SECTION 02 32 00.21

SUBSURFACE DRILLING, SAMPLING, AND TESTING AND BATHYMETRIC SURVEYS

PART 1 GENERAL

1.1 SOIL BORINGS AND GEOTECHNICAL DATA INFORMATION

All available soil boring and geotechnical information has been provided with the reference and construction documents and serve as the basis of the design for the contract repairs. Prior to beginning construction work, the contractor shall obtain the services of an independent geotechnical firm to provide soil borings, sampling and testing, and laboratory reports to verify existing subsurface conditions.

1.2 BATHYMETRIC SURVEYS

All available information pertaining to the existing water depths along the bulkheads, existing underwater structures, and the locations of missing and damaged piles have been provided with the reference and contract documents.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D1586	(2011) Penetration Test and Split-Barrel Sampling of Soils
ASTM D2113	(2014) Rock Core Drilling and Sampling of Rock for Site Investigation
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	(2009a) Description and Identification of Soils (Visual-Manual Procedure)

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-012 Preconstruction Submittals
Geotechnical Consultant; G
Bathymetric Survey Company; G
Underwater Dive Inspection Team; G

SD-06 Test Reports
Geotechnical Report; G
Bathymetric Surveys; G

Existing Water Depth Survey (Sounding)
Underwater Sheet Pile Gap Inspection Survey; G
Underwater Debris and Obstruction Survey; G
Post Construction Underwater Survey and Inspections; G
Underwater Material Deposit Survey; G
Pre Construction Underwater Material Deposit Survey; G
Post Construction Underwater Material Deposit Survey; G
Construction Underwater Material Deposit Survey; G

SD-03 Product Data
Permits, Certifications, and Licenses
Schedule of Drilling, Sampling, and Testing; G
Schedule for Bathymetric Surveys and Inspections; G

1.5 SOIL BORING AND SAMPLING SYSTEM DESCRIPTION

Provide the data to determine the type, nature, and characteristics of subsurface materials and the extent and conditions of the various materials as they exist to the depths and at the locations specified. This is to be accomplished by means of auger borings or drive sample borings. This information is to aid the contractor in estimating potential settlement for the provisions of the stone fill and marine mattresses, refine his grout curtain mix design, aid with the contractor's ground anchor design, and incidental related work.

1.5.1 Geotechnical Consultant

The contractor shall employ the services of an independent licensed Geotechnical engineer and organization with at least 10 years experience specializing in Geotechnical engineering and experienced in soil mechanics who shall perform site investigations, soil borings, laboratory testing, and provide a soil's characteristic reports.

1.5.2 Borings and Sampling

Perform drilling and sampling in accordance with ASTM Standards and other standards, including but not limited to ASTM D 1587, ASTM D 1452, and ASTM D2113. Take soil samples at 5 feet intervals along the entire depth in each of the borings. Standard Penetration Tests (SPT) shall be performed in accordance with ASTM D1586.

Preserve samples as per ASTM Standards and prepare field boring logs under the supervision of the Geotechnical Engineer Consultant.

1.5.3 Sequencing and Scheduling

1.5.3.1 Schedule of Drilling, Sampling, and Testing

Prior to starting work, submit a plan for drilling, sampling, testing, and safety. The plan shall include, but shall not be limited to, the proposed method of drilling and sampling including a description of the equipment and sampling tools that will be used, a listing of any subcontractors to include a description of how the subcontractors will be used and a description of all methods and procedures that will be utilized to insure a safe operation and to protect the environment. No work shall be performed until this plan has been approved and no deviation from the approved plan will be permitted without prior approval by the Contracting Officer. The locations and boring depths are listed in the following schedule:

SCHEDULE OF DRILLING, SAMPLING AND TESTING			
LOCATION	NUMBER(S), SPACING, AND LOCATIONS OF BORINGS	DEPTH OF BORING BELOW GRADE OR MLLW	SPECIAL INSTRUCTIONS
Patriot's Point	(1) at the approximate center location for the ground anchors	Elevation -50.0' below existing ground/pavement surface	
CEP175 Waterside STA 8+00 to 18+00	(1) each at an approximate 200-foot spacing along the bulkhead for a total of (6) borings	Elevation -75.0' below MLLW	Obtain boring from an approximately 5 foot distance from the offshore face of the existing bulkhead
CEP175 Shore Side STA 8+00 to 18+00	(1) each at an approximate 200-foot spacing along the bulkhead for a total of (6) borings	Elevation -40.0' below Existing Pavement	Obtain boring along the anticipated path of the soil grout curtain. Excavation and core drilling through the relieving platforms will be required

1.5.3.2 Order of Work

The order in which the work is to be accomplished will be determined after contract award and based upon the contractor's approved construction schedule.

1.5.3.2.1 Soil Testing

Perform the following field or laboratory tests as appropriate on representative soil samples taken at adequate intervals to accurately characterize subsurface conditions encountered. Use this information to establish the Geotechnical design parameters and other information required for the design and construction of the Project. As a minimum perform tests in accordance with the applicable ASTM Specification and other recognized standards.

a. Soil classification: ASTM D2487, ASTM D2488.
b. Moisture content: ASTM D2216.

For Cohesive Soils:
a. Atterberg limits: ASTM D4318.
b. Unconfined compressive strength: ASTM D2166.
c. Consolidation: ASTM D2435.
d. Presence of organic or other deleterious materials.
e. Swelling: ASTM D4546.
f. Insitu density: ASTM D2167, ASTM D2922.

For granular soils
a. Grain-size distribution: ASTM D422.

b. Shear-strength.
c. Presence of organic or other deleterious materials.

1.5.3.2.2 Geotechnical Report

Provide a separate, signed independent Geotechnical report as required to determine existing soil conditions. The project specific foundation and soils (Geotechnical) investigation as required to comply with the Building Code of Virginia.

Provide boring logs plotted and graphically presented showing boring number, sampling method used, date of start and finish, surface elevations, description of soil and thickness of each stratum, depth to loss or gain of drilling fluid, number of blows per foot (N value) and, where applicable, depth to wet cave-in, depth to artesian head, depth to or elevation of groundwater during and after completion of boring (repeat observation after 24 hours) and presence of gases if observed. Note the location of strata containing organic materials, wet materials or other inconsistencies that might affect the design or construction of the proposed structure. Include representative profile(s) through the site reflecting subsurface conditions and results of all laboratory tests performed including test methods or standards used.

Analyze the information developed by the investigation all aspects of subsurface conditions which may affect the design and construction of the proposed structures.

1.6 BATHYMETRIC SURVEY SYSTEM DESCRIPTION

In order to aid the Contractor in placement of the stone bedding and marine mattress and the Contracting Officer to validate payment quantities for the associated "unit priced" bid items, the contractor shall provide pre and post construction bathymetric surveys. By-weekly bathymetric surveys will also be provided during the placement of the stone fill, in areas not yet in receipt of the mattress cover, to ensure fill material is not being lost due to erosion.

In addition, permit compliance requirements of the ACOE permit "Water Resource Policies and Authorities POLICY AND PROCEDURAL GUIDANCE FOR PROCESSING REQUESTS TO ALTER US ARMY CORPS OF ENGINEERS CIVIL WORKS PROJECTS PURSUANT TO 33 USC 408" requires assurance that the performance of this project does not result in any additional deposit of debris into the waterways that could become a hazard to navigation or future dredging operations. A pre construction underwater survey will be required to identify existing underwater debris fields conditions, and a post construction survey and report shall be required upon completion of all underwater work to ensure no additional debris has been deposited. The Government will forward to the responsible agency the final survey and report for contract compliance.

1.6.1 Bathymetric Survey Company

The Contractor shall employ an independent licensed Surveyor and organization with at least 10 years experience specializing in Bathymetric Surveys and underwater data and object identification who shall perform underwater site survey, water depth determinations, identification of debris fields and structures, and provide plot drawing surveys and reports during the performance of this contract.

1.6.2 Horizontal Datum

All positions will be referenced to the North American Datum of 1983 (NAD 83). This datum must be used throughout a survey project for everything that has a geographic position or for which a position is to be determined. In addition, all software used on a survey must contain the correct datum parameters.

1.6.2.1 Sounding Datum

All sounding data will be reduced to Mean Lower Low Water (MLLW). Heights of top of curb will be referenced to Mean High Water (MHW).

1.6.3 Horizontal Position Uncertainty

The Total Horizontal Uncertainty (THU) in position of soundings, at the 95 percent confidence level, will not exceed 10 feet. This accuracy requirement is independent of survey scale.

1.7 SURVEY REQUIREMENTS

1.7.1 Existing Water Depth Survey (Sounding)

Water Depths along the bulkhead shall be provided by a single beam survey-grade echo sounder operating at a minimum frequency of 200 kHz in order to capture a digital profile records as well as digitized depth information Digital depth data was logged directly to the navigation computer along with date, time, and position for post processing and mapping. For areas not accessible, readings along the bulkhead shall be preformed by weighted lines.

1.7.1.1 Calibrations

Provide a bar check calibration for speed of sound prior to commencing survey operations. Use variations between the true bar depth and the observed depth and adjust the sound velocity on the echo sounder until it read correctly.

1.7.1.2 Processing

Remove outliers and cross-reference against the echo sounder digital chart recordings. Reduced the sounding to MLLW using the predicted tidal data obtained from NOAA and exported as an XYZ file that can also be utilized by the government. Provide exported XYZ data contoured at one foot intervals for final charting, indexed every 5 feet.

1.7.2 **Underwater Sheet Pile Gap Inspection Survey**

Divers will be required to be employed for inspection.

1.7.2.1 **Existing Sheet Pile Gap Verification Report**

After the placement of the marine mattress and prior to beginning pressure injection grouting behind the bulkheads, the contractor shall conduct an underwater and above water visual inspection along the entire length and the exposed height of the CP175 sheet pile bulkhead between STA 07+00 and 18+00 and for the Z308 Bulkhead between STA 42+25 and STA 43+50. The inspection and survey will document and report the presence of existing gaps and any other opening or area in which fill may be passing through the

bulkhead fascia or that may allow grout to freely flow during the grouting operations.

The inspection shall be preformed by an independent dive team and inspectors and consist of a visual inspection of the entire exposed face of each sheet pile bulkheads for presents of open gaps between section, greater than 1" in width, all expansion joint locations within the relieving platform or pile caps, and all utility outfalls or other openings through the sheet piles that may result in fill being lost. The inspection shall also include areas beneath the piers.

Note: There may be the requirement to remove existing marine growth in order to verify dimensions or to facilitate the inspection of gaps or opening. For bidding purposes, it shall be assumed that 10% of the below water surface area to be inspected will require the use of a high pressure water blaster to clean those areas. The level of cleaning is only required to be sufficient to performed the inspection and document the finding.

When encountered, the inspector(s) shall probe any gap or opening with a thin bar, with a minimum length of 3 feet, determine if the gap, joint, and/or opening, may be allowing fill to be the lost or may allow grout to freely flow into the waterways during the repairs.

In addition, any area, along the exposed face of the sheet piles, in which there are is an observed open concrete spalls, greater than 3 inches deep, or that may have exposed reinforcement shall be measured, documented and reported.

Scaled drawings with dimensions and a descriptive report including photographs, shall describe all locations of potential fill loss through joint, gap, and openings, and any spalls found shall be provided to the Contracting Officer for his review and approval. The Contracting Officer will then identify areas to be sealed, by the contractor, prior to beginning the grouting operation. The contractor shall submit (4) copies of all reports to the Contracting Officer.

The Contracting Officer shall also utilize the report to determine underwater concrete spall repairs to be preformed by the contractor.

1.7.3 Underwater Debris and Material Placement Verification

1.7.3.1 Underwater Debris and Obstruction Survey

Side-scan sonar and divers will be required to be employed for these surveys and inspections.

1.7.3.1.1 Pre Construction Underwater Survey and Inspections

Prior to demolition, the contractor shall conduct an underwater survey and inspection of the work site to identify existing underwater debris, pile stubs found exposed above the river bottom, and the location and the of all existing fender piles along the bulkheads.

In addition, for areas in which the "prestressed concrete" fender piles are to be provided, the river bottom shall be probed for debris or broken piles, which may exist below the river bottom surface, that could affect the installation of these fender piles. Locations for prestressed fender piles shall be probed to a minimum depth of 15 feet for broken piles, timbers, debris, or rubble that could affect the installation.

Below grade probing, at locations for the composite fender piles, is not required.

Scaled drawings and a descriptive report which locates and describes all debris and piles found during his inspection shall be provided to the Contracting Officer for his review and approval prior to beginning demolition.

The contractor shall document the location and condition of all exiting timber piles prior to their removal and all obstruction found during the inspection, in and around the work areas shall be identified. Items found adjacent to these areas, but not affecting the installation of the prestressed concrete piles, shall also be identified in the report.

The report shall contain a descriptive report of all possible obstructions uncounted at or below the mud line including actual dimensions to the location of the prestressed fender pilings to be installed.

The scaled survey results and written description report shall graphically depicts all existing fender piles and all items found during the survey and inspection. Included on the drawings will the relationship of all items found to the locations and position to existing piles identified in the contract documents sand to those piles identified in the contract to be provided. The report shall delineate those items which are required to be removed and those that would not affect the pile installation. All items in the original contract documents are required to be removed and disposed, the Contracting Officer will review the submission and identify those additional items, previously not included in the contract, that may be included for removal.

1.7.3.1.2 Post Construction Underwater Survey and Inspections

Upon completion of all the work a post construction inspection survey shall be required to ensure no additional debris has been deposited due to the demolition and or construction. Additional debris, not reflected on the preconstruction report, and determined to be material from this contract, shall be required to be removed by the contractor at no additional cost to the government.

A scaled drawings and a descriptive report for all debris found during his inspection shall be provided to the Contracting Officer for his review and approval prior to moving to the next work quadrant.

Underwater Material Deposit Survey (PROVISION OF MARINE MATTRESS)

Side-scan sonar and depth sounding will be required to be employed for this survey.

1.7.3.2 Pre Construction Underwater Material Deposit Survey

Provide a pre construction profile survey of the river bottom features and contours for areas designated to receive stone fill and marine mattress by the use of a side scan sonar system and marine magnetometer.

Deployed a marine magnetometer was in order to confirm man-made objects versus natural objects.

Scaled drawings depicting the river bottom contours and a descriptive

report describing conditions found in the area shall be provided to the Contracting Officer for his review and approval prior to beginning the placement of materials.

1.7.3.3 Construction Underwater Material Deposit Survey

During construction and the placement of materials associated with the marine mattresses the contractor shall provide progress side-scan surveys of the work in progress which will then be utilized, along with with the material delivery tickets, by the Contracting Officer to valid the proper placement of the material and marine mattresses for contractor invoice payments. The frequency of these surveys will be dependant upon the contractor, but payment for in-place work shall not be provided until the Contracting Officer has approved of the in-progress surveys.

Scaled drawings identifying the area of placement and elevation contours shall be provided to the Contracting Officer for his review and approval.

1.7.3.4 Post Construction Underwater Material Deposit Survey

Upon completion of all the work associated with the provision of the marine mattress a final post construction inspection survey shall be required to ensure the proper placement to the elevations and profile required in the contract.

Scaled drawings identifying the area of placement and elevation contours shall be provided to the Contracting Officer for his review and approval and prior to moving to the next work quadrant.

1.7.4 Side Scan Sonar System Requirements

Side Scan data recording are not expected to be provided in waters less than 5 feet deep or areas inaccessible by boat or the contractor's equipment. Locations will be assessed by the contractor and the Contracting Officer for safety, access, or where there is potential for damage to the bottom environment or equipment, before proceeding with any work. For those areas, the dive team shall perform these surveys and inspections.

Provide a side scan sonar system shall consisted of a digital, dual-frequency, towfish interfaced to the topside data-logging computer with acquisition software. Deploy the towfish and traversed all accessible areas along the bulkhead work sites out to 25 feet from the face of the bulkheads and the bathymetric coverage of the vertical bulkhead face shall be within 1.5 feet of the water surface. In areas in which the marine mattresses will be provided, extend the subsurface survey out to 75 feet from the face of the bulkhead.

The surveys will be conducted with a minimum 400-kHz multi-beam side scan sonar. Minimum data density not to average less than 300 soundings per square foot along the vertical bulkhead surface and 90-100 soundings per square along the foot overall.

1.7.4.1 Processing

Utilize government compatible software to complete post-processing. Corrected for towfish altitude during data processing and edit navigation data for errant position fixes and velocity errors. Analyze each line for debris, piling, vegetation, stone deposits, marine mattress location, and

any incidental object or obstruction that could affect the work.

1.7.4.2 Survey Crew and Equipment

The Lead Member of the Survey Crew shall have a minimum of (10) years experience with underwater inspection. The personnel make up of the crew shall comply with EM 385-1-1, OSHA, and all contract and local requirements for conduction their operations. The lead member must be thoroughly familiar with the design plans and specifications to sufficiently understand the engineering aspects of the underwater construction and to be able to recognize and document potential problem areas such as improperly constructed or defective areas.

Provide all necessary equipment to provide the surveys and conduct surveillance and inspection services, including survey equipment, survey boat, and communication equipment. Diver(s) must be equipped to maintain two-way communication with QC and government personnel during all operations.

The Survey Crew shall be an independent third party hired directly by the Prime Contractor and approved by the Contracting Officer and shall have no involvement with the design, preparation of Contract, or installation of the work.

1.7.5 Underwater Dive Inspection Team

The Dive Team employed to perform the underwater surveys, inspections, and work progress surveillance for the Contractor must have current commercial diver's license, with a minimum of ten (10) years experience with underwater inspection. The personnel make up of the team shall comply with EM 385-1-1, OSHA and local requirements for Contract diving operations. The lead diver must be thoroughly familiar with the design plans and specifications to sufficiently understand the engineering aspects of the underwater construction and to be able to recognize and document potential problem areas such as improperly constructed or defective areas.

Provide all necessary equipment to conduct surveys, inspections, and surveillance, including diver's equipment, dive boat, communication equipment, and photographic/video equipment. Diver(s) must be equipped to maintain two-way communication with QC personnel during diving operations and the boat personnel my maintain contract with Port Operations.

The Dive Team shall be an independent third party hired directly by the Prime Contractor and approved by the Contracting Officer and have no involvement with the design, preparation of Contract, or installation of the work. The Dive Team member(s) may also perform the same functions required for the underwater QC if they meet those requirements.

1.8 SEQUENCING AND SCHEDULING

1.8.1 Schedule for Bathymetric Surveys and Inspections

Prior to starting work, submit a plan for each survey to be preformed and include a safety plan. The plan shall include, but shall not be limited to, the proposed methods for each survey and include a description of the survey equipment and watercraft that will be used, a listing of any subcontractors to include a description of how the subcontractors will be used and a description of all methods and procedures that will be utilized to insure a safe operation and to protect the environment. No work shall

be performed until this plan has been approved and no deviation from the approved plan will be permitted without prior approval by the Contracting Officer. The locations and assumed methods for obtaining data are listed in the following schedule:

SCHEDULE OF BATHYMETRIC SURVEYS			
LOCATION	TYPE	DISTANCE OUT FROM THE FACE OF THE EXISTING BULKHEAD	SPECIAL INSTRUCTIONS
Patriots Point	Sounding (10 foot increment along the work area)	20 feet	Provide sounding in 5 foot increments out from to identify the extent of the existing rip-rap
CEP175 STA 1+00 to 24+98	Soundings (10 foot increment along the bulkhead)	Adjacent to the bulkhead	Measurements to identify existing river bottom for determination of the depth required for grout curtain wall
CEP175 STA 1+100 to STA 8+00	side-scan sonar/dive team	25 feet	Pre construction and post construction condition surveys for underwater debris and Permit Compliance
CEP175 STA 8+00 to 18+00	side-scan sonar/dive team	75 feet	Existing precondition survey for river bottom profile and existing debris and potential obstructions; during construction the verification of stone filler material and marine mattress placement; and post construction condition survey for quality assurance, underwater debris, and Permit Compliance
CEP175 STA 18+00 to STA 24+98	side-scan sonar/dive team	25 feet	Pre construction and post construction condition surveys for underwater debris and Permit Compliance
Z308 STA 43+25 to 45+50	Soundings (10 foot increment along the bulkhead)	Adjacent to the bulkhead	Measurements to identify existing river bottom for determination of the depth required for grout curtain wall

SCHEDULE OF BATHYMETRIC SURVEYS			
Z308 STA 37+00 to STA 49+00	side-scan sonar	25 feet	Pre construction and post construction condition surveys for underwater debris and Permit Compliance

1.9 ORDER OF WORK AND PERFORMANCE OF SURVEYS

The order in which the surveys will be accomplished will be determined after contract award and based upon the contractor's approved construction schedule.

1.10 QUALITY ASSURANCE

Comply with all Federal, State and local laws, regulations and ordinances relating to the performance of this work. Procure all required permits, certifications and licenses required by Federal, State, and local law for the execution of this work. Submit copies of all permits, certifications, and licenses prior to starting work. This submittal shall also include a statement of the prior experience, in the type of work described in these specifications, of the person or persons designated to perform the work specified herein.

1.11 PROJECT/SITE CONDITIONS

1.11.1 Environmental Requirements

In order to prevent and to provide for abatement and control of any environmental pollution arising from Contractor activities in the performance of this contract, the Contractor and its subcontractors shall comply with all applicable Federal, State, and local laws, regulations, and ordinances concerning environmental pollution control and abatement.

a. The Contractor is responsible for keeping informed of all updates and changes in all applicable laws, regulations, and ordinances.

b. Do not pollute waterways or groundwater with drill fluids, fuels, oils, bitumens, calcium chloride, insecticides, herbicides, or other materials that may be harmful to the environment.

PART 2 PRODUCTS

2.1 SOIL REPORTS AND BATHYMETRIC SURVEYS

2.1.1 Survey Result Drawings, Findings, and Reports

Submit complete and legible copies of all surveys and reports for each preformed survey or inspection to the Contracting Officer within 5 working days of the completions of the work. Surveys and reports shall be signed by the organization who preformed the work.

The information provide with the survey and inspection reports shall reflect all aspects of underwater conditions that pertain to the construction.

Post Construction and Post Underwater Debris Verification Surveys and

Report shall be submitted and approved by the Contracting Officer prior to moving to the next Work Quadrant.

PART 3 EXECUTION

3.1 MOBILIZATION AND DEMOBILIZATION

3.2 BACKFILLING

3.2.1 Drill Holes

Unless otherwise noted in these specifications or directed by the Contracting Officer, all drill holes through the relieving platform shall be filled with a non-shrink grout and the area backfilled until final repairs have been accomplished.

-- End of Section --