ATTACHMENT L-7: CARDNO HRBT EXPANSION -

PRELIMINARY SEDIMENT STUDY (JULY 23, 2018)

HAMPTON ROADS BRIDGE TUNNEL EXPANSION PRELIMINARY SEDIMENT STUDY

July 23, 2018

Prepared for:
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July 23, 2018

Mr. James Martin
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**Subject: Hampton Roads Bridge Tunnel Expansion
Preliminary Sediment Study**

Dear Mr. Martin:

Please find enclosed the Hampton Roads Bridge Tunnel (*HRBT*) Expansion Preliminary Sediment Study Report. The report describes the sampling methodologies and laboratory data for potential offerors to evaluate sediment/dredge spoil management/disposal in preparing their proposal.

Please include this report with the project solicitation documents so that potential offerors can review this preliminary study and evaluate for their proposal response such as determining additional data needs. If you have any questions or require additional information, please feel free to contact us.

Sincerely,

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Enclosures: Preliminary Sediment Study Report

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1 Introduction

1.1 Project Description

The Virginia Department of Transportation (*VDOT*) plans to expand the I-64 Hampton Roads Bridge Tunnel (*HRBT*) system connecting the cities of Hampton and Norfolk, Virginia. The existing and general proposed HRBT bridge/tunnel alignments are depicted on the *Vicinity Map, Appendix A* and *Site Map, Appendix B*. The proposed expansion alignment parallels (to the south) the existing pair of submerged tubes and trestles for a distance of approximately 26,200 feet. Of this distance, approximately 7,286 feet consists of two existing submerged tubes installed beneath the Thimble Shoals Channel. The expansion project will include the construction of a new tube (the third tube), new trestles, and expanding the north and south tunnel islands. The forthcoming design-build project allows for offerors to consider designing and constructing either a bored tunnel (*BT*) or an immersed tube tunnel (*ITT*) for the submerged portion of the project. Note that the maps and figures provided in this report are for general illustration purposes only. For preliminary design details, the reader should review the project's website http://hrbtexpansion.org including the request for proposal documents.

In general, sediments to be removed/managed as part of the HRBT expansion could include dredge excavations (for ITT installation, trestle removal/installation, island expansion activities, potential access channels, etc.) and spoils generated from the tunnel boring machine in a BT method. Potential management/disposal options for sediment/dredge spoils include upland disposal (such as in a permitted quarry/mining pit reclamation), landfill disposal at a permitted commercial landfill and/or ocean disposal (with Section 103 approval). The design-build (*DB*) offeror may consider, but is not limited to, these options or others including a beneficial reuse such as shoreline nourishment or restoration. It should be noted that additives like polymers and slurry/grout material are reportedly introduced into the various processes like BT drilling, and therefore could be part of the final spoils/material to be managed. This *Preliminary Sediment Study Report* could not predict various DB influenced project activities like potential additive mixtures or differing sediment processing/dewatering procedures. Therefore, the offerors will have to take these construction and management processes into consideration for their proposal including the potential influence and restrictions should additives be used during construction.

A geotechnical study of sediments was performed for the HRBT expansion project by Jacobs Engineering Group (Jacobs) of Boston, Massachusetts and Warren George Incorporated (WGI) of Jersey City, New Jersey. For details of the geotechnical study such as borehole coordinates and borehole logs with sediment descriptions, the reader should review the geotechnical report. For this *Preliminary Sediment Study* described herein, samples of sediment were also collected for chemical testing from 12 of the geotechnical boreholes. This sediment chemical testing effort focused on providing testing information of sub-bottom materials for DB offerors to consider in evaluating potential sediment management/disposal options for preparing their proposal. It is important to note that adjustments to the design/approach could modify the extent or configuration of both the tube and trestle segments along the alignment. Therefore, the information provided from this study is intended as a general screening of subsurface conditions. Follow-up sampling/testing will likely be required to verify and fully characterize conditions along the final alignment/configuration and DB means and methods. In addition, a separate environmental study (*Phase II Environmental Site Assessment* dated July 9, 2018 by Cardno) was prepared to provide information on the Willoughby Spit part of the project (Willoughby Spit project staging/equipment laydown area).

1.2 Scope of Investigation

The screening-level sampling results presented in this report provide preliminary information to the DB offerors to consider in evaluating potential disposal and management options.

The tasks required to meet this objective included:

> Sediment sampling – Acquire bulk sediment and surface water samples at 12 locations;

> Laboratory testing –Test certain chemical and physical parameters typically required for disposal considerations; and

> Report – Provide the sampling framework, methods and results in context of disposal option considerations.

1.3 Sampling Plan

The Sampling and Analysis Plan (*SAP*) submitted by Cardno to VDOT in December 2017 addressed typical components for both ocean and upland disposal. However, it is important to note that this report likely does not address all considerations required for gaining approval for disposal. For this study, samples were collected of the upper 10 feet of sediment at each of the 12 boring locations (referred to as B-001, B-003, B-008, B-013, B-017, B-023, B-028, B-030, B033, B-038, B-039, and B-044) spaced along the tunnel and trestle alignments (*Site Map, Appendix B*). This uppermost 10-foot sediment horizon was presumed to be the most probable zone potentially exposed to any anthropogenic impacts, and therefore was selected for testing. Deeper horizons were also sampled at two mid-channel locations (B-017 and B-023) where spoils could be generated from tube installation. At each boring location, a surface water sample was also obtained for testing. The testing approach in this preliminary study was an initial screening and not necessarily full characterization for either testing frequency or test parameters including bioassay testing. Samples were taken to provide general information for the DB offeror to evaluate management/disposal options such as upland disposal, landfill disposal or ocean disposal. It is Cardno's understanding that sediment disposal at the *Craney Island Dredged Material Management Area* operated by the U.S. Army Corps of Engineers (*USACE*) facility appears not applicable for the HRBT expansion as that facility is to support navigation improvement projects.

1.3.1 Upland Disposal

To provide information on a potential upland disposal scenario, requirements were reviewed for an example site called the Weanack Land Limited, LLC's (Weanack) facility at Shirley Plantation along the James River in Charles City County, Virginia. The Weanack facility was chosen for general comparison purposes, but is not to be construed as an endorsement or recommendation. The Weanack Land Reclamation Project is permitted under Virginia Department of Environmental Quality (*DEQ*) Virginia Pollution Abatement (*VPA*) Permit No. VPA00579 – Modification Date December 12, 2014. The VPA Permit states that dredge material may be disposed at Weanack if testing indicates that parameter concentrations are equal to or less than their tabulated Exclusion Criteria (*EC*). For the HRBT preliminary characterization, sediments were analyzed for parameters consistent with the Weanack permit including metals, polychlorinated biphenyls (*PCBs*), pesticides, and polyaromatic hydrocarbons (*PAHs*). The test results were then compared to the EC. Estuarine and marine dredge materials are placed in Weanack's Earle Basin, a purpose built upland basin. The inherent concentrations of sodium and chloride may likely preclude sediments from the HRBT project area from being placed as "clean fill" at Weanack outside the Earle Basin. In addition, sediments were tested for volatile organic compounds (*VOCs*), kepone, physical characteristics including grain size distribution, total organic carbon (TOC), total solids/percent moisture, specific gravity, bulk density, Atterberg limits and agronomic properties including acid-base potential or Acid-Base Accounting (*ABA*) to provide further data for evaluating management/disposal.

1.3.2 Landfill Disposal

To provide information on a potential landfill disposal scenario, requirements were reviewed under the Solid Waste Management Regulations (9VAC-20-81). In general, Virginia waste disposal facilities such as sanitary or industrial landfills don't accept Resource Conservation and Recovery Act (*RCRA*) hazardous wastes, free liquids, PCB wastes over 50 parts per million (ppm) or dioxins over 0.001 parts per million. However, these Subtitle D landfills can accept non-hazardous wastes and require a DEQ permit with regulatory compliance including design and operational performance standards including liners, leachate collection and monitoring. Depending on the specific permit, a particular landfill may have a specific concentration of petroleum-impacted waste it can receive (based on the total petroleum hydrocarbon or TPH level). In addition, depending on the characteristics, soil/sediment type material may potentially be used by landfills as daily cover.

Most of the test parameters to evaluate upland disposal could also be used to evaluate landfill disposal. However, additional landfill scenario tests performed in this preliminary characterization included petroleum compounds, organic halides and paint filter test.

1.3.3 Ocean Disposal

To provide preliminary information on a potential ocean disposal scenario, requirements were reviewed for the Norfolk Ocean Disposal Site (*NODS*) located in the Atlantic Ocean approximately 17 miles east of Cape Henry. The NODS has been formerly designated for the placement of suitable dredged materials pursuant to the Marine Protection, Research, and Sanctuaries Act (*MPRSA*). The USACE may implement MPRSA in projects involving ocean disposal of dredged materials but relies on EPA's ocean dumping criteria (and EPA review) when evaluating requests for the transportation of dredged material for the purpose of disposal.

For an ocean disposal evaluation, both sediment and surface water samples collected from the 12 borehole locations were separately analyzed. In addition, a sediment and water mixture was also combined to create a third sample type called an elutriate to simulate the dissolution of sediment constituents into the water column during open-water (ocean) dredge disposal. Elutriate samples were only prepared for the shallower sub-bottom horizons since spoils generated from deeper bored horizons would presumably contain drilling fluid additives/residues and therefore likely be ineligible for ocean disposal.

There are minor variations in the testing parameters for the sediment, water, and elutriate for ocean disposal but in general consist of pesticides, dioxins and furan congeners, PCB congeners, metals (both total and simultaneous extracted (SEM)), and semi-volatile organic compounds (*SVOCs*) including PAHs. Note that this preliminary analytical testing approach does not constitute full Section 103 characterization including ecotoxicology or tissue testing.

1.4 Project Setting

Sediments encountered in the project area consist of native geologic formation materials (i.e. Norfolk Formation and Yorktown Formation) and recent (Holocene) alluvial materials. In general, grain size of the probable dredge material is generally silty clay with embedded sands consistent with the native geologic formation; however, the geotechnical report should be reviewed for the full sediment profile descriptions. Because the proposed project alignment parallels the existing HRBT and crosses the historic deep water harbor and approaches, it is expected that sub-bottom materials have been disturbed by human activity including dredging, dredge disposal and construction activity. Several areas along the alignment are known to have been disturbed and modified particularly areas fringing the existing tunnel islands and along the southern trestle approaches where significant filling has occurred in the past. Likewise, the construction of the HRBT bridge tunnel complex beginning in the late 1950s, combined with earlier harbor channel dredging and improvements has modified the hydraulic and depositional properties of the outer Hampton Roads basin, creating new areas of scour and fill over the last 60 years. Water depths along the project alignment range from as little as five feet Mean Low Low Water (MLLW) along the trestle sections to nearly 70 feet in the mid-channel.

2 Field and Laboratory Methods

Investigation procedures used in this study are largely based on the USACE/United States Environmental Protection Agency (EPA) *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual*, commonly referred to as the Inland Testing Manual (ITM).

2.1 Site Access and Coordination

Sample collection was coordinated with the Jacobs/WGI geotechnical drilling program commissioned by VDOT to support the preliminary engineering design. Cardno, Inc. was contracted by VDOT to coordinate with the drilling and geotechnical contractors to obtain samples required for the preliminary sediment study. A Cardno geologist was on board the drilling rig during all sampling events included in this report.

Drilling equipment including the drilling barge, drill rig, and support vessels was provided by WGI. The drilling platform consisted of a 130-foot by 32-foot steel barge (CT-511) equipped with two 90-foot spuds which were lowered into the seabed to maintain a fixed position over each drill hole. A mobile B-51 rotary drill rig positioned amidships deploys drilling rods through a wet well located in the center of the barge. A 58-foot, 600-hp tug operated by WGI was used to transport the drilling barge to the job site and to maneuver it into position over each boring location as determined by a survey-grade Global Positioning System (*GPS*). Drill crews were shuttled to and from the barge using a 35-foot aluminium crew boat. Environmental sampling operations began on November 27, 2017 and were complete by April 5, 2018.

2.2 Sample Locations

Sub-bottom samples for sediment testing were collected in conjunction with the geotechnical sampling and testing undertaken for preliminary design. Geotechnical test borings were advanced along and in some cases parallel to the proposed highway centreline. However, environmental samples were only collected at 12 of the locations for this preliminary screening effort. As previously noted, all 12 project boreholes were sampled from the upper ten feet of sediment. In addition, deeper samples were also collected in two of the boreholes in the channel. Sample locations and depths are summarized below in *Table 1*. *Figures 1-7* in *Appendix C* provide general borehole locations depicted on the base maps from the *Geotechnical Plan for the HRBT Location (VDOT, May 2017).* Cardno used the same borehole nomenclature as the geotechnical boreholes, so for details of the borehole including coordinates and logging/material descriptions, the reader should review the geotechnical report.

2.3 Boring and Sample Identification

For each sediment sample, boring numbers are appended with the sample interval such as 0-10’, 80-90’ etc. indicating the depth interval relative to the seabed or mud line. Water samples were simply numbered with the boring location.

2.4 Sediment Sampling

Most sub-bottom samples were collected using a combination of 2-foot split spoon (SPT) samplers and/or a 10-foot bulk core barrel advanced using the mud-rotary drilling method. Poor recovery at some locations required use of a 10-foot bulk core barrel that recovered sediments from the entire ten-foot interval in one run.

Once the drilling barge was moved on station, each hole began with the installation of a 12-inch surface casing, generally advanced to a depth of 10 or 20 feet into the seabed, depending on the stability of the substrate. The surface casing extended above the seafloor to just below the height of the drilling table. The borehole was then advanced inside the surface casing by driving either the SPT sampler with blows using a 100-lb hydraulic hammer or with the 10-foot core barrel using hydraulic pressure. In cases where the SPT sampler was used, sediment samples were obtained by pushing either a 2- or 3-inch by 2-foot long SPT sampler through each sediment horizon. Drilling mud was introduced and circulated through the borehole to maintain a stable hole. In cases where the sediment was coarse and recovery poor, multiple runs of the SPT sampler or the 10-foot bulk core barrel were required to obtain sufficient volume for the environmental (dredge) samples.

For the geotechnical study, the Jacobs engineer collected sediment samples from the SPT samplers and kept records of blow counts and sediment characteristics. Since the geotechnical study only required archiving a small aliquot of sediment for laboratory study, the remainder could be dedicated to the dredge spoil sample. After each penetration of the SPT, the 2-foot long sampler was withdrawn from the hole, removed from the drill rod, opened, inspected and sampled. In most cases, dredge spoils were collected from the same SPT sampler as the geotechnical sample. For the dredge spoil analyses, sediments recovered from the entire ten-foot target interval were collected in a clean plastic bucket and then mixed to create a composite sample.

TABLE 1 – SUMMARY OF BOREHOLE LOCATIONS AND ANALYSES OF SEDIMENT SAMPLES

Geotech Borehole ID	Figure #	Location	Depth (feet from top of sediment)	Depth (feet MLLW[1])	Ocean Disposal Analyte List	Upland and Landfill Disposal Analyte List
B-001	2	North Bridge – Trestle	0-10	3-13	X	X
B-003	2	North Bridge – Trestle	0-10	7-17	X	X
B-008	3	North Island – North Island Expansion	0-10	11-21	X	X
B-013	4	Bored Tunnel/ITT SE of North Island Expansion	0-10	18-28	X	X
B-017	4	Inbound Thimble Shoals Channel NW: ITT Top Dredging Unit ITT Bottom Dredging Unit Bored Tunnel	0-10 20-30 80-90	75-85 95-105 155-165	X	X X X
B-023	4	Outbound Thimble Shoals Channel SE: ITT Top Dredging Unit ITT Bottom Dredging Unit Bored Tunnel	0-10 28-38 88-98	70-80 98-108 158-168	X	X X X
B-028	4	Bored Tunnel/ITT NE of South Island Expansion	0-10	12-22	X	X
B-030	5	South Island – South Island Expansion	0-10	13-23	X	X
B-033	6	South Bridge – Trestle	0-10	6-16	X	X
B-038	6	South Bridge – Trestle	0-10	4-14	X	X
B-039	7	Willoughby Bay – Trestle	0-10	4-14	X	X
B-044	7	Willoughby Bay – Trestle	0-10	6-16	X	X

MLLW = Mean Low Low Water based on North American Datum (NAD) 1983

2.5 Sample Collection, Labelling, Transport and Storage

Sediment and water samples were collected using methods designed to insure the materials originated from the designated boring location and from the planned target horizon or depth. Following recovery, all samples were properly containerized, labelled, preserved and packaged for shipment to maintain sample integrity during transport to the laboratory.

Upon arrival at each drilling location, Cardno staff confirmed station identity and geographic coordinates of the site as displayed on the ship's GPS navigation system and as confirmed by the drilling superintendent. Site locations were then compared against the intended sample inventory coordinates. The time of day and geographic coordinates of the location were immediately recorded in the field log along with the water depth as reported by the drilling supervisor measured from the seafloor to the drill collar.

2.5.1 <u>Water Sample Collection</u>

Once on station, the surface water sample was collected using a 12-volt diaphragm pump equipped with a 20-foot polyethylene, 5/8-inch diameter intake hose weighted and marked to withdraw water from a depth of 10 feet below the water surface or at least one foot off the seafloor at locations where the water depth was less than 10 feet. Before sampling, the pump was started and allowed to purge for three minutes before the discharge line was inserted in a 5-gallon, laboratory-supplied, pre-cleaned polyethylene sample jug or carboy. The sample container was filled to overflowing and then capped, sealed, labelled and placed in a cooler with ice for transport to the laboratory. Iced sample coolers were maintained at a temperature of 4°C or lower for the duration of the holding period. Each water sample was typically collected within an hour of the corresponding sediment sample.

Water samples were not filtered and therefore reflect a “totals” concentration instead of a “dissolved” concentration.

2.5.2 Sediment Sampling

Drilling typically commenced immediately upon arrival on site although in some cases, equipment breakdowns, weather, shift changes or other events delayed operations for some period of time. However, once drilling began, the surface casing was set, and an attempt was made to recover the upper ten feet of sediment in two-foot increments using the SPT sampler. As each SPT was collected, the core barrel was opened, the material examined, described and accumulated in a new dedicated 5-gallon bucket which remained sealed with a plastic lid between each core run. An attempt was made to collect and composite approximately 2.5-gallons of sediment per 10-foot target horizon, or enough material to fill six pre-cleaned, 32-ounce laboratory glass sample jars and two one-gallon plastic Zip-Lok® freezer bags. This process typically required compositing material from all five SPT samplers (2 feet per run) and in some cases additional SPTs were deployed across the sample interval to obtain sufficient material for all analyses. As mentioned earlier, coarse sediments required the use of the ten-foot core barrel. Once sufficient material was accumulated in the stainless steel mixing bowl, it was thoroughly homogenized and containerized in the pre-labelled glass jars and plastic bags, which were immediately sealed.

2.6 Quality Assurance/Quality Control

2.6.1 Documentation and Chain of Custody

The borehole number, date obtained, and project information were recorded on labels attached to each corresponding sample jar or bag and corresponding notes recorded in the field notebook at the time of collection. Since dredge spoil samples represent a composite of multiple SPT runs across five or more horizons, the sample time was recorded as the first SPT sample (0-2 feet below mudline) was retrieved from the drill hole. This collection time initiated the holding time period for all sediment samples. For elutriate water samples, sample and holding times were initiated when pumping into the sample container commenced.

All samples were entered on a chain of custody (*COC*) form documenting the sample ID, collection date and time, media type (sediment/water) and requested analytes. The COC forms followed samples from the field during transport and to the laboratory for delivery by Cardno personnel. The transport coolers remained sealed until arrival at the lab. All samples were kept under the exclusive custody of Cardno personnel throughout the process. Upon arrival at the lab, custody was transferred to laboratory staff who signed the COC form, unsealed the coolers, inspected the contents for completeness and damage and checked the sample temperature blank.

2.6.2 Holding Times

Holding times for all sediment samples including collection and transport were kept to within 48 hours from the time of initial water sample collection in order to meet controlling minimum time limits for submitting the accompanying water samples for nitrate/nitrate for elutriate testing. Consequently, all samples were hand delivered to the laboratory by Cardno field staff within 48 hours of collection.

2.6.3 Field Equipment Decontamination

Equipment and materials coming in contact with the sediment and water samples were thoroughly decontaminated to reduce the chance for cross-contamination or exposure to extraneous chemicals or petroleum.

Sediment samples only came in contact with the SPT sample barrel, metal sampling scoop and five-gallon plastic bucket before being containerized and transported to the laboratory. Between each deployment, SPT sample tubes were decontaminated with laboratory supplied deionized water and Alconox® using a stiff bristle scrub brush followed by a rinse with deionized water. The sample bowl and spoon were also scrubbed with the Alconox/water mixture followed by a de-ionized water rinse before each composite sample accumulation.

The pump used for collecting the water samples was decontaminated by pumping deionized water through the entire pump and hose assembly between each sample. No other equipment or materials came in contact with the water samples other than the polyethylene containers themselves.

To verify the efficacy of the decontamination process, Cardno collected an equipment rinsate blank at borehole site B-030. The rinsate followed the normal decontamination process described above for both sediment and water sampling equipment and consisted of spraying the SPT sampler with laboratory-supplied deionized water, capturing this water in the sample mixing pan, stirring it with the mixing spoon and then capturing a sample of this water in 5-gallon polyethylene containers.

2.6.4 Duplicate Sample

Duplicate sediment and water samples were collected and analyzed from the B-044 boring site to provide a basis for evaluating the repeatability of analyses derived from each medium. Duplicate sediment samples were collected by splitting in half the composited 0-10’ sample interval and then separately containerizing and labelling two sets of containers. Both sets of containers were submitted to the laboratory for analysis of all parameters. An effort was made to insure equal splits of the entire interval were included in each split by thoroughly mixing the composite before splitting and containerizing the samples.

Duplicate water samples were collected by filling two sets of containers – alternately filling the original and duplicate containers so as to minimize any temporal variations in water characteristics over the course of the sampling period (roughly 30 minutes).

Duplicate elutriate samples were prepared at the laboratory by combining the sediment and water sample splits described above.

2.7 Laboratory Analytical Methods

The bulk sediment and water samples were submitted by Cardno directly to Air Water and Soil Laboratories Inc. (AWS) of Richmond, Virginia for chemical and physical analysis and to Virginia Tech Soil Laboratory for agronomic testing. A summary of analytical methods for each sample type is presented in *Table 2*. For some tests, samples submitted to AWS were split and sent to subcontractor laboratories including Eurofins (Eurofins Calscience and Eurofins Lancaster) for organotins, dioxins, furans and acid volatile sulfide and Testamerica for pesticides. Note that chemical analysis of the sediment samples is reported on a dry basis, which is common for sediment disposal evaluations. Splits were also sent to Geotechnical Testing Services (GTS Coraopolis, PA) for grain size, Atterberg Limits and specific gravity. *Table 2* summarizes the analyses and laboratories.

TABLE 2 – SUMMARY OF ANALYTICAL METHODS USED IN EVALUATING SEDIMENT, WATER AND ELUTRIATES

Method	Analytes	Lab	Bulk Sediment	Elutriate	Surface Water
			Ocean/Upland/Landfill Disposal	Ocean Disposal	Ocean Disposal
SW6010C/7471B	Total Metals/Mercury	AWS	X	X	X
SW6010C/7471B	Simultaneous Extracted Metals/Mercury	Eurofins	X	X	X
SW8015C	TPH-Volatiles (Gasoline Range Organics/GRO) and TPH-Diesel Range Organics (DRO)	AWS	X		
SW8260B	Volatile Organic Compounds (VOCs)	AWS	X	X	
SW8270D	Semi-volatile Organic Compounds (SVOCs)	AWS	X	X	X
SW8082A	Organochlorine Pesticides	AWS	X	X	X
SW8141A	PCB Aroclors	AWS	X		
EPA 1668	PCB Congeners & Individual Congeners	Eurofins	X	X	X
SW8081	Organochlorine Pesticides	TA	X	X	X
SW8141A	Organophosphorus Pesticides (GC/NPD)	AWS/ TA	X	X	X
EPA350.1 (R2.0)	Ammonia as N	AWS	X	X	X
SW9012B	Cyanide	AWS	X	X	X
SW9056A	Extractable Organic Halides (EOX)	AWS	X	X	
SW9056A	Nitrate as N	AWS	X	X	
Calc	Nitrate as N	AWS	X	X	X
SW9056A	Nitrite as N	AWS	X	X	X
SM-22 4500-NO3F	Nitrate + Nitrite as N	AWS	X	X	X
SM22 4500PE-2011	Phosphorus (total)	AWS	X	X	X
SW9095B	Paint Filter	AWS	X		
SM18 2540G	Percent Solids	AWS	X		
SW9060A	Total Organic Carbon	AWS	X	X	X
SW9040C	pH	AWS	X		
SW9034	Sulfide	AWS	X	X	X
EPA351.2 R2.0	TKN as N	AWS	X	X	X
ASTM4318D	Atterberg Limits	GTS	X		
ASTM-D854	Specific Gravity	GTS	X		
EPA1613B	Dioxin and Furans	Eurofins	X		
Krone et al	Organotins	Eurofins	X	X	X
EPA-821-R-91-100	Acid Volatile Sulfide	Eurofins	X	X	
ASTM D6913-17/D4318-17/D7928-17	Grain Size – Particle Size Distribution	GTS	X		
Sobek	Total Sulfur/ Potential Peroxide Activity	VT	X		

AWS=Air Water and Soil, Richmond, VA; Eurofins = Eurofins Garden Grove, CA; TA=TestAmerica, Pittsburgh, PA; GTS=Geotechnical Testing Services; VT=Virginia Tech Soils Lab, Blacksburg, VA

3 Data Comparisons

The laboratory data were compared to the various reference values depending on the potential disposal scenario. The comparison approach is summarized below.

3.1 Upland Disposal

To screen for an upland disposal option, bulk sediment data were compared to Weanack's EC.

3.2 Landfill Disposal

To screen for disposal in a Virginia landfill, the data were compared to typical permit requirements such as RCRA hazardous waste limits (40 CFR 261.24 *Characteristics of Hazardous Waste*) along with PCBs, TPH and paint filter test.

3.3 Ocean Disposal

To screen for ocean disposal, the sediment results were compared to the National Oceanic and Atmospheric Administration's (*NOAA*) *Screening Quick Reference Tables*, or SquiRTs (2008). The SquiRTs were developed to help evaluate potential risks from contaminated water, sediment, or soil and reflect a reference tool presenting screening concentrations for inorganic and organic contaminants in various environmental media. For this HRBT preliminary sediment study, the primary comparison to evaluate potential ocean disposal was the "Effects Range-Low" (*ERL*), indicative of concentrations below which adverse effects rarely occur. If an ERL was exceeded, then a comparison was also made to the "Effects Range-Median" (*ERM*) values, representative of concentrations above which effects frequently occur.

Results of elutriate and surface water testing were compared to the NOAA SquiRT values listed in the following column: *Surface Waters, Marine, Acute*. Similar to the sediment SquiRT values, the water concentrations are also to be used as a general screening comparison. The NOAA guidance describes that preference for surface water benchmarks is given to U.S. EPA Ambient Water Quality Criteria (*AWQC*). This is generally followed by Tier II Secondary Acute Values (*SAVs*) or available standards and guidelines from other regulatory agencies. However, note that SquiRT values listed as proposed or footnoted to an international reference were not included in the data tables.

4 Results

The laboratory certificates of analysis are provided in *Appendix D,* which contain the laboratory detections along with the laboratory QA/QC documentation. The results for each of the sample media are summarized in *Tables 3-5*. The results tables are divided into *Sediment – Table 3; Elutriate – Table 4;* and *Water –Table 5*. The following should be noted while viewing the tables:

> The sediment chemical analyses are typically reported as dry weight;

> The tables depict parameters grouped by type (metals, pesticides, etc.) where the units (mg/kg, ug/kg, etc.) may differ by group, but the applicable units are provided with each group description header;

> Non-detects are indicated by a "<" sign;

> Bolded results shown on the tables indicate detections in the samples;

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION
SEDIMENT

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-017 80-90'	B-023 0-10'	B-023 28-38'	B-023 88-98'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
% solids					70.9%	76.0%	81.3%	81.6%	76.0%	66.3%	80.3%	56.7%	52.8%	84.4%	87.7%	84.2%	79.4%	72.1%	59.7%	54.1%	54.2%
Total Recoverable Metals (mg/kg)																					
7429-90-5	Aluminum	-	-	-	980	4,380	2,750	1,150	5,040	16,900	NT	27,800	23,700	NT	1,010	457	630	9,750	19,800	16,100	12,300
7440-36-0	Antimony	-	-	410	< 6.72	< 6.01	< 5.91	< 5.65	< 5.70	< 6.92	< 5.86	< 8.16	< 9.22	< 5.82	< 5.21	< 5.93	< 5.89	< 6.64	< 7.94	< 6.28	< 5.89
7440-38-2	Arsenic	8.2	70	41	< 1.34	1.91	1.21	1.14	3.02	5.72	4.95	8.53	9.11	3.09	1.43	1.5	< 1.18	6.26	11.3	14.4	16.3
7440-39-3	Barium	-	-	19,000	3.17	11.9	9.15	9.09	13.7	31.4	18.3	54	69.5	16.2	3.33	6.9	6.39	24.8	37.8	38.1	32.5
7440-41-7	Beryllium	-	-	2,000	< 0.269	< 0.240	< 0.236	< 0.226	< 0.228	< 0.277	< 0.234	< 0.326	< 0.369	< 0.233	< 0.208	< 0.237	< 0.236	< 0.266	< 0.318	< 0.251	< 0.236
7440-43-9	Cadmium	1.2	9.6	810	< 0.269	0.242	0.417	< 0.226	0.367	0.998	0.728	1.64	1.57	0.416	< 0.208	< 0.237	< 0.236	0.765	1.31	2.01	2.11
7440-47-3	Chromium	81	370	1,200	4.16	7.90	7.11	3.45	8.78	26.7	18.3	37.9	34.3	5.96	8	2.34	3.14	22.2	33.1	35.4	33.2
7440-48-4	Cobalt	-	-	300	0.751	1.81	1.84	0.811	2.86	8.15	2.84	13.3	11.5	1.71	1.01	0.404	0.547	6.68	9.04	8.31	8.57
7440-50-8	Copper	34	270.0	4,300	< 3.36	< 3.00	< 2.95	< 2.82	< 2.85	< 3.46	< 2.93	11.5	6.26	< 2.91	< 2.60	< 2.97	< 2.95	< 3.32	5.04	11.6	13
7439-89-6	Iron	-	-	150,000	1,520	4,470	4,700	2,030	8,250	21,300	14,300	34,300	33,400	7,480	2,730	864	1,500	15,600	28,300	30,600	30,800
7439-92-1	Lead	46.7	218	800	5.3	3.42	3.02	2.08	4.17	6.32	3.8	12.00	11.4	1.98	1.88	3.02	1.21	6.32	10.2	32.6	26
7439-96-5	Manganese	-	-	-	13.2	37.8	23.3	21.7	153	298		1040	661		40.7	13.6	19.2	212	221	230	241
7439-97-6	Mercury	0.15	0.71	100	< 0.010	0.012	< 0.008	< 0.009	< 0.010	< 0.011	< 0.009	0.014	0.018	< 0.009	< 0.009	< 0.009	< 0.010	< 0.010	0.015	0.093	0.071
7440-02-0	Nickel	20.9	51.6	1,000	1.45	3.7	2.48	1.22	5.13	15.3	5.79	25.3	22.1	2.71	2.96	0.983	0.938	11.7	18.7	16.4	16
7782-49-2	Selenium	-	-	5,100	< 3.36	< 3.00	< 2.95	< 2.82	< 2.85	< 3.46	< 2.93	< 4.08	< 4.61	< 2.91	< 2.60	< 2.97	< 2.95	< 3.32	< 3.97	< 3.14	< 2.95
7440-22-4	Silver	1	3.7	5,100	< 0.672	< 0.601	< 0.591	< 0.565	< 0.570	< 0.692	< 0.586	< 0.816	< 0.922	< 0.582	< 0.521	< 0.593	< 0.589	< 0.664	< 0.794	< 0.628	< 0.589
7440-28-0	Thallium	-	-	5	< 3.36	< 3.00	< 2.95	< 2.82	< 2.85	< 3.46	< 2.93	< 4.08	< 4.61	< 2.91	< 2.60	< 2.97	< 2.95	< 3.32	< 3.97	< 3.14	< 2.95
7440-31-5	Tin	-	-	-	< 6.72	< 6.01	< 5.91	< 5.65	< 5.70	< 6.92		< 8.16	< 9.22		< 5.21	< 5.93	< 5.89	< 6.64	< 7.94	< 6.28	< 5.89
7440-62-2	Vanadium	-	-	5,200	3.85	9.32	6.58	4.31	10.8	29.9	15.8	45.5	40.7	6.77	3.76	1.68	2.1	28.6	43.2	47.6	41.7
7440-66-6	Zinc	150	410	7,500	7.85	11.3	7.4	4.7	16.2	43.9	18.4	76.4	68	8.82	6.39	3.67	2.88	29.7	55.4	91.5	96.9
Simultaneous Extracted Metals (umoles/g)																					
7440-43-9	Cadmium	-	-	-	0.000340 J	0.00109 J	0.000666 J	0.000472 J	0.000314 J	<0.000171	NT	<0.000188	<0.000241	NT	0.000352 J	0.000252 J	<0.000139	0.000449 J	0.000769 J	0.00291 J	0.00237 J
7440-50-8	Copper	-	-	-	0.00968	0.0774	0.0142	0.0340	0.0153	<0.00135	NT	0.0409	0.314	NT	0.0576	0.0306	0.0177	0.102	0.0752	0.115	0.126
7439-92-1	Lead	-	-	-	0.00543	0.0139	0.00749	0.00619	0.00961	0.00725	NT	0.0216	0.0465	NT	0.00577	0.00431	0.00478	0.016	0.0305	0.0834	0.065
7440-02-0	Nickel	-	-	-	0.00709 J	0.0142	0.0107 J	0.148	0.0764	0.0314	NT	0.140	0.433	NT	0.218	0.109	0.122	0.349	0.389	0.0671	0.215
7440-66-6	Zinc	-	-	-	0.0563	0.245	0.0419	0.0529	0.0778	0.236	NT	0.356	0.428	NT	0.0466	0.0429	0.0393	0.145	0.312	0.828	0.645
7439-97-6	Mercury	-	-	-	<0.0000089	<0.0000099	<0.0000099	<0.0000089	<0.0000093	<0.000011	NT	<0.000012	<0.000015	NT	<0.0000085	<0.0000086	<0.0000087	<0.0000097	<0.000012	<0.000014	<0.000013
-	Acid Volatile Sulfide	-	-	-	<0.78	<0.87	<0.84	<0.77	<0.79	<0.90	NT	<0.97	<1.3	NT	<0.72	<0.75	<0.75	<0.86	<1.1	14.3	9.3
-	Moisture %	-	-	-	19.4	27.4	24.8	18.5	20.6	30	NT	35.3	50.1	NT	13.1	15.9	16.0	26.7	40.8	48.3	45.5
PCBs (mg/kg)																					
12674-11-2	Aroclor 1016	-	-	21	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
11104-28-2	Aroclor 1221	-	-	0.62	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
11141-16-5	Aroclor 1232	-	-	0.62	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
53469-21-9	Aroclor 1242	-	-	0.74	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
12672-29-6	Aroclor 1248	-	-	0.74	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
11097-69-1	Aroclor 1254	-	-	0.74	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
11096-82-5	Aroclor 1260	-	-	0.74	< 0.137	<0.112	<0.112	<0.109	< 0.125	< 0.148	< 0.113	< 0.172	< 0.179	< 0.109	< 0.109	< 0.116	<0.118	< 0.121	< 0.167	< 0.176	< 0.183
1336-36-3	Total PCBs, sum of above 7 Aroclors	-	-	25.2	<0.959	<0.784	<0.784	<0.763	<0.875	<1.036	<0.791	<1.204	<1.253	<0.763	<0.763	<0.812	<0.826	<0.847	<1.169	<1.232	<1.281

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION

SEDIMENT

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-017 80-90'	B-023 0-10'	B-023 28-38'	B-023 88-98'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Pesticides (ug/kg)																					
86-50-0	Azinphos-methyl	-	-	-	< 8.16	< 7.01	<7.21	< 7.33	**47.6**	< 8.01	NT	< 10.6	< 10.0	NT	< 6.54	< 7.03	< 7.38	< 8.26	< 10.00	< 10.4	< 10.7
125-75-0	Demeton, o+s	-	-	-	< 16.3	< 14.0	<14.4	< 14.7	< 14.8	< 16.0	NT	< 21.2	< 20.0	NT	< 13.1	< 14.1	< 14.8	< 16.5	< 20.0	< 20.7	< 21.3
56-38-2	Ethyl Parathion	-	-	-	< 8.16	< 7.01	<7.21	< 7.33	< 7.38	< 8.01	NT	< 10.6	< 10.0	NT	< 6.54	< 7.03	< 7.38	< 8.26	< 10.0	< 10.4	< 10.7
121-75-5	Malathion	-	-	-	< 8.16	< 7.01	<7.21	< 7.33	< 7.38	< 8.01	NT	< 10.6	< 10.0	NT	< 6.54	< 7.03	< 7.38	< 8.26	< 10.0	< 10.4	< 10.7
56-38-2	Methyl parathion	-	-	-	< 8.16	< 7.01	<7.21	< 7.33	< 7.38	< 8.01	NT	< 10.6	< 10.0	NT	< 6.54	< 7.03	< 7.38	< 8.26	< 10.0	< 10.4	< 10.7
53-19-0	2,4'-DDD	-	-	-	**17**	**0.56**	**0.072 JP**	<0.11	<0.1	<2.6	<0.11	<0.064	**0.027 J P**	**0.021 J P**	**0.40**	**3.6**	<0.05	<0.11	<0.14	<0.16	<0.15
3424-82-6	2,4'-DDE	-	-	-	**0.42**	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	**0.11**	<0.05	<0.11	<0.14	**0.072 J**	<0.15
789-02-6	2,4'-DDT	-	-	-	**12**	**0.44**	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	**0.24**	**3.0**	<0.05	<0.11	<0.14	<0.16	<0.15
72-54-8	4,4'-DDD	2	20	7,200	**30**	**1.2**	<0.1	<0.11	<0.1	<2.6	<0.11	**0.075**	**0.042 J**	<0.048	**0.79**	**6.5**	<0.05	<0.11	<0.14	**0.16 P**	**0.17 P**
72-55-9	4,4'-DDE	2.2	27	5,100	**4.2**	**0.15**	<0.1	<0.11	<0.1	<2.6	<0.11	**0.063 J**	<0.075	<0.048	**0.10**	**0.93**	<0.05	<0.11	<0.14	**0.45**	**0.43**
50-29-3	4,4'-DDT	1	7	7,000	**87**	**4.0**	<0.1	<0.11	<0.1	<2.6	<0.11	**0.074**	<0.075	<0.048	**2.5**	**32**	<0.05	<0.11	**0.070 J P**	<0.16	<0.15
-	Total DDT (ND=0)	1.58	46.1	-	**99.0**	**4.4**	0	0	0	0	0	**0.074**	0	0	**3.29**	**35.0**	0	0	0	**0.45**	**0.43**
309-00-2	Aldrin	-	-	110	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
319-84-6	alpha-BHC	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
319-85-7	beta-BHC	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
57-74-9	Chlordane (technical)	0.5	6.00	-	<0.57	<0.54	<1	<1.1	<1	<26	<1.1	<0.64	<0.75	<0.48	<0.46	<0.54	<0.5	<1.1	<1.4	<1.6	<1.5
103-17-3	Chlorobenside	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
1861-32-1	DCPA	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	**0.14 J P**	**0.12 J P**
319-86-8	delta-BHC	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.080**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
60-57-1	Dieldrin	0.02	8	110	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.087**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
959-98-8	Endosulfan I	-	-	3,700,000	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.062 J**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
33213-65-9	Endosulfan II	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	**0.021 J P**	<0.05	<0.11	<0.14	<0.16	<0.15
1031-07-8	Endosulfan sulfate	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.049 J**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
72-20-8	Endrin	-	-	180,000	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.088**	<0.075	<0.048	<0.046	<0.054	<0.05	**0.26 P**	<0.14	<0.16	**0.47**
7421-93-4	Endrin aldehyde	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.15**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
58-89-9	gamma-BHC (Lindane)	-	-	520	<0.057	<0.054	**0.16 P**	**0.28**	**0.070 J P**	<2.6	**0.22 P**	**0.042 J P**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
76-44-8	Heptachlor	-	-	380	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	**0.062 J**	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
1024-57-3	Heptachlor epoxide	-	-	190	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	**0.076 J P**	<0.14	<0.16	<0.15
72-43-5	Methoxychlor	-	-	3,100,000	<0.057	<0.054	<0.21	<0.21	<0.21	<5.1	<0.22	**0.057 J**	**2.2**	**0.047 J**	<0.046	<0.054	<0.05	<0.23	<0.27	<0.31	<0.3
2385-85-5	Mirex	-	-	-	<0.057	<0.054	<0.1	<0.11	<0.1	<2.6	<0.11	<0.064	<0.075	<0.048	<0.046	<0.054	<0.05	<0.11	<0.14	<0.16	<0.15
8001-35-2	Toxaphene	-	-	1,600	<2.3	<2.2	<4.2	<4.3	<4.2	<100	<4.4	<2.6	<3	<1.9	<1.9	<2.1	<2	<4.6	<5.4	<6.3	<6

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION
SEDIMENT

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		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
SW8260B Volatiles (ug/kg)																					
630-20-6	1,1,1,2-Tetrachloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 2.45	< 8.38	< 9.18	< 9.14
71-5-56	1,1,1-Trichloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
79-3-45	1,1,2,2-Tetrachloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 2.45	< 8.38	< 9.18	< 9.14
79-00-5	1,1,2-Trichloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
72-56-0	1,1-Dichloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
72-55-9	1,1-Dichloroethylene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
563-58-6	1,1-Dichloropropene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
87-61-6	1,2,3-Trichlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
96-18-4	1,2,3-Trichloropropane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
120-82-1	1,2,4-Trichlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
95-63-6	1,2,4-Trimethylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
106-93-4	1,2-Dibromoethane (EDB)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
95-50-1	1,2-Dichlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
1070-62	1,2-Dichloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
78-77-5	1,2-Dichloropropane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
108-67-8	1,3,5-Trimethylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
541-73-1	1,3-Dichlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
142-28-9	1,3-Dichloropropane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
106-46-7	1,4-Dichlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
594-20-7	2,2-Dichloropropane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-97-8	2-Butanone (MEK)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 61.3	< 8.38	< 9.18	< 9.14
95-49-8	2-Chlorotoluene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
110-12-3	2-Hexanone (MBK)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 30.7	< 8.38	< 9.18	< 9.14
106-43-4	4-Chlorotoluene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
99-87-6	4-Isopropyltoluene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
10-81-01	4-Methyl-2-pentanone (MIBK)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 30.7	< 8.38	< 9.18	< 9.14
67-64-1	Acetone	-	-	-	< 64.7	< 60.9	< 61.5	< 58.9	**15.3**	**27.7**	**31.2**	< 80.9	**203**	**25.3**	< 54.8	< 58.2	< 60.0	< 61.3	**21.9**	**58**	**39**
71-43-2	Benzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-86-1	Bromobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
74-97-5	Bromochloromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-27-4	Bromodichloromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
75-25-2	Bromoform	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
74-86-9	Bromomethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-15-0	Carbon disulfide	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 61.3	< 8.38	< 9.18	< 9.14
56-23-5	Carbon tetrachloride	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-90-7	Chlorobenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-00-3	Chloroethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
67-66-3	Chloroform	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
74-87-3	Chloromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
156-59-2	cis-1,2-Dichloroethylene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
10061-01-5	cis-1,3-Dichloropropene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
124-48-1	Dibromochloromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
74-95-3	Dibromomethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-71-8	Dichlorodifluoromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-20-3	Di-isopropyl ether (DIPE)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 30.7	< 8.38	< 9.18	< 9.14
100-41-4	Ethylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
87-68-3	Hexachlorobutadiene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 4.91	< 8.38	< 9.18	< 9.14
74-88-4	Iodomethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 61.3	< 8.38	< 9.18	< 9.14
98-82-8	Isopropylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-38-3	m+p-Xylenes	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 12.3	< 8.38	< 9.18	< 9.14
75-09-2	Methylene chloride	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 24.5	< 8.38	< 9.18	< 9.14

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-017 80-90'	B-023 0-10'	B-023 28-38'	B-023 88-98'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
SW8260B Volatiles Contd (ug/kg)																					
1634-04-4	Methyl-t-butyl ether (MTBE)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
91-20-3	Naphthalene	160	2,100	230,000	**75.4**	**67**	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
104-51-8	n-Butylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
103-65-1	n-Propylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
95-47-6	o-Xylene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
135-98-8	sec-Butylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
100-42-5	Styrene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
98-06-6	tert-Butylbenzene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
127-18-4	Tetrachloroethylene (PCE)	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-88-3	Toluene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
156-60-5	trans-1,2-Dichloroethylene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
10061-02-6	trans-1,3-Dichloropropene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
79-01-6	Trichloroethylene	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
75-69-4	Trichlorofluoromethane	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 6.13	< 8.38	< 9.18	< 9.14
108-05-4	Vinyl acetate	-	-	-	< 64.7	< 60.9	< 61.5	< 58.9	< 13.1	< 15.1	< 12.4	< 80.9	< 80.9	< 11.9	< 54.8	< 58.2	< 60.0	< 61.3	< 16.8	< 18.4	< 18.3
75-01-4	Vinyl chloride	-	-	-	< 32.4	< 30.5	< 30.7	< 29.4	< 6.57	< 7.54	< 6.18	< 40.4	< 40.4	< 5.93	< 27.4	< 29.1	< 30.0	< 3.07	< 8.38	< 9.18	< 9.14
1330-20-7	Xylenes, Total	-	-	-	< 97.1	< 91.4	< 92.2	< 88.3	< 19.7	< 22.6	< 18.5	< 121	< 121	< 17.8	< 82.3	< 87.3	< 89.9	< 18.4	< 25.1	< 27.5	< 27.4
SW8270 Semi Volatiles (ug/kg)																					
120-82-1	1,2,4-Trichlorobenzene	-	-	400,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
95-50-1	1,2-Dichlorobenzene	-	-	10,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
122-66-7	1,2-Diphenylhydrazine	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
541-73-1	1,3-Dichlorobenzene	-	-	5,100,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
106-46-7	1,4-Dichlorobenzene	-	-	570,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
90-12-0	1-Methylnaphthalene	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
108-20-3	2,2'-Oxybis (1-chloropropane)	-	-	2,300,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
95-95-4	2,4,5-Trichlorophenol	-	-	62,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
88-06-2	2,4,6-Trichlorophenol	-	-	160,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
120-83-2	2,4-Dichlorophenol	-	-	1,800,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
105-67-9	2,4-Dimethylphenol	-	-	12,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
51-28-5	2,4-Dinitrophenol	-	-	1,200,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
121-14-2	2,4-Dinitrotoluene	-	-	1,200,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
606-20-3	2,6-Dinitrotoluene	-	-	620,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
91-58-7	2-Chloronaphthalene	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
95-57-8	2-Chlorophenol	-	-	5,100,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
91-57-6	2-Methylnaphthalene	70	670	4,100,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
88-75-5	2-Nitrophenol	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
91-94-1	3,3'-Dichlorobenzidine	-	-	3,800	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
99-09-2	3-Nitroaniline	-	-	82,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
534-52-1	4,6-Dinitro-2-methylphenol	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
101-55-3	4-Bromophenyl phenyl ether	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
106-47-8	4-Chloroaniline	-	-	230,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 83.3	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
7005-72-3	4-Chlorophenyl phenyl ether	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
100-01-6	4-Nitroaniline	-	-	82,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
100-02-7	4-Nitrophenol	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
83-32-9	Acenaphthene	16	500	33,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
208-96-8	Acenaphthylene	44	640	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
120-12-7	Anthracene	85.3	1,100	170,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
56-55-3	Benzo (a) anthracene	261	1600	2,100	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
50-32-8	Benzo (a) pyrene	430	1600	660	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
207-08-9	Benzo (b) fluoranthene	-	-	2,100	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
191-24-2	Benzo (g,h,i) perylene	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
207-08-9	Benzo (k) fluoranthene	-	-	21,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
65-85-0	Benzoic acid	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION
SEDIMENT

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-017 80-90'	B-023 0-10'	B-023 28-38'	B-023 88-98'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
SW8270 Semi Volatiles contd (ug/kg)																					
100-51-4	Benzyl alcohol	-	-	-	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
111-91-1	bis (2-Chloroethoxy) methane	-	-	1,800,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
111-44-4	bis (2-Chloroethyl) ether	-	-	900	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
117-81-7	bis (2-Ethylhexyl) phthalate	-	-	120,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
85-68-7	Butyl benzyl phthalate	-	-	1,100,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
218-01-9	Chrysene	384	2800	210,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
53-70-3	Dibenz (a,h) anthracene	63.4	260	660	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
132-64-9	Dibenzofuran	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
84-66-2	Diethyl phthalate	-	-	490,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
131-11-3	Dimethyl phthalate	-	-	10,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
84-74-2	Di-n-butyl phthalate	-	-	5,700,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
117-84-0	Di-n-octyl phthalate	-	-	1,100,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
206-44-0	Fluoranthene	600	5100	22,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
86-73-7	Fluorene	19	540	22,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
118-74-1	Hexachlorobenzene	-	-	1,100	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
87-68-3	Hexachlorobutadiene	-	-	22,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
77-47-4	Hexachlorocyclopentadiene	-	-	3,700,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
67-72-1	Hexachloroethane	-	-	120,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
193-39-5	Indeno (1,2,3-cd) pyrene	-	-	2,100	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
78-59-1	Isophorone	-	-	1,800,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
143-50-0	Kepone	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
76-60-8	m+p-Cresols	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
91-20-3	Naphthalene	160	2,100	230,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
98-95-3	Nitrobenzene	-	-	280,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
62-75-9	n-Nitrosodimethylamine	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	NT	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
621-64-7	n-Nitrosodi-n-propylamine	-	-	660	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
86-30-6	n-Nitrosodiphenylamine	-	-	350,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
76-60-8	o-Cresol	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
59-50-7	p-Chloro-m-cresol	-	-	0	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
87-86-5	Pentachlorophenol	-	-	9,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
85-01-8	Phenanthrene	240	1,500	0	< 110	< 106	< 101	< 96.3	< 104	< 118	NT	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
108-95-2	Phenol	-	-	180,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
129-00-0	Pyrene	665	2,600	17,000,000	< 110	< 106	< 101	< 96.3	< 104	< 118	< 99.5	< 144	< 151	< 95.5	< 90.8	< 89.7	< 103	< 109	< 140	< 152	< 153
-	Sum LPAHs (ND=0)	552	3,160	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	Sum HPAHs (ND=0)	1,700	9,600	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-	Sum PAHs (ND=0)	4,022	44,792	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum (mg/kg)																					
-	TPH-Semi-Volatiles (DRO)	-	-	-	**62**	**27.8**	< 11.6	< 11.2	< 12.4	< 14.6	< 11.3	< 17.1	< 18.6	< 11.7	< 10.5	< 11.6	< 11.9	< 13.6	< 16.2	**23.7**	**32.8**
-	TPH-Volatiles (GRO)	-	-	-	<0.69	**0.27**	< 0.12	< 0.12	< 0.66	< 0.57	< 0.46	< 0.82	< 0.95	< 0.12	< 0.11	< 0.12	< 0.13	< 0.61	< 0.84	< 0.92	< 0.92
Wet Chemistry/Miscellaneous (mg/kg)																					
-	Extractable Organic Halides (EOX)	-	-	-	< 14.1	< 13.2	< 12.3	< 12.3	< 13.2	< 15.1	< 12.4	< 17.6	< 18.9	< 11.9	**16.6**	< 11.9	< 12.6	< 13.9	< 16.8	< 18.5	< 18.4
7664-41-7	Ammonia as N	-	-	-	< 13.9	< 11.9	< 12.0	< 11.0	**22**	**41.4**	NT	**91.5**	**447**	NT	< 10.9	< 11.4	< 12.3	**23.9**	**44.7**	**60.7**	**59.3**
57-12-5	Cyanide, Total	-	-	20,000	< 1.39	< 1.31	< 1.21	< 1.19	< 1.29	< 1.34	< 1.22	< 1.70	< 1.85	< 1.13	< 1.09	< 1.16	< 1.24	< 1.37	< 1.67	< 1.81	< 1.80
14797-55-8	Nitrate as N	-	-	-	< 2.82	< 2.63	< 2.46	< 2.45	< 2.63	< 3.02	NT	< 3.53	< 3.78	NT	< 2.28	< 2.38	**2.98**	< 2.77	**4.91**	< 3.69	< 3.69
14797-65-0	Nitrite as N	-	-	-	< 2.8	< 2.6	< 2.5	< 2.5	< 2.6	< 3.0	NT	< 3.5	< 3.8	NT	< 2.3	< 2.4	< 2.5	< 2.8	< 3.4	< 3.7	< 3.7
7723-14-0	Phosphorus (total)	-	-	-	**19.7**	**43.6**	**67.1**	**33.8**	**50.7**	**222**	NT	**417**	**572**	NT	**33.7**	**16.6**	**18.8**	**194**	**292**	**398**	**346**
-	Paint Filter (<1 ml/100g)	-	-	-	< 1	< 1	< 1	< 1	**2**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	**1**	< 1	< 1	< 1	< 1
-	Percent Solids	-	-	-	**70.9**	**76.0**	**81.3**	**81.6**	**76**	**66.3**	**80.8**	**56.7**	**52.8**	**84.4**	**87.7**	**84.2**	**79.4**	**72.1**	**59.7**	**54.1**	**54.2**
-	pH (SU)	-	-	-	**7.8**	**8.4**	**8.3**	**8.4**	**8.4**	**8.6**	**8.7**	**8.3**	**7.4**	**8.0**	**8.0**	**8.3**	**8.1**	**8.6**	**8.4**	**8.3**	**8.5**
18496-25-8	Sulfide	-	-	-	**1,670**	**700**	< 466	< 423	**1650**	**770**	NT	**1,360**	< 739	NT	**713**	**949**	< 453	**876**	**1,200**	**949**	**698**
	TKN as N	-	-	-	**161**	**222**	< 61.5	**71.8**	**162**	**422**	NT	**725**	**1230**	NT	**57.5**	< 59.3	< 60.7	**496**	**662**	**1,070**	**1,090**
-	TOC (Min)	-	-	-	**4,710**	**4,170**	**484**	**591**	**735**	**1,590**	NT	**3,480**	**827**	NT	**3,200**	**< 4280**	**586**	**10,800**	**3,530**	**2,380**	**3,340**
-	TOC (Max)	-	-	-	**8,600**	**7,890**	**572**	**680**	**784**	**1,640**	NT	**4,090**	**891**	NT	**3,700**	**6,230**	**649**	**12,100**	**3,930**	**2,850**	**3,900**
-	TOC (Mean)	-	-	-	**6,390**	**5,480**	**547**	**676**	**752**	**1,610**	NT	**3,900**	**869**	NT	**3,470**	**5,420**	**629**	**11,700**	**3,780**	**2,570**	**3,690**
		-	-	-																	
Butyltins (ug/kg)																					
77-58-7	Dibutyltin	-	-	-	<4.2	<3.9	<3.6	<3.5	<3.9	<4.4	<2.9	<5.5	<2.9	<2.9	<3.4	<3.6	<3.7	<4.1	<4.9	<5.4	<5.5
112-34-5	Monobutyltin	-	-	-	<4.2	<3.9	<3.6	<3.5	<3.9	<4.4	<2.9	<5.5	<2.9	<2.9	<3.4	<3.6	<3.7	<4.1	<4.9	<5.4	<5.5
36643-28-4	Tributyltin	-	-	-	<4.2	<3.9	<3.6	<3.5	<3.9	<4.4	<2.9	<5.5	<2.9	<2.9	<3.4	<3.6	<3.7	<4.1	<4.9	<5.4	<5.5

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION

SEDIMENT

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-017 80-90'	B-023 0-10'	B-023 28-38'	B-023 88-98'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
		ERL	ERM		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0257	18A0118	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Dioxins and Furans (ng/kg)																					
1746-01-6	2378-TCDD	-	-	18	0.0313 JB	0.0447 JBQ	<0.0440	0.0934 JQ	0.0722 JBQ	0.223 JQ	0.390 J	0.193 JQ	0.169 JQ	<0.0256	<0.0161	0.0191 JBQ	0.0438 JQ	0.194 JBQ	0.316 JBQ	0.732 JB	0.692 JBQ
40321-76-4	12378-PeCDD	-	-	-	0.0853 J	0.456 JQ	0.124 JQ	<0.0761	0.430 JBQ	1.72 JBQ	NT	1.57 JB	1.14 JB	NT	0.0659 JQ	0.0959 JQ	0.203 J	1.40 J	2.72 JB	3.20 JB	2.90 JBQ
39227-28-6	123478-HxCDD	-	-	-	0.223 JB	0.455 JB	0.171 JQ	0.246 JQ	0.641 JB	2.51 J	NT	2.27 J	1.78 J	NT	<0.0210	0.0915 JB	0.210 JBQ	2.01 JB	4.21 JB	3.40 JB	3.14 JB
57653-85-7	123678-HxCDD	-	-	-	0.345 JB	0.786 JB	0.197 JBQ	0.288 JBQ	1.13 JB	3.62 JB	NT	3.30 JB	2.59 JB	NT	0.0503 JBQ	0.151 JB	0.263 JQ	2.89 JB	6.25 JB	5.41 JB	5.57 JB
19408-74-3	123789-HxCDD	-	-	-	0.496 JBQ	1.31 JB	0.379 JB	0.675 JBQ	1.58 JB	6.14 JB	NT	5.83 JB	4.47 JB	NT	0.0731 JBQ	0.211 JBQ	0.234 JQ	4.66 JB	9.94 B	7.20 JB	7.67 JB
35822-46-9	1234678-HpCDD	-	-	-	7.83 B	19.1 B	11.2 B	9.75 B	27.9 B	71.8 B	NT	85.5 B	65.6 B	NT	0.952 JB	2.71 JB	3.12 JB	58.8 B	134 B	88.5 B	106 B
3268-87-9	OCDD	-	-	-	123 B	283 B	891 B	153 B	355 B	788 B	NT	1,110 B	762 B	NT	12.9 B	42.3 B	34.3 B	582 B	1,670 B	886 B	1,190 B
51207-31-9	2378-TCDF	-	-	-	0.0875 JB	0.156 JB	0.0417 JQ	<0.0300	<0.0251	<0.0633	NT	0.0531 JBQ	0.102 JBQ	NT	0.0224 JB	0.0516 JBQ	0.0625 JBQ	0.0547 JQ	0.134 JBQ	2.70 BC	1.69 JBCQ
57117-41-6	12378-PeCDF	-	-	-	0.133 JBQ	0.195 JB	0.110 JBQ	<0.0218	0.139 JBQ	0.0904 JQ	NT	0.125 JQ	0.176 JQ	NT	0.117 JBQ	0.0905 JBQ	0.170 JBQ	0.179 JBQ	0.226 JB	2.66 JB	1.63 JB
57117-31-4	23478-PeCDF	-	-	-	0.0727 JBQ	0.177 JB	0.0640 JBQ	0.0271 JBQ	0.163 JB	0.0990 JQ	NT	0.113 JQ	0.0664 J	NT	0.0739 JBQ	0.0950 JBQ	0.0886 JBQ	0.123 JBQ	0.192 JBQ	2.42 JB	1.75 JB
70918-21-9	123478-HxCDF	-	-	-	0.0935 JBQ	0.143 JBQ	0.0867 JQ	<0.0172	0.235 JB	<0.0559	NT	0.120 J	0.0705 JQ	NT	0.0481 JBQ	0.0264 JBQ	<0.0364	0.106 JBQ	0.266 JB	1.92 JB	1.28 JB
60851-34-5	123678-HxCDF	-	-	-	0.0731 JB	0.128 JBQ	0.0879 JB	<0.0145	0.244 JB	<0.0525	NT	0.101 JBQ	0.0856 JB	NT	0.0494 JBQ	0.0566 JBQ	0.101 JBQ	0.0943 JB	0.271 JBQ	1.91 JB	1.31 JB
55673-89-7	123789-HxCDF	-	-	-	0.103 JBQ	0.114 JBQ	0.231 JBQ	0.0848 JBQ	0.331 JBQ	0.179 JBQ	NT	0.135 JB	0.124 JBQ	NT	0.0740 JBQ	0.0405 JBQ	0.200 JBQ	0.125 JB	0.338 JBQ	0.619 JB	0.475 JB
60851-34-5	234678-HxCDF	-	-	-	0.0837 JBQ	0.152 JB	0.0992 JBQ	0.0623 JBQ	0.260 JB	0.101 JBQ	NT	0.0865 JBQ	0.0580 JB	NT	0.0475 JBQ	0.0428 JB	0.147 JBQ	0.0746 JBQ	0.241 JBQ	1.64 JB	1.30 JB
67562-39-4	1234678-HpCDF	-	-	-	0.374 JB	0.469 JB	0.170 J	0.156 J	2.31 JB	0.421 JBQ	NT	0.412 JB	0.364 JB	NT	0.119 JBQ	0.237 JBQ	0.222 JBQ	0.162 JB	1.31 JB	4.27 JB	4.40 JB
55673-89-7	1234789-HpCDF	-	-	-	0.0691 JBQ	0.0476 JB	0.0933 JQ	0.0430 JQ	0.389 JB	<0.0856	NT	0.0981 JBQ	0.0635 JBQ	NT	0.0326 JBQ	<0.0213	0.0936 JBQ	0.0561 JBQ	0.238 JBQ	0.678 JB	0.604 JB
39001-02-0	OCDF	-	-	-	0.410 JBQ	0.779 JBQ	0.371 JB	0.143 JBQ	7.64 JB	0.876 JB	NT	0.721 JB	0.703 JB	NT	0.148 JBQ	0.381 JB	0.707 JB	0.225 JBQ	4.40 JB	7.68 JB	8.12 JB
-	Toxic Equivalency Quotient (TEQ) ("<"=0)	-	-	-	0.412	1.17	0.66	0.38	1.41	4.19	NT	4.18	3.15	NT	0.16	0.256	0.45	3.40	7.12	8.42	7.88
-	Detection)	-	-	-	0.412	1.17	0.68	0.42	1.41	4.20	NT	4.18	3.15	NT	0.15	0.256	0.45	3.40	7.12	8.42	7.88
-	Toxic Equivalency Quotient (TEQ) ("<"=Detection)	-	-	-	0.412	1.17	0.702	0.465	1.413	4.207	NT	4.183	3.151	NT	0.14	0.256	0.449	3.40	7.122	8.419	7.877
PCB Congeners (ng/kg)																					
34883-43-7	PCB8	-	-	-	3.78 J	<2.04	<1.98	<1.83	<1.88	<2.10	NT	<2.22	<2.98	NT	<1.69	3.05 J	<1.74	<2.01	<2.43	11	13.6
-	PCB18+30	-	-	-	2.60 J	4.36 J	<2.11	<1.95	<2.01	<2.24	NT	<2.37	<3.17	NT	<1.80	<1.87	<1.86	<2.15	<2.59	4.21 J	5.42 J
-	PCB20+28	-	-	-	9.44	<2.99	<2.91	<2.68	<2.76	<3.08	NT	<3.26	<4.37	NT	<2.47	6.91	<2.56	<2.95	<3.56	10.2	13.7
35693-99-3	PCB52	-	-	-	9.11	8.21	4.72 J	2.33 J	<1.88	<2.10	NT	<2.22	<2.98	NT	<1.69	5.59 J	<1.74	<2.01	2.61 J	18.3	33.4
-	PCB49+69	-	-	-	6.94 J	<3.53	<3.44	<3.17	<3.26	<3.64	NT	<3.85	<5.16	NT	<2.92	4.59 J	<3.02	<3.49	<4.21	18.1 J	28
-	PCB44+47+65	-	-	-	8.93 J	8.37 J	<5.29	<4.87	5.48 JB	5.90 JB	NT	<5.93	<7.94	NT	<4.50	5.16 J	<4.65	<5.37	<6.47	20.2 B	32.9 B
32598-10-0	PCB66	-	-	-	9.35	10.4	2.78 J	<2.07	<2.13	<2.38	NT	<2.52	<3.37	NT	<1.91	5.31 J	<1.97	<2.28	<2.75	<3.20	<2.98
-	PCB90+101+113	-	-	-	19.0 J	10.8 J	7.18 J	<5.73	<5.90	<6.58	NT	<6.96	<9.33	NT	<5.29	<5.48	<5.46	<6.30	<7.60	<8.85	46.1
-	PCB86+87+97+109+119+125	-	-	-	9.92 J	<10.0	13.2 J	<9.02	<9.28	<10.4	NT	<11.0	<14.7	NT	<8.32	<8.63	<8.59	<9.93	<12.0	<13.9	19.7 J
70362-49-1	PCB77	-	-	-	<1.68	<1.90	<1.85	<1.71	<1.76	<1.96	NT	<2.07	<2.78	NT	<1.57	<1.63	<1.63	<1.88	<2.27	<2.64	<2.45
31508-00-6	PCB118	-	-	-	16.5	10.4 J	6.30 J	<3.66	<3.76	<4.20	NT	<4.45	<5.95	NT	<3.37	7.08 J	<3.48	<4.02	<4.85	21.6	33.4
32598-14-4	PCB105	-	-	-	5.28 J	3.70 J	<2.25	<2.07	<2.13	<2.38	NT	<2.52	<3.37	NT	<1.91	<1.98	<1.97	<2.28	<2.75	<3.20	5.29 J
74472-48-3	PCB184	-	-	-	<1.68	<1.90	<1.85	<1.71	<1.76	<1.96	NT	<2.07	<2.78	NT	<1.57	<1.63	<1.63	<1.88	<2.27	<2.64	<2.45
-	PCB153+168	-	-	-	29.8	<4.07	5.11 J	<3.66	4.42 J	<4.20	NT	<4.45	<5.95	NT	<3.37	10.8 J	<3.48	<4.02	<4.85	39.3	60.6
-	PCB129+138+163	-	-	-	27.4	12.4 J	<8.33	<7.68	<7.90	<8.81	NT	<9.34	<12.5	NT	<7.09	8.48 J	<7.32	<8.45	<10.2	24.0 J	46.8
57465-28-8	PCB126	-	-	-	<1.92	<2.17	<2.11	<1.95	<2.01	<2.24	NT	<2.37	<3.17	NT	<1.80	<1.87	<1.86	<2.15	<2.59	<3.01	<2.80
-	PCB128+166	-	-	-	<3.49	<3.94	<3.83	<3.53	<3.64	<4.06	NT	<4.30	<5.75	NT	<3.26	<3.38	<3.37	<3.89	<4.69	<5.46	<5.08
52663-68-0	PCB187	-	-	-	12.4	<2.31	<2.25	<2.07	3.61 J	<2.38	NT	<2.52	<3.37	NT	<1.91	4.30 J	<1.97	<2.28	<2.75	<3.20	<2.98
-	PCB183+185	-	-	-	5.56 J	<3.80	<3.70	<3.41	<3.51	<3.92	NT	<4.15	<5.56	NT	<3.15	<3.26	<3.25	<3.76	<4.53	<5.27	<4.91
-	PCB156+157	-	-	-	<2.77	<3.12	<3.04	<2.80	<2.89	<3.22	NT	<3.41	<4.56	NT	<2.59	<2.68	<2.67	<3.09	<3.72	<4.33	4.83 J
-	PCB180+193	-	-	-	13.9	7.23 J	<3.97	<3.66	<3.76	<4.20	NT	<4.45	<5.95	NT	<3.37	4.15 J	<3.48	<4.02	<4.85	<5.65	<5.26
35065-30-6	PCB170	-	-	-	6.17	4.16 J	<1.59	<1.46	<1.51	<1.68	NT	<1.78	<2.38	NT	<1.35	1.82 J	<1.39	<1.61	<1.94	7.07 J	11.6
32774-16-6	PCB169	-	-	-	<1.80	<2.04	<1.98	<1.83	<1.88	<2.10	NT	<2.22	<2.98	NT	<1.69	<1.75	<1.74	<2.01	<2.43	<2.83	<2.63
52663-78-2	PCB195	-	-	-	<2.64	<2.99	<2.91	<2.68	<2.76	<3.08	NT	<3.26	<4.37	NT	<2.47	<2.56	<2.56	<2.95	<3.56	<4.14	<3.86
40186-72-9	PCB206	-	-	-	3.00 J	4.96 J	<2.11	<1.95	<2.01	<2.24	NT	<2.37	<3.17	NT	<1.80	<1.87	<1.86	<2.15	<2.59	3.03 J	4.56 J
2051-24-3	PCB209	-	-	-	6.17	4.11 J	28.9 B	3.44 JB	5.43 JB	2.98 JB	NT	3.31 JB	4.12 JB	NT	<1.80	3.50 J	2.92 JB	5.76 JB	3.86 JB	10.8 B	14.1 B
-	Total PCBs(<=0)	22,700	180,000	-	205.1	89.1	68.2	5.8	18.9	8.9	NT	3.3	4.1	NT	0.0	70.7	2.9	5.76	6.5	157.9	374.0
-	Total PCBs(<=1/2 Detection)	22,700	180,000	-	213.0	112.5	96.9	44.3	54.1	51.5	NT	51.3	68.4	NT	37.4	90.0	40.5	49.2	57.7	195.6	391.7
-	Total PCBs(<=Detection)	22,700	180,000	-	221.0	135.9	125.7	82.9	89.3	94.0	NT	99.4	132.7	NT	74.7	109.3	78.2	92.7	108.9	233.2	409.4

TABLE 3-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE PRELIMINARY DREDGE SPOIL CHARACTERIZATION
SEDIMENT

Method/ CAS	Parameter/Lab Certificates	SQuiRT Guidelines (Ocean Disposal)		Weanack Exclusion Criteria (Upland Disposal)	BOREHOLES																
					B-001 0-10'	**B-003 0-10'**	**B-008 0-10'**	**B-013 0-10'**	**B-017 0-10'**	**B-017 20-30'**	**B-017 80-90'**	**B-023 0-10'**	**B-023 28-38'**	**B-023 88-98'**	**B-028 0-10'**	**B-030 0-10'**	**B-033 0-10'**	**B-038 0-10'**	**B-039 0-10'**	**B-044 0-10'**	**B-044 Dup 0-10'**
		ERL	**ERM**		**18D0180**	**18D0181**	**17K0927**	**17K0936**	**18A0006**	**18A0257**	**18A0257**	**18A0118**	**18A0118**	**18A0118**	**18D0179**	**18D0178**	**17L0317**	**18C0046**	**18A0006**	**18A0006**	**18A0006**
Grain size (%) USCS																					
-	Gravel (-3" and +#4)	-	-	-	0.0	0	0.0	**0.4**	**1.4**	0.0	**1.1**	**24.8**	**6.2**	0.0	**42.9**	**11.0**	0.0	**0.6**	**7.5**	**0.2**	0.0
-	Sand (-#4 and +#200)	-	-	-	**96.3**	**82.7**	**92.2**	**94.6**	**88.3**	**51.2**	**50.0**	**66.8**	**15.7**	**25.7**	**54.6**	**85.6**	**91.9**	**29.0**	**15.1**	**25.9**	**21.1**
-	Fines (-#200)	-	-	-	**3.7**	**17.2**	**7.8**	**5.1**	**10.3**	**48.8**	**48.9**	**8.4**	**78.2**	**74.3**	**2.4**	**3.5**	**8.1**	**70.3**	**77.4**	**73.9**	**78.9**
Agricultural Data																					
-	PPA (tons $CaCO_3$/1000 tons materials)	-	-	-	**1.28**	0	**6.01**	0.00	0.00	**1.12**	**5.99**	**4.38**	**1.59**	0.00	0.00	0.00	0.00	0.00	**11.39**	**4.88**	NT
-	% Total Sulfur	-	-	-	**0.03**	**0.14**	**0.04**	**0.09**	**0.1**	**0.42**	**0.67**	**0.7**	**0.41**	0.00	<0.01	**0.01**	**0.01**	**0.01**	**0.94**	**0.97**	NT
-	Sobek NP (tons CaCO3Eq/1000 tons materials)	-	-	-	**0.3**	**8.08**	**3.82**	**45.42**	**46.45**	**11.00**	**11.98**	**15.37**	**8.33**	**251.88**	**7.08**	**17.42**	**177**	**179**	**13.28**	**19.99**	NT

Shaded **Detection Exceeds Criteria**
Shaded **Reporting Limit Exceeds Criteria**
NT-Not Tested
Bold-Detected-Non J and J Values
ERL-Effects Range Low
ERM-Effects Range Median

Laboratory Flags
B Detected in Method Blank
J Estimated concentration between Method Detection Limit and Minimum Reporting Level
P-Duplicate analysis does not meet the acceptance criteria for precision
Q EMPC - Estimated Maximum Possible Concentration

TABLE 4-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
STANDARD ELUTRIATE RESULTS

Method/CAS	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES														
			B-001 0-10'	**B-003 0-10'**	**B-008 0-10'**	**B-013 0-10'**	**B-017 0-10'**	**B-017 20-30'**	**B-023 0-10'**	**B-023 28-38'**	**B-028 0-10'**	**B-030 0-10'**	**B-033 0-10'**	**B-038 0-10'**	**B-039 0-10'**	**B-044 0-10'**	**B-044 Dup 0-10'**
	Lab Certificate Number		**18D0180**	**18D0181**	**17K0927**	**17K0936**	**18A0006**	**18A0257**	**18A0118**	**18A0118**	**18D0179**	**18D0178**	**17L0317**	**18C0046**	**18A0006**	**18A0006**	**18A0006**
Total Recoveral Metals (mg/l)																	
7429-90-5	Aluminum	-	**4.35**	**6.54**	**5.8**	**6.53**	**1.45**	**0.714**	**1.38**	**5.26**	**5.92**	**3.40**	**14.6**	**0.670**	**2.89**	**0.828**	**0.998**
7440-36-0	Antimony	-	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100
7440-38-2	Arsenic	0.069	< 0.0200	**0.0246**	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**0.0272**	< 0.0200	< 0.0200
7440-41-7	Beryllium	-	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040
7440-43-9	Cadmium	0.040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040
7440-47-3	Chromium	1.1	**0.0116**	< 0.0100	< 0.0100	**0.0105**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0156**	**0.0130**	**0.0371**	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7440-48-4	Cobalt	-	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	**0.0040**	< 0.0040	< 0.0040	< 0.0040	< 0.0040
7440-50-8	Copper	0.0048	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0182**	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7439-89-6	Iron	-	**6.25**	**6.04**	**6.18**	**5.68**	**3.04**	**1.03**	**1.51**	**4.73**	**10.5**	**6.31**	**21.2**	**0.848**	**1.87**	**1.35**	**1.85**
7439-92-1	Lead	0.21	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0127**	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7439-96-5	Manganese	-	**0.0727**	**0.0689**	**0.0288**	**0.0597**	**0.153**	**0.0458**	**0.286**	**0.247**	**0.200**	**0.0913**	**0.189**	**0.0813**	**0.0408**	**0.103**	**0.118**
7439-97-6	Mercury	0.0018	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
7440-02-0	Nickel	0.074	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0128**	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7782-49-2	Selenium	0.290	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
7440-22-4	Silver	0.00095	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7440-28-0	Thallium	2.13	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
7440-31-5	Tin	-	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200
7440-66-6	Zinc	0.090	**0.0311**	**0.0182**	< 0.0100	**0.0112**	< 0.0100	< 0.0100	< 0.0100	**0.0122**	**0.0404**	**0.0298**	**0.0486**	< 0.0100	< 0.0100	**0.0102**	**0.0120**
Simultaneous Extracted Metals (umoles/g)																	
7440-43-9	Cadmium	-	<0.000116	<0.000119	**0.000156 J**	**0.000251 J**	**0.000185 J**	<0.000117	<0.000118	<0.000117	<0.000118	<0.000118	<0.000117	<0.000119	**0.000132 J**	<0.000118	<0.000118
7440-50-8	Copper	-	**0.00240 J**	**0.00589 J**	<0.000931	**0.0483**	**0.0381**	**0.00246 J**	**0.00210 J**	**0.00112 J**	**0.000943 J**	**0.00624 J**	**0.00110 J**	**0.00609 J**	**0.0105**	**0.00604 J**	**0.00228 J**
7439-92-1	Lead	-	**<0.000700**	<0.000715	<0.000714	<0.000704	<0.000710	<0.000703	<0.000710	<0.000707	<0.000709	<0.000712	**0.000837 J**	<0.000720	<0.000714	<0.000714	<0.000712
7440-02-0	Nickel	-	**0.000708 J**	**0.120**	**0.00235 J**	**0.561**	**0.333**	**0.00148 J**	**0.00247 J**	**0.000627 J**	**0.00102 J**	**0.102**	**0.00121 J**	**0.104**	**0.139**	**0.000647 J**	**0.00121 J**
7440-66-6	Zinc	-	**0.00181 J**	**0.00108 J**	**0.00246 J**	**0.00252 J**	**0.00176 J**	**0.00225 J**	**0.00568 J**	**0.00217 J**	**0.00118 J**	**0.00140 J**	**0.00217 J**	**0.00167 J**	**0.00355 J**	**0.00218 J**	**0.00741 J**
7439-97-6	Mercury	-	**0.0000086 J**	<0.0000074	<0.0000074	<0.0000073	<0.0000073	**0.000012 J**	<0.0000073	<0.0000073	<0.0000073	<0.0000074	<0.0000073	**0.000028 J**	<0.0000074	**0.000029 J**	<0.0000074
-	Acid Volatile Sulfide	-	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63
-	SEM-Ratio	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
STANDARD ELUTRIATE RESULTS

Method/CAS	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES														
			B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-023 0-10'	B-023 28-38'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
	Lab Certificate Number		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Pesticides (ug/l)																	
86-50-0	Azinphos-methyl	-	< 0.204	< 0.200	< 0.208	< 0.208	< 0.208	< 0.206	< 0.206	< 0.206	< 0.200	< 0.204	< 0.208	< 0.211	< 0.200	< 0.217	< 0.213
125-75-0	Demeton, o+s	-	< 0.408	< 0.400	< 0.417	< 0.417	< 0.417	< 0.412	< 0.412	< 0.412	< 0.400	< 0.408	< 0.417	< 0.421	< 0.400	< 0.435	< 0.426
56-38-2	Ethyl Parathion	-	< 0.204	< 0.200	< 0.208	< 0.208	< 0.208	< 0.206	< 0.206	< 0.206	< 0.200	< 0.204	< 0.208	< 0.211	< 0.200	< 0.217	< 0.213
121-75-5	Malathion	-	< 0.204	< 0.200	< 0.208	< 0.208	< 0.208	< 0.206	< 0.206	< 0.206	< 0.200	< 0.204	< 0.208	< 0.211	< 0.200	< 0.217	< 0.213
56-38-2	Methyl parathion	-	< 0.204	< 0.200	< 0.208	< 0.208	< 0.208	< 0.206	< 0.206	< 0.206	< 0.200	< 0.204	< 0.208	< 0.211	< 0.200	< 0.217	< 0.213
53-19-0	2,4'-DDD	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
3424-82-6	2,4'-DDE	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	**0.0004 JP**	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
789-02-6	2,4'-DDT	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	**0.00017 J P**	**0.00021 JP**	**0.00026 J**	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
72-54-8	4,4'-DDD	3.6	<0.0013	<0.0013	**0.00031 J**	**0.00030 J**	**0.00066 J**	**0.00057 J**	<0.0013	<0.0013	<0.0013	<0.0013	**0.00051 J**	<0.0013	**0.00044 J**	<0.0013	**0.00064 J**
72-55-9	4,4'-DDE	14	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
50-29-3	4,4'-DDT	0.065	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
309-00-2	Aldrin	0.65	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
319-84-6	alpha-BHC	0.08	<0.0013	<0.0013	**0.0011 J**	**0.0013**	**0.0012 JP**	**0.00031 JP**	<0.0013	**0.0018 P**	<0.0013	<0.0013	**0.0012 JP**	**0.0011 JP**	<0.0014	0.0019 P	<0.0013
319-85-7	beta-BHC	0.08	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
57-74-9	Chlordane (technical)	0.045	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
103-17-3	Chlorobenside	-	<0.0032	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0032	<0.0034	<0.0033	<0.0033
1861-32-1	DCPA	-	<0.0025	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0025	<0.0027	<0.0026	<0.0026
319-86-8	delta-BHC	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
60-57-1	Dieldrin	0.355	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
959-98-8	Endosulfan I	0.017	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	**0.00016 JP**	<0.0013	<0.0013
33213-65-9	Endosulfan II	0.017	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
1031-07-8	Endosulfan sulfate	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
72-20-8	Endrin	0.0185	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
7421-93-4	Endrin aldehyde	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	**0.00041 JP**	**0.0012 JP**	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
58-89-9	gamma-BHC (Lindane)	0.08	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	**0.00031 JP**	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
76-44-8	Heptachlor	0.0265	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
1024-57-3	Heptachlor epoxide	0.0265	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
72-43-5	Methoxychlor	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
2385-85-5	Mirex	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0013	<0.0013
8001-35-2	Toxaphene	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.11	<0.10	<0.10
Semivolatiles 8270 (ug/l)																	
87-61-6	1,2,4-Trichlorobenzene	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
122-66-7	1,2-Diphenylhydrazine	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
90-12-0	1-Methylnaphthalene	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
108-60-1	2,2'-Oxybis (1-chloropropane)	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
95-95-4	2,4,6-Trichlorophenol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
120-83-2	2,4-Dichlorophenol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
105-67-9	2,4-Dimethylphenol	-	< 0.53	< 0.54	< 0.52	< 0.52	< 0.52	< 0.52	< 0.52	< 0.52	< 0.51	< 0.52	< 0.52	< 0.52	< 0.55	< 0.50	< 0.53
51-28-5	2,4-Dinitrophenol	-	< 52.6	< 53.8	< 52.1	< 51.5	< 51.5	< 52.1	< 51.5	< 51.5	< 51.0	< 51.5	< 52.1	< 51.5	< 54.9	< 50.0	< 52.6
606-20-2	2,6-Dinitrotoluene	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
91-58-7	2-Chloronaphthalene	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
95-57-8	2-Chlorophenol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
91-57-6	2-Methylnaphthalene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
88-75-5	2-Nitrophenol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
91-94-1	3,3'-Dichlorobenzidine	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
534-52-1	4,6-Dinitro-2-methylphenol	-	< 52.6	< 53.8	< 52.1	< 51.5	< 51.5	< 52.1	< 51.5	< 51.5	< 51.0	< 51.5	< 52.1	< 51.5	< 54.9	< 50.0	< 52.6

TABLE 4-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
STANDARD ELUTRIATE RESULTS

Method/CAS	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES														
			B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-023 0-10'	B-023 28-38'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
	Lab Certificate Number		18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18A0118	18A0118	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Semivolatiles 8270 (ug/l) cont.'d																	
101-55-3	4-Bromophenyl phenyl ether	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
7005-72-3	4-Chlorophenyl phenyl ether	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
100-02-7	4-Nitrophenol	-	< 52.6	< 53.8	< 52.1	< 51.5	< 51.5	< 52.1	< 51.5	< 51.5	< 51.0	< 51.5	< 52.1	< 51.5	< 54.9	< 50.0	< 52.6
83-32-9	Acenaphthene	970	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
208-96-8	Acenaphthylene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
120-12-7	Anthracene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
56-55-3	Benzo (a) anthracene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
50-32-8	Benzo (a) pyrene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
205-99-2	Benzo (b) fluoranthene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
191-24-2	Benzo (g,h,i) perylene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
207-08-9	Benzo (k) fluoranthene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
65-85-0	Benzoic acid	-	< 52.6	< 53.8	< 52.1	< 51.5	< 51.5	< 52.1	< 51.5	< 51.5	< 51.0	< 51.5	< 52.1	< 51.5	< 54.9	< 50.0	< 52.6
100-51-6	Benzyl alcohol	-	< 21.1	< 21.5	< 20.8	< 20.6	< 20.6	< 20.8	< 20.6	< 20.6	< 20.4	< 20.6	< 20.8	< 20.6	< 22.0	< 20.0	< 21.1
111-91-1	bis (2-Chloroethoxy) methane	12,000	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
111-44-4	bis (2-Chloroethyl) ether	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
117-81-7	bis (2-Ethylhexyl) phthalate	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
85-68-7	Butyl benzyl phthalate	2,944	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
218-01-9	Chrysene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
53-70-3	Dibenz (a,h) anthracene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
132-64-9	Dibenzofuran	-	< 5.26	< 5.38	< 5.21	< 5.15	< 5.15	< 5.21	< 5.15	< 5.15	< 5.10	< 5.15	< 5.21	< 5.15	< 5.49	< 5.00	< 5.26
84-66-2	Diethyl phthalate	2,944	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
84-74-2	Di-n-butyl phthalate	2,944	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
117-84-0	Di-n-octyl phthalate	2,944	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
206-44-0	Fluoranthene	40	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
86-73-7	Fluorene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
118-74-1	Hexachlorobenzene	160	< 1.05	< 1.08	< 1.04	< 1.03	< 1.03	< 1.04	< 1.03	< 1.03	< 1.02	< 1.03	< 1.04	< 1.03	< 1.10	< 1.00	< 1.05
87-68-3	Hexachlorobutadiene	32	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
77-47-4	Hexachlorocyclopentadiene	7	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
67-72-1	Hexachloroethane	940	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
193-39-5	Indeno (1,2,3-cd) pyrene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
78-59-1	Isophorone	12,900	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
143-50-0	Kepone	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
84989-04-8	m+p-Cresols	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
91-20-3	Naphthalene	2,350	< 5.26	< 5.38	< 5.21	< 5.15	< 5.15	< 5.21	< 5.15	< 5.15	< 5.10	< 5.15	< 5.21	< 5.15	< 5.49	< 5.00	< 5.26
98-95-3	Nitrobenzene	6,680	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
62-75-9	n-Nitrosodimethylamine	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
621-64-7	n-Nitrosodi-n-propylamine	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
86-30-6	n-Nitrosodiphenylamine	3,300,000	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
95-48-7	o-Cresol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
59-50-7	p-Chloro-m-cresol	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
87-86-5	Pentachlorophenol	13	< 21.1	< 21.5	< 20.8	< 20.6	< 20.6	< 20.8	< 20.6	< 20.6	< 20.4	< 20.6	< 20.8	< 20.6	< 22.0	< 20.0	< 21.1
85-01-8	Phenanthrene	-	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
108-95-2	Phenol	5,800	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5
129-00-0	Pyrene	300	< 10.5	< 10.8	< 10.4	< 10.3	< 10.3	< 10.4	< 10.3	< 10.3	< 10.2	< 10.3	< 10.4	< 10.3	< 11.0	< 10.0	< 10.5

TABLE 4-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
STANDARD ELUTRIATE RESULTS

Method/CAS	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES														
			B-001 0-10'	**B-003 0-10'**	**B-008 0-10'**	**B-013 0-10'**	**B-017 0-10'**	**B-017 20-30'**	**B-023 0-10'**	**B-023 28-38'**	**B-028 0-10'**	**B-030 0-10'**	**B-033 0-10'**	**B-038 0-10'**	**B-039 0-10'**	**B-044 0-10'**	**B-044 Dup 0-10'**
	Lab Certificate Number		**18D0180**	**18D0181**	**17K0927**	**17K0936**	**18A0006**	**18A0257**	**18A0118**	**18A0118**	**18D0179**	**18D0178**	**17L0317**	**18C0046**	**18A0006**	**18A0006**	**18A0006**
Wet Chemistry/Miscellaneous (mg/l)																	
7664-41-7	Ammonia as N	-	< 0.10	**0.12**	< 0.10	< 0.10	**0.62**	< 0.10	**2.81**	**5.36**	**0.12**	**0.10**	< 0.10	**0.75**	**0.56**	**1.13**	**1.10**
57-12-5	Cyanide, Total	0.001	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
14797-55-8	Nitrate as N	-	< 0.150	< 0.150	< 10	< 10	< 0.150	< 0.150	< 0.150	< 0.150	< 0.150	< 0.150	<25.0	< 0.150	< 0.150	< 0.150	< 0.150
NA	Nitrate+Nitrite as N	-	< 0.10	<0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
14797-65-0	Nitrite as N	-	< 0.05	<0.05	< 1.00	< 1.00	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<5.00	< 0.05	< 0.05	< 0.05	< 0.05
7723-14-0	Phosphorus (total)	-	**0.32**	**0.265**	**0.193**	**0.161**	**0.161**	**0.214**	**0.233**	**0.264**	**0.550**	**0.280**	**0.469**	**0.145**	**0.122**	**0.103**	**0.157**
18496-25-8	Sulfide	-	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
7727-37-9	TKN as N	-	**1.28**	**0.81**	< 0.50	**0.88**	**1.50**	**1.95**	**3.82**	**6.96**	**1.700**	**1.23**	**1.08**	<0.50	**1.13**	**1.73**	**1.69**
-	TOC (Min)	-	**1.3**	**1.1**	< 1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.4**	< 1.0	< 1.0	**1.1**	< 20.0	< 1.0	< 1.0
-	TOC (Max)	-	**1.4**	**1.3**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.6**	< 1.0	**1.2**	**1.2**	< 20.0	< 1.0	< 1.0
-	TOC (Mean)	-	**1.4**	**1.2**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**1.5**	< 1.0	< 1.0	**1.2**	< 20.0	< 1.0	< 1.0
Butyltins (ug/l)																	
77-58-7	Dibutyltin	-	<0.0029	<0.0029	<0.0031	<0.0031	<0.0031	<0.0030	<0.0030	<0.0030	<0.0029	<2.9	<0.0030	<0.0029	<0.0031	<0.0030	<0.0030
112-34-5	Monobutyltin	-	<0.0029	<0.0029	<0.0031	<0.0031	<0.0031	<0.0030	<0.0030	<0.0030	<0.0029	<2.9	<0.0030	<0.0029	<0.0031	<0.0030	<0.0030
36643-28-4	Tributyltin	0.42	<0.0029	<0.0029	<0.0031	<0.0031	<0.0031	<0.0030	<0.0030	<0.0030	<0.0029	<2.9	<0.0030	<0.0029	<0.0031	<0.0030	<0.0030
Dioxins and Furans (pg/l)																	
7727-37-3	2378-TCDD	-	<0.131	<0.180	<0.375	<0.187	<0.406	<0.338	<0.108	<0.329	**0.327 JQ**	<0.238	<0.209	<0.130	<0.395	<0.188	**0.322 JBQ**
8118-44-9	12378-PeCDD	-	**0.815 JQ**	**0.748 JQ**	<0.338	<0.321	**0.771 JB**	<0.777	**0.493 JBQ**	<0.598	**0.577 JQ**	**1.48 JQ**	<0.383	**0.433 JBQ**	**1.63 JBQ**	**0.669 JBQ**	**0.738 JBQ**
7117-22-3	123478-HxCDD	-	**0.929 JBQ**	<0.255	<0.247	<0.338	**3.11 JBQ**	<0.608	**0.239 JBQ**	**1.39 JBQ**	**1.04 JBQ**	**1.98 JBQ**	**0.875 JQ**	**0.514 JBQ**	**1.66 JB**	**0.813 JB**	**0.744 JB**
57117-44-9	123678-HxCDD	-	**1.66 JB**	**0.846 JBQ**	<0.247	**0.500 JB**	**4.14 JBQ**	**1.10 JBQ**	**0.493 JB**	**1.18 JBQ**	**1.66 JB**	**1.67 JBQ**	**1.13 JBQ**	**0.508 JBQ**	**2.40 JBQ**	**1.59 JB**	**1.58 JB**
8118-22-6	123789-HxCDD	-	**2.41 JB**	**1.52 JBQ**	<0.263	<0.380	**7.50 JB**	**2.01 JBQ**	**0.668 JB**	**3.45 JB**	**2.30 JB**	**2.21 JB**	**1.15 JQ**	**1.20 JBQ**	**2.58 JB**	**1.74 JB**	**1.41 JBQ**
35822-46-9	1234678-HpCDD	-	38.4 B	21.8 B	**3.61 JB**	**6.81 JBQ**	**124 B**	**23.5 B**	**10.6 B**	**68.9 B**	**42.4 B**	**27.8 BQ**	**17.5 B**	**12.0 B**	**50.9 B**	**35.7 B**	**34.7 B**
3268-87-9	OCDD	-	775 B	592 B	**313 B**	**147 B**	**3,140 B**	**473 B**	**186 B**	**1,200 B**	**841 B**	**714 B**	**423 B**	**329 B**	**1,530 B**	**596 B**	**669 B**
51207-31-9	2378-TCDF	-	**0.886 JBQ**	**0.108 JBQ**	<0.269	<0.167	**0.475 JBQ**	<0.471	**0.225 JBQ**	<0.260	**0.544 JBQ**	<0.314	**0.413 J**	<0.0889	**0.718 JQ**	**0.722 JQ**	**0.526 JQ**
8118-77-4	12378-PeCDF	-	**1.05 JB**	**0.770 JB**	**0.549 JBQ**	<0.112	**0.968 JBQ**	**0.563 JBQ**	**0.243 JBQ**	**0.572 JBQ**	**0.274 JBQ**	**0.716 JBQ**	**0.466 JQ**	**0.440 JB**	**1.43 JB**	**0.849 JBQ**	**0.701 JBQ**
57117-31-4	23478-PeCDF	-	**0.409 JB**	**0.453 JBQ**	**0.762 JBQ**	<0.105	**0.857 JBQ**	**0.494 JBQ**	**0.297 JBQ**	**0.409 JBQ**	**0.677 JB**	<0.255	<0.0945	**0.291 JBQ**	**1.03 JBQ**	**0.480 JBQ**	**0.264 JBQ**
7117-22-3	123478-HxCDF	-	**0.436 JBQ**	**0.324 JBQ**	**0.631 JQ**	<0.0736	**0.729 JBQ**	**0.206 JBQ**	**0.233 JBQ**	**0.418 JBQ**	**0.611 JB**	**1.64 JBQ**	<0.0770	**0.274 JB**	**0.975 JB**	**0.912 JBQ**	**0.644 JBQ**
7117-99-5	123678-HxCDF	-	**0.537 JBQ**	**0.295 JBQ**	**0.128 JQ**	<0.0706	**0.800 JB**	**0.562 JBQ**	**0.258 JBQ**	**0.139 JB**	**0.547 JB**	**0.662 JBQ**	<0.0724	**0.303 JBQ**	**0.923 JB**	**0.554 JBQ**	**0.616 JBQ**
8118-44-4	123789-HxCDF	-	**1.02 JB**	**0.740 JBQ**	**0.545 JBQ**	<0.0870	**1.18 JB**	<0.397	**1.24 JBQ**	**0.789 JBQ**	**0.884 JB**	**1.21 JBQ**	**0.291 JQ**	**0.988 JB**	**1.12 JBQ**	**1.02 JB**	**0.912 JBQ**
7227-66-9	234678-HxCDF	-	**0.516 JBQ**	**0.260 JBQ**	<0.127	<0.0846	**0.655 JBQ**	**0.462 JB**	**0.195 JBQ**	**0.321 JBQ**	**0.698 JB**	**0.545 JB**	<0.0799	**0.255 JB**	**0.900 JBQ**	**0.519 JB**	**0.632 JBQ**
6116-66-9	1234678-HpCDF	-	**2.27 JB**	**0.460 JBQ**	<0.119	<0.0709	**3.99 JBQ**	**3.31 JBQ**	**1.19 JB**	**1.33 JBQ**	**2.04 JBQ**	**1.77 JB**	**0.336 JQ**	**0.472 JBQ**	**3.84 JBQ**	**4.36 JB**	**3.70 JB**
55673-89-7	1234789-HpCDF	-	**0.211 JBQ**	**0.137 JBQ**	**0.279 JQ**	<0.0879	**0.418 JBQ**	**0.448 JBQ**	**0.144 JBQ**	**0.653 JBQ**	**0.349 JBQ**	<0.205	**0.382 JQ**	**0.197 JB**	**0.854 JB**	**0.541 JBQ**	**0.487 JB**
9O3D-10 -8	OCDF	-	**3.44 JB**	**0.992 JBQ**	<0.148	<0.128	**17.0 JB**	**8.15 JBQ**	**4.73 JBQ**	**6.68 JBQ**	**3.73 JBQ**	**3.10 JB**	**0.880 JBQ**	**2.17 JBQ**	**14.0 JBQ**	**13.9 JB**	**12.6 JB**
7727-37-0	TEQ ("<"=0)	-	2.58	1.92	0.508	0.162	5.14	1.01	1.12	1.98	2.64	3.35	0.709	1.30	4.13	2.21	2.46
7727-37-6	TEQ ("<"=1/2 Detection)	-	2.52	1.82	0.923	0.494	5.347	1.65	1.17	2.45	2.64	3.18	1.03	1.23	4.32	2.31	2.46
7727-37-2	TEQ ("<"=Detection)	-	2.45	1.72	1.34	0.83	5.55	2.28	1.23	2.93	2.64	3.00	1.35	1.16	4.52	2.40	2.46

Method/CAS	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES B-001 0-10'	B-003 0-10'	B-008 0-10'	B-013 0-10'	B-017 0-10'	B-017 20-30'	B-023 0-10'	B-023 28-38'	B-028 0-10'	B-030 0-10'	B-033 0-10'	B-038 0-10'	B-039 0-10'	B-044 0-10'	B-044 Dup 0-10'
	Lab Certificate Number		**18D0180**	**18D0181**	**17K0927**	**17K0936**	**18A0006**	**18A0257**	**18A0118**	**18A0118**	**18D0179**	**18D0178**	**17L0317**	**18C0046**	**18A0006**	**18A0006**	**18A0006**
PCB Congeners (pg/l)																	
34883-43-7	PCB8	-	<15.0	<15.2	<31.8	<31.9	<15.2	<15.0	<15.4	<15.5	**46.0 J**	**40.5 J**	<15.3	<15.4	<17.5	**64**	**30.9 J**
-	PCB18+30	-	<16.0	**28.4 J**	<34.0	<34.0	<16.2	<16.0	<16.5	<16.5	**23.8 J**	**48 J**	<16.3	<16.5	<18.6	**74.4**	**47.4 J**
-	PCB20+28	-	**62.5**	<22.3	<46.7	<46.8	<22.3	<22.1	<22.7	<22.7	**95.4**	**83.4**	<22.4	<22.6	<25.6	**96.9**	**54**
35693-99-3	PCB52	-	**59.1**	**62.8**	<31.8	<31.9	<15.2	<15.0	<15.4	<15.5	**92.2**	**74.2**	**17.5 J**	<15.4	<17.5	**315**	**165**
-	PCB49+69	-	**51.6 J**	**48.2 J**	<55.2	<55.3	<26.3	<26.1	<26.8	<26.8	**86.6 J**	**59.7 J**	<26.4	<26.7	<30.3	**314**	**153**
-	PCB44+47+65	-	**64.7 J**	**66.9 J**	<84.9	<85.1	<40.5	<40.1	<41.2	<41.2	**96.2 J**	**61.9 J**	<40.7	<41.2	<46.6	**303**	**153**
32598-10-0	PCB66	-	**72.6**	**86.7**	<36.1	<36.2	<17.2	<17.1	<17.5	<17.5	**108**	**60.8**	<17.3	<17.5	<19.8	**190**	**89.2**
-	PCB90+101+113	-	**138 J**	**105 J**	<99.8	<100	<47.6	<47.1	<48.4	<48.5	**164 J**	<46.2	<47.8	<48.4	<54.8	**469**	**214**
-	PCB86+87+97+109+119+125	-	<74.0	<75.0	**286 J**	<157	<74.9	<74.2	<76.2	<76.3	<73.6	<72.8	<75.3	<76.1	<86.2	**187 J**	**85.2 J**
70362-49-1	PCB77	-	<14.0	<14.2	<29.7	<29.8	<14.2	<14.0	<14.4	<14.4	<13.9	<13.8	<14.2	<14.4	<16.3	**18.8 J**	**<14.3**
31508-00-6	PCB118	-	**130**	**116**	<63.7	<63.8	<30.4	<30.1	<30.9	<30.9	**156**	**83.6 J**	<30.5	<30.9	<35.0	**310**	**134**
32598-14-4	PCB105	-	**39.9 J**	**41.9 J**	<36.1	<36.2	<17.2	<17.1	<17.5	<17.5	**38.4 J**	**22.6 J**	<17.3	<17.5	<19.8	**35.3 J**	<17.3
74472-48-3	PCB184	-	<14.0	<14.2	<29.7	<29.8	<14.2	<14.0	<14.4	<14.4	<13.9	<13.8	<14.2	<14.4	<16.3	<14.3	<14.3
-	PCB153+168	-	**249**	**141**	<63.7	<63.8	<30.4	<30.1	<30.9	<30.9	**307**	**137**	<30.5	<30.9	**40.5 J**	**590**	**275**
-	PCB129+138+163	-	**213**	**141 J**	<134	<134	<63.8	<63.2	<64.9	<64.9	**219**	**101 J**	<64.1	<64.8	<73.4	**340**	**154 J**
57465-28-8	PCB126	-	<16.0	<16.2	<34.0	<34.0	<16.2	<16.0	<16.5	<16.5	<15.9	<15.7	<16.3	<16.5	<18.6	<16.3	<16.3
-	PCB128+166	-	<29.0	<29.4	<61.6	<61.7	<29.4	<29.1	<29.9	<29.9	<28.8	<28.5	<29.5	<29.8	<33.8	<29.5	<29.5
52663-68-0	PCB187	-	**107**	**60.5**	<36.1	<36.2	<17.2	<17.1	<17.5	<17.5	**117**	**57.6**	<17.3	<17.5	<19.8	**207**	**93**
-	PCB183+185	-	**41.9 J**	<28.4	<59.4	<59.6	<28.3	<28.1	<28.8	<28.9	<27.8	<27.5	<28.5	<28.8	<32.6	**82.8 J**	**29.0 J**
-	PCB156+157	-	<23.0	<23.3	<48.8	<48.9	<23.3	<23.1	<23.7	<23.7	<22.9	<22.6	<23.4	<23.7	<26.8	**28.9 J**	<23.4
-	PCB180+193	-	**113**	**69.5 J**	<63.7	<63.8	<30.4	<30.1	<30.9	<30.9	**99.7**	**46.5 J**	<30.5	<30.9	<35.0	<30.5	**90.3 J**
35065-30-6	PCB170	-	**50.9**	<12.2	<25.5	<25.5	<12.1	<12.0	<12.4	<12.4	**42.6 J**	**18.1 J**	<12.2	<12.3	<14.0	**96.5**	**41.5 J**
32774-16-6	PCB169	-	<15.0	<15.2	<31.8	<31.9	<15.2	<15.0	<15.4	<15.5	<14.9	<14.7	<15.3	<15.4	<17.5	<15.3	<15.3
52663-78-2	PCB195	-	<22.0	<22.3	<46.7	<46.8	<22.3	<22.1	<22.7	<22.7	<21.9	<21.6	<22.4	<22.6	<25.6	<22.4	<22.4
40186-72-9	PCB206	-	<16.0	**52.7**	<34.0	<34.0	<16.2	<16.0	<16.5	<16.5	**31.6 J**	<15.7	<16.3	<16.5	<18.6	**40.9 J**	**18.8 J**
2051-24-3	PCB209	-	**47.1 J**	**52.8**	**71.0 JB**	**71.1 JB**	**38.7 JB**	**22.4 J**	**20.7 J**	**22.5 J**	**101**	**52.1**	**31.8 JB**	**53.7 B**	**26.3 J**	**181**	**97.9**
7727-37-4	Total PCBs(<=0)	33,000	1,440	957	357	71.1	38.7	22.4	20.7	22.5	1,838	465	49.3	53.7	66.8	3,945	1,925
7727-37-3	Total PCBs(<=1/2 Detection)	33,000	1,567	1,117	966	760	367	347	354	357	1,948	612	371	387	427	4,009	2,002
7727-37-6	Total PCBs(<=Detection)	33,000	1,694	1,276	1,576	1,449	695	672	688	691	2,058	758	693	720	787	4,073	2,078

Shaded **Detection Exceeds Criteria**
Shaded **Reporting Limit Exceeds Criteria**
NT-Not Tested
Bold-Detected-Non J and J Values

Laboratory Flags
B Detected in Method Blank
J Estimated concentration between Method Detection Limit and Minimum Reporting Level
P-Duplicate analysis does not meet the acceptance criteria for precision
Q EMPC - Estimated Maximum Possible Concentration

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Total Recoverable Metals (mg/l)															
7429-90-5	Aluminum	-	**0.166**	**0.171**	**0.0645**	**0.134**	**0.106**	**0.195**	**0.168**	**0.218**	**0.115**	**0.0610**	**0.251**	**0.288**	**0.236**
7440-36-0	Antimony	-	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100
7440-38-2	Arsenic	0.069	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200
7440-41-7	Beryllium	-	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040
7440-43-9	Cadmium	0.040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040
7440-47-3	Chromium	1.1	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0040	< 0.0100	< 0.0100	< 0.0100
7440-48-4	Cobalt	-	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0040	< 0.0100	< 0.0040	< 0.0040	< 0.0040
7440-50-8	Copper	0.0048	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7439-89-6	Iron	-	**0.119**	**0.128**	**0.0449**	**0.136**	**0.0818**	**0.115**	**0.134**	**0.176**	**0.104**	**0.0404**	**0.239**	**0.340**	**0.508**
7439-92-1	Lead	0.21	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7439-96-5	Manganese	-	**0.0116**	**0.0113**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0143**	**0.0140**	< 0.0100	**0.0146**	**0.0105**	**0.0134**	**0.0177**
7439-97-6	Mercury	0.0018	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
7440-02-0	Nickel	0.074	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7782-49-2	Selenium	0.290	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
7440-22-4	Silver	0.00095	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
7440-28-0	Thallium	2.13	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500	< 0.0500
7440-31-5	Tin	-	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200
7440-66-6	Zinc	0.090	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.0119**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute- Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Pesticides (ug/l)															
86-50-0	Azinphos-methyl	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
126-75-0	Demeton 1	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
126-75-0	Demeton 2	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
125-75-0	Demeton, o+s	-	< 0.408	< 0.412	< 0.412	< 0.426	< 0.435	< 0.412	< 0.412	< 0.408	< 0.417	< 0.426	< 0.421	< 0.444	< 0.449
56-38-2	Ethyl Parathion	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
121-75-5	Malathion	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
56-38-2	Methyl parathion	-	< 0.204	< 0.206	< 0.206	< 0.213	< 0.217	< 0.206	< 0.206	< 0.204	< 0.208	< 0.213	< 0.211	< 0.222	< 0.225
53-19-0	2,4'-DDD	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
3424-82-6	2,4'-DDE	-	<0.0013	**0.00032 JP**	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	**0.00025 JP**
789-02-6	2,4'-DDT	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
72-54-8	4,4'-DDD	3.6	<0.0013	<0.0013	**0.00036 J**	**0.00026 J**	**0.00059 J**	**0.00024 JP**	<0.0014	<0.0014	<0.0014	<0.0013	**0.00060 J**	**0.00067 J**	**0.00056 J**
72-55-9	4,4'-DDE	14	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
50-29-3	4,4'-DDT	0.065	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
309-00-2	Aldrin	0.65	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
319-84-6	alpha-BHC	0.08	<0.0013	<0.0013	<0.0013	<0.0013	**0.0015 P**	**0.00037 JP**	<0.0014	<0.0014	**0.0013 JP**	<0.0013	**0.0012 JP**	0.0013 P	**0.0033**
319-85-7	beta-BHC	0.08	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
57-74-9	Chlordane (technical)	0.045	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.014	<0.013	<0.015
103-17-3	Chlorobenside	-	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0033	<0.0037	<0.0033	<0.0039
1861-32-1	DCPA	-	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0026	<0.0029	<0.0026	<0.003
319-86-8	delta-BHC	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
60-57-1	Dieldrin	0.355	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
959-98-8	Endosulfan I	0.017	<0.0013	<0.0013	**0.00028 J**	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
33213-65-9	Endosulfan II	0.017	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
1031-07-8	Endosulfan sulfate	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
72-20-8	Endrin	0.0185	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
7421-93-4	Endrin aldehyde	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	**0.00042 JP**	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
58-89-9	gamma-BHC (Lindane)	0.08	**0.00046 JP**	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	**0.00020 JP**	<0.0016
76-44-8	Heptachlor	0.0265	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	**0.00054 JP**	<0.0015	<0.0013	<0.0016
1024-57-3	Heptachlor epoxide	0.0265	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
72-43-5	Methoxychlor	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
2385-85-5	Mirex	-	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0013	<0.0014	<0.0014	<0.0014	<0.0013	<0.0015	<0.0013	<0.0016
8001-35-2	Toxaphene	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.11	<0.10	<0.12

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Semivolatiles 8270 (ug/l)															
87-61-6	1,2,4-Trichlorobenzene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
122-66-7	1,2-Diphenylhydrazine	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
90-12-0	1-Methylnaphthalene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
108-60-1	2,2'-Oxybis (1-chloropropane)	-	<10.2	<10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
95-95-4	2,4,6-Trichlorophenol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
120-83-2	2,4-Dichlorophenol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
105-67-9	2,4-Dimethylphenol	-	<0.51	<0.52	< 0.51	< 0.52	< 0.56	< 0.53	< 0.51	< 0.52	< 0.53	< 0.52	< 0.56	< 0.56	< 0.56
51-28-5	2,4-Dinitrophenol	-	<51.0	<51.5	< 50.5	< 51.5	< 55.6	< 53.2	< 51.0	< 51.5	< 52.6	< 52.1	< 55.6	< 55.6	< 55.6
51-28-5	2,4-Dinitrotoluene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
606-20-2	2,6-Dinitrotoluene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
91-58-7	2-Chloronaphthalene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
95-57-8	2-Chlorophenol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
91-57-6	2-Methylnaphthalene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
88-75-5	2-Nitrophenol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
91-94-1	3,3'-Dichlorobenzidine	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
534-52-1	4,6-Dinitro-2-methylphenol	-	<51.0	<51.5	< 50.5	< 51.5	< 55.6	< 53.2	< 51.0	< 51.5	< 52.6	< 52.1	< 55.6	< 55.6	< 55.6
101-55-3	4-Bromophenyl phenyl ether	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
7005-72-3	4-Chlorophenyl phenyl ether	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
100-02-7	4-Nitrophenol	-	<51.0	<51.5	< 50.5	< 51.5	< 55.6	< 53.2	< 51.0	< 51.5	< 52.6	< 52.1	< 55.6	< 55.6	< 55.6
83-32-9	Acenaphthene	970	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
208-96-8	Acenaphthylene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
120-12-7	Anthracene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
56-55-3	Benzo (a) anthracene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
50-32-8	Benzo (a) pyrene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
205-99-2	Benzo (b) fluoranthene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
191-24-2	Benzo (g,h,i) perylene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
207-08-9	Benzo (k) fluoranthene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
65-85-0	Benzoic acid	-	<51.0	<51.5	< 50.5	< 51.5	< 55.6	< 53.2	< 51.0	< 51.5	< 52.6	< 52.1	< 55.6	< 55.6	< 55.6
100-51-6	Benzyl alcohol	-	<20.4	<20.6	< 20.2	< 20.6	< 22.2	< 21.3	< 20.4	< 20.6	< 21.1	< 20.8	< 22.2	< 22.2	< 22.2
111-91-1	bis (2-Chloroethoxy) methane	12,000	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
111-44-4	bis (2-Chloroethyl) ether	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
117-81-7	bis (2-Ethylhexyl) phthalate	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
85-68-7	Butyl benzyl phthalate	2,944	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
218-01-9	Chrysene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Semivolatiles 8270 (ug/l)															
53-70-3	Dibenz (a,h) anthracene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
132-64-9	Dibenzofuran	-	<5.10	<5.15	< 5.05	< 5.15	< 5.56	< 5.32	< 5.10	< 5.15	< 5.26	< 5.21	< 5.56	< 5.56	< 5.56
84-66-2	Diethyl phthalate	2,944	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
84-74-2	Dimethyl phthalate	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
117-84-0	Di-n-butyl phthalate	2,944	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
206-44-0	Di-n-octyl phthalate	2,944	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
206-44-0	Fluoranthene	40	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
86-73-7	Fluorene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
118-74-1	Hexachlorobenzene	160	<1.02	<1.03	< 1.01	< 1.03	< 1.11	< 1.06	< 1.02	< 1.03	< 1.05	< 1.04	< 1.11	< 1.11	< 1.11
87-68-3	Hexachlorobutadiene	32	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
77-47-4	Hexachlorocyclopentadiene	7	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
67-72-1	Hexachloroethane	940	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
193-39-5	Indeno (1,2,3-cd) pyrene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
78-59-1	Isophorone	12,900	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
143-50-0	Kepone	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
84989-04-8	m+p-Cresols	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
91-20-3	Naphthalene	2,350	<5.10	<5.15	< 5.05	< 5.15	< 5.56	< 5.32	< 5.10	< 5.15	< 5.26	< 5.21	< 5.56	< 5.56	< 5.56
98-95-3	Nitrobenzene	6,680	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
62-75-9	n-Nitrosodimethylamine	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
621-64-7	n-Nitrosodi-n-propylamine	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
86-30-6	n-Nitrosodiphenylamine	3,300,000	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
95-48-7	o-Cresol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
59-50-7	p-Chloro-m-cresol	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
87-86-5	Pentachlorophenol	13	<20.4	<20.6	< 20.2	< 20.6	< 22.2	< 21.3	< 20.4	< 20.6	< 21.1	< 20.8	< 22.2	< 22.2	< 22.2
85-01-8	Phenanthrene	-	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
108-95-2	Phenol	5,800	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
129-00-0	Pyrene	300	<10.2	< 10.3	< 10.1	< 10.3	< 11.1	< 10.6	< 10.2	< 10.3	< 10.5	< 10.4	< 11.1	< 11.1	< 11.1
Wet Chemistry/Miscellaneous (mg/l)															
7664-41-7	Ammonia as N	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	**1.33**	< 0.10	**0.15**	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
57-12-5	Cyanide, Total	0.001	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
14797-55-8	Nitrate as N	-	< 0.150	< 0.150	< 0.150	< 10.0	< 0.150	< 0.150	< 0.150	< 0.150	< 100	<0.150	< 0.150	< 0.150	< 0.150
14797-65-0	Nitrite as N	-	< 0.05	< 0.05	< 0.05	< 1.00	< 0.05	< 0.05	< 0.05	<0.05	**18**	< 0.05	< 0.05	< 0.05	< 0.05
7723-14-0	Nitrate+Nitrite as N	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	<0.10	<0.10	< 0.10	< 0.10	< 0.10	< 0.10
7723-14-0	Phosphorus (total)	-	< 0.100	<0.100	**0.038**	**0.027**	**0.020**	< 0.02	< 0.100	< 0.100	**0.027**	< 0.020	**0.036**	**0.054**	**0.062**
18496-25-8	Sulfide	-	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
-	TKN as N	-	**0.53**	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	**0.74**	**0.50**	< 0.50	< 0.50	< 0.50	< 0.50	**0.51**
-	TOC (Min)	-	**1.0**	**1.0**	< 1.0	< 1.0	< 1.0	< 1.0	**1.5**	< 1.0	< 1.0	< 1.0	< 20.0	< 1.0	< 1.0
-	TOC (Max)	-	**1.3**	**1.3**	< 1.0	< 1.0	< 1.0	< 1.0	**1.2**	< 1.0	< 1.0	< 1.0	< 20.0	< 1.0	< 1.0
-	TOC (Mean)	-	**1.2**	**1.2**	< 1.0	< 1.0	< 1.0	< 1.0	**1.3**	< 1.0	< 1.0	< 1.0	< 20.0	< 1.0	< 1.0

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
Butyltins (ug/l)															
77-58-7	Dibutyltin	-	<0.0030	<0.0030	<0.0031	<0.0031	<0.0033	<0.0031	<0.0029	<0.0030	<0.0030	<0.0031	<0.0031	<0.0033	<0.0033
112-34-5	Monobutyltin	-	<0.0030	<0.0030	<0.0031	<0.0031	**0.27**	<0.0031	<0.0029	<0.0030	**0.80**	<0.0031	<0.0031	<0.0033	<0.0033
36643-28-4	Tributyltin	0.42	<0.0030	<0.0030	<0.0031	<0.0031	<0.0033	<0.0031	<0.0029	<0.0030	<0.0030	<0.0031	<0.0031	<0.0033	<0.0033
Dioxins and Furans (pg/l)															
1746-01-6	2378-TCDD	-	<0.0714	**0.287 JBQ**	<0.216	<0.190	<0.157	<0.0862	**0.200 JBQ**	**0.0967 JBQ**	**0.603 JQ**	<0.119	<0.210	<0.257	**0.343 JBQ**
40321-76-4	12378-PeCDD	-	**0.291 JBQ**	**0.745 JBQ**	<0.302	<0.233	**0.707 JBQ**	**0.293 JBQ**	**0.251 JBQ**	<0.158	**0.887 JBQ**	**0.764 JBQ**	<0.259	**0.854 JBQ**	**0.753 JB**
39227-28-6	123478-HxCDD	-	**0.165 JB**	**0.119 JB**	<0.181	<0.119	**0.348 JBQ**	<0.147	**0.128 JBQ**	**0.175 JBQ**	**0.902 JQ**	**0.493 JB**	**0.326 JBQ**	**0.512 JBQ**	**0.385 JBQ**
57653-85-7	123678-HxCDD	-	**0.259 JBQ**	**0.262 JBQ**	<0.174	<0.120	**0.923 JBQ**	**0.190 JBQ**	**0.187 JBQ**	**0.311 JBQ**	**3.48 JBQ**	**0.478 JB**	**0.658 JB**	**0.984 JB**	**0.982 JBQ**
19408-74-3	123789-HxCDD	-	**0.252 JB**	**0.387 JBQ**	<0.223	<0.122	**0.653 JBQ**	**0.344 JBQ**	**0.294 JBQ**	**0.127 JBQ**	**1.40 JBQ**	**0.209 JB**	**0.435 JBQ**	**0.791 JBQ**	**0.608 JBQ**
35822-46-9	1234678-HpCDD	-	**1.63 JBQ**	**1.37 JBQ**	<0.224	**0.342 JBQ**	**17.2 B**	**8.41 JB**	**1.32 JB**	**1.88 JBQ**	**131 B**	**3.80 JB**	**18.9 B**	**18.9 B**	**22.6 B**
3268-87-9	OCDD	-	**24.2 B**	**28.5 B**	**5.06 JBQ**	**2.35 JBQ**	**94.0 B**	**91.2 B**	**24.4 B**	**35.4 B**	**981 B**	**54.0 B**	**139 B**	**126 B**	**149 B**
51207-31-9	2378-TCDF	-	**0.365 JB**	<0.0592	<0.258	<0.145	**0.239 JBQ**	**0.238 JBQ**	**0.0571 JBQ**	**0.204 JBQ**	<0.358	**0.153 JBQ**	<0.239	<0.201	0.337 JQ
57117-41-6	12378-PeCDF	-	**0.280 JBQ**	**0.804 JBQ**	<0.151	**0.598 JB**	**0.892 JBQ**	**0.493 JBQ**	**0.538 JBQ**	**0.486 JBQ**	**0.680 JQ**	**0.740 JBQ**	**0.768 JBQ**	**<0.109**	**0.595 JBQ**
57117-31-4	23478-PeCDF	-	**0.203 JBQ**	**0.445 JBQ**	<0.180	**0.668 JBQ**	**0.575 JBQ**	**0.217 JBQ**	**0.241 JBQ**	**0.130 JBQ**	**0.706 JQ**	**0.392 JBQ**	**0.468 JBQ**	**0.591 JBQ**	**0.639 JBQ**
70918-21-9	123478-HxCDF	-	**0.148 JBQ**	**0.377 JBQ**	<0.0907	<0.0943	**0.462 JBQ**	**0.297 JBQ**	**0.151 JBQ**	**0.148 JB**	**1.48 JBQ**	**0.351 JBQ**	**0.404 JB**	**0.682 JBQ**	**0.500 JB**
60851-34-5	123678-HxCDF	-	**0.226 JB**	**0.356 JBQ**	**0.190 JQ**	**0.289 JQ**	**0.592 JB**	**0.313 JBQ**	**0.195 JB**	**0.230 JB**	**0.478 JQ**	**0.265 JBQ**	**0.307 JBQ**	**0.452 JB**	**0.467 JBQ**
55673-89-7	123789-HxCDF	-	**0.792 JB**	**0.982 JBQ**	**0.390 JBQ**	**0.566 JB**	**0.903 JB**	**0.576 JBQ**	**0.863 JB**	**0.743 JB**	**1.69 JBQ**	**0.805 JBQ**	**0.953 JBQ**	**0.994 JB**	**1.03 JB**
60851-34-5	234678-HxCDF	-	**0.167 JBQ**	**0.337 JBQ**	<0.125	**0.187 JBQ**	**0.289 JB**	**0.318 JBQ**	**0.148 JBQ**	**0.109 JBQ**	**0.946 JQ**	**0.266 JBQ**	**0.289 JBQ**	**0.362 JBQ**	**0.342 JBQ**
67562-39-4	1234678-HpCDF	-	**0.224 JBQ**	**0.260 JBQ**	**0.0800 JQ**	<0.0516	**2.70 JB**	**1.62 JB**	**0.253 JBQ**	**0.261 JBQ**	**31.5 B**	**0.731 JB**	**3.35 JB**	**2.75 JB**	**3.93 JB**
55673-89-7	1234789-HpCDF	-	**0.165 JBQ**	**0.230 JBQ**	<0.0874	<0.0623	**0.360 JB**	**0.148 JBQ**	**0.144 JB**	**0.162 JB**	**2.64 JBQ**	**0.426 JBQ**	**0.555 JB**	**0.428 JB**	**0.460 JB**
39001-02-0	OCDF	-	<0.0940	0.574 JB	<0.114	<0.100	**10.8 JB**	**5.78 JB**	**0.347 JBQ**	**0.662 JBQ**	**105 B**	**2.04 JBQ**	**13.7 JB**	**12.6 JB**	**14.3 JB**

TABLE 5-HAMPTON ROADS BRIDGE TUNNEL THIRD TUBE SEDIMENT STUDY
WATER RESULTS

CASRN	Parameter/Lab Certificates	SQuiRT (Surface Water, Marine, Acute-Ocean Disposal)	BOREHOLES												
			B-001	B-003	B-008	B-013	B-017	B-023	B-028	B-030	B-033	B-038	B-039	B-044	B-044 Dup
			18D0180	18D0181	17K0927	17K0936	18A0006	18A0257	18D0179	18D0178	17L0317	18C0046	18A0006	18A0006	18A0006
PCB Congeners (pg/l)															
34883-43-7	PCB8	-	<16.3	<16.6	<30.6	<29.6	<15.8	<16.2	<15.7	<16.1	<15.3	<14.9	<16.7	<16.8	<16.8
-	PCB18+30	-	<17.4	<17.7	<32.7	<31.6	<16.9	<17.3	<16.7	<17.2	<16.3	<15.9	<17.8	<17.9	<17.9
-	PCB20+28	-	<23.9	<24.4	<44.9	<43.5	<23.2	<23.8	<23.0	<23.6	<22.4	<21.8	<24.5	<24.6	<24.6
35693-99-3	PCB52	-	<16.3	<16.6	<30.6	<29.6	<15.8	<16.2	<15.7	<16.1	<15.3	<14.9	<16.7	<16.8	<16.8
-	PCB49+69	-	<28.2	<28.8	<53.1	<51.4	<27.4	<28.1	<27.2	<27.9	<26.5	<25.8	<29.0	<29.1	<29.1
-	PCB44+47+65	-	<43.4	<44.3	<81.6	<79.1	<42.2	<43.3	<41.8	<42.9	<40.8	<39.7	<44.6	<44.7	<44.7
32598-10-0	PCB66	-	<18.4	<18.8	<34.7	<33.6	<17.9	<18.4	<17.8	<18.2	<17.3	<16.9	<19.0	<19.0	<19.0
-	PCB90+101+113	-	<51.0	<52.0	<95.9	<92.9	<49.6	<50.9	<49.1	<50.4	<47.9	<46.7	<52.4	<52.5	<52.6
-	PCB86+87+97+109+119+125	-	<80.3	<81.9	<151	<146	<78.1	<80.1	<77.3	<79.4	<75.4	<73.5	<82.5	<82.7	<82.8
70362-49-1	PCB77	-	<15.2	<15.5	<28.6	<27.7	<14.8	<15.2	<14.6	<15.0	<14.3	<13.9	<15.6	<15.6	<15.7
31508-00-6	PCB118	-	<32.5	<33.2	<61.2	<59.3	<31.6	<32.5	<31.3	<32.2	<30.6	<29.8	<33.4	<33.5	<33.6
32598-14-4	PCB105	-	<18.4	<18.8	<34.7	<33.6	<17.9	<18.4	<17.8	<18.2	<17.3	<16.9	<19.0	<19.0	<19.0
74472-48-3	PCB184	-	<15.2	<15.5	<28.6	<27.7	<14.8	<15.2	<14.6	<15.0	<14.3	<13.9	<15.6	<15.6	<15.7
-	PCB153+168	-	<32.5	<33.2	<61.2	<59.3	<31.6	<32.5	<31.3	<32.2	<30.6	<29.8	<33.4	<33.5	**39.6 J**
-	PCB129+138+163	-	<68.3	<69.8	<129	<125	<66.5	<68.2	<65.8	<67.6	<64.2	<62.6	<70.2	<70.4	<70.5
57465-28-8	PCB126	-	<17.4	<17.7	<32.7	<31.6	<16.9	<17.3	<16.7	<17.2	<16.3	<15.9	<17.8	<17.9	<17.9
-	PCB128+166	-	<31.5	<32.1	<59.2	<57.3	<30.6	<31.4	<30.3	<31.1	<29.6	<28.8	<32.3	<32.4	<32.4
52663-68-0	PCB187	-	<18.4	<18.8	<34.7	<33.6	<17.9	<18.4	<17.8	<18.2	<17.3	<16.9	<19.0	<19.0	<19.0
-	PCB183+185	-	<30.4	<31.0	<57.1	<55.3	<29.5	<30.3	<29.3	<30.0	<28.5	<27.8	<31.2	<31.3	<31.3
-	PCB156+157	-	<24.9	<25.5	<46.9	<45.5	<24.3	<24.9	<24.0	<24.7	<23.4	<22.8	<25.6	<25.7	<25.7
-	PCB180+193	-	<32.5	<33.2	<61.2	<59.3	<31.6	<32.5	<31.3	<32.2	<30.6	<29.8	<33.4	<33.5	<33.6
35065-30-6	PCB170	-	<13.0	<13.3	<24.5	<23.7	<12.7	<13.0	<12.5	<12.9	<12.2	<11.9	<13.4	<13.4	<13.4
32774-16-6	PCB169	-	<16.3	<16.6	<30.6	<29.6	<15.8	<16.2	<15.7	<16.1	<15.3	<14.9	<16.7	<16.8	<16.8
52663-78-2	PCB195	-	<23.9	<24.4	<44.9	<43.5	<23.2	<23.8	<23.0	<23.6	<22.4	<21.8	<24.5	<24.6	<24.6
40186-72-9	PCB206	-	<17.4	<17.7	<32.7	<31.6	<16.9	<17.3	<16.7	<17.2	<16.3	<15.9	<17.8	<17.9	<17.9
2051-24-3	PCB209	-	<17.4	<17.7	**59.3 JB**	**99.9 B**	**18.8 JB**	**22.1 J**	**18.2 J**	<17.2	**51.7 B**	**51.8 B**	**23.6 JB**	**24.7 J**	**27.1 J**

Shaded Detection Exceeds Criteria
Shaded Reporting Limit Exceeds Criteria
NT-Not Tested
Bold-Detected-Non J and J Values
Laboratory Flags
B Detected in Method Blank
J Estimated concentration between Method Detection Limit and Minimum Reporting Level
P-Duplicate analysis does not meet the acceptance criteria for precision
Q EMPC - Estimated Maximum Possible Concentration

> Laboratory data flags are explained in the table footnotes. For example a “J” flag signifies an estimated organic value (typically above the laboratory detection limit but below the laboratory quantification/reporting limit);

> Detections above a comparison value are highlighted in yellow; and

> Non-detections with laboratory reporting limits above a comparison value are highlighted in blue.

In general, samples collected from the northern and southern landward locations consisted of finer grained materials and those collected from the middle segments tended to have higher proportions of coarser-grained materials. The coarsest sediments were encountered in cores recovered from locations in the vicinity of the south tunnel island. The following general sediment data were summarized from *Table 3*:

> Sample B-023 (0-10’) and B-028 (0-10’) had a large percentage of gravel, 24.8% and 42.9% respectively. All other samples were less than 7.5%;

> Sand was greater than 90% in B-001 (0-10’), B-008 (0-10’), B-013 (0-10’), and B-033 (0-10’); and

> Fines were 70% or greater in B-023 (28-38’), B-023 (88-98’), B-038 (0-10’), B-039 (0-10’) and B-044 (0-10’).

Other general test results in *Table 3* are summarized as follows:

> In bulk sediment samples, no SVOCs, PCB Aroclors or butyltin compounds were detected;

> The sediment pH ranged from 7.4 to 8.7 standard units; and

> Although acetone was detected in seven boreholes, acetone is considered by the EPA to be a common laboratory contaminant (Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual, Part A) and likely not site related.

Results specific to the various disposal options are summarized below.

4.1 Upland Disposal Results

Observations from the *Table 3* sediment data are summarized below with respect to potential upland disposal.

4.1.1 Weanack Comparison

Metals

> No sediment samples contained concentrations exceeding any of the 17 Weanack’s EC for metals.

Chemicals

> No sediment samples contained chemicals or organic concentrations exceeding any of the Weanack EC including those for PCB Aroclors, pesticides, and dioxins.

> Although TPH was detected in sediment at three borehole locations, which ranged in combined TPH (TPH-DRO + TPH-GRO) from 23.7 mg/kg to 62 mg/kg, there is no Weanack EC for TPH. In general, TPH measures the mixture of hydrocarbons found in a sample, but is not a test typically used to quantify risk, which likely explains why no EC exists.

In summary, it appears the bulk sediment data may meet Weanack’s exclusion criteria for acceptance as disposal into their Earle Basin. However it should be noted that additives such as introduced into the BT drilling process may contain petroleum and other compounds which the DB offerors may further evaluate as to potential additional testing and management requirements if introduced into the material for disposal.

4.1.2 Other Potential Upland Disposal Sites

Other potential upland disposal sites may exist including additional mining excavations like sand and gravel pits. To provide information for potential use of HRBT sediments at other upland areas, the DEQ clean fill limit for

TPH was reviewed. Virginia Solid Waste Management Regulations (VSWMR) 9VAC20-81-660 (*Soil Contaminated with Petroleum Products*) establishes clean fill limit requirements including:

> No failure of RCRA hazardous waste characteristics

> Extractable Organic Halides (EOX) below 100 mg/kg and benzene, toluene, ethylbenzene and xylene (BTEX) below 10 mg/kg

> TPH below 50 mg/kg

If the above criteria are met, the regulations can allow use with restrictions including set back limitations such as disposal no closer than 100 feet of any regularly flowing surface water body; 500 feet of any well, spring or other groundwater source of drinking water, and 200 feet from any residence, school, hospital, nursing home, or recreational park area. The HRBT sediment data detections included the following:

> The only EOX detection (16.6 mg/kg) was below the 100 mg/kg limit;

> No BTEX was detected;

> TPH detections in sediment occurred in the following three borehole locations.

- B-001 near the Hampton shore with TPH-DRO of 62 mg/kg from 0-10 feet deep.
- B-003 between the Hampton shore and north island with TPH-DRO of 27.8 mg/kg and TPH-GRO of 0.27 mg/kg from 0-10 feet deep.
- B-044 (and its duplicate) near the Norfolk shore with TPH-DRO ranging from 23.7 mg/kg to 32.8 mg/kg from 0-10 feet deep.

> Naphthalene, a common petroleum related organic compound was also detected as a VOC in sediment (0.067 mg/kg to 0.0754 mg/kg) in the same B-001 and B-003 samples were TPH was detected.

Except for the B-001 sample, those HRBT results for petroleum related parameters appear to meet the petroleum clean fill limits. However, it should be noted that additives such as introduced into the BT drilling process may contain petroleum, which the DB offerors should take into consideration when evaluating sediment management in their proposal. Without knowing the potential upland disposal scenario, site setting details and land use plans that a DB offeror may consider, it was not possible to adequately evaluate likely candidate disposal sites and the appropriate data comparison/reference values in this preliminary study. The DB offerors can review this preliminary data set including the non-petroleum detections and take into consideration as part of their overall sediment management in their proposal.

4.2 Landfill Disposal Results

Observations from *Table 3* sediment data are summarized below with respect to potential placement in a Virginia landfill.

> No parameter appeared to exceed any RCRA hazardous waste limit (no hazardous waste was identified).

> Although some PCB Congeners (which have a much lower laboratory reporting limit) were detected in sediment, PCB Aroclors (which have a higher laboratory reporting limit) were not detected in sediment (all total PCB sums less than 1.281 mg/kg). The PCB detections were below the typical 50 mg/kg landfill regulatory maximum.

> As described above, TPH was detected in sediment at three borehole locations, which ranged in combined TPH (TPH-DRO + TPH-GRO) from 23.7 mg/kg to 62 mg/kg. These TPH detections are below typical landfill permit maximums.

The sediment data described above would appear to allow for disposal in a Virginia landfill, but not require/dictate disposal in a landfill as other options may be considered. Two related items in particular that the DB offeror may also consider are the following:

> Any additives to the dredge sediment such as drilling additives introduced into a BT process that may contain polymers/petroleum should also be considered when selecting a disposal location like an appropriate landfill; and

> Most landfills are not allowed to receive material containing free liquids and typically have requirements for the material they receive to pass a paint filter test. Both paint filter tests and percent solids tests for the bulk sediment samples were conducted in this study. Paint filter tests were <1 ml/100g except for two samples (1 ml/100g at B-033 0-10 feet and 2 ml/100g at B-017 0-10 feet) whereas percent solids ranged from 52.8% and 87.7%. The DB offerors can evaluate the paint filter and percent solids data along with their proposed means/methods to evaluate appropriate handling/disposal and water management.

4.3 Ocean Disposal Results

The *Table 3* (sediment), *Table 4* (elutriate), and *Table 5* (water) data are summarized below with respect to potential ocean disposal.

4.3.1 <u>Metals</u>

In the sediment (*Table 3*):

> The ERL for arsenic (8.2 mg/kg) was exceeded in three boreholes (B-023 at 0-10 feet and 28-28 feet, B-039 from 0-10 feet and B-044 from 0-10 feet). Those arsenic exceedances ranged from 8.53 mg/kg to 16.3 mg/kg.

> The ERL for cadmium (1.2 mg/kg) was exceeded in three boreholes (B-023 at 0-10 feet and 28-28 feet, B-039 from 0-10 feet and B-044 from 0-10 feet). Those cadmium exceedances ranged from 1.31 mg/kg to 2.11 mg/kg.

> The ERL for nickel (20.9 mg/kg) was exceeded in one boreholes (B-023 at 0-10 feet and 28-28 feet). Those nickel exceedances ranged from 22.1 mg/kg to 25.3 mg/kg.

> All other metals concentrations were below the ERL.

> No metal ERM values were exceeded.

In the elutriate and water samples (*Table 4* and *Table 5*):

> The only metal detected above a SQUIRT VALUE was copper, which only occurred in the elutriate sample for the B-033 0-10 feet sample. For this elutriate sample, the detection of 0.0182 mg/l exceeded the salt water acute criterion of 0.0048 mg/l.

> The rest of the copper data and all of the silver data were non-detect; however, the laboratory reporting limit (0.01 mg/l for both metals) exceeded their respective SQUIRT value If the DB offerors wish to further pursue ocean disposal, then additional test methods/approaches may be considered.

4.3.2 <u>Chemicals/Organics</u>

In the sediment, the following chemicals/organic compounds exceeded the sediment ERL (*Table 3*):

> The ERL for the pesticide 4,4'-DDD (2 ug/kg) was exceeded in two boreholes (B-001 from 0-10 feet and B-030 from 0-10 feet). Those ERL exceedances ranged from 6.5 ug/kg to 30 ug/kg. Note that the B-001 (0-10 feet) concentration (30 ug/kg) also exceeded the ERM of 20 ug/kg;

> The ERL for the pesticide 4,4'-DDE (2.2 ug/kg) was exceeded in one borehole (B-001 from 0-10 feet) with a concentration of 4.2 ug/kg;

> The ERL for the pesticide 4,4'-DDT (1 ug/kg) was exceeded in four boreholes (B-001 from 0-10 feet, B-003 from 0-10 feet,B-028 from 0-10 feet and B-030 from 0-10 feet). Those ERL exceedances ranged from 2.5 ug/kg to 87 ug/kg. Note that the B-001 (0-10 feet) concentration of 87 ug/kg and B-030 (0-10 feet) concentration of 32 ug/kg also exceeded the ERM of 7 ug/kg;

> Similar to 4,4'-DDT, the ERL for total DDT (1.58 ug/kg) was exceeded in four boreholes (B-001 from 0-10 feet, B-003 from 0-10 feet, B-028 from 0-10 feet and B-030 from 0-10 feet) with a concentration range of 3.29 ug/kg to 99.0 ug/kg. In addition, the total DDT ERM (46.1 ug/kg) was exceeded at B-001 (0-10 feet) with a concentration of 99.0 ug/kg;

> The ERL for the pesticide dieldrin (0.02 ug/kg) was exceeded in only one borehole (B-023 from 0-10') with a concentration of 0.087 ug/kg; and

> Certain organic parameters were not detected, but their laboratory reporting limit was higher than the ERL, which occurred at least partially for 4,4'-DDD, 4,4'-DDE, chlordane, dieldrin, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, and fluorene. However, none of the laboratory reporting limits exceeded the ERM. If the DB offerors wish to further pursue ocean disposal, then additional test methods/approaches may be considered.

In the standard elutriate and water samples (*Table 4* and *Table 5*):

> No chemical parameters for the elutriate and water samples contained a detection above a SQUIRT value.

> Certain organic parameters were not detected, but their laboratory reporting limit was higher than the SQUIRT value, which occurred for the SVOC pentachlorophenol and total cyanide. If the DB offerors wish to further pursue ocean disposal, then additional test methods/approaches may be considered.

In summary for an ocean disposal option, the ERL in sediment was exceeded in certain locations for three metals (arsenic, cadmium and nickel) and five pesticide constituents (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Total DDT and dieldrin). In the elutriate and surface water samples, the only confirmed exceedance of a SQUIRT value was one location (elutriate for B-033 0-10 feet) for one parameter (copper). However as previously mentioned, this preliminary study does not constitute full Section 103 characterization. Furthermore, the potential addition of other materials with the sediment such as drilling fluid additives may effect/restrict the disposal options such as ocean disposal.

5 Conclusions

For this preliminary study, sediment samples were collected from 12 locations distributed along the proposed HRBT Third Tube alignment. The information provided from this preliminary study is intended as a general screening of sediment conditions and not intended for use as a final/complete disposal determination. These screening-level results provide preliminary information for the DB offerors to consider in evaluating potential disposal and management options to prepare their proposals. Additionally, the following should be noted while reading this report.

> The maps and figures provided in this report are for general illustration purposes only. For design details, the reader should review the project's website including the request for proposal documents;

> For details of the geotechnical study such as borehole coordinates and borehole logs with sediment descriptions, the reader should review the geotechnical report; and

> Tables were prepared in this report as a visual aid summary; however, the reader should reference the laboratory certificates of analysis to review the full testing data. Note to pay close attention to the units reported on the laboratory certificates of analysis, which vary depending on the test.

The conclusions of this preliminary sediment study include the following:

> Potential management/disposal options for sediment/dredge spoils include upland disposal (such as in a permitted quarry/mining pit reclamation), landfill disposal at a permitted landfill and/or ocean disposal with Section 103 approval. This preliminary sediment study did not appear to rule out further consideration on these disposal options. The DB offeror may consider, but is not limited to, these options or others including a beneficial reuse such as shoreline nourishment or restoration;

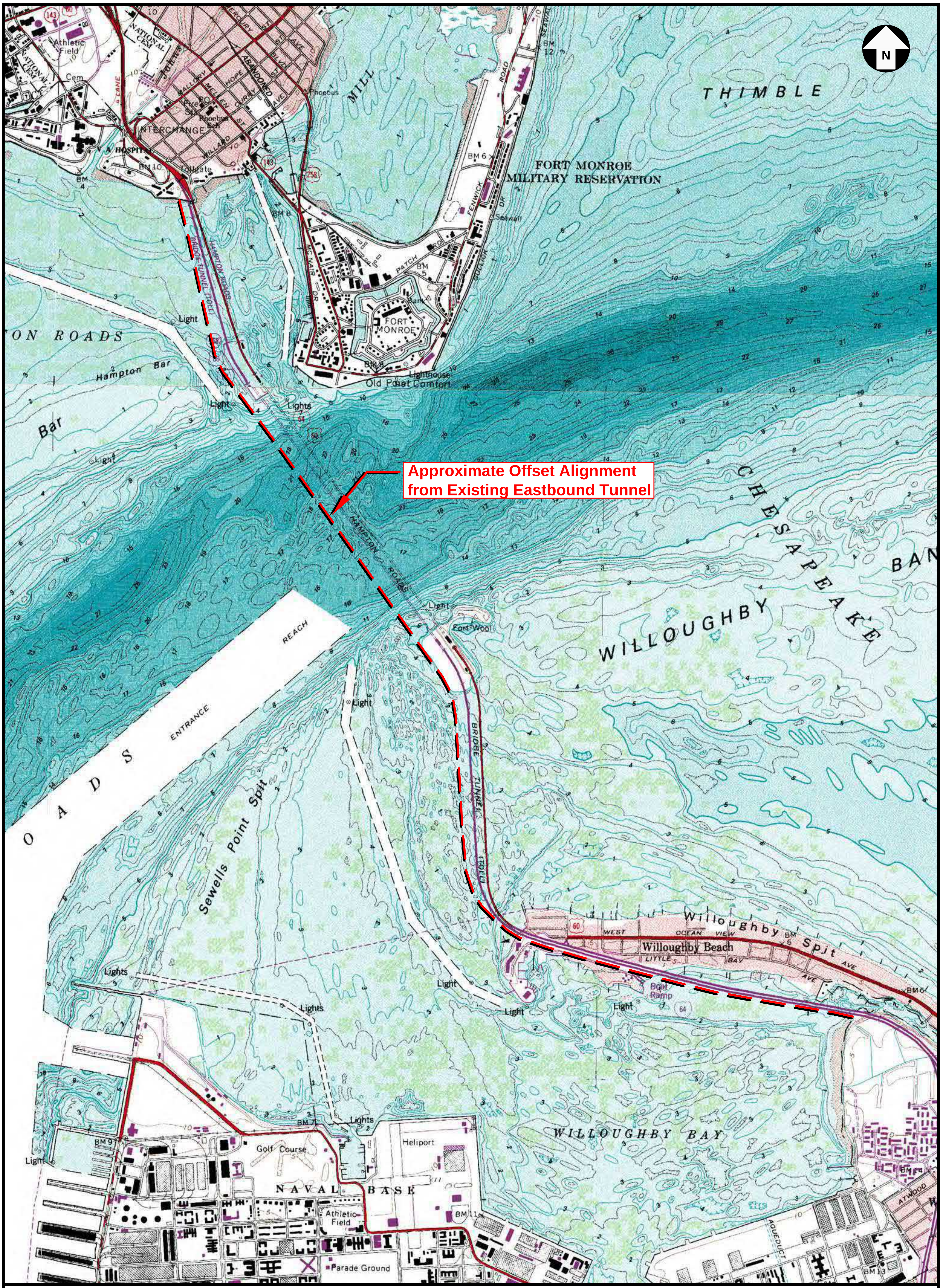
> The DB offerors should consider determining any additional sediment sampling and testing needs associated with their design and construction means and methods including additional sample locations/depths/types, frequency, test methods and comparison/reference standards; and

> It should be noted that certain bridge tunnel installation/construction activities like BT drilling reportedly incorporate additives like polymers and slurry/grout material, and therefore could be part of the final spoils/material to be managed. This *Preliminary Sediment Study Report* could not predict various DB influenced project activities like potential additive mixtures or differing sediment processing/dewatering procedures and water management means and methods. Therefore, the offerors should take these construction and management processes into consideration for their proposal including the potential influence and restrictions should additives be used during construction.

Hampton Roads Bridge
Tunnel Expansion
Preliminary Sediment Study

APPENDIX A

VICINITY MAP



USGS 7.5' HAMPTON, VA QUADRANGLE - 1965
USGS 7.5' NORFOLK NORTH, VA QUADRANGLE - 1965
PHOTOREVISED 1986
CONTOUR INTERVAL=5'

(FOR ILLUSTRATIVE PURPOSES ONLY)

Cardno
ASHLAND, VA.

Vicinity Map

VDOT

HRBT Third Tube

2,000' 0 2,000'
Approximate Scale: 1" = 2,000'

VHR040
06/22/2018

VIRGINIA

Hampton Roads Bridge
Tunnel Expansion
Preliminary Sediment Study

APPENDIX

B

SITE MAP

B001 Borehole Location with Chemical Testing

(FOR ILLUSTRATIVE PURPOSES ONLY)

Site (Aerial) Map

VDOT

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VHR040
06/22/2018

2,000' 0 2,000'

Approximate Scale: 1" = 2,000'

VIRGINIA

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ASHLAND, VA.

Hampton Roads Bridge
Tunnel Expansion
Preliminary Sediment Study

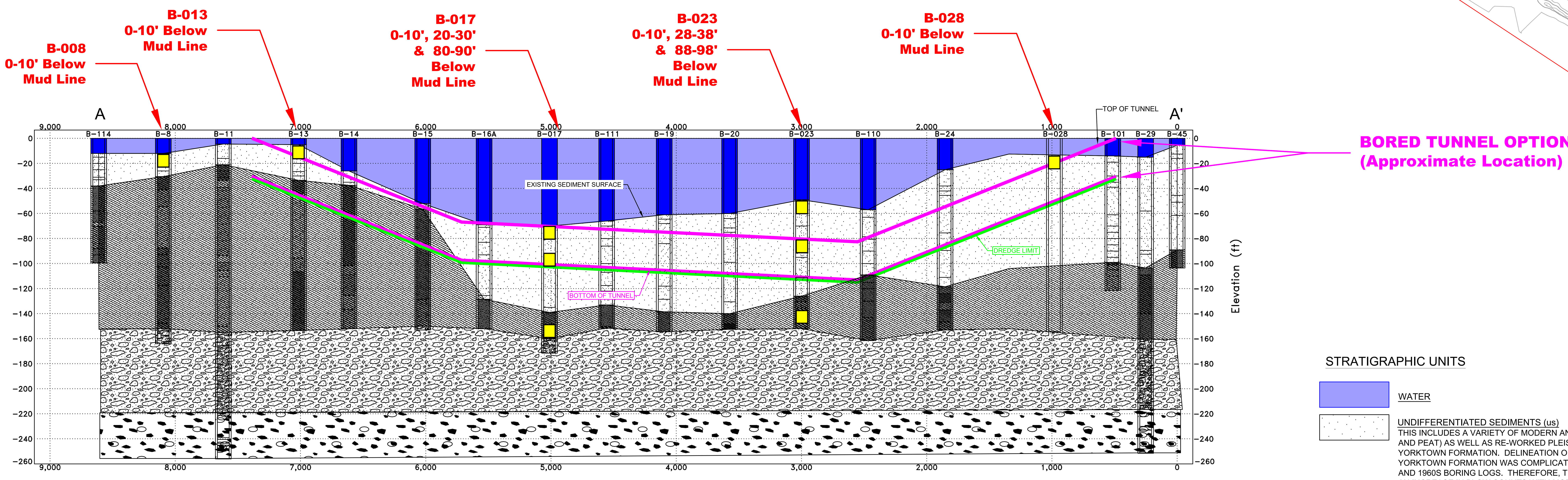
APPENDIX

C

FIGURES 1 – 7

PLAN VIEW

500' 0 500'
HORIZONTAL SCALE: 1" = 500'



SAMPLE INTERVAL

250 FT OFFSET ALIGNMENT FROM EXISTING EASTBOUND TUNNEL C

GEOLOGIC PROFILE

500' 0 500'
HORIZONTAL SCALE: 1" = 500'
50' 0 50'
VERTICAL SCALE: 1" = 50'

STRATIGRAPHIC UNITS

WATER

UNDIFFERENTIATED SEDIMENTS (us)
THIS INCLUDES A VARIETY OF MODERN AND RECENTLY-DEPOSITED SEDIMENTS (SAND, SILT, CLAY, GRAVEL, ORGANICS, AND PEAT) AS WELL AS RE-WORKED PLEISTOCENE THROUGH HOLOCENE UNITS AND THE UNDERLYING PLIOCENE YORKTOWN FORMATION. DELINEATION OF THE CONTACT BETWEEN THIS LUMPED UNIT AND THE UNDERLYING YORKTOWN FORMATION WAS COMPLICATED BY LIMITED DETAILS IN THE LITHOLOGIC DESCRIPTIONS FROM THE 1950S AND 1960S BORING LOGS. THEREFORE, THIS CONTACT WAS INTERPRETED BASED ON SEVERAL FACTORS, INCLUDING: 1) AN INCREASE IN BLOW COUNTS WITH MODERN AND REWORKED SEDIMENTS INTERPRETED AS BEING SOFTER THAN *IN-SITU* YORKTOWN SEDIMENTS; AND 2) LITHOLOGIC DESCRIPTIONS INDICATIVE OF THE YORKTOWN FORMATION (E.G., GREEN OR GREENISH-GRAY VERY FINE TO COARSE SAND WITH INTERBEDS OF SILT AND CLAY, PRESENCE OF SHELLS, AND LACK OF GRAVEL). RE-WORKED PLEISTOCENE THROUGH HOLOCENE UNITS ABOVE THE YORKTOWN FORMATION INCLUDE THE:

- ALLUVIUM (HOLOCENE AND PLEISTOCENE): FINE TO COARSE GRAVELLY SAND AND SANDY GRAVEL, SILT, AND CLAY, LIGHT TO MEDIUM GRAY AND YELLOWISH-GRAY (MIXON *ET AL.*, 1989).
- TABB FORMATION (UPPER PLEISTOCENE): SAND, SILT, CLAY, AND PEAT (MIXON *ET AL.*, 1989).
- SHIRLEY FORMATION (MIDDLE PLEISTOCENE): LIGHT TO DARK-GRAY, BLUISH-GRAY AND BROWN SAND, GRAVEL, SILT, CLAY, AND PEAT. MARGINAL-MARINE FACIES IN LOWER JAMES RIVER IS SILTY FINE SAND AND SANDY SILT CONTAINING FOSSIL MOLLUSKS (MIXON *ET AL.*, 1989).

YORKTOWN FORMATION (Ty)
(LOWER UPPER AND LOWER PLIOCENE): BLUISH-GRAY AND GREENISH-GRAY SAND, FINE TO COARSE, IN PART GLAUCONITIC AND PHOSPHATIC, COMMONLY VERY SHELLY, INTERBEDDED WITH SANDY AND SILTY BLUE-GRAY CLAY. IN LOWER YORK AND JAMES RIVER BASINS, UNIT INCLUDES CROSS-BEDDED SHELL HASH (MIXON *ET AL.*, 1989). THE BASIS FOR DELINEATING THE CONTACT BETWEEN THIS UNIT AND THE OVERLYING UNDIFFERENTIATED SEDIMENTS IS DESCRIBED ABOVE.

EASTOVER FORMATION (Te)
(UPPER MIOCENE): DARK-GRAY TO BLUISH-GRAY, MUDDY SAND, VERY FINE TO FINE, MICACEOUS, INTERBEDDED WITH SANDY SILT AND CLAY. LOWER PART OF UNIT IS DOMINANTLY MEDIUM- TO VERY THIN-BEDDED AND LAMINATED SILT AND CLAY INTERBEDDED WITH VERY FINE SAND, LENTICULAR AND WAVY BEDDING COMMON; UPPER PART IS MAINLY VERY FINE TO FINE SAND CONTAINING ABUNDANT CLAY LAMINAE. FOSSILIFEROUS (MIXON *ET AL.,* 1989). THE CONTACT BETWEEN THE EASTOVER FORMATION AND THE OVERLYING YORKTOWN FORMATION WAS BASED ON CORRELATION WITH THE CROSS-SECTION FOR THE CBBT (JACOBS, 2015) AS WELL AS LITHOLOGIC DESCRIPTIONS IN THE BORING LOGS INDICATING A CHANGE TO GRAY FROM GREENISH-GRAY AND FINER TEXTURE. MANY OF THE BORINGS WERE NOT ADVANCED TO DEPTHS WHERE THIS UNIT WOULD BE ENCOUNTERED.

ST. MARYS FORMATION (Tm)
(UPPER AND MIDDLE MIOCENE). BLUISH- TO PINKISH-GRAY, MUDDY, VERY FINE SAND AND SANDY CLAY-SILT, LOCALLY ABUNDANTLY SHELLY (MIXON *ET AL.,* 1989). A POSSIBLE CONTACT BETWEEN THIS UNIT AND THE OVERLYING EASTOVER FORMATION WAS INTERPRETED BASED ON THE CBBT CROSS-SECTION (JACOBS, 2015) AS WELL AS CHANGES IN LITHOLOGIC DESCRIPTIONS BETWEEN APPROXIMATELY -210 AND -225 FEET ABOVE MEAN SEA LEVEL (AMSL) IN THE TWO DEEPEST BORINGS, B-11 AND B-29.

(FOR ILLUSTRATIVE PURPOSES ONLY)

HRBT THIRD HARBOR TUNNEL
HAMPTON, VIRGINIA

Cardno

Prepared For: VDOT

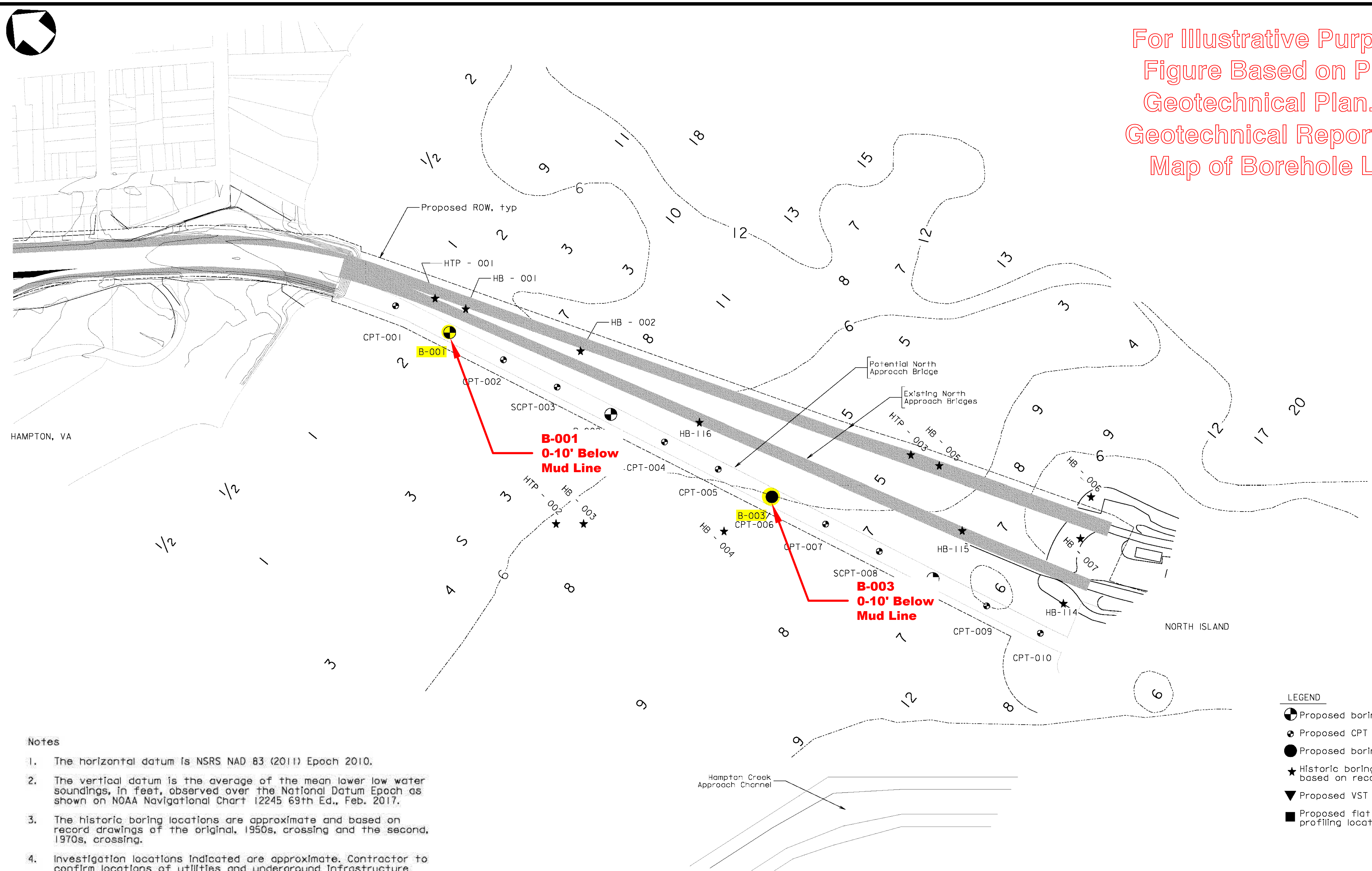
DESIGNED:	ERP
DRAWN:	DES
CHECKED:	VA
DATE:	06/22/18
SCALE:	AS SHOWN
FILE NO.:	VHR040_Figures.dwg
PROJECT NO.:	VHR040
OFFICE LOC.:	ASHLAND, VA

VDOT
HRBT Third Tube

Geologic Profile and Plan View

Figure 1

For Illustrative Purposes Only. Figure Based on Preliminary Geotechnical Plan. See Final Geotechnical Report for Official Map of Borehole Locations.



Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
2. The vertical datum is the average of the mean lower low water soundings, in feet, observed over the National Datum Epoch as shown on NOAA Navigational Chart 12245 69th Ed., Feb. 2017.
3. The historic boring locations are approximate and based on record drawings of the original, 1950s, crossing and the second, 1970s, crossing.
4. Investigation locations indicated are approximate. Contractor to confirm locations of utilities and underground infrastructure with utility owners and with VDOT prior to commencement of work. The Contractor shall propose changes to investigation locations for the acceptance of the Engineer as required to safeguard existing utilities and underground infrastructure.
5. Vane shear test (VST) and flat plate dilatometer (DMT) profiling locations shall be offset a few feet from the adjacent cone penetration test (CPT) or seismic cone penetration test (SCPT) location.

LEGEND

- Proposed boring location
- Proposed CPT or SCPT location
- Proposed boring and CPT location
- Historic boring location approximate based on record drawing
- Proposed VST profiling location
- Proposed flat plate dilometere (DMT) profiling location

Note: Base Map provided by VDOT

200' 0' 200' 400' 600'
GRAPHIC SCALE

Cardno

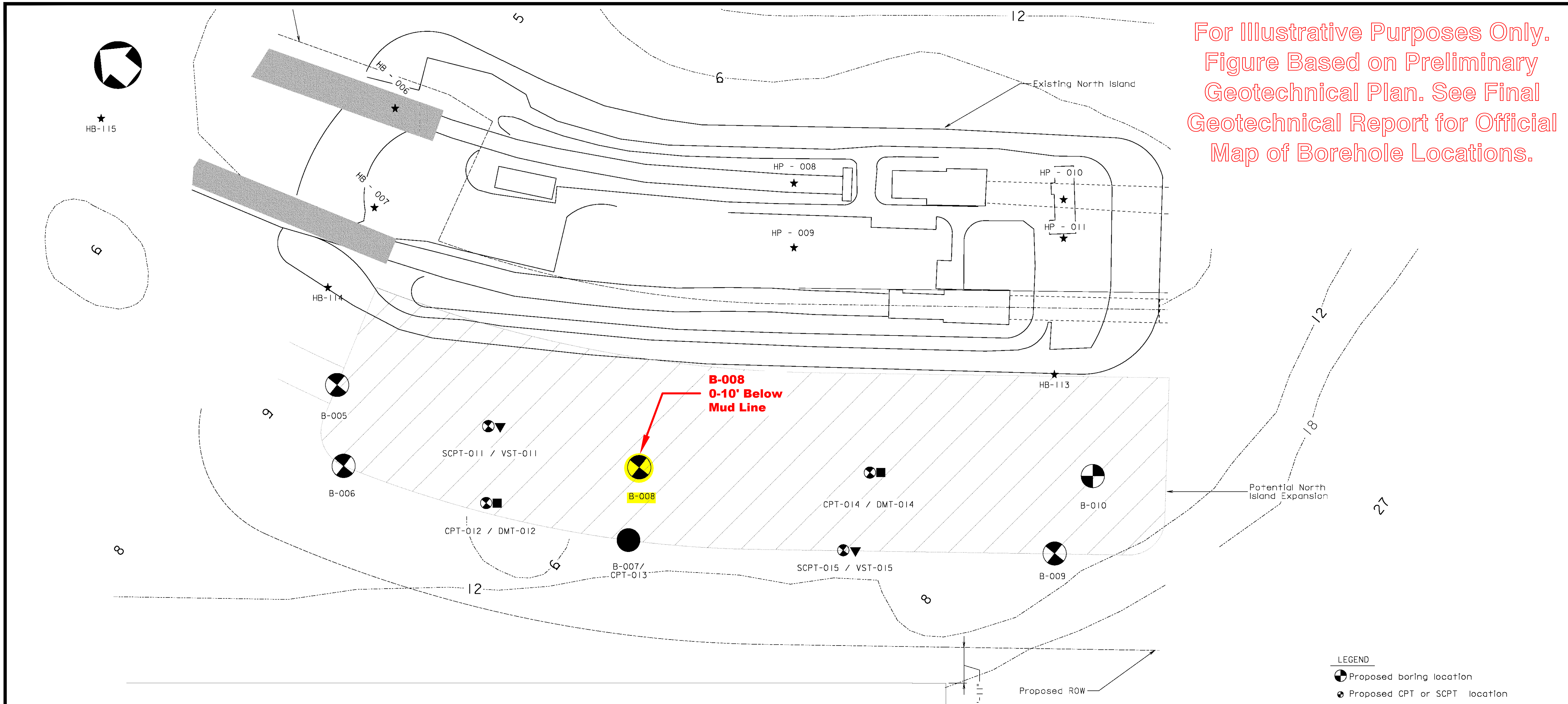
Prepared For:
VDOT

DESIGNED:	ERP
DRAWN:	DES
CHECKED:	VA
DATE:	06/22/2018
SCALE:	AS SHOWN
FILE NO.:	VHR040_Figures.dwg
PROJECT NO.:	VHR040
OFFICE LOC.:	ASHLAND, VA

VDOT
HRBT Third Tube

Borehole Locations

Figure
2



Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
2. The vertical datum is the average of the mean lower low water soundings, in feet, observed over the National Datum Epoch as shown on NOAA Navigational Chart 12245 69th Ed., Feb. 2017.
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5. Vane shear test (VST) and flat plate dilatometer (DMT) profiling locations shall be offset a few feet from the adjacent cone penetration test (CPT) or seismic cone penetration test (SCPT) location.

Note: Base Map provided by VDOT

Cardno

Prepared For: VDOT

DESIGNED:	ERP
DRAWN:	DES
CHECKED:	VA
DATE:	06/22/2018
SCALE:	AS SHOWN
FILE NO.:	VHR040_Figures.dwg
PROJECT NO.:	VHR040
OFFICE LOC.:	ASHLAND, VA

VDOT
HRBT Third Tube

Borehole Locations

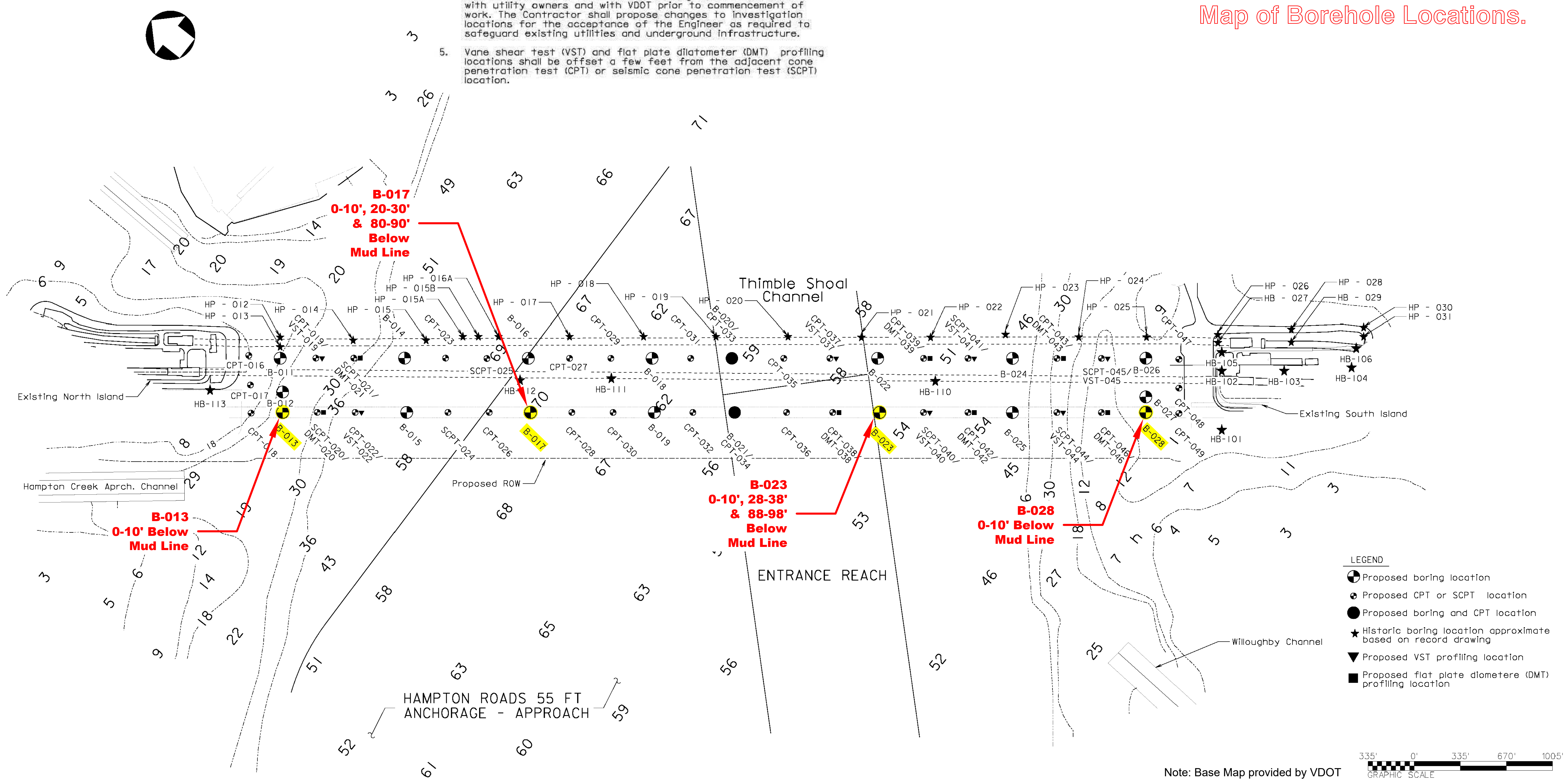
Figure

3

Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
2. The vertical datum is the average of the mean lower low water soundings, in feet, observed over the National Datum Epoch as shown on NOAA Navigational Chart 12245 69th Ed., Feb. 2017.
3. The historic boring locations are approximate and based on record drawings of the original, 1950s, crossing and the second, 1970s, crossing.
4. Investigation locations indicated are approximate. Contractor to confirm locations of utilities and underground infrastructure with utility owners and with VDOT prior to commencement of work. The Contractor shall propose changes to investigation locations for the acceptance of the Engineer as required to safeguard existing utilities and underground infrastructure.
5. Vane shear test (VST) and flat plate dilatometer (DMT) profiling locations shall be offset a few feet from the adjacent cone penetration test (CPT) or seismic cone penetration test (SCPT) location.

For Illustrative Purposes Only. Figure Based on Preliminary Geotechnical Plan. See Final Geotechnical Report for Official Map of Borehole Locations.



Note: Base Map provided by VDOT

DESIGNED:	ERP
DRAWN:	DES
CHECKED:	VA
DATE:	06/22/2018
SCALE:	AS SHOWN
FILE NO.:	VHR040_Figures.dwg
PROJECT NO.:	VHR040
OFFICE LOC.:	ASHLAND, VA

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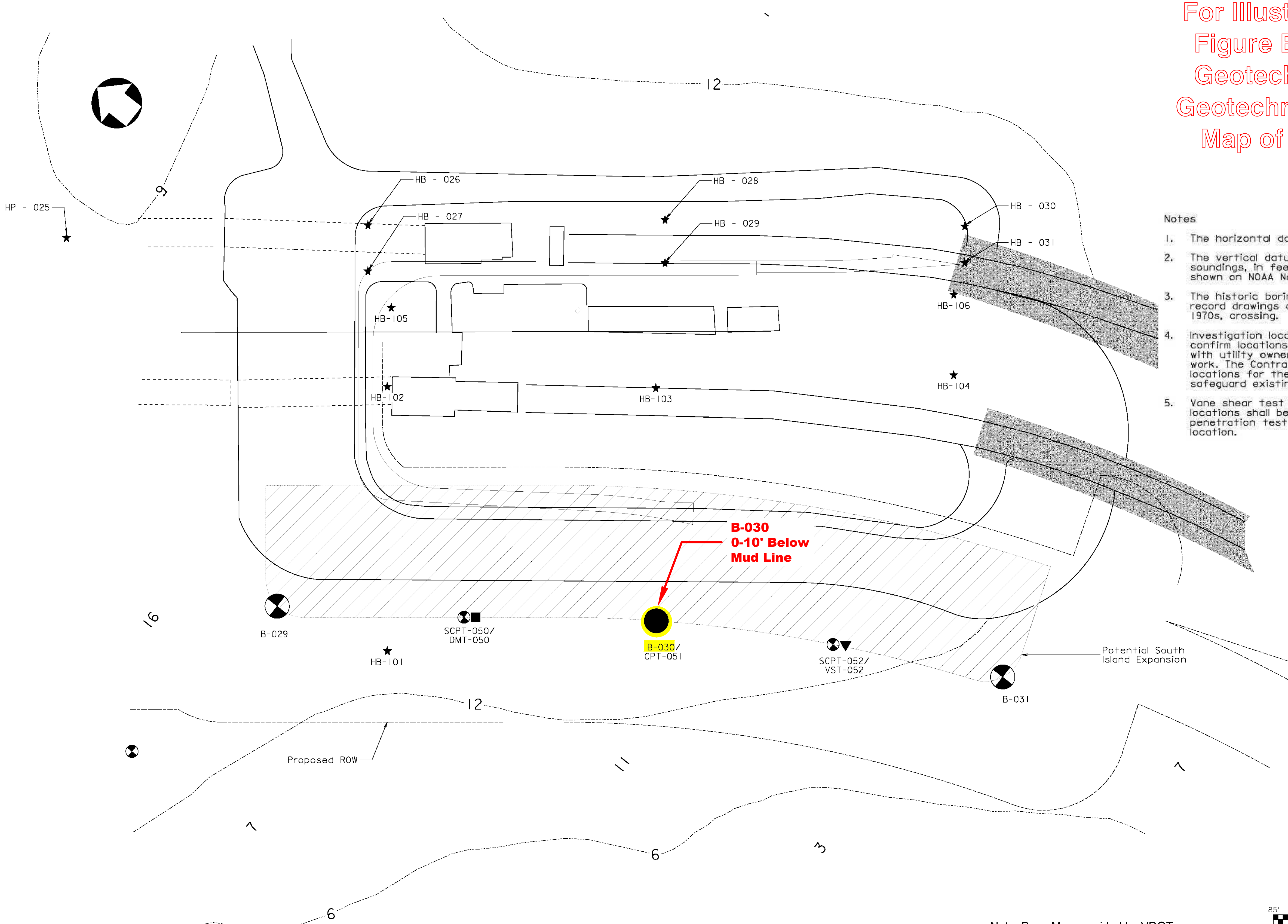
Borehole Locations

Figure 4

For Illustrative Purposes Only. Figure Based on Preliminary Geotechnical Plan. See Final Geotechnical Report for Official Map of Borehole Locations.



Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
2. The vertical datum is the average of the mean lower low water soundings, in feet, observed over the National Datum Epoch as shown on NOAA Navigational Chart 12245 69th Ed., Feb. 2017.
3. The historic boring locations are approximate and based on record drawings of the original, 1950s, crossing and the second, 1970s, crossing.
4. Investigation locations indicated are approximate. Contractor to confirm locations of utilities and underground infrastructure with utility owners and with VDOT prior to commencement of work. The Contractor shall propose changes to investigation locations for the acceptance of the Engineer as required to safeguard existing utilities and underground infrastructure.
5. Vane shear test (VST) and flat plate dilatometer (DMT) profiling locations shall be offset a few feet from the adjacent cone penetration test (CPT) or seismic cone penetration test (SCPT) location.

LEGEND
- Proposed boring location
- Proposed CPT or SCPT location
- Proposed boring and CPT location
- Historic boring location approximate based on record drawing
- Proposed VST profiling location
- Proposed flat plate diometere (DMT) profiling location

Note: Base Map provided by VDOT

85' 0' 85' 170' 255'
GRAPHIC SCALE

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Borehole Locations

Figure
5

For Illustrative Purposes Only. Figure Based on Preliminary Geotechnical Plan. See Final Geotechnical Report for Official Map of Borehole Locations.

Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
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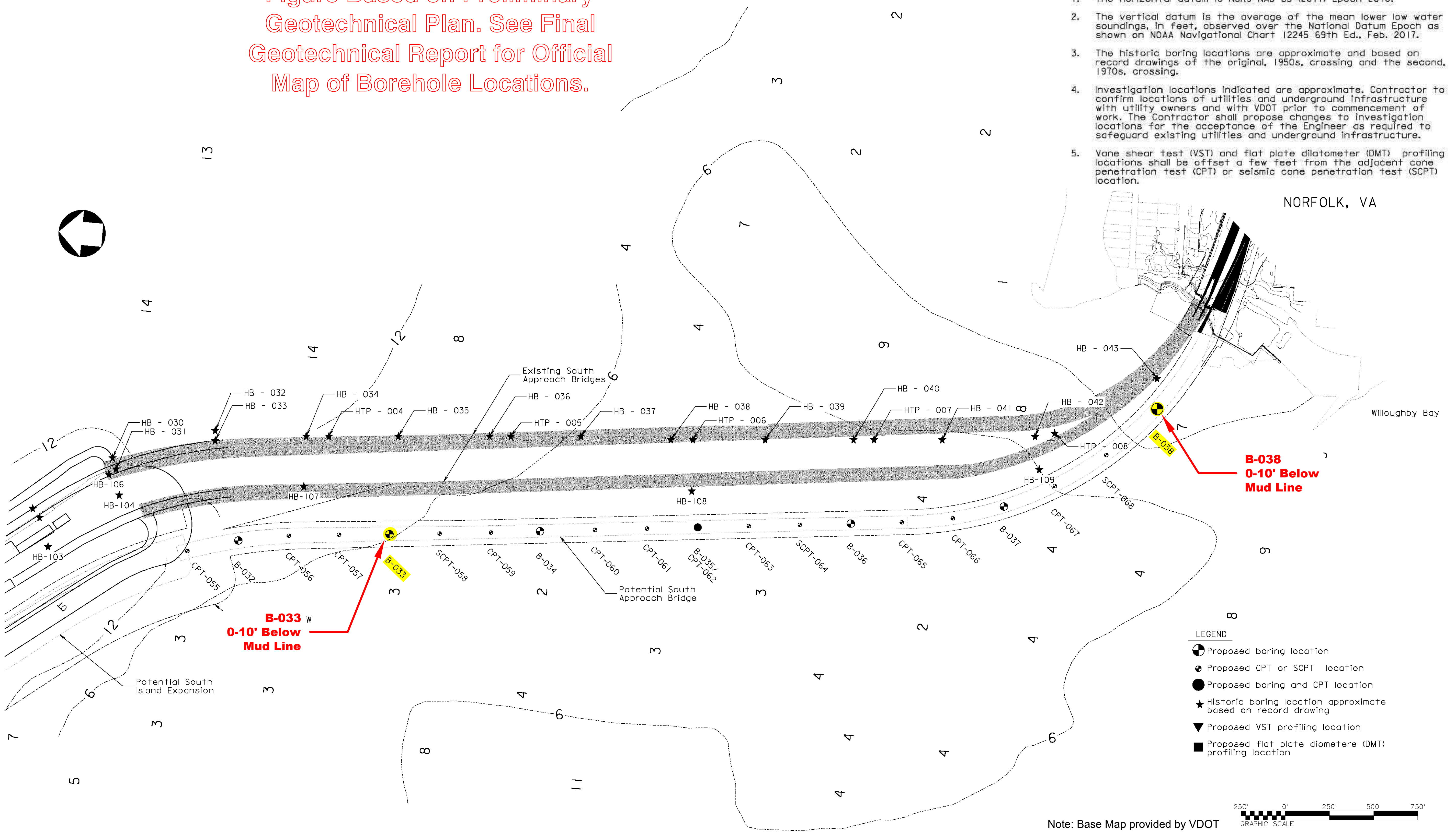

Note: Base Map provided by VDOT

Cardno

Prepared For: VDOT

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CHECKED:	VA
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SCALE:	AS SHOWN
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PROJECT NO.:	VHR040
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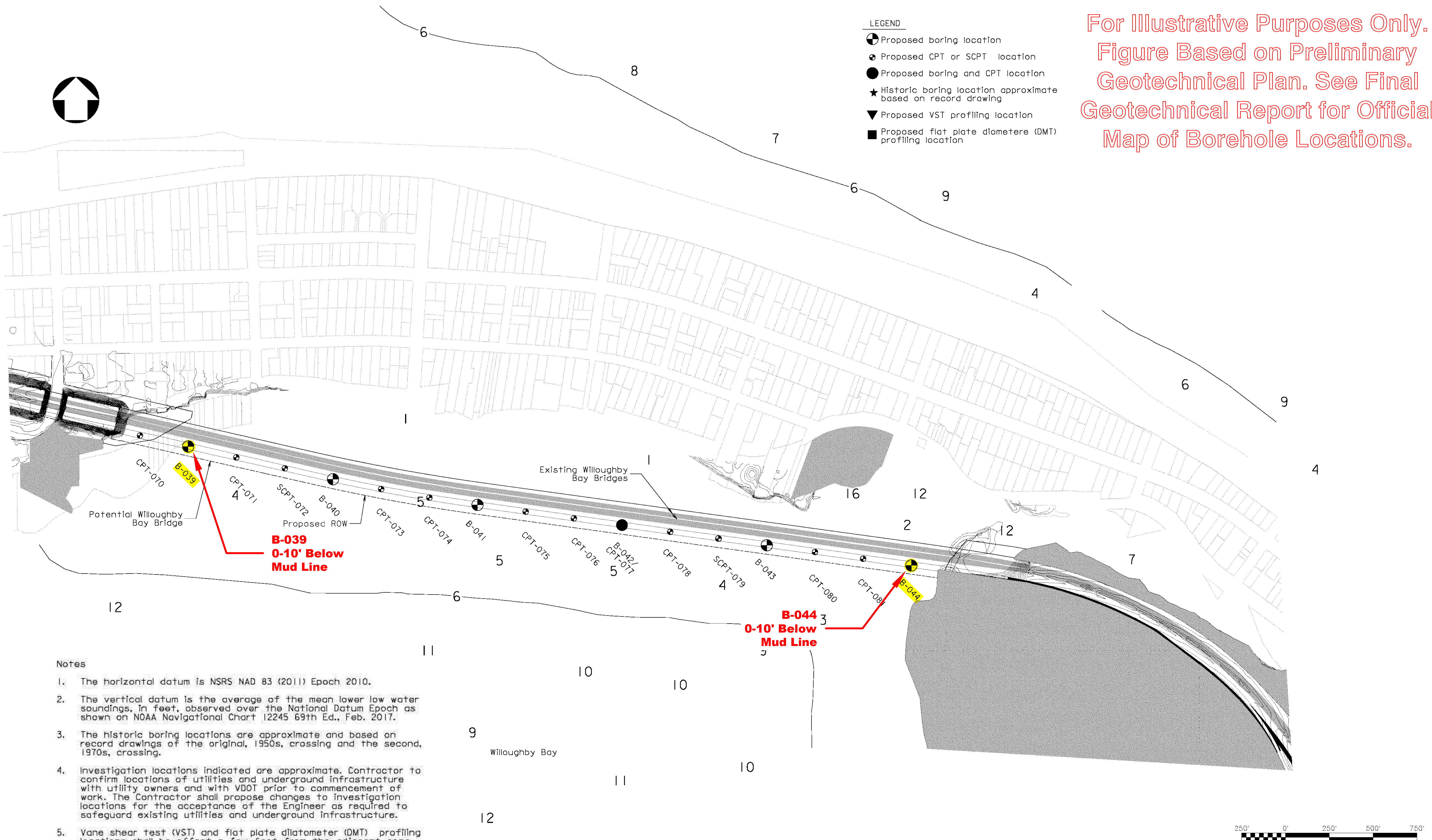
Borehole Locations

Figure

6

For Illustrative Purposes Only. Figure Based on Preliminary Geotechnical Plan. See Final Geotechnical Report for Official Map of Borehole Locations.



Notes

1. The horizontal datum is NSRS NAD 83 (2011) Epoch 2010.
2. The vertical datum is the average of the mean lower low water soundings, in feet, observed over the National Datum Epoch as shown on NOAA Navigational Chart 12245 69th Ed., Feb. 2017.
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Note: Base Map provided by VDOT

250' 0' 250' 500' 750'
GRAPHIC SCALE

Cardno

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Borehole Locations

Figure
7

Hampton Roads Bridge
Tunnel Expansion
Preliminary Sediment Study

APPENDIX

E

AGRICULTURAL TEST RESULTS

COUNTY/STUDY: **Saunders**
DATE: **4/24/2018**

	Potential Peroxide Acidity	CCE/Sobek-NP	Saturated Paste			
Sample ID	**Tons $CaCO_3$/1000 Tons Material**	**Tons CaCO3 Eq/1000tons material**	**pH**	**EC (mS/cm)**	**% Total S**	**HCL Fizz Test**
B-001E	1.28	0.30	6.85	14.12	0.03	None
B-003E	0.00	8.08	7.41	22.70	0.14	Slight
B-028E	0.00	7.08	7.83	6.63	<0.01	Slight
B-030E	0.00	17.42	7.81	9.77	0.01	Moderate

COUNTY/STUDY: **Saunders - HRBT**
DATE: **12/7/2017-12/20/17**

	Potential Peroxide Acidity	CCE/Sobek-NP	Saturated Paste			
Sample ID	**Tons $CaCO_3$/1000 Tons Material**	**Tons CaCO3 Eq/1000lbs material**	**pH**	**EC (dS/m)**	**% Total S**	**HCL Fizz Test**
ENV-D1	0.00	82.11	7.39	38.90	1.16	Moderate
VDOT B-0008	1.23		7.84	16.49	0.07	None
VDOT B-033	0.00	11.47	7.93	0.02	0.05	Slight

Particle Size Analysis

Data ID#	171121
Lab #	ENV-D1
Series	ENVIVA
%VCS	3.0
%CS	2.9
%MS	6.7
%FS	14.8
%VFS	4.4
Total % Sand	31.7
%CSI	0.9
%MSI	13.5
%FSI	13.0
Total % Silt	27.4
Total % Clay	40.9
Textural Class	C

COUNTY/STUDY: **Saunders - HRBT**
DATE: **1/26/2018**

	Potential Peroxide Acidity	CCE/Sobek-NP	Saturated Paste			
Sample ID	**Tons $CaCO_3$/1000 Tons Material**	**Tons CaCO3 Eq/1000lbs material**	**pH**	**EC (dS/m)**	**% Total S**	**HCL Fizz Test**
B-008	6.01	3.82	7.80	13.80	0.04	None
B-013	0.00	45.42	7.52	15.74	0.09	Slight
B-017	0.00	46.45	7.65	24.50	0.1	Slight
B-039	11.39	13.28	7.67	36.10	0.94	None
B-044	4.88	19.99	7.90	36.70	0.97	None

COUNTY/STUDY: **Saunders**
DATE: **3/2/2018**

	Potential Peroxide Acidity	CCE/Sobek-NP	Saturated Paste			
Sample ID	**Tons $CaCO_3$/1000 Tons Material**	**Tons CaCO3 Eq/1000tons material**	**pH**	**EC (mS/cm)**	**% Total S**	**HCL Fizz Test**
B-017, 20-30	1.12	11.00	7.56	27.20	0.42	None
B-017, 80-90	5.99	11.98	7.77	14.73	0.67	None

CARDNO C. Saunders: VDOT-HRBT
Updated: 2/9/2018

Sample	Sample Depth (ft)									Sobek
		NP	% S	MPA	NNP	NP/MPA	PPA	pH	EC (uS/m)	Fizz #
B-023	0-10	15.37	0.7	21.88	-6.51	0.70	4.38	7.99	36	None
B-023	28-38	8.33	0.41	12.81	-4.48	0.65	1.59	7.41	35	None
B-023	88-98	251.88	0	0.00	251.88	#DIV/0!	0.00	7.79	32	Moderate

TS= <0.01 no detection

COUNTY/STUDY: **Saunders**
DATE: **3/14/2018**

	Potential Peroxide Acidity	CCE/Sobek-NP	Saturated Paste			
Sample ID	**Tons $CaCO_3$/1000 Tons Material**	**Tons CaCO3 Eq/1000tons material**	**pH**	**EC (mS/cm)**	**% Total S**	**HCL Fizz Test**
B-038, 0-10	0.00	179.21	7.71	23.20	0.01	Strong
B-038, 0-10	0.00	176.77	7.66	23.70	0.01	Strong