond

f. KorKap

2. Specific Criteria

a. Provide in wet wells, underground (not encased), chemical areas, outside, and damp areas. Provide with PVC coated fittings, boxes and touch-up material.

b. Provide 8” of PVC coated conduit were stubbed up through concrete (washdown areas)

D. Galvanized Rigid Steel

1. Specific Criteria

a. Provide with applications other than PVC coated above.

E. PVC

1. Specific Criteria

a. Underground/encased reinforced concrete, Schedule 40 can be substituted for galvanized conduit in duct banks where EMI is not a threat.

F. Tools Used

1. Specific Criteria

a. Use suitable tools with conduit.

G. Patching/Repair

1. Specific Criteria

a. Use appropriate material to patch and repair.

H. Flex – Liquidtite & Fittings

1. Manufacturers

a. Crouse Hinds

2. Specific Criteria

a. Use fittings to suit installed conduit.

b. Shall be metallic stainless steel, aluminum or equal.

I. Fixtures & Fittings (pull boxes)

1. Specific Criteria

a. Use appropriate fittings and materials.

J. Struts and Straps

1. Specific Criteria

a. To suit conduit materials

b. Use matching fasteners.

c. In outside, wet or damp areas use stainless steel fasteners.

d. PVC coated channel or unistrut are not acceptable.

e. Stainless Steel Straps are preferred over PVC Coated Straps. For certain applications please contact owner/engineer for approval.

K. Pull Boxes (wire pulled through) and Junction Boxes (wires terminated inside)

1. Specific Criteria

a. In outside, wet or damp areas, use stainless steel fasteners.

b. Over 6-inch x 6 inch are to be hinged

c. Gasketed

d. Use stainless steel or aluminum in outside or damp areas.

L. Red Dye (Duct bank)

1. Specific Criteria

a. Provide red dye in concrete duct banks.

(1) See typical duct bank details in Attachment I

XIII. Item No. 13

A. Wire

1. Specific Criteria

a. Provide copper stranded wire only.

b. Provide separation of power, signal and telephone services

c. Use compression type lugs only.

d. Do not splice wire – Splicing not allowed unless approved by the Owner/Engineer Sectionalizing cabinets are not acceptable and must be approved by the Owner/Engineer

e. Direct buried cable is not acceptable. Cable must be protected in a conduit or duct bank system

f. Telephone

(1) Provide conduit and wiring for telephone.

g. Welding cable (DLO) – Design based on intermittent duty vs. continuous duty.

h. THHN, THWN, XHHW (for duct banks)

(1) Follow NEC color coding.

(2) All wire shall be stranded wire, rated for 600 volts.

(3) #12 minimum wire size for typical applications

i. Instrumentation

(1) All wire (MTW) or signal wire shall be rated at 600 volts.

(2) DC wire shall be color-coded blue #16 AWG minimum.

(3) AC wire shall be color-coded red #16 AWG minimum.

(4) Analog signals shall be #18-2 with a shield (minimum), tinned.

(5) Provide Ethernet cable/CAT 6 for communications to equipment.

(6) Reference 33-31 Attachment EE – Color Code Wire Char

j. Wire Marking – Wires shall be marked at all termination points using heat-resistant sleeve-type labels (Brady PermaSleeve High Temperature or equivalent). Wrap-around labels shall not be used. Labels shall be white with black lettering.

k. Tracer Wire - Do not splice wire – Splicing not allowed unless approved by Owner/Engineer
Note: Cabinets with multiple sources must be clearly marked as such

XIV. Item No. 14 - Relays

A. Industrial

1. Manufacturers

a. Allen Bradley

b. Eaton

2. Specific Criteria

a. Fixed base

B. Electronic

1. Manufacturers

    a. IDEC

    b. Potter-Brumfield

    c. Agastat

2. Specific Criteria

    a. Plug in ice cube type with pilot lights.

XV. Item No. 15 - Lockout / Tagout (Safety) Refer to Section 22 – HRSD Safety Program in this manual for specifics.

XVI. Item No. 16

A. Switches / Receptacles / Plugs

1. Manufacturers

    a. Pass & Seymour

    b. Hubbell

    c. Crouse Hinds

2. Specific Criteria

    a. Provide compression type screw terminals on receptacles. Wire binding receptacles or switches are not acceptable.

    b. Provide for dedicated circuits for sump pumps.

    c. Provide one weatherproof (WP)/watertight receptacle with lockable cover on exterior wall of the pump station on a separate circuit; separately switches and should not be hot at all times.

    d. Provide a receptacle on each wall of the PS, upper & lower levels.

    e. Lower levels shall be mounted at 48 inches above finished floor -Provide one

    f. weatherproof/watertight receptacle on exterior walls on a single circuit, separately switched (Should be “hot” all the time)

    g. Provide ground fault receptacles and breakers where required.

    h. Provide power receptacles in control cabinets.

    i. Provide “in use” covers for indoor sump applications.

XVII. Item No. 17 – Electric Unit Heaters

A. Not used, do not supply unless a condition requires it.

XVIII. Item No. 18

A. Electrical Drawings

1. Specific Criteria

a. Process and Instrumentation Diagrams (P&IDs) are to conform to ISA modified standards (Consulting engineer to provide.

b. Provide functional descriptions with the P&IDs (Consulting engineer to provide)

c. Provide Point-to-Point connection drawings. Contractor shall develop.

d. Review and approval by the engineer shall be prior to installation.

e. Label all conduits inside building.

f. Place metal tags on cables in manholes.

g. Provide final conduit & cable schedule on disk (AutoCAD, PDF or VISIO)

XIX. Item No. 19

A. Safety Switches (fused or unfused)

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Light duty safety switches are unacceptable.

b. Must be pad lockable.

XX. Item No. 20

A. Transformers (Dry)

1. Manufacturers

a. Square D

b. Eaton

c. GE

2. Specific Criteria

a. No aluminum wires.

b. Provide 220° C insulation system for 15 kVA and larger.

c. Provide 180° C insulation system for transformers less than 15 kVA.

d. Transformers shall handle a 15% overload without exceeding the insulation rating.

XXI. Item No. 21 – Metering Vaults / Pits

A. Dehumidifiers

1. Specific Criteria

a. Provide receptacle and location for HRSD installation.

B. Power Requirements

1. Specific Requirements

a. Provide two receptacles with weatherproof covers.

C. Exhaust Fans

1. See Exhaust Fans (item#9)

D. Sump Pumps

1. Provide “in use” receptacle with a remote GFCI breaker located in station power panel.

2. Provide explosion proof sump pump in Class 1 division 1 areas.

E. Lighting

XXII. Item No. 22

A. Pressure Sustaining/Regulating Valves

1. Manufacturers

a. KTM

b. Foxboro

c. Clow

2. Specific Criteria

a. No butterfly valves or pinch valves with controls

b. Provide 4-20 mA operated valves. Do not use pulsed control valves.

c. Automatic Controls of Virginia or Valve Automation for actuator applications

B. Valve Actuators

1. Manufacturers

a. EIM/Bettis

b. Limitorque (refer to Attachment P)

2. Specific Criteria

a. Auma and Rototorque are not acceptable.

XXIII. Item No. 23

A. Manufacturer

1. Pure Air or approved equal Alarm Systems

B. Specific Criteria

1. HRSD will provide and install the alarm system. Contractor shall provide sensors and wiring to a junction box and terminate on a terminal strip adjacent to the alarm panel location

2. HRSD will provide alarm points.

C. Station Bypass Alarm Systems (Refer to Attachment F)

1. Specific Criteria

a. A minimum of two (2) weeks' notice is required to set up temporary alarms for a scheduled station bypass operation.

b. HRSD will provide and install the temporary alarm system. Contractor shall provide sensors and wiring to a junction box and terminate on a terminal strip adjacent to the alarm panel location.

c. HRSD will provide alarm points.

d. Contractors to provide contact names and numbers for alarming purposes.

XXIV. Item No. 24 – Flow Meters (Size for average flows)

A. Magnetic

1. Manufacturers

a. Rosemount

b. Foxboro

2. Specific Criteria

a. Use for control or billing applications.

b. Ensure vendor is clear on application.

c. Provide with remote head, display and keyboard.

B. Ultrasonics (strap on)

1. Manufacturers

a. Fuji

b. Flexim (refer to Attachment N) (Concrete pipe application)

c. Pulsar

2. Specific Criteria

a. Do not use for control.

b. Locate inside station.

C. Venturi

1. Specific Criteria

a. Generally, not used in most applications.

XXV. Item No. 25 – Antenna

A. Mobil Mark

1. Specific Requirements – Contractor to provide ALL OTHER Antenna components not limited to the Antenna, Antenna Mast, Antenna Cable, Lighting Arrestors, Connectors, Supports, Fasteners, and appropriate Coax Cable. HRSD will provide the Cisco Router and Telog if needed (project specific)

B. Shark Fin Type

C. Omni Directional

XXVI. Item No. 26

A. Louvers/Dampers

1. Specific Criteria

a. See Emergency Diesel Generator Louvers and Dampers (Item #2)

XXVII. Item No. 27

A. Cathodic Protection (Test Stations)

1. Specific Criteria

a. Use Flush Fink Test Stations

XXVIII. Item No. 28

A. Junction Boxes and Misc. Enclosures

1. Manufacturers

a. Hoffman

b. Saginaw

c. Hammond

d. Rittal

2. Specific Criteria

a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit. Use “like” materials.

3. Inside

a. Specific Criteria

(1) Stainless steel, fiberglass reinforced plastic (FRP), NEMA 4x

4. Outside

a. Specific Criteria

(1) Stainless steel, NEMA 4x with Myers hubs

5. Wet

a. Use with PVC coated conduit and PVC coated hubs.

(1) Stainless steel, fiberglass reinforced plastic, NEMA 4x with watertight fittings (Myers)

XXIX. Item No. 29

A. Panel Boards/Control Panels

1. Manufacturers

a. Eaton

b. Square D

c. GE

2. Specific Criteria

a. Provide with tin-plated copper bus.

b. Provide 25% spares (minimum)

c. Provide bolt-in breakers.

d. Do not provide cans with pre-stamped knockouts.

e. Provide with hinged panel cover with a latching door.

f. Provide heavy duty industrial grade panel boards.

g. Breaker operator should be outside of panel.

h. Breaker should be located inside of panel.

i. HOA switches should be on the outside of panel.

j. Dead front Hinge panel cover if available.

k. Provide LED work light, if warranted

l. Provide phenolic labels with black backgrounds and white lettering.

XXX. Item No. 30 – Miscellaneous Electrical

A. Electrical Equipment Testing

1. Specific Criteria

a. Provide testing in off-peak hours or switch off an equivalent amount of load prior to testing.

B. One Line Diagram

1. Specific Criteria

a. Provide an update to the one-line diagram with significant changes in the electrical system.

C. Thermographic Inspection

1. Specific Criteria

a. Provide a thermographic inspection of the new systems upon completion.

D. Short Circuit / Coordination Study / Arc Flash

1. Specific Criteria

a. Provide a coordination study short circuit, coordination, and arc flash analysis for new systems or systems with significant changes.

b. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum

(1) contribution from the utility and will assume the maximum number of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable. Include Arc flash analysis

results for generator protective device.

c. Contractor must adhere to NFPA 70E Electrical Safety requirements when working on electrical equipment in HRSD facilities.

d. Engineer must design electrical systems in accordance with NFPA 70E.

Refer to Attachment A

XXXI. Item No. 31- Lightning Protection Refer to NFPA 820 and NFPA 780. - Lightning Protection applications will be site specific (Discuss with HRSD Electrical Staff).

XXXII. Item No 32 - SCADA Site Drawing (Refer to Attachment G)

A. For sites without generators should provide battery charger and batteries to maintain reliability.

XXXIII. Item No 33 – SCADA Flowchart (refer to Attachment K)

XXXIV. Item No 34 – Dominion Energy Coordination (refer to Attachment J)

A. Easements

1. It is imperative that the design engineer contacts the utility company (i.e., Dominion Energy, Rappahannock Power, Prince George Electric Cooperative, etc.) to determine the responsible territory.

2. Design Engineer and HRSD should inquire with the utility company if single phase or 3- phase power is available at the proposed site.

3. Design Engineer should incorporate right-of-way (ROW), multi-use utility easements, identify property owners, and VDOT requirements as part of the preliminary engineering report (PER) to prevent delays and cost increase during the construction phase of the project. The items listed above should be explored in advance especially in rural communities where 3-phase electrical service is not available.

a. See Attachment J for Dominion Project Workflow Brochure “HRSD Interface on New Projects with Dominion Energy Virginia (DEV)”

B. Utility Service Transformer Placement

1. The Utility Service Transformer shall be located within 50 feet of the Utility Service Metering Base (or as required by the specific utility) such that the transformer secondary cabling is installed, owned, and maintained by the respective utility

a. The installation of conduit for the secondary cabling shall be conducted in accordance with the requirements of the respective utility

b. If circumstances prevent the requirements above to be

followed and HRSD is responsible to own and maintain the transformer secondary cabling, the conduit for this cabling shall be installed in accordance with the requirements as specified in this standard.

XXXV. Item No. 35

A. Analyzers/Monitors: Process

1. pH

2. Manufacturers

a. Foxboro

b. E&H Memosens CPS16D pH probe (Incinerator scrubber water process) (Site Specific/Specific applications)

c. M4 Knick (Site Specific/Specific applications)

B. Conductivity

1. Manufacturers

a. Hach

XXXVI. Item No. 36

A. Grounding

"50.53 Grounding Electrode System Installation.

(A) Rod, Pipe, and Plate Electrodes. Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3).

(1) Below Permanent Moisture Level. If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.

(B) Supplemental Electrode Required. A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:

a. Rod, pipe, or plate electrode
b. Grounding electrode conductor
c. Grounded service-entrance conductor
d. Nonflexible grounded service raceway
e. Any grounded service enclosure

Exception: If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.

(3)Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart

XXXVII. Item No. 37

A. NFPA 820 Classification –

"1. Purpose to provide explosion and fire protection for life property, and operations.
2. Reduce or mitigate the effects of fire or explosion
3. Consult with AHJ (Authority Having Jurisdiction) to ensure that the NFPA 820 standard will be enforced.

NFPA 70 – Article 500

Class I: Flammable Gases/Vapors Class

II: Combustible Dust

Class III: Ignitable Fibers

Wastewater/Treatment/Collections Systems

Class I, Div 1 or 2, Group D (Methane)

Class I, Div 1 or 2, Group G (Sludge)

Wet Well Pump Station

Less than 12 air changes – Division 1
Greater than 12 air changes – Division 2

Typical classified areas: Barscreen, Headworks or Preliminary Treatment Facility, Grit Removal, Odor Control, Sludge Handling and Thickening, etc.

Evaluate equipment type (i.e., explosion proof, conduit seals, etc.)

NFPA 820 4.2.2 – Collections Systems – See Attachment Y

NFPA 820 5.2.2 – Liquid Streaming – See Attachment Z

NFPA 820 6.2.2 – Solids Treatment Processes – See Attachment S

Consideration requirements: exhaust fans, continuous ventilation, alarming, air flow and monitoring."

XXXVIII. Item No. 38 – Standard Details

(A) For detailed drawings refer to Section 37, Series 700

XXXIX. Item No. 39 – Air Purification – Hydrogen Sulfide (H2S) Mitigation for Electrical Room – See Attachment AA

(A) Manufacturer Pure Aire or approved equal.

XL. Item No 40 – Backup Battery Systems

A. Manufacturer

1. Liebert (See Attachment BB)

XLI. Item No. 41 – I&C System Subcontractors

A. Instrumentation and control system subcontractors shall be regularly engaged in the detailed design, fabrication, installation, and startup of instrumentation and control systems for water and wastewater treatment facilities and remote telemetry systems for wastewater collection systems. Instrumentation and control system subcontractors shall have a minimum of five years of such experience and shall have completed a minimum of three projects of similar type and size as that specified herein. Where specific manufacturers/models of major hardware or software products (PLC, HMI software, network, etc.) are specified to be used on this project, the instrumentation and control system subcontractor shall have completed at least three projects using that specified hardware or software. As used herein, the term "completed" shall mean that a project has been brought to final completion. In addition to the requirements listed above, the instrumentation and control system subcontractor shall have adequate staff that are experienced in the programming of Emerson ControlWave ® Micro – Hybrid RTU/PLC (i.e. ACCOL III FBL and BSAP). The instrumentation and control system subcontractor shall generator documentation showing that these requirements have been met and provide them to the Contractor during the bid phase.

B. Acceptable instrumentation and control system subcontractors shall be CEC controls Company, Inc; Systems East, Inc; or approved equal as qualifier per requirements herein.

XLII. Item 42 – Cable Routing/Disconnect – See Attachment CC

Treatment Plant – Electrical & Instrumentation Requirements

I. Item No. 1

A. Switchgear

1. Manufacturers

a. Eaton

b. Square D

2. Specific Criteria

a. Design to meet arc flash standard; Reduce hazard category rating to a "potential incident energy level of 8 cal/cm^2 or lower.(MCC and VFD's should be designed to meet incident energy of 1.2 Cal/Cm2 or below if attainable); Reference HRSD Arc Flash Mitigation Document Dated July 9-10, 2013.

b. Provide two 48 VDC control voltage. 48 VDC redundant battery systems for control voltage per incoming primary voltage source. Use 1 Best Battery Selector to switch between each set of batteries (per primary source side) for control voltage.

c. Stored charge breaker systems are unacceptable.

d. Sealed Lead acid (VRLA)

e. NiCAD are not acceptable unless approved by Owner.

f. Provide tin-plated copper bus.

g. Provide switchgear indoors in a NEMA 1 (gasketed) enclosure.

h. Switchgear to be located indoors.

i. Provide with push to test lights.

j. Bottom entry versus top entry must be evaluated for application.

k. Provide in a room strictly for switchgear.

l. Install 3- or 4-inch windows on switchgear for IR testing for new installations (consult with Electrical Manager)

m. Equipment should be designed to be double end fed with tie breakers.

n. Rack out breakers must be racked in and out remotely without opening doors.

o. Provide remote open/close operator to protect personnel

from Arc Flash Incident; operator should be outside of arc flash boundary where possible (refer to Attachment M).

p. Provide ARMS “Arc Reduction Maintenance Switch” or equal, when activating downstream breakers incident energy levels will be reduced. Also, add separate pilot light to indicate when maintenance mode is enabled or disabled.

q. Provide hinged doors if available.

r. Design electrical gear/equipment to achieve an arc flash rating of Cat 2 or less.

s. Provide trip units with fault indication to determine status (i.e., overloads or fault conditions)

t. Provide LSIG digital trip unit if =/> 1000 amps and LSI if < 1000 amps

u. Provide extra fasteners for door cover.

v. Provide phenolic labels with black backgrounds and white lettering.

w. The size of the electrical gear is based on the ampacity of the bus within. Typically, electrical rooms are designed to accommodate equipment layout without future considerations for growth, therefore electrical buildings should be sized adequately to accommodate where wall space is needed for future equipment.

x. Electrical rooms should be conditioned to increase the life of sensitive electrical and electronic equipment. Thermostat should be set up to 80 F to control condensation/moisture. Also include a hydrogen sulfide (H2S) removal system if needed.

y. Mimic Bus is not required if there is graphical representation of the system displayed on the HMI Touchscreen.

Note: 1. For reliability and the ability to safely troubleshoot and perform maintenance on switchgear and MCC’s, the main switchgear should be double ended with a Bus tie. (The main gear shall provide each piece of major electrical equipment with an A and B feeder from each end.) Each MCC shall have a double ended configuration with Bus ties and Kirk Key interlocks to allow isolation of ½ the electrical gear at the MCC level.

2. When this is not possible, alternatives shall be

investigated for critical electrical equipment for critical processes. (Return to MCCs)

Reference HRSD Arc Flash Mitigation Document Dated July 9-10, 2013, and additional Power Study Specifications example by SKM Power Systems Analysis, Inc.
Refer to Attachment A

B. Breakers/Solid State Breakers

1. Manufacturers

a. Eaton

b. Square D

c. Provide breaker/trip testing report from startup and commissioning.

2. Specific Criteria

a. Provide appropriate spares and spaces.

C. Metering or Monitoring Package (Utility Grade Metering)

1. Manufacturers

a. Schweitzer Engineering Laboratories (SEL)

b. Eaton

c. Schneider Electric (Square D)

d. GE

e. Basler

2. Specific Criteria

a. Provide utility grade metering.

b. Volt Meter 3 phase & off

c. Ammeter 3 phase & off

d. kW

e. PF

f. kVA

g. kVAR

h. Utility grade CTs & PTs

i. Metering packages (See Item No. 8)

j. Provide 3 phase undervoltage & overcurrent protection (open Delta PTs are unacceptable)

k. Provide testing that trips the main with a loss of any of

the three legs.

l. Generator must be designed to be manually initiated to return to utility.

D. Selector Switches, Push Buttons, Lighted Push Buttons

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Expandable contact blocks on operators

b. NEMA/IEC rated switches are not acceptable.

E. Contactors

1. Manufacturers

a. Eaton

b. Square D - Schneider contactors size 5 or larger should not be selected and approved during design. In addition, these contactors should not be installed in HRSD facilities.

c. Allen Bradley

2. Specific Criteria

a. Provide with expandable auxiliary contacts for 120-volt control circuits.

b. NEMA/IEC rated contactors are not acceptable.

F. Fuses & Fuse Holders

1. Specific Criteria

a. Must be locally available.

G. Switchgear Control Transformers

1. Specific Criteria

a. Provide copper coils.

b. Aluminum coils are unacceptable.

H. Terminal Strips / DIN Rail (Space Saver)

1. Manufacturers

a. Phoenix

b. Contact

c. ILSCO

d. Square D

e. Weidmuller

f. Panduit Panduct

2. Specific Criteria

a. Rail mount if possible

b. Industrial rated

c. Finger safe

d. Provide compression type screws terminals on jumpers.

I. Rubber Mats

1. Specific Criteria

a. Contractor will provide and install at substantial completion (OSHA Approved: Type II ASTM D178)

b. Add matting in front of gear.

J. Pilot Lighting

1. Specific Criteria

a. Provide LED type pilot lights.

b. 30mm preferred but 22mm is acceptable for specific applications if Approved by Owner/Engineer. i.e. Master Control Panel

K. Protective Relays

1. Manufacturers

a. Schweitzer Engineering Laboratories

b. GE

c. Basler

2. Specific Criteria

a. Provide 10-year warranty.

b. Solid State

c. Provide integral remote racking system of breakers from control room via HMI to ensure the safety of employees by removing the breaker on and off bus safely and out of the Arc Flash boundary

L. MCCs

1. Manufacturers

   a. Eaton

   b. Square D

   c. Allen Bradley

2. Specific Criteria

   a. Provide with tin-plated copper bus.

   b. MCCs to be placed indoors in a NEMA 12 (gasketed) enclosure.

   c. Provide redundant feeders to either end of the MCCs with a bus tie in the middle whenever possible.

   d. Provide with Kirk key interlocks door (mounted)

   e. Do not provide in the same room with chemical tanks or pumps.

   f. Provide with “push to test” lights.

   g. Wiring – internal wiring for control circuits is 16 AWG standard. In some applications the control wiring of 14 AWG can be requested from the manufacturer but will result in additional cost per vertical section.

   h. Preferred minimum of 65 KAIC (Kilo Ampere Interrupting Current) for Switchboards, Switchgear, Panelboards, MCC’s (Motor Control Centers), and ECB’s (Enclosed Circuit Breakers).

   i. Bottom entry vs. top entry must be evaluated based on application.

   j. Provide with face mounted operators and resets.

   k. Design to meet arc flash standard.

   l. Provide extra fasteners for door cover.

   m. Provide phenolic labels with black backgrounds and white lettering.

   n. Provide spare terminals for intermediate terminal blocks for controls.

   o. The size of the electrical gear is based on the ampacity of the bus within. Typically, electrical rooms are designed to accommodate equipment layout without future considerations for growth, therefore electrical buildings should be sized adequately to accommodate where wall

space is needed for future equipment.

p. Electrical rooms should be conditioned to increase the life of sensitive electrical and electronic equipment. Thermostat should be set up to 80 F to control condensation/moisture. Also include a hydrogen sulfide (H2S) removal system if needed.

q. Wiring – internal wiring for control circuits is 16 AWG standard. In some applications the control wiring of 14 AWG can be requested from the manufacturer but, will result in additional cost per vertical section.

r. Buss A and buss B shall be in separate compartments of MCCs and switchboards (except for the tie breaker compartment). This is to allow a physical separation between the busses so that one side can be isolated and deenergized for maintenance or modifications. This also provides a level of protection from damage should there be a fault on one busses.

Notes: See General Notes, Item 1 – Switchgear

M. Breakers/Solid State Breakers

1. Manufacturers

a. Eaton

b. Square D

N. Metering/Monitoring Package (For applications other than utility grade metering)

1. Manufacturers

a. Eaton IQ SEL

b. Square D

c. Power Logic

d. Schweitzer Engineering Laboratories (SEL)

2. Specific Criteria

a. Volt Meter 3 phase & off

b. Ammeter 3 phase & off

c. kW

d. PF

e. kVA

f. kVAR

g. CTs & PTs

h. Metering packages (See Item No. 8)

O. Selector Switches, Push Buttons, Lighted Push Buttons

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Expandable contact blocks on operators

P. Contactors

1. Manufacturers

a. Eaton

b. Square D (Contactor must be able to reclose after short power blips)

c. Allen Bradley

2. Specific Criteria

a. Provide with expandable auxiliary contacts for 120-volt control circuits.

Q. Fuses & Fuse Holders

1. Manufacturers

a. Bussmann

b. Shawmut

2. Specific Criteria

a. Must be locally available.

R. MCC CTs and PTs

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Metering

b. Provide copper coils.

c. Aluminum coils are unacceptable.

S. Terminal Strips

1. Manufacturers

a. Pheonix

b. Contract

c. ILSCO

d. Square D

e. Weidmuller

2. Specific Criteria

a. Rail mount instrumentation if possible

b. Industrial rated

T. Combination Starters (Buckets)

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. 120-volt control voltage

b. Run light – red.

c. Stop light – green.

d. Fault light – amber

e. Power available light – white

f. Provide push to test indicator lights.

g. Elapsed time meters–graduated in 1/10 hours Resettable or Non-resettable (plant/site specific; incorporate time meters on DCS if available)

h. Provide overload resets operational from the front (external)

i. Provide with adjustable thermo-mag breakers.

j. Fused control transformer.

k. 25% spares and/or spaces for all sizes of buckets or expandable option

l. MCC mounted lighting panels shall be provided with

25% spare breakers.

m. Provide connections for motor leads directly from the motors to the starter. Do not use intermediate terminal blocks (50 HP and smaller)

n. Provide standalone combination starters in the proper enclosures (See Junction/Pull Boxes and Miscellaneous Enclosures)

U. Rubber Mats (to be placed in front of gear)

1. Manufacturers

a. Grainger

b. Chesapeake Bay Rubber

2. Specific Criteria

a. Contractor will provide and install at substantial completion (OSHA approved: Type II ASTM D178)

V. Voltage Test Points

1. Manufacturer

a. Safeside-Grace Engineered Products (Load side of Main Breaker) (600 Volt or less equipment)

b. Panduit VeriSafe

II. <u>Item No. 2</u>

A. MCCs

1. Manufacturers

a. Eaton

b. Square D

c. Allen Bradley

2. Specific Criteria

a. Provide with tin-plated copper bus.

b. MCCs to be placed indoors in a NEMA 12 (gasketed) enclosure.

c. Provide redundant feeders to either end of the MCCs with a bus tie in the middle whenever possible.

d. Provide with Kirk key interlocks door (mounted)

e. Do not provide in the same room with chemical tanks or pumps.

f. Provide with “push to test” lights.

g. Bottom entry vs. top entry must be evaluated based on application.

h. Provide with face mounted operators and resets.

i. Design to meet arc flash standard.

j. Provide extra fasteners for door cover.

k. Provide phenolic labels with black backgrounds and white lettering.

l. Provide spare terminals for intermediate terminal blocks for controls.

m. The size of the electrical gear is based on the ampacity of the bus within. Typically, electrical rooms are designed to accommodate equipment layout without future considerations for growth, therefore electrical buildings should be sized adequately to accommodate where wall space is needed for future equipment.

n. Electrical rooms should be conditioned to increase the life of sensitive electrical and electronic equipment. Thermostat should be set up to 80 F to control condensation/moisture. Also include a hydrogen sulfide (H2S) removal system if needed.

Notes: See General Notes, Item 1 – Switchgear

B. Breakers/Solid State Breakers

1. Manufacturers

a. Eaton

b. Square D

c. Provide breaker/trip testing report from startup and commissioning.

C. Metering/Monitoring Package (For applications other than utility grade metering)

1. Manufacturers

a. Eaton IQ SEL

b. Square D

c. Power Logic

d. Schweitzer Engineering Laboratories (SEL)

2. Specific Criteria

    a. Volt Meter 3 phase & off

    b. Ammeter 3 phase & off

    c. kW

    d. PF

    e. kVA

    f. kVAR

    g. CTs & PTs

    h. Metering packages (See Item No. 8)

D. Selector Switches, Push Buttons, Lighted Push Buttons

1. Manufacturers

    a. Square D

    b. Eaton

    c. Allen Bradley

2. Specific Criteria

    a. Expandable contact blocks on operators

E. Contactors

1. Manufacturers

    a. Eaton

    b. Square D (Contactor must be able to reclose after short power blips)

    c. Allen Bradley

2. Specific Criteria

    a. Provide with expandable auxiliary contacts for 120-volt control circuits.

F. Fuses & Fuse Holders

1. Manufacturers

    a. Bussmann

    b. Shawmut

2. Specific Criteria

    a. Must be locally available.

G. MCC CTs and PTs

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. Metering

b. Provide copper coils.

c. Aluminum coils are unacceptable.

H. Terminal Strips

1. Manufacturers

a. Pheonix

b. Contract

c. ILSCO

d. Square D

e. Weidmuller

2. Specific Criteria

a. Rail mount instrumentation if possible

b. Industrial rated

I. Combination Starters (Buckets)

1. Manufacturers

a. Square D

b. Eaton

c. Allen Bradley

2. Specific Criteria

a. 120-volt control voltage

b. Run light – red.

c. Stop light – green.

d. Fault light – amber

e. Power available light – white

f. Provide push to test indicator lights.

g. Elapsed time meters–graduated in 1/10 hours Resettable or Non-resettable (plant/site specific; incorporate time meters on DCS if available)

h. Provide overload resets operational from the front (external)

i. Provide with adjustable thermo-mag breakers.

j. Fused control transformer.

k. 25% spares and/or spaces for all sizes of buckets or expandable option

l. MCC mounted lighting panels shall be provided with 25% spare breakers.

m. Provide connections for motor leads directly from the motors to the starter. Do not use intermediate terminal blocks (50 HP and smaller)

n. Provide standalone combination starters in the proper enclosures (See Junction/Pull Boxes and Miscellaneous Enclosures)

J. Rubber Mats (to be placed in front of gear)

1. Manufacturers

a. Grainger

b. Chesapeake Bay Rubber

2. Specific Criteria

a. Contractor will provide and install at substantial completion (OSHA approved: Type II ASTM D178)

K. Voltage Test Points

1. Manufacturer

a. Safeside-Grace Engineered Products (Load side of Main Breaker) (600 Volt or less equipment)

b. Panduit VeriSafe

III. Item No. 3

A. Emergency Generators

1. Manufacturers

a. Caterpillar

b. Cummins

2. Specific Criteria

a. Diesel generators

b. Turbine generators are not acceptable unless approved by Owner.

c. Engines to be of domestic manufacture whenever possible.

d. 4-stroke diesels **ONLY**

e. Parts must be available in 48 hours or less.

f. Must meet current U.S. EPA and Virginia DEQ air standards.

g. Low emission units

h. All units shall be Standby Rated

i. Remote Emergency stop pushbuttons at doorways (Pilla Model GS120 w/clear, hinged, plastic cover)

j. Provide separate room for indoor generator to reduce heat and noise.

B. Generator

1. Manufacturers

a. Stamford

b. Newage

c. Caterpillar

d. KATO

e. LIMA

f. Marathon

g. Cummins

2. Specific Criteria

a. Generators 1 MWatt and larger require a two-bearing generator unless the manufacturer has engineered the engine main bearing to reliably withstand the dynamic rotor loads and weights

b. The rectifier shall be a brushless, full-wave bridge.

c. <400 kW and below at 480 volts bring all leads out to the terminal box.

d. 400 kW and above – bring out 3 leads and a neutral (minimum) to the terminal box.

e. Neutrals shall be sized to full rating (brought out to the

terminal box)

f. Temperature rise on generator voltages 4160 & higher shall not exceed Class B rating with 80□ C ambient rise. All others shall not exceed 105□ C rating.

g. Alternator shall have a space heater that switches off when running.

h. Provide for 2/3 winding pitch.

i. Minimum Class H insulation (operating temperature class 180□ C) with topicalization (anti-fungus)

j. Provide voltage regulation less than +/- 1%

k. Provide 150% minimum overspeed capability.

l. Provide amortisseur winding.

m. Provide less than 5% THD (Total Harmonic Distortion)

n. Provide less than 50 TIF (Telephone influence factor)

o. Voltage regulator shall be 3-phase.

C. Diesel Engine

1. Manufacturers

a. Caterpillar

b. Cummins

2. Specific Criteria

a. Heavy-duty, direct-injected, 4-stroke diesel engine.

b. Provide electronically controlled engines.

c. Provide electronically controlled engines with an electronic control system.

d. Require vendor to identify the control system to be provided.

e. Provide system software and training to fully troubleshoot and operate the engine

f. Provide isochronous frequency regulation (no load to full load)

g. Provide +/- 0.25% steady state frequency regulation (minimum)

h. Air, fuel and oil filters shall be sized to provide a minimum of 250 hours of operation before servicing

i. Engine manufacturers shall provide fuel water separators.

j. The air filter is to be a dry type with a restriction indicator.

k. Provide RTD's for monitoring bearing and winding temperatures.

l. Add vibration monitoring if > 1000 KW.

m. Provide a Racor heavy duty crankcase vapor coalesce.

n. All radiators and supporting appurtenances are to be galvanized steel.

o. The radiator core shall have solder coated fins to prevent corrosion by hydrogen sulfide gas.

p. Size radiator to prevent overheating in the most severe conditions (122°F ambient)

q. Exhaust system and muffler shall be residential grade muffler (lowest DB reduction available). All insulation must be blanket type (non-asbestos), removable for servicing of exhaust system.

r. The starting system shall be 24-volt DC.

s. Provide all diagnostic equipment for complete trouble shooting (software/technical manuals/hardware etc.)

t. Speed sensing shall be provided to protect against accidental starter engagement into a moving flywheel.

u. Battery charging alternation output voltage will not be acceptable for this purpose.

v. Provide an adjustable (0-15 minutes) cool down time.

w. Provide a large red emergency stop push button.

x. Low oil pressure, high coolant temperature, overspeed, and over-crank shall shut down the engine and provide indicator lights.

y. Analog or digital displays shall be provided for coolant temperature, oil pressure, ser- vice hours, engine RPM, system DC volts and system diagnostic code.

z. Provide Kim Hot-Start engine block heater (thermostatically controlled) set in accordance with manufacturer's recommendation (120□F – 140□F).

aa. Provide vibration isolators between generator set base and floor.

bb. bb. Provide lifting eyes.

cc. Provide brake mean effective pressure (BMEP) calculations.

dd. Provide means of quantifying flows from the day tank to

the diesel and from the diesel back to the main tank.

D. Battery Chargers

1. Manufacturers

a. LaMarche

b. Cummins

c. SENS

2. Specific Criteria

a. 24-volt chargers or LaMarche equal

b. Automatic, solid state, provide continuous taper charging.

c. UL listed, provide with under/over voltage, current failure and loss of power acknowledgment.

d. Full Float Charge versus trickle charge must be evaluated for application.

E. Starting Batteries

1. Manufacturers

a. Delco -DEKA

b. Exide Switch locations

2. Specific Criteria

a. Use 8D lead-acid batteries (4D is not acceptable)

b. Provide a minimum of 2. The batteries shall provide 1200 CCA each.

c. Provide with insulated battery rack.

d. Provide a 2-year full replacement guarantee.

e. Provide as a minimum 2 cranking cycles at a minimum of 30 seconds each.

F. Air Starter

1. Manufacturers

a. Ingersoll Rand

2. Specific Criteria

a. Site Specific

G. Day Tanks

1. Manufacturers

a. Pryco

b. Simplex

c. Tramont

2. Specific Criteria

a. UL Listed – double wall.

b. Provide with Oberndorfer bronze gear type pump. Pumps with rubber or nitrile impellers will not be accepted

c. Provide with a low-level alarm. Size for 2-hour minimum running time

d. Provide a fuel level indicator on the day tank.

e. Provide a two-pump system. Each pump shall be capable of pumping 100% of the fuel oil for all generators.

f. Fuel shall be returned to the day tank.

g. Provide Not in Auto lamp or other warning device.

h. Meet all VDEQ requirements.

H. Underground Storage Tanks (UST)

1. Manufacturers

a. Veeder Root TLS450 PLUS

b. Xerxes

2. Specific Criteria

a. Provide in accordance with EPA and all applicable state and local standards.

b. Provide with leak detection system.

c. Provide a graduated stick for level measuring.

d. Provide for stick access and refueling.

e. Provide with 7 days of fuel tank capacity.

f. Provide an electronic tank level indicating system with a 4-20 mA output calibrated to the tank or Ethernet connection (TCP/IP)

g. Provide AMI Model 8CH-DAC 8 channel digital/analog converter (4-20ma)

I. Enclosure

1. Sound level is site specific. Must not exceed 75dBA @ 23 ft.

2. Must have full access to engine, generator, and controls.

3. Must be able to operate at 100% load in all weather conditions.

J. Louvers and Dampers

1. Manufacturers

   a. Greenheck

   b. Ruskin

2. Specific Criteria

   a. Aluminum or PVC with hardware

   b. Provide for gravity dampers on emergency generator systems (For motor operated applications, must fail to open position if power loss)

   c. Provide anodized aluminum dampers with nylon bushings or ball bearings.

   d. Steel and/or steel shafts are not acceptable.

   e. Provide with bird screens readily removable without removing louvers or dampers.

   f. Designed to limit rainwater in building.

   g. Where louvers and dampers are required, provide recessed dampers (inside) and flange mounted louvers (outside)

   h. Manufacturer shall set and balance the system.

K. Metering/Monitoring Package

1. Specific Criteria

   a. Volt meter 3 phase & off

   b. Ammeter 3 phase & off

   c. Frequency

   d. kW

   e. PF

   f. kVA

   g. kVAR

   h. kWh

   i. Utility grade CTs & PTs

   j. Metering packages (See Item No. 8)

   k. Provide 3 phase undervoltage & overcurrent protection.

l. Synchroscope

m. Sync lights

n. Supply a TCP/IP modbus link with an HRSD supplied IP address, subnet mask, and gateway to allow the Emerson DCS (or other monitoring system) to read all data registers from the generators and the associated MCC hardware. This includes run statuses, breaker statuses, voltage, current, diesel generator engine data, etc.

L. System Operation

1. Specific Criteria

a. Provide protection such that the two sources (utility & emergency generator) can never be closed out of phase

b. Provide approvals by Dominion Virginia Power on the paralleling protection scheme

c. Provide a selector switch to allow the operator to choose “curtailment” or “loss of power” (typically set to “loss of power”).

d. In the loss of power setting, the system shall have automatic and manual operation. The manual operation would be provided in the event the automatic functions failed.

e. If the operator switches to curtailment:

f. Depressing a single push button in the automatic mode will start the engine, parallel with the utility, ramp the plant load onto the generator and open the utility breaker.

g. Depressing a second push button will ramp the load back to the utility and shut down the generators.

h. Provide a detailed sequence of operation for generator and switchgear operation.

i. Monitor temporary generator master control panel connect to DCS for monitoring.

M. Start Up and Testing

1. Specific Criteria

a. Provide factory test data.

b. Simulate and test all safety equipment. Using a reactive load bank (0.8PF) run the generator:

(1) 15 minutes at idle speed

(2) 30 minutes at 25% load

(3) 30 minutes at 50% load

(4) 60 minutes at 75% load

(5) 120 minutes at 100% load

(6) 15 minutes at 25% load

(7) 15 minutes at 0% load (cool down) off record stator, bearing, oil, ambient, and water temperatures every 15 minutes.

c. Record speed, voltage and amperage at 15-minute intervals as well as just prior to and after a load change.

d. Demonstrate all warnings and shutdowns with laptop.

e. Hook up the generator to the main switchgear. Perform all automatic and manual functions a minimum of three times each. The plant will load the generators as much as possible. Particular attention should be observed to the larger starting loads. Record same parameters every 15 minutes and before and after changing load. Tests to be witnessed by HRSD Automotive Superintendent and HRSD Electrical Engineer or designee.

f. Create and attach to the switchgear detailed instructions. The instructions shall be laminated. The instructions shall be simple enough for anybody to pick them up and operate the diesel generator set.

g. Group A, B, and C phase cable together to cancel out EMF (Electromagnetic Field)

N. Stationary Fuel Filtering System.

1. Acceptable Manufacturers – Simplex or Tramont.

2. Water Filter/Separator – Required.

3. Particulate Filter – 2 Micron Required.

4. Automatic Timer with Manual Switch – Required.

5. System Size Site Specific to Accommodate Tank size.

6. Must be installed to manufacture's requirements.

O. Energy Efficient Motors

1. Specific Criteria

a. See HRSD Electric Motor Specifications in *Attachment*

E "HRSD Electric Motor Specifications".

b. Provide ammeters on motors 50 HP & larger.

c. Local stop pushbuttons for VFDs, Use HOA for constant speed applications.

d. Add momentary push button at Motor.

P. Sump Pumps

Q. Specific Criteria

1. Provide with 120-volt plug and receptacle. Refer to Treatment Plant/Miscellaneous Items.

R. Level Sensing Systems

1. Specific Criteria

a. Provide 4-20 mA signal.

(1) See Treatment Plant No. 24

(2) See Chemical Systems Plants

S. Bubbler Type – Level Sensing Systems

1. Specific Criteria

a. Complete purged air bubbler system with time delay for sensing wet well liquid level which generates and transmits level signals to control pump operations.

b. Provide UPS backup for controls.

c. Provide power light – white.

d. Provide a pressure sensing device (Foxboro or equal)

e. Provide externally mounted duplex air compressors mounted on 30-gallon horizontal receiving tank

f. Provide push button for manual purging of bubbler piping.

g. Provide manual alternation of air compressors.

h. Provide lead/lag switch – on off.

i. Provide panel mounted 4 ½ inch 0 level gauge/Analog gauge.

j. Mount air compressors outside of panel whenever possible

k. Provide pressure activated switches for point applications (Barksdale)

T. Ultrasonic – Level Sensing Systems

1. Manufacturers

a. Rosemont

b. Siemens

2. Specific Criteria

a. Microprocessor

b. FM approved (frequency modulation)

U. Capacitance – Level Sensing Systems (Not Acceptable)

1. Manufacturers

a. Warrick

b. Drexelbrook

2. Specific Criteria

a. Provide with point applications only.

b. Not for 4-20 ma applications

V. Pressure Transmitters – Level Sensing Systems

1. Manufacturers

a. Foxboro

b. Rosemount

c. Air Monitor – Incinerator draft

d. Siemens

2. Specific Criteria

a. All other locations

W. FloatBalls

1. Manufacturers

a. Flygt

b. Optifloat

2. Specific Criteria

a. Non mercury

b. Fiber Optic

X. Pressure Sensing System – Level Sensing Systems

1. Specific Criteria

a. Provide either an Ashcroft or Red Valve (series 40) brand pressure seal with Viton boot.

b. Provide Ashcroft Gauges 100 psi.

c. Provide Foxboro IDPT 10 absolute pressure electronic transmitter.

d. See Standard Detail “Pressure Reducing Station Pressure Sensor Detail”

Y. Diaphragm – Level Sensing Systems

1. Manufacturers

a. Foxboro

b. Rosemont

2. Specific Criteria

a. Pressure Transmitter (Diaphragm Type)

Z. Radar – Level Sensing Systems

1. Manufacturers

a. Rosemont

2. Specific Criteria

a. Non-Contacting and Guided Wave types will be application dependent.

AA. Variable Frequency Drives (VFDs)

1. Manufacturers

a. Yaskawa

b. Allen Bradley

2. Specific Criteria

a. Install the equipment with the idea of keeping it clean and temperature regulated.

b. Provide thumbscrews for removable/washable filters or thumb screws replaced by snap in grills that are removable from the front of the cabinet (reusable)

c. Provide a programmable ramp time.

d. Provide input reactors (MTE Corp) or TCI

e. Pulse Width Modulated (PWM)

f. Use IGBTs

g. Automatic restart on power disruption

h. Tune out a minimum of 3 frequencies.

i. Hand/Off/Automatic (HOA) selector switch

j. Manual speed control by potentiometer (door mounted) in addition to keypad control.

k. Tune drive to motor with a harmonics meter

l. Provide an input circuit breaker for short circuit protection (Fuses are not acceptable)

m. The controller electronics shall contain indicators of the following conditions:

(1) Undervoltage

(2) Overvoltage

(3) Over temperature

(4) Memory failure

(5) Emergency Stop

(6) Ground fault

(7) Instantaneous overcurrent

n. Provide a NEMA 12 flanged disconnect free standing enclosure.

o. Provide auxiliary run contactor wired to run command for ventilation fan.

p. Mount the resets & appropriate indicator lighting on the front of the drive or the outside of the box to prevent employees from opening the panel.

q. Provide four contact outputs for run status, power failure, VFD failure, not in auto status.

r. The following are site specific options:

(1) VFD must be able to be isolated and bypassed (auto/manual operation) allowing the motor to operate across the line at full-load speed and current. Site specific

(2) Provide manual isolation and bypass capability.

(3) Provide three contactors for bypass operation.

s. VFD “T” leads in free air shall be run in RGS or PVC coated RGS.

t. “T” leads can be run in PVC if in a duct bank.

u. Do not run “T” leads in conduit with any other conductors.

v. “T” leads shall be run in a separate conduit per each drive.

w. 6 pulse drive or Matrix drive or AB 755T

3. Additional Design Considerations

a. All electrical components must be NEMA only. IEC or NEMS/IEC is not acceptable.

b. Filters to HVAC units must be maintained and free from dust during construction phase.

c. VFD parameters must be included on as built prints (i.e., momentary power loss ride thru, energy savings, and fault reset)

d. Specify coil locks (Power Quality Solutions) on control relays for power dip ride thru capabilities.

e. Specify Baker SKF EP 1000 Dynamic motor link on all motor/VFD system 100HP and above or designated as critical equipment.

f. Provide Bypass mode for critical VFD's. Soft start or across the line depending on application.

g. Specify main circuit breaker cable operators for breaker operation instead of standard door operating mechanisms.

h. Provide One reset button to reset VFD and control circuit faults.

i. Provide finger safe barriers for main sideline breaker lugs.

j. Provide enough fans to replace each fan within a VFD (spare parts) where several VFD's of the same size and model are specified.

k. Provide paper copies of VFD manuals.

l. To support large and heavy VFD's 60 HP and above, provide a pedestal with a flat plate mounted inside the enclosure for VFD to rest for easy removal. Also provide a lift table to remove VFD.

m. Provide external air filter for easy access on cabinets.

n. VFD shall be sized to provide current necessary for motor to produce continuous rated horsepower and service factor horsepower at highest carrier frequency.

o. Contractor to perform static tuning for optimal performance during startup. Contractor to supply panel shop with motor data sheets including the number of poles per motor. Also, include number of motor poles on motor nameplate.

p. Provide extended warranty by VFD manufacturer where replacement cost is justified.

q. Need all switches to indicate when not in auto.

r. Need indication when control power is loss in addition to VFD fault.

s. Evaluate best routing method for bottom versus top entry of wire.

t. Provide VFD Cable with copper shielding, XLPE insulation manufacture by Belden or equal.

(1) Consider these factors when designing motor HP, motor voltage and motor full load current, ambient temperature, VFD cable and connector ratings, and number of cables in raceway.

u. A Harmonic Study Analysis should be performed for all VFD applications by using IEE 519 guidelines. The design engineer should evaluate the best solution to reduce Harmonic Distortion (ie. passive and active filters or active front end included as part of the VFD) (refer to Attachment C)

v. The VFD shall have MODBUS TCP/IP communication capability

w. 3.w The following signals shall be hardwired between the VFD and the PLC:

(1) RUN Status

(2) START/RUN Command

(3) Speed Reference

(4) Speed Feedback

(5) AUTO Status

(6) General Fault/Alarm

x. VFD programmable parameters shall be provided for review and approval prior to energized field testing. Final VFD programmable parameters following substantial completion shall also be provided.

Provide auxiliary (AUX) to remove run command of VFD before opening contact. Refer to Disconnect – Aux Contact

IV. Item No. 4

A. Energy Efficient Motors

1. Specific Criteria

a. See HRSD Electric Motor Specifications in *Attachment E "HRSD Electric Motor Specifications".*

b. Provide ammeters on motors 50 HP & larger.

c. Local stop pushbuttons for VFDs, Use HOA for constant speed applications.

d. Add momentary push button at Motor.

V. Item No. 5

A. Sump Pumps

1. Specific Criteria

a. Provide with 120-volt plug and receptacle. Refer to Treatment Plant/Miscellaneous Items.

VI. Item No. 6

A. Level Sensing Systems

1. Specific Criteria

a. Provide 4-20 mA signal.

(1) See Treatment Plant No. 24

(2) See Chemical Systems Plants

B. Bubbler Type – Level Sensing Systems

1. Specific Criteria

a. Complete purged air bubbler system with time delay for sensing wet well liquid level which generates and transmits level signals to control pump operations.

b. Provide UPS backup for controls.

c. Provide power light – white.

d. Provide a pressure sensing device (Foxboro or equal)

e. Provide externally mounted duplex air compressors mounted on 30-gallon horizontal receiving tank

f. Provide push button for manual purging of bubbler piping.

g. Provide manual alternation of air compressors.

h. Provide lead/lag switch – on off.

i. Provide panel mounted 4 ½ inch 0 level gauge/Analog gauge.

j. Mount air compressors outside of panel whenever possible

k. Provide pressure activated switches for point applications (Barksdale)

C. Ultrasonic – Level Sensing Systems

1. Manufacturers

a. Rosemont

b. Siemens

2. Specific Criteria

a. Microprocessor

b. FM approved (frequency modulation)

D. Capacitance – Level Sensing Systems (Not Acceptable)

1. Manufacturers

a. Warrick

b. Drexelbrook

2. Specific Criteria

a. Provide with point applications only.

b. Not for 4-20 ma applications

E. Pressure Transmitters – Level Sensing Systems

1. Manufacturers

a. Foxboro

b. Rosemount

c. Air Monitor – Incinerator draft

d. Siemens

2. Specific Criteria

a. All other locations

F. FloatBalls

1. Manufacturers

a. Flygt

b. Optifloat

2. Specific Criteria

a. Non mercury

b. Fiber Optic

G. Pressure Sensing System – Level Sensing Systems

1. Specific Criteria

a. Provide either an Ashcroft or Red Valve (series 40) brand pressure seal with Viton boot.

b. Provide Ashcroft Gauges 100 psi.

c. Provide Foxboro IDPT 10 absolute pressure electronic transmitter.

d. See Standard Detail "Pressure Reducing Station Pressure Sensor Detail"

H. Diaphragm – Level Sensing Systems

1. Manufacturers

a. Foxboro

b. Rosemont

2. Specific Criteria

a. Pressure Transmitter (Diaphragm Type)

I. Radar – Level Sensing Systems

1. Manufacturers

a. Rosemont

2. Specific Criteria

a. Non-Contacting and Guided Wave types will be application dependent.

VII. Item No. 7

A. Variable Frequency Drives (VFDs)

1. Manufacturers

a. Yaskawa

b. Allen Bradley

2. Specific Criteria

a. Install the equipment with the idea of keeping it clean and temperature regulated.

b. Provide thumbscrews for removable/washable filters or thumb screws replaced by snap in grills that are removable from the front of the cabinet (reusable)

c. Provide a programmable ramp time.

d. Provide input reactors (MTE Corp) or TCI

e. Pulse Width Modulated (PWM)

f. Use IGBTs

g. Automatic restart on power disruption

h. Tune out a minimum of 3 frequencies.

i. Hand/Off/Automatic (HOA) selector switch

j. Manual speed control by potentiometer (door mounted) in addition to keypad control.

k. Tune drive to motor with a harmonics meter

l. Provide an input circuit breaker for short circuit protection (Fuses are not acceptable)

m. The controller electronics shall contain indicators of the following conditions:

(1) Undervoltage

(2) Overvoltage

(3) Over temperature

(4) Memory failure

(5) Emergency Stop

(6) Ground fault

(7) Instantaneous overcurrent

n. Provide a NEMA 12 flanged disconnect free standing enclosure.

o. Provide auxiliary run contactor wired to run command for ventilation fan.

p. Mount the resets & appropriate indicator lighting on the front of the drive or the outside of the box to prevent employees from opening the panel.

q. Provide four contact outputs for run status, power failure, VFD failure, not in auto status.

r. The following are site specific options:

(1) VFD must be able to be isolated and bypassed (auto/manual operation) allowing the motor to operate across the line at full-load speed and current. Site specific

(2) Provide manual isolation and bypass capability.

(3) Provide three contactors for bypass operation.

s. VFD “T” leads in free air shall be run in RGS or PVC coated RGS.

t. “T” leads can be run in PVC if in a duct bank.

u. Do not run “T” leads in conduit with any other conductors.

v. “T” leads shall be run in a separate conduit per each drive.

w. 6 pulse drive or Matrix drive or AB 755T

3. Additional Design Considerations

a. All electrical components must be NEMA only. IEC or NEMS/IEC is not acceptable.

b. Filters to HVAC units must be maintained and free from dust during construction phase.

c. VFD parameters must be included on as built prints (i.e., momentary power loss ride thru, energy savings, and fault reset)

d. Specify coil locks (Power Quality Solutions) on control relays for power dip ride thru capabilities.

e. Specify Baker SKF EP 1000 Dynamic motor link on all motor/VFD system 100HP and above or designated as critical equipment.

f. Provide Bypass mode for critical VFD’s. Soft start or across the line depending on application.

g. Specify main circuit breaker cable operators for breaker operation instead of standard door operating mechanisms.

h. Provide One reset button to reset VFD and control circuit faults.

i. Provide finger safe barriers for main sideline breaker lugs.

j. Provide enough fans to replace each fan within a VFD (spare parts) where several VFD’s of the same size and model are specified.

k. Provide paper copies of VFD manuals.

l. To support large and heavy VFD’s 60 HP and above, provide a pedestal with a flat plate mounted inside the enclosure for VFD to rest for easy removal. Also provide a lift table to remove VFD.

m. Provide external air filter for easy access on cabinets.

n. VFD shall be sized to provide current necessary for motor to produce continuous rated horsepower and service

factor horsepower at highest carrier frequency.

o. Contractor to perform static tuning for optimal performance during startup. Contractor to supply panel shop with motor data sheets including the number of poles per motor. Also, include number of motor poles on motor nameplate.

p. Provide extended warranty by VFD manufacturer where replacement cost is justified.

q. Need all switches to indicate when not in auto.

r. Need indication when control power is loss in addition to VFD fault.

s. Evaluate best routing method for bottom versus top entry of wire.

t. Provide VFD Cable with copper shielding, XLPE insulation manufactured by Belden or equal.

(1) Consider these factors when designing motor HP, motor voltage and motor full load current, ambient temperature, VFD cable and connector ratings, and number of cables in raceway.

u. A Harmonic Study Analysis should be performed for all VFD applications by using IEE 519 guidelines. The design engineer should evaluate the best solution to reduce Harmonic Distortion (ie. passive and active filters or active front end included as part of the VFD) (refer to Attachment C)

Provide auxiliary (AUX) to remove run command of VFD before opening contact. Refer to Disconnect – Aux Contact

B. DC Drives

1. Specific Criteria

a. Unacceptable

C. Eddy Current Brake Systems

1. Specific Criteria

a. Unacceptable

D. DC Drives

1. Specific Criteria

a. Unacceptable

E. Eddy Current Brake Systems

1. Specific Criteria
    a. Unacceptable

VIII. Item No. 8

A. Metering Packages for Switchgear

1. Manufacturers

a. Schweitzer Engineering Lab (SEL)

b. Xpert (Eaton)

c. Power Logic (Square D)

d. Multilin (GE)

2. Specific Criteria

a. Provide cumulative watt-hour meters on each MCC, or specific motor

b. Provide a meter on each MCC to indicate 3 phase parameters on the MCC, i.e., volts, amps, kW, PF, kVA, kWh, etc.

c. Provide with motors 200 HP and above.

IX. Item No. 9

A. PLCs

1. Manufacturers

a. Allen Bradley (i.e. –SLC 500, Compact Logix 5000, Micro Logix 5000)

2. Specific Criteria

a. Provide functional descriptions, the application program, the job- specific program data, and a copy of the as-built software documentation

b. Include PLC fail indicator.

c. Provide license, software, programmed files with labels (as Built)

d. PLC’s and RTU’s shall be equipped with isolation relays for all digital inputs. Ex- ample: (Idec 5-blade – 24 VDC coils- with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay inputs. Whether a junction box is used or control panel a 24 VDC power supply with sufficient capacity to energize all the 24 VDC relay coils simultaneously when necessary for all PLC or RTU inputs.

e.

X. Item No. 10

A. Exhaust Fans

1. Manufacturers

a. ILG

b. Dayton

c. Greenheck

d. Airovent

e. Mk Plastics

2. Specific Criteria

a. Corrosion resistant including hardware.

b. Must be explosion proof in hazardous areas.

c. Direct Drive

(1) Belt drive not acceptable unless approved by Owner (Air detection is required if approved).

XI. Item No. 11

A. Lighting

1. Manufacturers

a. Holophane

b. Hubbell

c. Thomas

d. Crouse-Hinds

2. Specific Criteria

a. Replace all light fixtures with LEDs if Non-LED style fixture cannot be repaired.

b. Provide proper levels of lighting over major equipment including switchgear, generators, pump motors, and controls. Minimum lighting levels should conform to the IES lighting handbook.

c. Exterior lights shall be placed on a single photocell (within reason)

Refer to Attachment D - Lighting Policy

3. Other

a. HPS

(1) Specific Criteria

(a) Not acceptable for any application

b. LPS

(1) Specific Criteria

(a) Not acceptable for any application

c. Mercury Vapor

(1) Specific Criteria

(a) Not acceptable for any application

d. Emergency Lighting

(1) Manufacturers

(a) Dual Lite

(b) Emergency Lite

(c) Note: Install dual input inverters if applicable

(2) Specific Criteria

(a) Dual Lite GMM-EL-W2 in admin areas

(b) Emerg Lite PRO-2 in corrosive areas

e. Exit Lighting

(1) Manufacturers

(a) Dual Lite

(b) Lithonia

(2) Specific Criteria

(a) Highly visible 24 hours/day for life (self- illuminating)

(b) Provide lighted only if required.

f. High-Mast Lighting

(1) Manufacturers

(a) Holophane

(2) Specific Criteria

(a) Site specific

g. LED

(1) Specific Criteria

(a) To reduce maintenance

(b) Perform payback analysis.

XII. Item No. 12

A. Concrete Housekeeping Pads

1. Specific Criteria

a. Provide a minimum of 4-inch thickness under Switchgear, MCCs, transformers, general electrical equipment, and around conduits at floor penetrations.

b. Chamfer all edges.

XIII. Item No. 13

A. Conduit and Conduit Systems

1. Specific Criteria

a. Provide three separate conduit systems. One for power circuits >600 volts, one for power circuits less than 600 volts, and one for communication circuits

b. Instrumentation (<25v) can be placed in the communication duct bank.

c. Use compression type lugs only.

d. Ream and chamfer all edges.

e. EMT or IMC are not acceptable unless approved by Owner.

f. All flexible conduits shall be heavy duty metallic liquidtite or equal.

g. Provide ¾ inch minimum size (when specifically approved or when instrumentation restricts this size, ½ inch can be used)

h. Do not use plastic anchors.

i. Seal conduits with a silicone product as necessary (in the manholes to the buildings)

j. Administrative areas (plenum) can use EMT down to ½ inch (lighting only)

k. Label all conduits inside of building (Engineer must provide conduit schedule)

l. Circuit # must be brought back to the panel/breaker.

m. Place metal tags on cables in manholes

n. See the Miscellaneous section of these standards for markings and coatings.

o. Provide Oz Gedney conduit and cable seals or silicone where seals are not available.

p. Cable trays must be approved by Owner or Engineer.

q. Evaluate cost of stainless steel or aluminum conduit vs. PVC coated rigid steel conduit (where applicable)

B. Spare Conduits

1. Specific Criteria

a. Provide with service entrance.

b. Add appropriate spares with pull wires.

C. Future Conduits

1. Specific Criteria

a. Some future conduits may become trip hazards, they must be cut flush and grouted at the finish floor in some cases.

D. PVC Coated Rigid Steel (inside and out)

1. Manufacturers

a. Robroy

b. Plasti-Bond

c. Perma-cote

d. Korkap

e. Ocal

f. Gafco Industries

2. Specific Criteria

a. Provide in corrosive areas, underground (not encased), chemical areas, chemical containment areas, outside and damp areas.

b. Provide with PVC coated fittings, boxes and touch-up material.

c. Provide 8” of PVC coated conduit were stubbed up through concrete (wash-down areas)

E. PVC

1. Specific Criteria

a. Underground/encased reinforced concrete.

b. Can replace RGS in duct banks where EMI is not a threat.

F. Rigid Galvanized Steel

1. Specific Criteria

a. Provide in all other areas not covered by PVC and PVC coated.

G. Tools Used

1. Specific Criteria

a. Use suitable tools with conduit.

H. Patching/Repair

1. Specific Criteria

a. Use appropriate material to patch and repair.

I. Flex – Liquidtite & Fittings

1. Specific Criteria

a. Use Myers hubs where suitable.

b. Use coated fittings where appropriate.

c. Heavy duty metallic fittings require.

d. Shall be metallic stainless steel, aluminum or equal.

J. Explosion Proof Fittings

1. Manufacturers

a. Crouse Hinds

b. Appleton

2. Specific Criteria

a. Use fittings to match installed conduit.

K. Fixtures & Fittings

1. Specific Criteria

a. Use appropriate fittings and materials.

L. Struts and Straps

1. Specific Criteria

a. To suit conduit materials

b. Use matching fasteners.

c. In outside, wet or damp areas use stainless steel fasteners.

d. Stainless Steel Straps are preferred over PVC Coated Straps. For certain applications please contact owner/engineer for approval.

M. Pull Boxes (wire pulled through) and Junction Boxes (wires terminated inside)

1. Specific Criteria

a. Over 6-inch x 6 inch are to be hinged

b. Gasketed

c. Use stainless steel/aluminum in outside/wet areas.

d. Use PVC coated reinforced fiberglass in hazardous and chemical areas.

N. Wire Hangers

1. Specific Criteria

a. Appropriately locate above dropped ceilings.

O. Red Dye

1. Specific Criteria

a. Provide red dye in concrete duct bank.

b. 4000 psi

c. See typical duct bank details in Attachment I

XIV. Item No. 14

A. Wire

1. Specific Criteria

a. Provide copper stranded wire only.

b. Provide for separation of power, signal and telephone services.

c. Do not splice wire - Splicing not allowed unless approved by Owner/Engineer

d. If approved, medium voltage splicing and termination kit installations must be performed by certified personnel as demonstrated by the NCSCB program.

e. Sectionalizing cabinets are not acceptable and must be approved by Owner/Engineer

f. **Direct buried cable is not acceptable. Cable must be**

protected in conduit or duct bank system

g. Use compression type lugs only.

h. Place metal tags on cables in manholes

i. Welding cable (DLO) – Design based on intermittent duty vs. continuous duty.

j. Provide Ethernet cable/CAT 6 for communications to equipment.

k. Provide MV cable pulling calculations prior to installation

B. Telephone – Wire

1. Specific Criteria

a. Minimum wire gauge #22-24 AWG

b. Provide plenum rated cable in return air plenums.

C. THHN, THWN, XHHW – Wire

1. Specific Criteria

a. Follow NEC color coding.

b. All shall be stranded wire, rated for 600-volt.

c. #12 minimum wire size for typical applications

D. Instrumentation – Wire

1. Specific Criteria

a. All wire MTW or signal wire shall be rated at 600-volt.

b. Do not combine analog circuits (twisted shielded pair-TSP) with other circuits in the same conduit.

c. Instrumentation control wires should be sized accordingly (#16 stranded wire recommended)

d. DC wire shall be color-coded blue #16 AWG minimum.

e. AC wire shall be color-coded red #16 AWG minimum.

f. Unless otherwise specified by the manufacturer, provide analog signals with #18-2 AWG with a shield, tinned

g. Reference 33-31 Attachment EE – Color Code Wire Chart

E. Wire Markers -Wires shall be marked at all termination points using heat resistant sleeve-type labels (Brady PermaSleeve High Temperature or equivalent). Wrap-around labels shall not be

used. Labels shall be white with black lettering.

F. Tracer Wire - Do not splice wire – Splicing not allowed unless approved by Owner/Engineer

Note: Cabinets with multiple sources must be clearly marked as such

G. High Voltage Cable – Wire

1. Specific Criteria

a. Follow appropriate code.

H. Heat Tracing – Wire

1. Manufacturers

a. Letco-Dual Controls

b. Chromalox

2. Specific Criteria

a. Provide terminations above the insulation.

b. Provide thermostatically controlled constant watt tracing.

c. Provide with insulation.

d. Provide with protective outer coating.

e. Provide a metal strip on PVC pipe to distribute heat.

f. Provide with indicator light.

g. Provide with stainless steel leads in corrosive areas.

h. Provide coating for chemically corrosive areas.

XV. Item No. 15 - Relays

A. Industrial

1. Manufacturers

a. Allen Bradley

b. Eaton

2. Specific Criteria

a. Fixed base

B. Electronic

1. Manufacturers

a. IDEC

b. Potter-Brumfield

c. Agastat

2. Specific Criteria

a. Plug-in/ice cube type with pilot lights

XVI. Item No. 16

A. Lockout / Tagout □ Safety

1. Specific Criteria

a. Provided for in Section 22 – HRSD Safety Program in this manual. Provide local lockout devices for all equipment.

XVII. Item No. 17

A. Switches / Receptacles / Plugs

1. Manufacturers

a. Pass & Seymour

b. Hubbell

c. Crouse Hinds

2. Specific Criteria

a. Provide compression type screw terminals on receptacles. Wire binding receptacles or switches are not acceptable.

b. Provide for dedicated circuits for sump pumps.

c. Provide power receptacle in control cabinets.

d. Provide a neutral for each circuit, multi wire circuits are not allowed without special approval and then with a two-pole breaker.

e. Provide “in use” covers for indoor sump area applications.

XVIII. Item No. 18 – Unit Heaters

A. Unit Heaters - Electric

1. Manufacturers

a. QMark

b. Dayton

2. Unit Heaters – Gas

a. Space Ray

b. Dayton

XIX. Item No. 19

A. Electrical Drawings

1. Specific Criteria

a. Process and Instrumentation Diagrams (P&IDs) are to conform to ISA modified standards (Consulting engineer to provide)

b. Provide functional descriptions with the P&IDs (Consulting engineer to provide)

c. Provide Point-to-Point connection drawings. Contractor shall develop.

d. Review and approval by the engineer shall be prior to installation.

e. Label all conduits inside building.

f. Place metal tags on cables in manholes

g. Provide final conduit & cable schedule on disk (AutoCAD, PDF & VISIO)

XX. Item No. 20

A. Safety Switches (fused or unfused)

1. Manufacturers

a. Square D

b. Eaton

c. Westinghouse

d. Allen Bradley

2. Specific Criteria

a. Light duty safety switches are unacceptable.

b. Must be pad lockable.

XXI. Item No. 21 - Transformers

A. Dry Transformers

1. Manufacturers

a. Square D

b. Eaton

c. GE

d. ACME

2. Specific Criteria

a. No Aluminum Wire

b. Provide 220□ C insulation system for 15kVA and larger.

c. Provide 180□ C insulation system for transformers less than 15kVA.

d. Transformers shall handle a 15% overload without exceeding the insulation rating.

e. Place on 4” housekeeping pads

B. Oil Filled Transformers

1. Manufacturers

a. Square D

b. Eaton

c. GE

2. Specific Criteria

a. No PCBs allowed.

b. Provide with FR3 oil.

c. Provide housekeeping pad – elevate pad in places prone for flooding.

d. Require external sample ports.

e. Provide grounding of transformer per NEC. Provide ground loop around transformer with four (4) ground rods at each corner. Connect primary and secondary compartment ground studs and transformer to ground loop. Connect exposed metallic conduits, XO terminal, ground pads, surge arrestor, and medium voltage ground shields to ground loop.

f. Provide devices in external NEMA 4X, stainless steel enclosures with pad-lockable doors on the secondary side of the transformer: separate enclosure for 1 inch drain valve with sampling device; separate enclosure for liquid level gauge with auxiliary contacts, dial type thermometer gauge with auxiliary contacts, and pressure vacuum gauge with auxiliary contacts; and separate enclosure for auxiliary terminal blocks.

g. Minimum two (2) infrared inspection windows with covers on each of the primary and secondary compartment doors.

XXII. Item No. 22

A. Metering Vaults/Pits

1. Specific Criteria

a. Provide receptacle and receptacle location per HRSD direction.

b. Provide sump pumps as needed with remote GFCI circuit breaker protection.

c. Provide explosion proof sump pump in Class 1 division 1 areas.

B. Other Metering Vaults/Pits

1. Power Requirements

a. Specific Criteria

(1) Provide two receptacles with weatherproof covers with remote GFCI circuit breaker protection

2. Exhaust Fans

a. See Exhaust Fans

b. Size for 12 air changes per hour (minimum)

c. Bring exhaust duct to within 6 inches above finished floor.

3. Lighting

a. Provide incandescent lighting with a vapor tight glove and guard.

b. Provide light switch at access.

XXIII. Item No. 23

A. Pressure Sustaining/Regulating Valves

1. Manufacturers

a. KTM

b. Foxboro

c. Clow

2. Specific Criteria

a. Provide 4-20 mA operated valves. Do not use pulsed control valves.

b. Automatic Controls of Virginia or Valve Automation for actuator applications

c. Use EIM /Bettis actuators.

d. Limitorque (refer to Attachment P)

B. Other

1. Butterfly Valves

2. V Notch Plug Valves

3. V Notch Ball Valves

XXIV. Item No. 24

A. Flow Meters – Size for average flows

1. Parshall flume

a. Specific Criteria

(1) Use ultrasonic level indicator (Siemens)

2. Magnetic

a. Manufacturers

(1) Rosemont

(2) Foxboro

b. Specific Criteria

(1) Use for control or billing applications.

(2) Ensure vendor is clear on application.

(3) Provide with remote head, display and keyboard.

3. Ultrasonics (strap on)

a. Manufacturers

(1) Fuji

(2) Flexim (refer to Attachment N) (concrete pipe application)

(3) Pulsar

b. Specific Criteria

4. Ultrasonics level

a. Manufacturers

(1) Siemens

(2) Rosemount

5. Insertion (mass flow)

a. Manufacturers

(1) Magnetrol

(2) Sierra

(3) Kurz

b. Specific Criteria

(1) Air

6. Venturi

a. Specific Criteria

(1) Generally, not used in most applications.

(2) Do not use for control.

XXV. Item No. 25

A. RTUs (Remote Terminal Unit)

1. Manufacturers

a. Allen Bradley

b. Emerson-Control Wave

c. Emerson-OCC100

2. Specific Criteria

a. HRSD shall provide.

b. Physical size 24”x24”x8” in a NEMA 4x enclosure

c. Physical size 12”x12”x8” in a NEMA 4x enclosure

XXVI. Item No. 26

A. Louvers/Dampers

1. Manufacturers

a. Greenheck b. Ruskin

2. Specific Criteria

a. Provide gravity dampers for all applications.

b. See Emergency Generators

XXVII. Item No. 27

A. Transfer Switches

1. Manufacturers

a. Eaton

b. Square D

c. ASCO

2. Specific Criteria

a. Nema 12 Enclosure unless required otherwise.

b. IQ Plus Monitoring Device

c. Provide BUS status (A or B) to the DCS

d. Zenith transfer switches are not acceptable.

XXVIII. Item No. 28

A. On-Line Vibration Monitors

1. Manufacturers

a. Bentley-Nevada

2. Specific Criteria

a. Application specific

XXIX. Item No. 29

A. Panel Meters

1. Analog

a. Manufacturers

(1) GE/Yokogawa

(2) Simpson

2. Digital

a. Manufacturers

(1) Yokogawa

(2) Red Lion

(3) Simpson

3. Elapsed Time

a. Manufacturers

(1) Crompton

(2) ENB

(3) Yokogawa

b. Specific Criteria

(1) Non resettable / resettable (plant site specific)

4. Pulse Counters

a. Manufacturers

(1) Acromag

(2) Omron

5. Isolators

a. Manufacturers

(1) Acromag

(2) AGMPhoenix

b. Specific Criteria

(1) Isolate 4-20 MA and 1–5-volt signals

(2) Powered 4-20 MA isolator splitter.

(3) Terminal relay

(4) Compact panel temp sensor 4-20 MA

6. Signal Converters

a. Manufacturers

(1) AGM

(2) RIS

(3) Acromag

b. Specific Criteria

(1) Isolate 4-20 MA and digital.

7. Surge Protectors

a. Manufacturers

(1) Phoenix

(2) MTL-Crouse Hinds

b. Specific Criteria

(1) Provide 120v AC power supply surge protectors.

XXX. Item No. 30

A. Analyzers/Monitors: Safety / Gas

1. Combustible LEL

a. Manufacturers

(1) Detronics

(2) MSA

2. O2

a. Manufacturers

(1) Detronics

(2) MSA

3. SO2

a. Manufacturers

(1) Detronics

(2) Bisulfite

4. H2S

a. Manufacturers

(1) Detronics

b. Specific Criteria

(1) ATI is not used for Safety.

B. Analyzers/Monitors: Process

1. pH

a. Manufacturers

(1) Foxboro

(2) E&H Memosens CPS16D pH probe (Incinerator scrubber water process) (Site Specific/Specific applications)

(3) M4 Knick (Site Specific/Specific applications)

2. ORP

a. Manufacturers

(1) Foxboro

b. Specific Criteria

(1) Provide only.

(2) Stanco not acceptable

3. O2 (Incinerator)

a. Manufacturers

(1) COSA

b. Specific Criteria

(1) Provide only.

(2) Operating temperature >1500°F

4. DO

a. Manufacturers

(1) Hach

(2) Insite

b. Specific Criteria

(1) Optica

5. CL2

a. Manufacturers

(1) Rosemount

(2) Prominent

(3) Chemtrac

6. H2S

a. Manufacturers

(1) ATI

7. Conductivity

a. Manufacturers

(1) Hach

XXXI. Item No. 31

A. Miscellaneous Instrumentation

1. PID Controllers

a. Manufacturers

(1) Emerson Ovation

2. Electric Actuators

a. Manufacturers

(1) EIM/Bettis

(2) Limitorque (refer to Attachment P)

b. Note: Verify hazardous classification for small 120V actuators.

c. Specific Criteria

(1) 120 volts and 480 volts AC

3. Burner Actuators

a. Manufacturers

(1) Honeywell

(2) Barber Coleman

4. Alarm Panel

a. Manufacturers

(1) Ronan

5. Temperature Controllers

a. Manufacturers

(1) Yokogawa

XXXII. Item No. 32

A. Miscellaneous Electrical

1. Electrical Equipment Testing

a. Specific Criteria

(1) Provide testing in off-peak hours or switch off an equivalent amount of load prior to testing.

(2) Provide report of completed acceptance testing per NETA standards prior to energization

(3) Circuit Breakers: Provide factory installed test report; All breakers in the field above 100 amps must be tested by third party and report must be provided.

(4) Wire and Cable size AWG 8 or larger must be tested by third party per NETA standards and report must be provided.

2. One Line Diagram

a. Specific Criteria

(1) Provide an update to the one-line diagram with significant changes in the electrical system.

3. Thermographic Inspection

a. Specific Criteria

(1) Provide a thermographic inspection of the new systems upon completion.

4. Coordination Study/Short Circuit/Arc Flash

a. Specific Criteria

(1) Provide a coordination study short circuit, coordination, and arc flash

(a) analysis for new systems or systems with significant changes.

(2) The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum number of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable. Include Arc flash analysis results for generator protective device.

(3) Contractor must adhere to NFPA 70E Electrical Safety requirements when working on electrical equipment in HRSD facilities.

(4) Engineer must design electrical systems in accordance with NFPA 70E.

5. Installation of electrical equipment (i.e. wire, conduit, ductbank, switchgear, motor control centers, motor starters, industrial controls panels, transformers, etc.) to be completed by personnel classified and qualified as electricians.

Refer to Attachment A

XXXIII. Item No. 33

A. Heating and Cooling

1. Manufacturers

a. Honeywell

b. Barber Coleman

2. Specific Criteria

a. Louver actuators to be used with building heating/ventilation systems.

b. Provide low head controllers on HVAC Units in MCC Electrical Rooms to prevent AC Unit from tripping during

cooler months when the outdoor ambient temperature is low.

XXXIV. Item No. 34

A. Junction/Pull Boxes and Miscellaneous Enclosures

1. Manufacturers

a. Hoffman

b. Saginaw

c. Hammond

d. Rittal

2. Specific Criteria

a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit.

B. Administrative Areas

1. Manufacturers

a. Hoffman

b. Saginaw

c. Hammond

2. Specific Criteria

a. NEMA 4

C. Inside

1. Specific Criteria

a. Stainless steel, fiberglass reinforced plastic (FRP), steel, NEMA 4

D. Outside

1. Specific Criteria

a. Stainless steel, NEMA 4x with Myers hubs

E. Wet

1. Specific Criteria

a. Use with PVC coated conduit and PVC coated hubs.

b. Stainless steel, fiberglass reinforced plastic, NEMA 4x with watertight fittings (Myers).

XXXV. Item No. 35

A. Panel Boards/Control Panels

1. Manufacturers

    a. Eaton

    b. Square D

    c. Siemens

    d. GE

2. Specific Criteria

    a. Provide PVC coated boxes and/or fittings when using with PVC coated conduit.

    b. Provide with tin-plated copper bus.

    c. Provide 25% spares minimum.

    d. Provide bolt in breakers.

    e. Do not provide cans with pre-stamped knockouts.

    f. Provide with hinged panel cover with a latching door.

    g. Provide heavy duty, industrial grade panel boards.

    h. Breaker operator should be outside of panel.

    i. Breaker should be located inside of panel.

    j. HOA switches should be on the outside of panel.

    k. Provide dead front hinged panel.

    l. Provide LED work light, if warranted

XXXVI. Item No. 36

A. Distributed Control System (DCS)

1. Manufacturers

    a. Emerson

2. Specific Criteria

    a. Provide fail safe condition within the DCS located in the marshalling cabinet terminal strips.

    b. Contact in the field must be wired to a normally closed contact in the energized position. When fault occurs, the contact will open and be displayed as a system failure. This prevents contacts which do not close properly to indicate a fault to the system. A digital status that equals 1 (one) indicates a closed contact and a 0 (zero) indicates an open contact. An open contact occurs when a fault occurs (fail open).

c. DCS DCU's and RIO's shall be equipped with isolation relay junction box(s) (interposing relays) adjacent to all the DCU's and RIO's. The junction box shall contain ample room to house relays; Example: (Idec 5-blade – 24 VDC coils- with a form C configuration contactor) relays mounted on DIN rail for the purpose isolating relay junction box. This junction shall be equipped with a 24 VDC power supply with sufficient capacity to energize all the 24 VDC relay coils simultaneously when necessary for all DCS inputs.

Note: The following HRSD design standards shall be adhered to colors for graphical screens, graphics design, and control functionality. The current HRSD DCS standards are maintained by Industrial Automation within the E&I Department. These standards are available upon request.

XXXVII. Item No. 37 - Lightning Protection Refer to NFPA 820 and NFPA 780. - Lightning Protection applications will be site specific (Discuss with HRSD Electrical Staff).

XXXVIII. Item No. 38 - SWIFT (*Refer to Attachment H*)

XXXIX. Item No. 39 - Dominion Energy Coordination (refer to Attachment J)

A. Easements

1. It is imperative that the design engineer contacts the utility company (i.e., Dominion Energy, Rappahannock Power, Prince George Electric Cooperative, etc.) to determine the responsible territory.

2. Design Engineer and HRSD should inquire with the utility company if single phase or 3-phase power is available at the proposed site.

3. Design Engineer should incorporate right-of-way (ROW), multi-use utility easements, identify property owners, and VDOT requirements as part of the preliminary engineering report (PER) to prevent delays and cost increase during the construction phase of the project. The items listed above should be explored in advance, especially in rural communities where 3-phase electrical service is not available.

4. See Attachment J for Dominion Project Workflow Brochure "HRSD Interface on New Projects with Dominion Energy Virginia (DEV)

B. Utility Service Transformer Placement

1. The Utility Service Transformer shall be located within 50 feet

of the Utility Service Metering Base (or as required by the specific utility) such that the transformer secondary cabling is installed, owned, and maintained by the respective utility

a. The installation of conduit for the secondary cabling shall be conducted in accordance with the requirements of the respective utility

b. If circumstances prevent the requirements above to be followed and HRSD is responsible to own and maintain the transformer secondary cabling, the conduit for this cabling shall be installed in accordance with the requirements as specified in this standard.

XL. Item No. 40

A. Grounding

"50.53 Grounding Electrode System Installation.
(A) Rod, Pipe, and Plate Electrodes. Rod, pipe, and plate electrodes shall meet the requirements of 250.53(A)(1) through (A)(3).
(1) Below Permanent Moisture Level. If practicable, rod, pipe, and plate electrodes shall be embedded below permanent moisture level. Rod, pipe, and plate electrodes shall be free from nonconductive coatings such as paint or enamel.
(2) Supplemental Electrode Required. A single rod, pipe, or plate electrode shall be supplemented by an additional electrode of a type specified in 250.52(A)(2) through (A)(8). The supplemental electrode shall be permitted to be bonded to one of the following:
(1) Rod, pipe, or plate electrode
(2) Grounding electrode conductor
(3) Grounded service-entrance conductor
(4) Nonflexible grounded service raceway
(5) Any grounded service enclosure

Exception: If a single rod, pipe, or plate grounding electrode has a resistance to earth of 25 ohms or less, the supplemental electrode shall not be required.

(3) Supplemental Electrode. If multiple rod, pipe, or plate electrodes are installed to meet the requirements of this section, they shall not be less than 1.8 m (6 ft) apart."

XLI. Item No. 41 – NFPA 820 Classification

"1. Purpose to provide explosion and fire protection for life property, and operations.
2. Reduce or mitigate the effects of fire or explosion
3. Consult with AHJ (Authority Having Jurisdiction) to ensure that the NFPA

820 standard will be enforced.

NFPA 70 – Article 500

Class I: Flammable Gases/Vapors
Class II: Combustible Dust

Class III: Ignitable Fibers

Wastewater/Treatment/Collections

Systems Class I, Div 1 or 2, Group D

(Methane) Class I, Div 1 or 2, Group G

(Sludge)

Wet Well Pump Station

Less than 12 air changes – Division 1 Greater than 12 air changes – Division 2

Typical classified areas: Barscreen, Headworks or Preliminary Treatment Facility, Grit Removal, Odor Control, Sludge Handling and Thickening, etc.

Evaluate equipment type (i.e., explosion proof, conduit seals, etc.)

NFPA 820 4.2.2 – Collections Systems – See Attachment Y

NFPA 820 5.2.2 – Liquid Streaming – See Attachment Z

NFPA 820 6.2.2 – Solids Treatment Processes – See Attachment S

Consideration requirements: exhaust fans, continuous ventilation, alarming, air flow and monitoring."

XLII. Item No. 42 – Standard Details

A. For detailed drawings refer to Section 37, Series 700.

XLIII. Item No. 43 - Air Purification – Hydrogen Sulfide (H2S) Mitigation for Electrical Room - See Attachment AA

A. Manufacturer

1. Pure Air or approved equal.

XLIV. Item No. 44 – Backup Battery Systems

A. Manufacturer

1. Liebert (See Attachment BB)

DISTRIBUTED CONTROL SYSTEM (DCS) Electrical and Instrumentation Requirements

I. Strategic Automation Configuration

A. Refer to Attachment Q

Attachments

I. Attachments:

A. Arch Flash Mitigation & Power Study Specifications

B. Load Bank Connections

C. Variable Frequency Drive Specs.

D. Lighting Policy

E. HRSD Electric Motor Specifications

F. Temporary Portable Pump Alarms & Setup Standards

G. SCADA Site Drawings

H. SWIFT Requirements

I. Ductbank Directions

J. Dominion Energy Coordination

K. SCADA Flowchart

L. Remote Switch Operator

M. Remote Open-Close Operator Panel

N. Ultrasonics Technical Information

O. Limitorque

P. Waterpilot FMX-21 Technical Information

Q. Strategic Automation Configuration Guide

R. Controlwave & Telog Wiring Details

S. Solids Treatment Processes

T. Wet Well Pump Wiring Electrical Backboard Detail

U. Antenna Installation Detail

V. Intrinsic Safety Panel Details

W. Actuator Vault Electrical Backboard Detail

X. Wet Well Instrumentation Installation Detail

Y. Collections Systems

Z. Liquid Streaming

AA. Hydrogen Sulfide Mitigation for Electrical Room

BB. Backup Battery Systems

CC. Cable Routing Disconnect

DD. Manufacturers List

EE. Conductors Colors

End of Section

Section 34 – IT Infrastructure Hardware and Third-Party System Integration

I. Introduction – This section serves to provide information and standards pertaining to the hardware installation and/or upgrade of HRSD's Information Technology assets, to include new construction, renovation, and third-party integration within HRSD's control network. The objective of this section is to ensure consistency with HRSD's internal policy related to IT infrastructure hardware and to conform to Building Industry Consulting Service International (BICSI) standards as closely as practicable. See attachments A and B for HRSD's technical guidelines related to these topics.

II. General – The objectives are to standardize HRSD's server and network infrastructure designs as well as HRSD's processes to accommodate the integration of third-party systems within the control network environment to:

   A. Maximize functionality and performance

   B. Minimize time-to-resolution during troubleshooting efforts

   C. Facilitate the installation or upgrade process by clearly defining expectations so that re-work is minimized

   D. Enhance overall system capability and usefulness

   E. To provide enhanced monitoring and reporting for more streamlined workflows.

III. OT Cybersecurity Requirements – This section establishes requirements pertaining to the cybersecurity of Operational Technology (OT) systems and networks integrated within HRSD environments, including new construction, renovation, and third-party system implementations. The objective of this section is to ensure that OT systems are designed, delivered, and maintained in a secure manner consistent with HRSD's cybersecurity program and associated standards.

A. All Operational Technology (OT) systems, industrial networks, and associated components shall comply with the HRSD OT Cybersecurity Standards
B. Compliance shall be demonstrated prior to system acceptance and production deployment, including delivery and validation of required turnover artifacts
C. Systems shall be delivered in a secure-by-default state and shall not contain known high or critical vulnerabilities with available patches unless formally approved through the exception process
D. All system changes shall be performed in accordance with the approved Change Management process
E. The OT Cybersecurity Standards shall serve as the authoritative source for OT cybersecurity requirements; IT Infrastructure Hardware Guidelines and Third-Party Control Network Integration Guidelines remain applicable for infrastructure and connectivity, but do not replace OT cybersecurity requirements

IV. Attachments:

A. IT Infrastructure Hardware Guidelines
B. Third-Party Control Network Integration Guidelines
C. Operational Technology (OT) Cybersecurity Standards
D. Operational Technology (OT) Cybersecurity Standards Supporting Guidance
E. Physical Security Infrastructure Standards

End of Section

Section 35 - Miscellaneous

I. Introduction – This section provides design criteria, specific requests/recommendations and preferences related to specifying and constructing systems and materials used in HRSD facilities for items not discussed in the other sections. HRSD plant sites are harsh and aggressive industrial environments and the information provided is based on experience within these environments. HRSD expects the FIRM to evaluate all conditions and criteria related to environmental conditions of each project and to recommend and design suitable systems and materials for the specific project conditions. This section includes site work, concrete, masonry, metals and plastics, thermal and moisture protection, doors, windows and glass, finishes sections of the technical specifications, and architectural standards.

II. Site

A. Site Drainage

1. Refer to HRSD's Master Specification "01560 – Environmental Protection and Special Controls" within this manual.

III. Design site grading and surface paving to enhance natural stormwater sheet flow/runoff. Minimize underground storm piping systems to minimize maintenance.

IV. Require removal of all rocks, debris, etc. from finished grade soil.

V. Ensure that drawings and or specifications define the finish grade material.

VI. Construction methods to comply with State and locality stormwater requirements.

B. Landscaping

1. Specify grass seed appropriate for the specific times/seasons of year anticipated for planting.

2. Specify grass seed mixtures that will initially develop and grow without supplemental watering.

3. Provide a general stand of grass unless otherwise directed for specific locations. Do not specify elaborate grass planting plans with exotic fertilizers, mulches, and other requirements. Grass shall be compatible with existing grass type at the existing site. If new site,

grass type shall be reviewed and approved by HRSD and compatible for growth in southeastern Virginia.

a. Provide for compliance with the *Virginia Erosion and Sedimentation Control Manual*, latest edition.

b. Require/specify stabilization matting in all drainage swales/ditches.

4. Plant Material - Specify minimum plant material required by local municipalities, unless directed by HRSD.

5. Concrete Curb and Gutter

a. Specify only where required by municipalities or for other specific design/containment reasons.

b. Specify curb and /or gutter as drive over similar to VDOT CG-3 or 7, when required.

6. Sidewalks

a. Provide minimum width of three (3) feet.

b. Specify specific compaction under sidewalks to allow plant maintenance equipment to cross without cracking.

III. Concrete

1. Provide chamfered edges on all vertical and horizontal exposed edges. Prefer three-quarters to one (3/4 – 1) inch chamfered edges.

2. Specify and detail water stop material to ensure its proper installation and effectiveness.

3. Specify and detail expansion and construction joints to ensure proper installation and effectiveness against water leaking.

4. Design all plant and pump station concrete using ACI 350R.

5. The FIRM shall conduct a pre-construction meeting specifically related to concrete. This meeting will be held separately and in addition to the traditional Project Pre-Construction Meeting.

a. The following individuals should attend this meeting:

(1) FIRM’s structural design engineer
(2) Inspectors
(3) General and appropriate sub-contractors
(4) Supplier's field quality control representative
(5) Concrete testing company representative
(6) HRSD Project Manager

b. Minimum issues to be discussed at the meeting include:

(1) Concrete placement schedule and sequencing
(2) Review of appropriate codes
(3) Cold/warm weather issues
(4) Workmanship and aesthetic issues
(5) Approval and rejection of work
(6) Test panel as standard for approval of future work

IV. Masonry

A. Specify and detail rubberized asphalt flashing over all required openings in non-corrosive environments.

B. Specify and detail stainless steel flashing over all required openings in corrosive environments.

C. Specify and detail flashing material and installation to ensure correct installation and effectiveness.

D. Provide galvanized steel lintels over all exterior openings in non-corrosive environments

E. Provide 316 stainless steel lintels over all exterior and interior openings in corrosive environments.

F. Do not use precast concrete or stone copings.

V. Metals and Plastics

A. Hand/Guard Rails, Stair Systems: Specify and design all materials and systems to meet the criteria and conditions of the specific application and environment considering the following.

1. Provide aluminum or fiberglass materials for all corrosive interior and exterior environments.

2. Provide galvanized steel, anodized aluminum, or fiberglass materials for all interior and exterior non-corrosive environments.

B. Hatches (including all pre-manufactured hinged systems solid cover plates and assemblies). Design and specify all materials and systems to meet the criteria and conditions of the specific application and environment.

1. Specify anodized aluminum, fiberglass, or stainless-steel materials for all corrosive interior and exterior environments.

2. Specify galvanized steel, anodized aluminum, or fiberglass materials for all interior and exterior non-corrosive environments.

3. Design to be flush with surrounding surface (unless conditions require otherwise, and design is approved by HRSD).

4. Provide hatches with opening and hold open hardware integral with the hatch assembly.

5. Provide 316 stainless steel hardware.

6. Provide a minimum two (2) inches of bearing surface along all sides of the hatch cover.

7. Specify and/or design hatch covers to not exceed a maximum deflection of 1/150th of the span when loaded.

8. Provide post and chain or OSHA approved fall protection systems around all hatch openings.

9. Indicate design loading on the drawings.

C. Grating

1. Provide anodized aluminum, fiberglass, or stainless-steel materials for all corrosive interior and exterior environments.

2. Provide galvanized steel, anodized aluminum, or fiberglass materials for all interior and exterior non-corrosive environments.

3. Provide hardware compatible with the grating system material and environment.

4. Design to be flush with surrounding surfaces (unless conditions require otherwise, and design is approved by HRSD).

5. Provide continuous perimeter banding. All openings within the grating shall have continuous banding. At the annular space around

penetrations through gratings, install a cover-plate over the annular space (or otherwise close the opening) in compliance with OSHA.

6. Design grating to not exceed a maximum deflection of 1/150th of the span when loaded.

7. Indicate the design loading on the drawings.

VI. Thermal and Moisture Protection

A. Roofing

1. Provide a minimum of 1/4 inch of slope per foot.

2. Provide sumps around all roof drains.

3. Direct all roof surface water toward drains by built-up roof sections, crickets, etc.

4. Extend roof membrane up the backside of parapets.

5. Locate HVAC and other equipment off the roofs if feasible. If equipment is to be located on the roof, placement of equipment shall be more than ten (10) feet from any leading roof edge.

6. Provide minimum 36-inch-wide walkway protection pads from the roof access point to all roof top equipment.

7. Provide minimum 36-inch walkway protection pads around all four sides of all roof mounted equipment.

8. Provide roof access by roof hatch with ladder or by an exterior wall mounted ladder for all plant buildings.

9. Refer to Section 2 – “Architectural and Landscaping Design and Review Process”, Attachment A – Pump Station Architectural Guidelines for roof design.

10. Specify 40-year composite type Architectural shingle for pump station A-frame roofs or as indicated in Section 2 – “Architectural and Landscaping Design and Review Process” and as selected by HRSD Architectural Review Committee.

11. Install fall protection per OSHA Guidelines

12. Specify pre-finished aluminum coping or gravel stop system.

VII. Doors and Hardware

A. General

1. Provide entry doors with threshold elevation high enough to avoid concerns with potential flooding at 100-year flood elevation as referenced in Section 10 – “Flood Elevation Requirements” in this standards manual.

2. Provide non-removable hinge pins on outward swinging exterior doors.

3. Provide heavy duty industrial grade hardware.

4. Install kickplates on all exterior doors and all doors with closers.

5. Provide heavy duty industrial grade hardware on all overhead doors.

6. Provide overhead doors designed for 110 MPH wind load.

B. Pump Stations

1. Provide fiberglass doors and frames with stainless steel hardware in corrosive areas (i.e. wet wells).

2. Provide pre-finished aluminum doors in all other locations.

3. Provide double leaf (each three (3) feet wide) entry doors.

4. Provide continuous hinge on entry doors.

5. Specify that locksets shall be supplied by HRSD and installed by the Contractor.

C. Treatment Plants (See also: Ride-Out Space requirements.)

1. Provide anodized aluminum exterior doors and frames in maintenance and process areas.

2. Provide aluminum doors with continuous hinges in maintenance and process areas.

3. Provide a vision glass in all exterior doors.

4. At all office spaces provide a vision glass in the office entry door, unless a door sidelight or a borrowed light (interior window) is provided.

5. Provide hardware that is compatible with the door and frame material and the environment.

6. Provide locksets only on administration and storage spaces.

D. Electronic Entry-Access Control

1. Entry access control needs at HRSD facilities (at interior doors, exterior doors, site gates, etc.) shall be coordinated with HRSD for the specific requirements of the facility.

2. Across HRSD, a certified security vendor/company is currently used to purchase and install HRSD's security system equipment for entry access control. The primary method of electronic entry-access control is via employee-assigned ID proximity cards which operate card/badge readers (aka: proximity readers). The model prox reader that HRSD currently uses is the WaveLynx Ethos Reader. HRSD's I.T. services office coordinates electronic access control systems.

3. See the typical door access control diagram at the end of this section.

VIII. Painting and Coatings

A. Painting and Coatings Systems

1. Evaluate the various environments and recommend painting and coatings systems considering lifecycle costs and accessibility for re-coating. The FIRMs shall carefully review the information in HRSD Master Specification 09900 Protective Coatings in Section 40 of this standards manual and discuss how and/or why they anticipate complying with or deviating from the recommendation of the manual.

2. Provide a painting and coating schedule for the project.

B. Limits of Coatings in Covered Tanks

1. When covered tanks require coatings for corrosion protection, the coatings shall cover all surfaces in the vapor space and extending to one (1) foot below the minimum water surface and a minimum of four (4) inches beyond the edge of the cover.

2. Pay special attention to the coatings termination details to prevent deterioration and undercutting.

C. Pump Stations

1. Minimize surfaces to be painted.

2. Do not paint concrete floors.

3. Do not paint interior CMU walls. Specify that certain materials' unfinished face shall be the final finish and workmanship is critical.

4. Do not paint electrical conduit.

IX. Architectural/Structural

A. Shall be designed and constructed to Building Code requirements per locality where facilities are being built.

B. Ride-out space at Treatment Plants and administrative buildings to be designed to withstand a Category I hurricane / wind event and to be functional at that corresponding flood level.

1. Design Wind Loads: Comply with requirements of ASCE 7-10 for the locality's Ultimate Wind Speed and the facility's Risk Category. Structural design drawings shall show the Ultimate Wind Speed and the Components and Cladding design pressure local to the facility.

2. Wind-Borne-Debris Resistance: Exterior window and door assemblies shall show (without use of auxiliary protection) Florida Building Code "FLA (PAD)" approval for Large (D) and Small Missile impact and pressure cycling at design wind pressure. Windows shall pass the Wind-Borne Resistance test: ASTM E1996 Wind Zone 1, Enhanced Protection, for Large (D) Missile Impact.

3. Flood: At a minimum, comply with current flood zone (FIRM) map and Design Flood Elevation (DFE) for the locality of the facility. Consideration shall be given to climate-change flooding projections for the region. Design recommendation shall be reviewed with HRSD.

C. Indicate the use classifications for all building spaces.

D. Indicate design floor loads.

E. Post the design live load limit on the perimeter of storage mezzanines, in locations easily visible from the ground floor.

F. Pumping stations and other buildings and sites constructed in public areas shall be designed and configured to be in harmony with the surrounding setting. Architectural and landscaping designs and renderings will be submitted to and approved by HRSD's Architectural Review Committee at the PER stage.

1. Refer to the Pump Station Architectural Guidelines in Section 2 – "Architectural and Landscaping Design and Review Process" in this manual.

X. Interior Finishes

A. Epoxy/Urethane Flooring: In administrative, shop, and lab facilities, regular cleaning maintenance is typically performed by staff and not by outside contractors. As a result, highly durable, easily cleanable, monolithic floor finishes are preferred in all areas normally accessible to Operations personnel. Such spaces can include corridors, offices, lab areas, breakrooms, toilet/locker/shower rooms, maintenance shops, and other support spaces (housekeeping, workrooms, plans rooms, tools/supplies storage). Integral coved wall base is preferred. Products frequently specified for these areas include the following:

1. Flooring Type [Epx-1]: A decorative, colored-quartz, self-levelling fluid-applied flooring system having 100%-solids epoxy base coat(s), with broadcast aggregate, and clear-gloss top wear coat.
   a. Locations Used: Corridors, offices, and other non-wet areas.
   b. Appearance: Multi-colored aggregate, with clear gloss topcoat and orange-peel texture (meets ADA friction standards).
   c. Nominal Dry Thickness: 3/16"
   d. Basis of Design Product: Dur-A-Flex "Dur-A-Quartz" epoxy flooring system (www.dur-a-flex.com). Apply quartz granules in a double-broadcast method. Utilize manufacturer's fine aggregates for broadcast. Provide Armor-Top clear gloss topcoat. Achieve an orange-peel surface texture. VOC-compliant. Primer required.

2. Flooring Type [Epx-2]: A decorative, colored-quartz„ self-levelling fluid-applied hybrid flooring system having a urethane base coat with a 100%-solids epoxy overcoat(s), a urethane topcoat with broadcast aggregate, and a clear gloss top wear coat.
   a. Locations Used: Formulated with high moisture tolerance for use in shower, locker, and toilet areas.

b. Appearance: Multi-colored aggregate, with clear gloss topcoat and orange-peel texture (meets ADA friction standards).
c. Nominal Dry Thickness: 3/16”-to-1/4”
d. Basis of Design Product: Dur-A-Flex; “Hybri-Flex EQ" epoxy flooring system: www.dur-a-flex.com. Apply quartz granules in a double- broadcast method, Utilize manufacturer's fine aggregates for broadcast. Provide Armor-Top clear gloss topcoat. Achieve an orange-peel surface texture. VOC-compliant. Self-priming.
e. EPX-1 and EPX-2 can be made identical in appearance. Floor thickness transition taper to be made at doorways.

3. Flooring Type [Epx-3]: A solid-colored self-levelling hybrid fluid-applied flooring system having a surface-prep scratch coat, a urethane base coat with 100%-solids epoxy overcoat(s), a urethane topcoat with broadcast aggregate, and a pigmented gloss top wear coat.
a. Locations Used: Maintenance shops and tool/parts storage areas at shops.
b. Appearance: Opaque single-color gloss topcoat and orange-peel texture (meets ADA friction standards).
c. Nominal Dry Thickness: 3/ 16”
d. Basis of Design Product: Dur-A-Flex; “Poly-Crete SLB” urethane base coat with " Shop Floor" epoxy overcoat and “Armor Top” pigmented gloss urethane topcoat, for a system with superior bond over concrete or tile surfaces; www.dur-a-flex.com. Apply in a double-broadcast method utilizing manufacturer's flintshot aggregates, to achieve 3/16" dry finished thickness. Achieve an orange-peel surface texture. Provide Armor-Top pigmented gloss topcoat. VOC-compliant.

XI. Miscellaneous Accessories

A. Lockers: Lockers at Treatment Plants shall be single-high (6’) x 18” x 18”, on 4” curb, of heavy-duty (16-ga) steel construction, standard ventilated type. Provide two adjacent lockers per person, with one locker used for street gear and the other for work gear.

B. Locker Room Benches: Provide benches convenient to lockers. Bench seats shall be of 1- 1/2” thick solid polymer material.

C. Locker Room Coat-hook Racks: Provide coat-hook rack(s) in Locker Rooms. Used for hanging of full-length work coveralls, they shall be located convenient to locker users. Ideal hook spacing of 6” to 9” on center.

D. Locker Room Lavatories (Wash Sinks) at Treatment Plant Locker Rooms: ln addition to accommodating accessibility requirements, where possible the washroom should include a lavatory having a larger basin for forearm washing. This may be in the form of a stainless-steel scullery-type sink. Provide gooseneck faucet with wrist-blade.

XII. Attachments

A. Door Typical Drawings

End of Section

Section 36 – Standards for Capital Improvement Projects that Involve Construction Dewatering Activities

I. Introduction – This Section was introduced to assist FIRMs with developing approaches for evaluating, permitting, and monitoring suspected groundwater discharges from contaminated soils. Well point dewatering systems are often used to lower the groundwater for deep and long trench construction. The likelihood of encountering contaminated hot spots is increasing as programs to replace and rehabilitate HRSD aging infrastructure continue to grow in heavy urban corridors.

The Master Specification 02710 – Contaminated Groundwater Management was developed in conjunction with this Section and is to be used in the Bid Documents for contractors if groundwater contamination is anticipated.

II. Background - This Discharge Standard is designed to ensure that the discharge of groundwater from dewatering activities containing contaminants is undertaken in accordance with all applicable regulatory requirements to protect the waters of the state. The standard is also designed to ensure the requirements of the Municipal Separate Storm Sewer (MS4) are complied with where the discharge occurs.

The standard applies to construction dewatering activities managed by HRSD, and the selected FIRM and contractors. This standard shall be implemented by HRSD, the selected FIRM, and its contractor to ensure that proper characterization and treatment of groundwater occurs during construction prior to discharge. The FIRM shall follow HRSD's Construction Dewatering Policy, found on www.hrsd.com, to ensure proper permitting is in place prior to beginning work.

When groundwater dewatering is anticipated in an area that has a potential to have contaminated groundwater present due to the adjacent land use (ex. gasoline station, dry cleaner, industrial facility), the FIRM shall conduct groundwater testing within the proposed limits of construction to determine the likelihood of encountering contaminated groundwater during construction. This information will normally be provided to the contractor during the bidding process.

If contaminated groundwater is likely to be encountered during construction or known to exist within the footprint of the project, then the appropriate discharge permits shall be obtained by the contractor prior to commencement of dewatering activities. HRSD will require that the contractor be the permittee. As such, the contractor will be required to undertake all actions necessary to ensure that groundwater from dewatering is discharged in accordance with all applicable permit requirements. This will include securing the necessary permits, securing, and operating all treatment equipment required to meet effluent requirements, monitoring the discharge for quality, and filing the necessary reports.

During dewatering the contractor is responsible for conducting all effluent testing required by the permit and meet the reporting requirements by filing within the required timeframe specified in the permit. HRSD shall be provided with copies of all reporting, to include Discharge Monitoring Reports (DMRs), if applicable.

If contaminated groundwater is encountered during construction dewatering activities and no discharge permits have been acquired and/or a groundwater treatment system is not operational, then dewatering activities shall cease immediately until appropriate action is taken.

Construction dewatering activities shall only be conducted in accordance with the applicable permit(s) to comply with the regulation under Sections 301(a) and 402 of the Clean Water Act (CWA), as well as the requirements of the MS4 Permit in the locality where the discharge will take place.

III. Requirements

Appropriate discharge permits must be secured by the selected contractor prior to discharging contaminated groundwater from dewatering sites. The permits available for the discharge of contaminated groundwater are as follows:

- VDEQ VPDES General Permit for discharges of contaminated groundwater into the storm sewer system or state waters (VAG83).
- VDEQ VPDES Individual Permit for discharges of contaminated groundwater into the storm sewer system or state waters.
- HRSD Letter of Authorization for discharges into the sanitary sewer system. A Letter of Authorization may only be issued when VDEQ rejects coverage via a VPDES General Permit or Individual Permit.

VDEQ and HRSD will accept discharges of contaminated groundwater only after an assessment of groundwater quality has been performed, and only in accordance with permit conditions. A schedule of the approximate timelines from assessment to general permit acquisition and treatment is provided as **Attachment A**.

Chemical analyses shall be performed in accordance with EPA/VDEQ approved analytical methods by a laboratory accredited through the Virginia Environmental Laboratory Accreditation Program (1VAC30-45 or 1VAC30-46). Contaminant Identification Table for assistance in identifying parameters of concern is provided as **Attachment B**. However, VDEQ or HRSD may require additional sampling based on analytical results, emerging concerns, and/or receiving waters or treatment plant.

IV. Receiving Sewer System

A. Storm Sewer System

Groundwater discharges into the storm sewer system or directly into a surface water body must be in accordance with VDEQ and any local MS4 requirements. VDEQ has issued a VPDES General Permit (VAG83) which governs the discharge of wastewaters from sites contaminated by petroleum products, chlorinated hydrocarbon solvents, the hydrostatic testing of petroleum and natural gas storage tanks and pipelines, and the hydrostatic testing of water storage tanks and pipelines. Contaminated groundwater can only be discharged to state waters pursuant to this VPDES General Permit or an individual VPDES permit. The contractor must file a Registration Statement for coverage under VAG83 or file for an application for a VPDES Individual Permit.

Short-term discharges (14 days or less in duration) have immediate coverage under the VAG83 permit and are not required to submit a registration statement to the VDEQ to apply for permit coverage. However, written notification is required to be submitted to the VDEQ within 14 days of the completion of the discharge. This coverage may be used for emergency and planned short duration discharges. However, the contractor is still responsible for ensuring the discharge meets the criteria contained in the General Permit.

B. Sanitary Sewer System

When construction dewatering activities are discharged into the sanitary sewer, the discharge activities must be done in accordance with the HRSD Letter of Authorization. If the accepting sewage pump station is owned by a locality, the locality shall be contacted to confirm the volume of groundwater that can be discharged into its system.

Depending on site contamination and VDEQ permitting, some projects may require both a VPDES General Permit and an HRSD Letter of Authorization. VDEQ constituent threshold levels in water discharged directly to state waters are more stringent than those that can be accepted by HRSD; however, the discharge of groundwater is not limited by volume. The HRSD Letter of Authorization contains a maximum allowable volume of groundwater discharge based on the capacity of the downstream sewage pump station and limitations on the pollutants discharged.

C. Treatment Requirements

Effluent from dewatering activities must be filtered, at a minimum, to remove pollutants including sediment through an approved sediment

trapping device prior to release to state waters, the storm sewer system, or sanitary sewer system as required by the Virginia erosion and sediment control regulations (9 VAC 25-850-10 et seq.), the Virginia stormwater management regulations (9 VAC 25-870-10 et seq.), the Virginia Stormwater Management Program Construction General Permit regulations (9 VAC 25-880-10 et seq.), and/or the HRSD Letter of Authorization as applicable.

If treatment is necessary, the groundwater treatment system shall be designed to remove pollutants and sediment from the discharge and have the capacity to fully treat groundwater to the applicable discharge standard at the maximum expected concentrations of the constituent(s) of concern and at maximum discharge rate of the pump(s) being used for the anticipated duration of dewatering. EPA recommended treatment for constituents of concern is contained in **Attachment B**.

V. Contacts

Permit Contacts:
VDEQ: Tidewater Regional Office
Remediation Specialist…… (757) 518-2117
Main Number…….... (757) 518-2000
https://www.deq.virginia.gov/Home/Components/StaffDirectory/StaffDirectory/1182/478

VDEQ: Piedmont Regional Office
Remediation Specialist…….. (804) 527-5057
Main Number…….. (804) 527-5020
https://www.deq.virginia.gov/Home/Components/StaffDirectory/StaffDirectory/1178/478

HRSD: Pretreatment & Pollution Prevention Department
South Shore/North Shore…….. (757) 460-7048

VI. Attachments:

A. Anticipated Schedule from Initial Investigation to General Permit Acquisition

B. Contamination Identification Table

End of Section

Section 37 - Standard Details

I. Introduction – Standard Details have been developed to provide uniformity throughout HRSD. These details can be provided in electronic format. The FIRM must review all the Standard Details and select the ones that are appropriate for any given project. The FIRM must develop other details as required to incorporate into Bid Documents.

II. Listing of Standard Details – These standard details are available in AutoCAD format upon request. These listed Standard Details are included as PDF files in this manual.

A. Series 100: Miscellaneous

100	Standard Cover Sheet
101	Exterior Bollard Detail
102	Bollard Location Detail
103	Load Test Hinged Bank Box
104A/B	Flush-Mount Groundwater Monitoring Well
105	Standard Benchmark Sheet Template

B. Series 200: Collection Systems and Appurtenances

200A/B	Manhole with Extended Monolithic Base
201	Concrete Shallow Manhole with Extended Base
203	Connection into Existing Manholes
204	Sewer Manhole Flow Channel
205	Interior Gravity Main Drop Connection to Existing Manhole
206	Exterior Drop Connection with Precast Concrete Manhole
207	Interior Force Main Drop Connection to Existing Manhole
208	Precast Concrete Manhole Adjustment
209	Manhole Insert
226	Service Lateral & Gravity Main Connection to Existing Stub-out
227	Standard Manhole Frame and Cover
228	Watertight Manhole Frame and Cover
229A/B	Sanitary Service Lateral Installation
230	Sanitary Sewer Service Connection for New or Existing Gravity Main
231	Sanitary Service Lateral Deactivation
232	Alternate Service Lateral Connection to Existing Gravity Sewer Main
276	Sanitary Sewer Service Clean Out Frame and Cover (Traffic Rated)

277 Vacuum Air Intake Valve
278 Lateral Connection to Existing Vacuum Valve Pit Vacuum System Division Valve

C. Series 300: Interceptors and Appurtenances

300 Connection to Existing HRSD Valve with No Potential for Additional Development
301 Connection to Existing HRSD Valve with Future Development Potential
302 Connection to Existing HRSD Valve with Imminent Development Potential
303 New Wet Tap with No Additional Development Potential
304 New Wet Tap with Additional Development Potential
305 New Wet Tap with Imminent Development Potential
306A/B/C 2” Private Force Main Connection to Existing 2” HRSD Force Main Stub
307 Lawnes Point Private Connection Detail
308 Private Force Main Connection to HRSD Manhole
309 Private Force Main Service Connection Saddle to Existing HRSD Force Main
326 Horizontal Gate Valve
327 Vertical Gate Valve
328 Valve Box & Riser for Mainline Valve
329 Valve Box & Riser for Bypass Valves
330 Valve Riser Adjustment
331A/B Roadside Ditch Valve Box
332 Tracer Wire Locator Box
333 Eccentric Plug Valve Detail
351 Manual Air Vent
352A/B Air Release Valve Box Adjustment
353 Roadside Ditch Air Vent
354 Air Vent Frame & Cover
355 Automatic Air Release Valve Box
376 Tapping Saddle for Cast Iron, Ductile Iron, RC, PVC & Steel Pipes
377 Tapping Saddle for Concrete Cylinder Pipe
378A/B Steel Pipe Casing
379 Male Transition Adapter from Ductile Iron M.J. Spigot to Concrete Pipe
380 Female Transition Adapter from Ductile Iron M.J. Spigot to Concrete Pipe
381 Pressure Sensor Installation
382 Line-Stop Concrete Block for Concrete Pipe
383 Line-Stop Concrete Block for Ductile Iron Pipe
386 Support Crossing for Force Main or Gravity Main

D. Series 400: Pump Stations and PRS

400A/B Small Communities Submersible Pump Station Layout Plan
401A/B Diesel Fuel Double Wall Underground Storage Tank
402A/B Underground Storage Tank Installation

E. Series 500: Cathodic Protection for Pipes

500A/B Cathodic Protection Test Station and Terminal Board Wiring
501 Cathodic Protection Isolation Detail
502 Anode Test Station
503 Monitoring Test Station
504 Monitoring Test Station (with Riser)
505 Isolation Flange Test Station
506 Isolation Flange Test Station (with Riser)
507 Anode Header Cable Splice – Wye Type
508A Typical Thermite Weld Procedures on Bonding Plate
508B Typical Royston Handy Cap IP™ Installation
509 Isolating Flange Kit
510 Typical Bonding Plate
511 Copper Wire to Pipe Pin Brazing Procedures
521 Ductile Iron Pipe Galvanic System AC Ground Mat
522 Ductile Iron Pipe Galvanic System Insulating Corporation
523 Ductile Iron Pipe Galvanic System Main Bonding

F. Series 600: Cathodic Protection for Buildings

600 Installation of Discrete Galvanic Anodes
601 Installation of Distributed Galvanic Anodes
602 Distributed Galvanic Anodes at Top of Wall
603 Installation of Drilled-in Galvanic Anodes
604 Conductive Mortar Bridge for use with High Resistivity Repair Mortars
605 Typical Galvanic Anode Layout
606 Typical Galvanic Anode Connections
626 Removal of Unsound Concrete Typical Section
627 Concrete Rebuild Typical Section
628 Minimum Cover Concrete Rebuild
629 Removal of Unsound Concrete Corner Section
630 Concrete Rebuild Corner Section
631 Reinforcing Section Loss Table
632 Lap Splice – Option 1
633 Lap Splice Lengths – Option 1

634 Mechanical Splice – Option 2 Typical Removal Section
635 Mechanical Splice – Option 2 Typical Rebuild Section
636 Weld Splice – Option 3
637 Weld Splice Details – Option 3
638 Weld Splice Details – Option 3
639 Supplemental Reinforcement Requirements
640 Adhesive-Grouted Dowel Layout
641 Concrete Rebuild Embed Plate
642 Horizontal Shallow Depth (2” Max) Concrete Rebuild
643 Vertical Shallow Depth (2” Max) Concrete Rebuild
644 Partial Depth Concrete Rebuild Core Hole
645 Full Depth Concrete Rebuild Core Hole
646A/B Spall Repair with Exposed Reinforcing Steel
651 Joint Sealant

G. Series 700: Electrical and Instrumentation Details

700 Wet Well Pump Wiring Electrical Backboard
701A/B Antenna Installation
702A/B Intrinsic Safety Panel
703 Temporary Pump Connection Box, Connector and Control Wave Serial Port
704 Actuator Vault Electrical Backboard
705 Flow Meter and Pressure Vault Electrical Plan
706 Actuator Vault Electrical Plan
707A/B Wet Well Instrumentation Installation
708 Standard Loop Schematic for Centrifuge Pump Feed
709 Standard Loop Schematic for Pump Valve
710 Standard Loop Schematic for Centrifuge Pump Monitoring Process
711 Standard Loop Schematic for Centrifuge Pump Control
712 Standard Loop Schematic for Polymer Feed Pump
713 Schematic for Pump Run Status Wiring to Local PLC
714A/B/C/D Free Standing Equipment Mounting Rack
715 Lightning Protection
716A FRP Cable Tray Straight Section Assembly
716B FRP Cable Tray 90 Degree Vertical Outside Bend Assembly
717 Standard Pump Station Control Panel Power Wiring

End of Section

Section 38 - Suggested Division 1 Items

I. Introduction – HRSD created Master Technical Specifications in Section 41 under the Construction Specifications Institute (CSI), 2004 Master Format comprised of 16 Divisions; however, the use of the newer 50 Divisions may be considered with approval of the HRSD Project Manager. HRSD provides specific input on items that are normally located in Division 1 of the specifications. Among the Master Specifications sections included in this manual, some sections that comprise Division 1 are included and are to be used as a starting point for editing. Items covered in Division 1 should not be repeated in the other divisions of the technical specifications unless additional division or item-specific requirements exist. Any Division 1 items must be coordinated with the General Conditions where appropriate. With few exceptions, the list below of Division 1 items should serve as a checklist and instruction sheet and is intended to provide HRSD requirements. It should not be considered a complete list of items that may be required in Division 1 of the specifications.

II. The following table includes items that the FIRM should carefully review with the HRSD Project Manager in the preparation of Division 1 of the specifications. Typical sections where these items are commonly provided are indicated.

Potential Division 1 Items	Comments
Summary of Work - Limits of Work Area (Section 01010)	Show limits on drawings. Include access routes and Contractor parking areas.
Summary of Work - Permits and Fees (Section 01010)	Highlight any permits requiring bonds or for which plan approval has been received. Identify what fees and who is responsible for. Include copies of VDOT, Railroad, Corps of Engineers or other permits which have been obtained for the project. Advise Contractor of existing HRSD permits and requirements. Contractor required to obtain storm water permit for construction activities. If fees cannot be reasonably determined prior to bid, consider direct reimbursement by change order.
Miss Utility (Section 01040)	Require the Contractor to contact Miss Utility before performing any excavation.

Potential Division 1 Items	Comments
Special Conditions - Notification of Property Owners (Section 01060)	Clarify with HRSD's Public Information Specialist whether the Contractor or the FIRM will be responsible for notifying all easement owners or adjacent property owners who will be affected by the project at least seven (7) calendar days in advance of work.
Special Conditions - Surveys and Layout (Section 01060)	FIRM to provide baseline and benchmarks. Contractor to provide detailed project layout based on baseline and benchmarks, Contractor to have any benchmarks or property markers damaged or destroyed during construction reset by a surveyor licensed in Virginia.
Traffic Control (Section 01060)	Refer to Permits.
Special Conditions - Work Hours (Section 01060)	Highlight HRSD hours and holidays. Require Owner/FIRM approval for weekend work. Highlight any work hour restrictions. No tie-ins or work requiring Owner coordination on holidays or weekends without special approval.
Special Conditions - Wastewater Spills (Section 01060)	Refer to Section 21 – "Regulatory Reporting Requirements for Spills" in this standards manual. The Contractor must notify FIRM and HRSD of any wastewater spill caused by his work. This is an HRSD permit issue.
Special Conditions - Temporary Facilities (Section 01060)	HRSD will provide access points for power and water and provide reasonable quantities without charge at developed sites; Contractor to provide at undeveloped sites. Contractor to provide their own temporary sanitary services at all sites. Contractor to provide their own telephone service.
Special Conditions - Progress Meetings (Section 01060)	Require monthly project meetings and special coordination meetings as required.

Potential Division 1 Items	Comments
Record Documents (Section 01323)	FIRM is responsible for final Record Drawings to HRSD. Require Contractor to keep records and submit to FIRM to assist in preparation of final Record Drawings. Require periodic review of Contractor markups by FIRM.
Submittals (Section 01340)	HRSD requires one complete set of all shop drawings when issued. The inspector shall also keep a complete set that will be turned over to HRSD upon completion of the project. If multiple HRSD sites are involved in the project, additional sets (paper or digital) of approved drawings may be required.
Submittals – Operation and Maintenance Manuals (Section 01340)	Contractor should provide a complete indexed Operation and Maintenance Manual. Correct all copies after startup to represent final record conditions. Provide final record version in PDF format per *HRSD Design and Construction Standards*.
Maintenance of Operations - Partial Use of Facilities (Section 01520)	If multiple startups are anticipated, provide specifics and address in liquidated damages and contract times sections of the specifications.
Alterations to Existing Buildings (Section 01520)	If this work is to be extensive, a separate section listing specific constraints and the sequence of construction may be required.
Maintenance of Operations - Construction Sequencing/MOPO (Section 01520)	HRSD requests the FIRM to provide sufficient details on required sequencing to ensure the continuous maintenance of plant, pump station and pipeline operations. This will ensure that all parties know of at least one way to construct the project and will have a better handle on proposed contract time. This also provides input to the question of multiple substantial completion items and dates.

Potential Division 1 Items	Comments
Number of Sets of Plans and Specifications to be Provided to Contractor (List in Supplementary Conditions)	Estimate a “reasonable” number or consider providing reproducibles if the Contractor desires a format other than digital.
Safety and Security Requirements	Refer to Section 22 – “HRSD Safety Programs” in the standards manual.
Schedules (Covered in General Conditions)	Require a scheduling method appropriate for the project. It is essential that the Contractor develop a well-thought-out schedule that is used to build the project rather than creating a schedule that is submitted only to meet specification requirements and not used to manage project work.
Substitutions (Covered in General Conditions)	Add special requirements for submissions on substitutions.
Testing Labs (Soils, Concrete, Asphalt Testing) (N/A)	FIRM shall competitively acquire services of an independent testing lab under a Professional Services Agreement additional services and provide one copy of test reports to HRSD. Contractor may be required to provide concrete cylinder storage boxes or other support.

End of Section

Section 39 - Front End Documents

I. Introduction – The Hampton Roads Sanitation District (HRSD) Commission has approved a set of front-end documents (advertisement through supplementary conditions), which must be used on HRSD construction projects. HRSD documents for use on Design-Bid-Build project deliveries, Design-Build project deliveries, and Construction Manager project deliveries are based on the three versions of the Engineers Joint Contract Documents Committee (EJCDC) standards. Verify with HRSD on which project delivery method is to be used, along with the appropriate front-end documents. A complete set of the EJCDC documents for the traditional Design-Bid-Build project delivery is included at the end of this Section (please ask the HRSD Project Manager for the current version). The FIRM to coordinate with HRSD's Project Manager and HRSD Contract Specialist for Design-Build project delivery and/or Construction Manager project delivery for the appropriate front-end documents.

II. Responsibilities of the FIRM

A. Review the HRSD standard front-end documents.

B. Prepare a marked-up set of front-end documents providing required input, including selecting options and filling in blanks. Provide information for the specification cover, table of contents (including all specification sections and a complete list of drawings), and bid schedule (for anything other than single lump sum contracts) in Word. Forward to the HRSD Project Manager for review, then forward to the HRSD Contract Specialist for final typing.

C. Verify that the Project title, CIP Project Number (if applicable), and the date (month and year) on the drawings and technical specifications match the CIP worksheet. The date (month and year) of the advertisement appears on the specification cover.

D. Prepare technical specifications and construction drawings that are coordinated with the front-end documents.

E. Provide the approved plans and technical specifications to the Project Manager to submit to the HRSD Contract Specialist for incorporation with front end documents.

F. The Bid Form document is no longer a part of the front-end documents.

1. Determine if lump sum or unit prices apply to this Project. Provide a bid summary sheet and verify unit of measurements match the Opinion of Probable Construction Cost, and Measurement and Payments or Schedule of Values technical specifications section.

2. If Mobilization is to be included as a line item on the Bid Form, it shall be defined as not exceeding 6% of the total bid amount. For lump sum bids, mobilization shall be incidental to the lump sum bid amount and not a separate line item.

   a. Clearly define this item on the Bid summary sheet and in the Measurement and Payment section of the technical specifications.
   b. Review mobilization Bid item at all pre-bid meetings.
   c. Closely check each Bid for conformance with this requirement.
   d. Review how the percentage of mobilization vs. demobilization should be applied on each project with the HRSD Project Manager.
   e. Any variance from Mobilization as defined above shall be approved by the HRSD Project Manager. Do not cut and paste from past work!

III. Standard Front-End Documents are included at the end of this Section.

A. Project Specification Cover

B. Table of Contents

C. Advertisement for Bids

D. Instructions to Bidders

E. Questionnaire

F. Bid Bond

G. Agreement

H. Performance Bond

I. Payment Bond

J. Escrow Agreement (where applicable)

K. VCWRLF Requirements (where applicable)

L. WIFIA Requirements (where applicable)

M. Standard General Conditions of the Construction Contract

N. Supplementary Conditions

IV. Specific Documents Requiring FIRM Input – The FIRM is responsible for preparing a specification cover sheet and table of contents, as well as the complete set of technical specifications and drawings. Specific input that must be provided to HRSD is listed below.

A. Advertisement for Bid – Fill in the following:

1. Project title and CIP Number (if applicable)

2. Project location

3. FIRM name and address

4. Bid time and date (work with the HRSD Project Manager and HRSD Contract Specialist to accomplish this based on Commission meeting schedule and other active solicitations).

5. Provide a brief general project description.

6. Decide if pre-bid conference is required and establish the time, date, and location.

7. Work with the HRSD Project Manager and HRSD Contract Specialist if VCWRLF and/or WIFIA program requirements should be included.

8. Work with the HRSD Project Manager and the HRSD Contract Specialist to set the advertisement date. HRSD usually advertises on Monday using HRSD's Website, HRSD's Enterprise Resource Planning (ERP) system, and Virginia's eProcurement Marketplace (eVA) system.

B. Instructions to Bidders

1. Article -3 – Complete qualifications Bidder must possess to submit the bid. Coordinate with the HRSD Project Manager to establish these qualifications at the 90 percent design stage. Work with the HRSD Project Manager if VCWRLF and/or WIFIA program requirements should be included.

2. Article 4 – If a pre-bid conference is to be held, provide input.

3. Paragraph 5.02.A.4 – Work with the HRSD Project Manager if Geotechnical Baseline Report/Geotechnical Data Reports are needed.

4. Paragraph 5.03 – Work with the HRSD Project Manager if Other Site-related Documents are needed

5. Paragraph 5.04.B – Work with the HRSD Project Manager if a site visit will be scheduled following the pre-bid conference.

6. Article 14 –Identify basis of bid (Lump Sum, Base Bid with Alternates or Unit Price and Allowance)

7. Article 23 – Work with the HRSD Project Manager to determine if state tax exemption (Projects that are for abating or preventing air or water pollution) will apply to this Project.

8. Article 25– Work with HRSD's Project Manager to see if there are any contracts to be assigned for this Project.

9. Article 26 – Leave in if Partnering is being considered.

10. Article 27 – Work with the HRSD Project Manager if VCWRLF and/or WIFIA program requirements should be included.

C. Questionnaire

1. Number 16 and Number 17 – Work with HRSD's Project Manager if VCWRLF and/or WIFIA program requirements should be included.

D. Agreement

1. Project Information – Provide project title.

2. Article 1 – Update Project Description.

3. Article 2 – Provide the official name of FIRM (Engineer).

4. Paragraph 3.02 – Determine the time (days or dates) for Substantial Completion and Final Completion.

5. Paragraph 3.03 – Work with HRSD's Project Manager to see if there are any Milestones.

6. Paragraph 3.04 – Provide the liquidated damages amount and bonus (if applicable) for Substantial Completion and Final Completion. The FIRM must prepare a memorandum stating how the amounts were calculated and submit to HRSD's Contract Specialist before

advertisement for construction bids as identified in Section 14 – “Coordination of Preconstruction Phase Issues” of these Standards.

7. Article 4 – The HRSD Contract Specialist will complete this section when drafting the Agreement for the successful Bidder.

8. Paragraph 7.01.A.7 – List number of Drawings and Project title.

9. Paragraph 7.01.A.11– List other exhibits to this Agreement, if needed

E. Supplementary Conditions

1. Paragraph 5.03 – Provide the required information on reports and/or drawings of explorations and test of subsurface conditions.

2. Paragraph 5.06 – Determine if asbestos, PCBs, petroleum, hazardous waste, or radioactive materials have been identified at the site and provide the required information on reports and/or drawings.

3. Paragraph 6.03.H – Provide names and addresses for additional insureds on insurance policies.

4. Paragraph 6.04.A – The HRSD Project Manager and HRSD Contract Specialist will review with the Chief Engineer and Insurance Consultant if project will be over $10 million, including some items in 6.03.M. Provide dollar value if HRSD supplies equipment/material if cost is over $100,000. .

5. Paragraph 7.07.A – Select the appropriate option.

6. 7.10.B – Consult with HRSD Project Manager to determine if the state tax exemption (for projects that aim to abate or prevent air or water pollution) applies to this project and include or delete it as appropriate.

7. Paragraph 7.13.G.1 – Provide information.

8. Paragraph 8.02.A – Determine if other work will be performed at the site by others.

9. Paragraph 10.03.C – Review and modify duties between Resident Project Representative (RPR) and Contract Administrator.

V. Attachments

A. EJCDC 2018 Front End Documents
B. Table of Contents
C. Tax Exemption Procedure for Pollution Control Equipment

End of Section

Section 40 - Construction Administration Forms/Formats

I. Introduction – The FIRM is responsible for providing bid ready plans, specifications, Addenda, final opinion of probable construction costs to The HRSD Contract Specialist on Design-Bid-Build project delivery for bidding the appropriate project in HRSD's Enterprise Resource Planning (ERP) System. During the pre-construction phase the FIRM is to attend the pre-bid meeting (if one is specified), attend the site visit (if one is specified), submit an updated OPCC in ERP, attend the bid opening (if required), evaluate the received bids and qualifications of the bidder, and recommend award of a construction contract to the lowest responsive and responsible bidder. HRSD will then obtain Commission approval, issue the Notice of Award, review and approve the bonds and insurance certificates, sign the contracts using The HRSD Enterprise Project Management (Unifier) system. The FIRM will then be asked to issue the Notice to Proceed and administer and inspect the contract using HRSD's Unifier system. The following forms/formats shall be used in the administration of the traditional bid construction contracts. All are available in electronic format. The HRSD Contract Specialist and Project Manager will work with the FIRM to customize these forms/formats for each project. The forms will be available in HRSD's Unifier system.

II. Contract Administration Forms - The below listed forms/formats for traditional Design-Bid-Build project delivery will be provided by the HRSD Contract Specialist following contract award.

A. Notice of Award [*Issued by The HRSD Contract Specialist*]

B. Notice to Proceed

C. Emergency Contact List

D. Field Order

E. Request for Proposal

F. Work Change Directive

G. Change Order

H. Application for Payment

1. Summary Sheet

2. Schedule of Values – Lump Sum

3. Schedule of Values – Unit Price

4. Stored Materials Inventory

5. WIFIA Requirement Only: HRSD Contractor Progress Report

I. Certificate of Substantial Completion

J. Notice of Acceptability

K. Warranty Memorandum

End of Section

Section 41 - Master Specification Sections Overview

I. Introduction – Included in this publication are the below listed master specifications. These are to be used by the FIRM for Bid Document preparation for HRSD Design-Bid-Build project delivery along with other technical specification sections as developed by the FIRM. These sections are intended to be used primarily for HRSD interceptor system projects. The original versions of the HRSD provided specification sections are available in Microsoft Word format with Tracked Changes enabled on HRSD's homepage under *HRSD Design and Construction Standards*. The FIRM is to keep the Tracked Changes mode enabled when making suggested edits for the HRSD Project Manager's approval.

II. Listing of Master Specifications Sections.

Section	Title
01010	Summary of Work
01040	Coordination
01060	Special Conditions
01270	Measurement and Payment
01323	Record Documents
01340	Submittals
01520	Maintenance of Pipeline and Pumping Operations
01560	Environmental Protection and Special Controls
01650	Facility and System Start-Up
02510	Ductile Iron Pipe
02520	Polyvinyl Chloride Pipe
02530	High Density Polyethylene (HDPE) Pipe and Fittings
02531	Line Stops on Sanitary Sewer Force Main Systems
02610	Valves
02710	Contaminated Groundwater Management
02761	Television Inspection of Pipelines
02773	Ultrasonic Pipeline Inspection
02774	Condition Assessment Data Collection for Pipelines Being Repaired or to be Abandoned
03700	Concrete Rebuild
03800	Embedded Galvanic Anodes for Concrete Rebuild
07160	Reactive Waterproofing
07900	Joint Sealants and Expansion Joint Systems
09900	Protective Coatings
13110	Cathodic Protection

End of Section

Section 42 – VDEQ Project Funding

I. Introduction – HRSD has previously and will continue to apply for Virginia Clean Water Revolving Loan Funds (VCWRLF) for qualifying Capital Improvement Projects (CIP). The VCWRLF is a self-perpetuating loan fund which provides a low interest financing to Virginia local governments and wastewater authorities to assist with improvements to wastewater treatment plants and/or collections systems. VCWRLF projects must adhere to specific requirements that HRSD, the FIRMs, and the Contractors are collectively responsible for generating and providing documentation to be in full compliance with the Virginia Department of Environmental Quality (DEQ).

II. Program Compliance- DEQ requires the Owner to incorporate various contracting and employment compliance requirements for each project being funded by VCWRLF. The compliance requirements will be provided in detail by the HRSD Project Manager or Contract Specialist:

A. Davis Bacon and Prevailing Wage Rates

B. Contracting Good Faith Efforts

C. XBE protected class participation

D. American Iron and Steel (AIS)

E. Bipartisan Infrastructure Law/Build America Buy America Act (BABA) (where applicable)

III. DEQ Final Inspection/Evaluation Items:

A. Operations and Maintenance developed or updated

B. Statement of Substantial Completion

C. Final AIS Certifications

D. Final Quarterly WBE/MBE report

E. Final De Minimus Tracking log

F. Statement of Davis Bacon Compliance

G. As-Builts-Final

H. Certificate To Operate Issued

IV. Checklists – DEQ requires the Owner to complete the following checklist for each project being funded by VCWRLF and will be provided by the HRSD Project Manager or Contract Specialist:

A. Categorical Exclusion Checklist: HRSD Project Manager and/or Engineer

B. Preliminary Engineering Report for Conveyance Projects

C. Preliminary Engineering Report for Treatment Projects

D. Plans and Specifications: HRSD Contract Specialist

E. Map to Closing: HRSD Project Manager

F. Checklist for Project Completion and Final Disbursement

V. Attachments – the following referenced guidance documents and forms are attached to this section of the standards.

A. Overview Procedures

B. Procurement Requirements for Small Purchases

C. Davis Bacon Certified Payroll Form-WHD 347

D. Request for Authorization of Additional Classification and Rate-SF-1444

E. American Iron and Steel Initial Certification

F. American Iron and Steel Wavier Request

G. American Iron and Steel Wavier Request Review Checklist

H. American Iron and Steel Final Certification Statement

VI. Additional Resources – the following hyperlink is to DEQ webpage where additional information related to the VCWRLF is posted.

A. Virginia DEQ Virginia Clean Water Revolving Loan Fund Page

End of Section

VIRGINIA CLEAN WATER FINANCING AND ASSISTANCE PROGRAM
REVOLVING LOAN FUND
REQUEST FOR CATEGORICAL EXCLUSION

Loan Recipient: HRSD	Loan Number:
Project Name:	

A Categorical Exclusion is being requested for the above named project based on the project meeting one or more of the following conditions:

- ☐ An upgrade in level of treatment of an existing treatment works on the existing site of the works
- ☐ An expansion of an existing treatment works on the existing site of the works which would result in no more than a 25% increase to the existing service population
- ☐ Sewer rehabilitation or separation in order to correct infiltration/inflow or combined sewer overflow problems, which does not include significant sewer relocation or a significant increase in sewer capacity
- ☐ Replacement of existing equipment or structures at their present location
- ☐ Installation of on-site treatment technologies (individual or cluster septic tank/drainfields, mound systems, sand filters, etc.)
- ☐ Minor extensions of water or sewer lines which will be located within road right-of-way or otherwise previously disturbed areas

Detailed project description and discussion of how the project meets the above checked condition(s):
Please attach any applicable documentation to support the request.

Detailed Project Description:

Discussion:

Attachments included: ☐ Site Plan ☐ Aerial Photos ☐ Other: Site Plan Previously Provided

Project Status:

Loan Application Date: Plans and Specs Submission Date:
PER submission Date: CTC Issue Date:

Submitted by: Title: Date:

For DEQ Use Only

Was a site visit conducted? If yes, date. If no, why not?
Comments:

Recommendation:
Reviewed by: Date:

CLEAN WATER REVOLVING LOAN FUND
PRELIMINARY ENGINEERING REPORT REVIEW CHECKLIST
For Conveyance Projects

Locality:	Date:
Project Name:	Prepared By:
Loan #:	DEQ Reviewer

I. instructions

Indicate whether the following information is adequately addressed in the Preliminary Engineering Documents and where it is located (i.e. Section 2, page 10). This checklist may be completed electronically or by hand. Please submit all documents used to complete this checklist.

II. Current Collection System and Downstream Facilities

1. Description of the existing system: _____
2. Capacity of the existing system: _____
3. Discussion of deficiencies in the existing system: _____
4. Discussion of sewage overflows or bypasses: _____
5. Discussion of new connections or increases in capacity proposed: _____
6. Evaluation of downstream capacities to point of discharge: _____
7. Discussion of design flow determination to also address I&I, growth, and population trends: _____
8. Discussion of the Virginia SCAT regulations with respect to design flows, design basis, and design life:
   _____

III. Development and Evaluation of Alternatives

1. Description of each alternative provided including the rehabilitation of existing facilities?
   List Alternatives:

   List the recommended alternative:

2. Discussion of at least 3 of alternatives capable of meeting the project goal evaluated: _____
3. Costs of each alternative presented with a basis for comparison: _____
4. Discussion of O&M costs: _____
5. Alternative sites evaluated in terms of the advantages, disadvantages, and environmental impacts: _____
6. Summary of components for cost basis of each alternative: _____
7. Can alternative designed to deliver peak flows downstream to STP without overflows or bypasses: _____
8. Site layout schematics provided for each alternative: _____
9. Service area identified consistent with the design year: _____
10. If a pump station is proposed, is there a description of the proposed installation (including public safety considerations, instrumentation and instrumentation location, and reliability classification) (Recommend Class I reliability if overflows / bypasses will enter environmentally sensitive areas.)

    _____

IV. Selected Plan
1. Discussion of the basis for selected alternative: _____
2. Justification provided and tabulated (side by side) comparisons of the alternatives: _____
3. Implementation of the selected alternative including a schedule: _____
4. Conformance with the Virginia SCAT Regulations: _____
5. Discussion of financing plan and cost impacts on the system's users: _____
Comments:

V. DEQ Use	
Does the selected plan appear to be the most cost effective and environmentally sound? Summarize any deficiencies in the PER which should be addressed:	
Date of comment letter:	
Recommendation:	
Reviewed by Project Manager:	Date:
Reviewed by Project Oversight Team Lead:	Date:

CLEAN WATER REVOLVING LOAN FUND
PRELIMINARY ENGINEERING REPORT REVIEW CHECKLIST
For Treatment Projects

Locality:	Project:
Loan #: Grant #:	Reviewer:

I. Brief Description of Proposed Facilities

II. Permit Status and Effluent Limitations

1. Is a permit required for the proposed facility?
2. Has a permit been issued for the facility?

   If yes, what is the issuance date: Permit No.:

   If no, the PER review process should be suspended until the permit has been issued.
3. Have effluent limitations for the facility been determined?
4. Comments:

III. Current Wastewater Treatment Facilities

1. Describe existing treatment facility:

2. What information was included on the condition of the existing wastewater treatment plant?

3. Describe sludge management:

   Is the selected method of sludge management technically sound and consistent with the permit?

IV. Treatment Capacity, Flow Characteristics, and Collection System

1. Existing population served:
2. Existing average wastewater flow in MGD:
3. Average flow contribution percentage from industrial and commercial users:
4. Projected design service population:
   Basis of projection:

5. Does the proposed project include an increase in WWTP design flow?
   If yes, does the VPDES permit include the appropriate effluent flow tier?
   Have effluent limits been determined?
   If no, contact regional permit staff to discuss the proposed project and effluent flow increase. In addition, a comment letter may need to be sent and PER review should be suspended until the VPDES permit has been updated.
6. What is the projected design life for the facility?
7. Are projected design flows consistent with the design life?
8. Projected wastewater characteristics:

9. Does the system experience infiltration and inflow that causes:
   frequent sanitary sewer overflows
   hydraulic short-circuiting of treatment plant processes
   discharge exceedance of effluent design flow
   If yes, describe, including any information relating to public health or contaminated groundwater:

10. Does the PER propose an acceptable plan for handling excessive flow?
11. Is the locality currently under enforcement action for exceeding 95% of average design flow for three consecutive months?

    If yes, has a corrective action plan been submitted to DEQ?
12. Does the PER include an alternative that recommends flow equalization?
13. Is flow equalization included with the selected alternative?

    Explain:

14. Based upon information included within the PER, does the proposed project include adequate hydraulic capacity to treat existing influent flows including adequate peaking factors?

    If no, has a plan been presented in an effort to mitigate excess volumes of water (I/I) from entering the treatment plant?
15. Comments:

V. Development and Evaluation of Alternatives

1. Was optimization of existing facilities evaluated?
2. Are additional facilities still required?

   List the alternatives considered and briefly describe the recommended alternative including the estimated project cost:

3. Were a reasonable number of alternatives capable of meeting effluent limits evaluated?
4. Were the costs of the alternatives presented in terms of their present worth value, including both the estimated capital and operation/maintenance cost?
5. Does the proposed treatment plant reliability for the alternatives evaluated satisfy the permit?
6. Were alternative sites evaluated in terms of the advantages, disadvantages, and environmental impacts?
7. Is the locality currently under enforcement action?

   If yes, has a corrective action plan been included and does the proposed project address it?
8. Comments:

VI. Selected Plan
1. Does the selected plan appear capable of meeting the effluent limitations or water quality objectives for the facility? 2. Are a schematic flow diagram and unit process design parameters included? 3. Does the design appear to be in conformance with the Virginia SCAT Regulations? 4. Has a description of the financing plan and cost impacts on the system's users been presented? 5. Have the current and proposed sewer rate structures been provided? 6. Has a projected implementation schedule been presented? 7. Does the selected plan appear to be the most cost effective and environmentally sound? 8. Comments:

VII. Conclusion	
Summarize any deficiencies in the PER which should be addressed:	
Date of comment letter:	
Recommendation:	
Reviewed by Project Manager:	Date:
Reviewer by Project Oversight Team Lead:	Date:

Ad for Bis = Advertisement for Bids
ITB = Instructions to Bidders
GC = General Conditions
SC = Supplementary Conditions

VIRGINIA CLEAN WATER REVOLVING LOAN FUND (VCWRLF)
REVIEW OF CONSTRUCTION PLANS AND SPECIFICATIONS

Project Name:	Loan #:
Prepared by:	Date:
DEQ Reviewer:	Date Received:

INSTRUCTIONS

Indicate whether the following information is adequately addressed in the contract documents and note the location of the information. The questionnaire may be completed electronically or by hand. Please submit all documents, including design plans, used in the preparation of this questionnaire.

ADVERTISEMENT, INSTRUCTIONS, AND TERMS

Item	Yes/No	Location	For DEQ Use
Scope/Description of work	Yes	Ad for Bids 5th Paragraph	
Date/Time bids are to be received	Yes	Ad for Bids 1st Paragraph	
Date/Time of bid opening Date: Time: 2:00 p.m.	Yes	Ad for Bids 1st Paragraph	
Was adequate time allowed to prepare bids	Yes		
Instructions for submitting sealed bids	Yes	ITB Article 13	
Information to obtain/review bidding documents	Yes	Ad for Bid 3rd Paragraph	
Basis for awarding contract	Yes	ITB Articles 19, 20 & 22	
Provisions for modifying or withdrawing bids	Yes	ITB Article 16	
Bidders qualifications standards	Yes	ITB Article 3	
➢ Statement that bidders must comply with the President's Executive Order #11246, prohibiting discrimination in employment regarding race, color, creed, sex, or national origin, and Executive Orders #12138 and #11625 regarding utilization of MBE/WBE firms	Yes	ITB 27.01.B	
Certification that they do not or will not maintain or provide for their employees any facilities that are segregated on the basis of race, color, creed, or national origin; and Statement that bidders must comply with the Civil Rights Act of 1964.	Yes	ITB 27.01.B & 27.01.C	
Statement that Bidders must comply with the Davis-Bacon Act and AIS Provisions. Location of DB Wages: In Volume 1	Yes	ITB 3.01.C & E & 27.01	NOTE: If DB Wages are
☞ Instructions to Bidders/Offerors regarding MBE/WBE requirements, verbatim	Yes	ITB 3.01.D-E & 27.01.D	
☞ "Or Equal" clause allowing for the substitution of equipment, materials, or provisions	Yes	ITB Article 11 / GC 7.05	
☞ If sole source procurement, was authorization obtained from DEQ?	N/A		

All Documents are in Volume 1

VIRGINIA CLEAN WATER REVOLVING LOAN FUND (VCWRLF)
REVIEW OF CONSTRUCTION PLANS AND SPECIFICATIONS

Item	Yes/No	Location	For DEQ Use
☞Statement that contractor must abide by OSHA regulations	Yes	GC 7.13 / OPTIONAL SC 7.13	
Change Order procedures	Yes	GC Article 11 / SC Article 11	
Requirements for progress schedule	Yes	GC 2.03 & 4.02	
Liquidated damages	Yes	Agreement 3.04	
Shop Drawing procedures	Yes	GC 7.16	
As-Built Drawing procedures	Yes	GC 7.12 / SC 7.12	
Substantial Completion procedures	Yes	GC 15.03 / SC 15.03	
Erosion and Sediment Control procedures		Check Tech Specs	
☞Payment procedures (recommend 30 day period if payment is dependent of VCWRLF disbursement)	Yes	Agreement Article 5 / GC 15.01 / SC 15.01	
☞Final payment withholding (no more than 5% retained until completion of project) [10% allowed in FmHA projects]	Yes	Agreement 5.06 / GC 15.06 / SC 15.06	

BID FORM, PROPOSAL, AND CONTRACT SPECIFICATIONS			
Item	Yes/No	Location	For DEQ Use
Location for Bid Submittal	Yes	Ad for Bids 1st Paragraph	
Length of time for bids to remain open Number of days: 60 calendar days (Recommend at least 60 days to resolve financing agreement)	Yes	ITB Article 18	
Lump sum		ITB Article 14	
Unit price		ITB Article 14	
Alternate bids		ITB Article 14	
☞Statement that bidder did not participate in collusion or otherwise take any action in the restraint of free and competitive bidding	Yes	ITB 6.02	
Work schedule / completion timeline Days allowed for Substantial Completion: Days allowed for Final Completion:	Yes	Agreement 3.02	
☞Separation of eligible and non-eligible items, if applicable	N/A	Ask PM/ENG	
Option to escrow retainage for contractor (contracts for conveyance greater than $200,000 without FmHA participation)		Virtual: HRSD's Online Oracle ERP System: Requirements	
☞State Contract inserts, verbatim	Yes	Volume 1	
Correct Fair Share Dollar Objective	Yes	VCWRLF Contract Inserts	

VIRGINIA CLEAN WATER REVOLVING LOAN FUND (VCWRLF)
REVIEW OF CONSTRUCTION PLANS AND SPECIFICATIONS

☞BOND REQUIREMENTS			
Item	Yes/No	Location	For DEQ Use
5% bid bond	Yes	ITB Articles 8 & 21 / GC 6.01	
100% payment bond	Yes	ITB Article 21 / GC 6.01	
100% performance bond	Yes	ITB Article 21 / GC 6.01	

☞INSURANCE REQUIREMENTS			
Item	Yes/No	Location	For DEQ Use
Workmen's Compensation	Yes	GC 6.03 / SC 6.03	
Fire and Extended Coverage (Builders Risk)	Yes	GC 6.04 / SC 6.04	
Public Liability	Yes	GC 6.03 / SC 6.03	
Property Damage	Yes	GC 6.03 / SC 6.03	
Vehicle Liability	Yes	GC 6.03 / SC 6.03	
Flood Insurance (if required)	Yes	GC 6.04 / GC 6.04	

FORMS *per DEQ - include copies of forms not included (ok to send templates if final copies are not ready)			
Item	Yes/No	Location	For DEQ Use
Bid form	N/A	Virtual: HRSD's Online Oracle ERP system	
Agreement form	Yes	Volume 1	
Notice of award	N/A	Not included	
Notice to proceed	N/A	Not included	
Bid bond	Yes	Volume 1	
Payment bond	Yes	Volume 1	
Performance bond	Yes	Volume 1	
Escrow Agreement (if applicable)		Volume 1	
Partial payment request	N/A	Not included	
Change order	N/A	Not included	
Certificate of substantial completion	N/A	Not included	

GENERAL REVIEW OF PLANS AND SPECIFICATIONS DEQ will fill out		
Item	Yes/No	For DEQ Use
☞Design conforms to approved Preliminary Engineering Proposal		
Plan-in-hand site visit conducted (if so, describe in comments section or attach)		
Cursory review for conflicts, incompatibility, or other problems in plans and specifications (if so, describe in comments section or attach)		

VIRGINIA CLEAN WATER REVOLVING LOAN FUND (VCWRLF)
REVIEW OF CONSTRUCTION PLANS AND SPECIFICATIONS

COMMENTS

Recommendation:

- ☐ Approve
- ☐ Approve with conditions
- ☐ Return with comments

Project Manager: _____ Date: _____

Map to Loan Closing and Closeout
Wastewater Projects

In order to receive a VCWRLF Loan, there are several submittal packages that must be reviewed and approved by DEQ CWFAP staff. These documents allow DEQ to review the project's design, specifications, and develop a final loan budget based on as-bid engineering and construction contractual costs. Upon receipt of all required documents, the loan will be closed and you may begin requesting monthly reimbursements for all *eligible* costs incurred.

Required Submittals

Professional Services Procurement: All professional services that you will be requesting reimbursement for must be procured in accordance with the Virginia Public Procurement Act, regardless of population size. **Please provide the following to the Project Officer:**

- ☐ A letter stating that the Virginia Public Procurement Act was followed in the procurement of engineering professional services for the Virginia Clean Water Revolving Loan Fund project. One of the following individuals must sign the letter: Chief Executive (City or Town Manager or County Administrator) or City, County, or Town Attorney. A template will be provided on the DEQ website.

OR

- ☐ Evidence of RFP/RFQ advertisement
- ☐ Evaluation criteria used
- ☐ Ranking of respondents
- ☐ Statement detailing final selection
- ☐ Copy of executed contract/agreement

Preliminary Engineering Report (PER):

The PER for your project must be reviewed and approved by DEQ The PER must address the requirements for the Preliminary Engineering Proposal (PEP) described in the Sewage Collections and Treatment (SCAT) regulations. The PER must identify and select the most cost-effective solution for the project. All alternatives should include an evaluation of water and energy savings, and the use of green technology. **Please provide the following to the Project Manager:**

- ☐ Copy of the final PER (one hard copy and one electronic copy)

Categorical Exclusion (CE) or Environmental Assessment (EA):

The CE or EA for your project must be reviewed and approved by DEQ. Detailed information for these requirements may be found in Section 7 of the Procedural Guidelines. **Please provide the following to the Project Manager:**

- ☐ A letter requesting a Categorical Exclusion based on a qualifying justification. The exclusion request must include a description of the project, a discussion of how the project meets one or more of the exclusion conditions and support documentation.

OR

- ☐ An Environmental Assessment that must address and consider both the direct and indirect environmental impacts of the selected alternative. Accordingly, both adverse and beneficial impacts need to be identified and considered. Direct impacts are caused by the construction of the treatment works, and indirect impacts are caused by the development made possible by the project. The assessment must also evaluate and discuss the impacts that would result without the project (a take-no-action alternative). The Environmental Assessment, including a project description and site location map, must also be forwarded to all review agencies for review and comment.

Plans and Specifications:

The design and contract documents for your project must be reviewed and approved by DEQ in order for the construction costs to be eligible. It is strongly suggested that this package is submitted and approved by CWFAP staff prior to putting the project out for bid. **Please provide the following to the Project Manager:**

- ☐ Copy of the final design plans (one hard copy and one electronic copy)
- ☐ Specifications to include Loan Contract Inserts and latest Wage Determination
- ☐ Completed DEQ Plans and Specifications checklist
- ☐ Proposed Project Bid Advertisement
- ☐ Cost Estimate
- ☐ All Required Environmental Permits
- ☐ Approved Certificate to Construct

Land Acquisition:

If the loan will include funding for the purchase of land, the price paid for the land must be substantiated. **Please provide one of the following to the Project Officer:**

- ☐ Basic Administrative Report(s)
- ☐ Appraisal(s)

Construction Contract Procurement:

All goods and services for which you will be requesting reimbursement must be procured in accordance with the Virginia Public Procurement Act, regardless of population size. **Please provide the following to the Project Officer:**

- ☐ Evidence of Advertisement
- ☐ Bid Form(s) or Bid Proposal(s) from low bidder
- ☐ Bid Tabulation(s)
- ☐ Bid Bond
- ☐ WBE/MBE Solicitation documentation
- ☐ Initial American Iron and Steel Certification
- ☐ Correct Wage Determination: ten days prior to opening bids, the loan recipient must check the DOL website to ensure their wage determination has not been amended. If it has been amended, the recipient must issue a specification addendum to include the latest wage determination in the specifications.

Loan Closing:

Prior to Loan closing, **please provide the following to the Project Officer:**

- ☐ Signed Professional Services Task Order(s)
- ☐ Awarded/Executed Construction Contract, including payment and performance bonds

Reimbursements:

The VCWRLF program is a reimbursement-based program. Once the loan has been closed, you may begin requesting reimbursements based on invoices that have been received. We recommend that reimbursement requests be submitted at least quarterly; however monthly requests are highly encouraged. **For each request for payment, please provide the following to both the Project Officer and Project Manager:**

- Requisition for Reimbursement Letter on locality's letterhead
- Certificate of the Project Engineer
- Up-to-date Schedule 1
- Invoices to substantiate requested payments
- Change Order(s), including discussion of eligible items/costs (if any have been executed)

Project/Loan Close Out:

Reimbursements will be held at ninety-five percent (95%) of the total Loan amount to ensure satisfactory completion of the eligible project. In addition to submittal of the following documents, a final site inspection will be performed by CWFAP staff. **Please provide the following to the Project Manager:**

- ☐ Fiscal Sustainability Plan (FSP). If the cost for work on the FSP is funded by the loan, a copy of the completed FSP document must be submitted to the Project Manager with the certification statement and a completed FSP Checklist. If the cost for work on the FSP is not funded by the loan, the certification statement and a completed checklist should be submitted.
- ☐ Certificate of Substantial Completion
- ☐ Final change order for quantity adjustments, if applicable
- ☐ Final American Iron and Steel Certification
- ☐ Final Quarterly WBE/MBE report

Checklist for Project Completion and Final Disbursement

Project: _____ **Project No**. _____

Construction Contract Documents:

- ☐ Statement of Substantial Completion
- ☐ Affidavit of Payment of Debts & Claims
- ☐ Affidavit of Release of Liens
- ☐ Consent of Surety
- ☐ VDOT release of bonds (where applicable)

CWRLF Documents:

- ☐ Post-Construction AIS Certification
- ☐ Final MBE/WBE report
- ☐ Final IPE
- ☐ Fiscal Sustainability Plan received or approved (where applicable)
- ☐ All Change Orders on file and eligibility has been documented
- ☐ Final Construction payment agrees with change order eligible amount
- ☐ All payrolls submitted. All D-B compliance issues satisfactorily resolved

Other:

- ☐ As-Built Drawings Completed & Submitted to Owner
- ☐ O&M Manual submitted (where applicable)
- ☐ Application for a CTO submitted, CTO issued
- ☐ Statement from engineer that punch list items satisfactorily resolved