Broad Creek Federal Navigation Channel
Sediment and Effluent Water Investigation

Middlesex County, Virginia
April 2024

Presented by Biogenic Solutions Consulting, LLC

for Seaward Marine Corporation, the County of Middlesex (VA),

and the Middle Peninsula Planning District Commission

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Sign-Off Sheet

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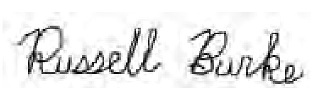

Russell Burke

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1.0 Project Description

1.1 Description

The River and Harbor Act of 2 March 1945 authorized the Broad Creek Federal Navigation Project. Broad Creek is located in Middlesex County, Virginia and provides a channel approximately 4,100 feet long, 7 feet deep, and 100 feet wide from deep water in the Rappahannock River to Broad Creek. Broad Creek requires maintenance dredging approximately once every ten years resulting in approximately 50,000 cubic yards of predominately sandy dredged material removed from the channel and placed in existing eight-acre upland confined disposal facility located at an area south of Route 33 (USACE 2008).

Figure 1. Broad Creek Federal Navigation Channel and sediment disposal/placement area.

1.2 Background

BSC is conducting this sediment and elutriate investigation in support of Seaward's contract with the County of Middlesex (VA), in coordination with the MPPDC. This investigation is undertaken, in part, to gather and provide the necessary information to the Virginia Department of Environmental Quality (VA DEQ) as part of the Virginia Water Protection Permit Program (VWPP), which includes the required 401-water quality certification mandated by the Clean Water Act (CWA). As was the intent of the United States Army Corps of Engineers (USACE) – Norfolk District in 2007/2008 (USACE 2008), this sediment and elutriate investigation will evaluate the effluent pathway to determine if dredged material placement operations in the upland confined disposal facility (CDF) will act as a pathway for the migration of contaminants. The bulk sediment testing will be evaluated for the presence or absence of contaminants of concern (COC). The sediment data will be evaluated using conservative screening protocols to determine the potential for impacts to the water column during dredged material placement operations. The elutriate data will be directly compared to numeric water quality criteria with consideration of initial dilution in an appropriate mixing zone to predict compliance with state standards.

The Broad Creek sediment and elutriate investigation has followed the framework established in the joint US Environmental Protection Agency (EPA) and USACE manual "Evaluation of Dredged Material For Discharge in Waters of the U.S. – Testing Manual" (EPA, 1998) and the USACE manual "Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual" (UTM)(USACE, 2003). The "Inland Testing Manual" (ITM), as it is often referred to, implements a tiered level approach for evaluating dredged material for disposal. Dredged material from the project shoals will be placed in existing CDFs. The tiered approach outlined in the ITM and UTM has been used to determine the suitability of dredged material for placement in the existing CDF and to ensure the appropriate process is followed under the Federal guidelines for evaluation of dredged material discharges (USACE 2008).

The tiered (tiers I – IV) approach to testing is designed to aid in generating appropriate information (i.e. physical, chemical, toxicity, and bioaccumulation data) sufficient to make factual determinations, but not more information than is necessary. Generally, as testing progresses through the tiers the level of intensity and costs increase for the investigation. Tier I evaluations utilize readily available, existing information for making factual determinations about the need for contaminant evaluations, testing exclusions, identifying contaminants of concern in dredged material, and to aid in the over-all decision-making process. The EPA and USACE recommends tier I reevaluations every three years for navigation projects that require annual or episodic dredging (EPA, 1998). The tier I reevaluation should reassess any new and previously evaluated data, changes in sediment composition, advances in analytical methods, and any regulatory changes to determine if further investigation under tier II is warranted (USACE 2008).

Tier II evaluations are concerned with sediment and water chemistry. The data generated in tier II allows for an evaluation of State water quality standard compliance. The tier II level evaluation for this project investigated the effluent water as a contaminant pathway which required the analysis of bulk sediment chemistry, site water, and elutriates for the specific COC. Analytical results from the modified elutriate analyses were utilized to evaluate effluent water quality against applicable water quality standards and state permit limits.

The list of target analytes required by the VA DEQ for Broad Creek includes the following: copper, zinc, and PCBs. This report will also include total organic carbon (TOC), particle-size, water content, specific gravity, and total suspended solids (elutriate only) for analysis to provide site specific data for further predictive modeling and screening evaluations if warranted.

1.3 Project Scope and Objectives

This sediment investigation was conducted within the Broad Creek Federal Navigation Channel in Middlesex County, Virginia. The dredged materials analyzed were maintenance sediments that had shoaled within the channel. However, unlike in 2007/2008, bulk sediment analysis did include new-work material in areas of interest <75 ft outside of the federal channel being considered for potential dredging in the future. This investigation was conducted to analyze the potential for a contaminant migration pathway from dredged material discharges from the associated CDF. This April 2024 investigation relied on predictive modeling (detailed in USACE 2008) to evaluate water column effects from effluent discharge to surface waters from dredged material placement operations from the CDF.

The work performed during this investigation involved the collection of sediment samples and site water. Additionally, the investigation involved the analysis of site water, bulk sediment chemistry for specific contaminants of concern (COC), preparation of elutriate samples, and analysis of effluent elutriate contaminant concentrations in the elutriate unfiltered sample (‘totals’) and the elutriate filtered sample (‘dissolved ‘fraction). Elutriate results were compared to applicable water quality standards. The stated objectives of the investigation were to:

- Collect sediments in the area to be dredged, both within the federal navigation channel and in select locations immediately adjacent to it.
- Collect samples representative of the bulk material to be dredged, both within the federal navigation channel and in select locations immediately adjacent to it.
- Test bulk sediments and site water in accordance with the USEPA/USACE, “Inland Testing Manual”.
- Prepare and test effluent elutriate in accordance with the “Upland Testing Manual” (USACE, 2003).
- Test bulk sediments, site water, and effluent elutriate for the copper, zinc, PCB, and physical characteristics of the sediment from the Broad Creek channel as well as select locations immediately adjacent to it.
- Compare analytical results of the effluent elutriate against applicable water quality standards with consideration of dilution in a mixing zone if needed.

1.4 Project Organization and Responsibilities

Project Manager: The Project Manager for this investigation is Dr. Russell Burke, the owner, and chief marine scientist of Biogenic Solutions Consulting, LLC (BSC).

Quality Assurance Officer: The Quality Assurance Officer (QAO) for this investigation is Dr. Russell Burke (BSC). The QAO is responsible for implementing the approved sampling plan.

Sampling Personnel: BSC employed trusted subcontractors to assist with sample collection (The Dive Locker LLC) and preparation (Getting It Done Company) on-board BSC's research vessel. BSC acquired the equipment and materials necessary for all sample collection and processing – some of which were provided by Universal Laboratories.

Primary Contract Laboratory: The contract laboratory for this investigation was Universal Laboratories (Hampton, VA). Universal Laboratories is National Environmental Laboratory Accreditation Program (NELAP) accredited, equipped, and capable of performing some of the proposed analytical work while meeting data quality objectives. The remaining analyses were subcontracted to Katahdin Analytical Services (Scarborough, ME), which is also NELAP accredited and certified to meet Virginia's standards.

2.0 Field Methodology

2.1 General Sampling Protocol

Sediment and site water samples were collected at the Broad Creek Federal Navigation Channel located in the Rappahannock River on April 20th and 21st, 2024. A total of eleven (11) discrete locations were sampled (Table 1). Sampling locations were located on shoaled areas previously identified by bathymetric survey within the Federal navigation channel. Sampling locations were selected to be representative of the project dredged material. The sampling methodologies utilized were consistent with EPA and USACE guidance for evaluating dredged materials under Section 404 of the CWA.

2.1.1 Water Sampling

Water samples were collected from two stations located within the project channel. Water was collected from approximately one meter above the channel bottom utilizing a submersible GeoTech pump utilizing 1/8" polyethylene tubing.

2.1.2 Sediment Sampling

2.1.2.1 Sampling Equipment

Sediment sampling was performed from a 24-foot Sea Ark aluminum johnboat owned and operated by BSC. Sediment samples were collected using a stainless steel tube auger. Sediment collected from each discrete location was placed in pre-labeled glass bottles and placed on ice within dedicated coolers.

Table 1. Coordinates of Broad Creek sediment, water, and elutriate sampling locations (April 2024).

Sample Site Number	Location (Inside/Outside Channel)	Latitude (N)	Longitude (W)
1*	Inside	37.55885	76.31400
2	Inside	37.55990	76.31381
3	Outside	37.56184	76.31417
4	Outside	37.56320	76.31433
5*	Inside	37.56361	76.31367
6	Outside	37.56615	76.31215
7	Inside	37.56686	76.31145
8	Outside	37.56751	76.31082
9	Outside	37.56839	76.31050
10 (and Duplicate Sample)	Outside	37.56958	76.30923
11	Inside	37.57074	76.30865

*Site where a separate water sample was collected

2.1.2.2 Sample Locations

The sample locations were preselected using a bathymetric map generated by the USACE (2023), and located in the field using a Garmin 76s GPS unit. Sample locations were located and two anchors (one at the bow, and one at the stern) were placed to mark sample locations to keep the boat on location. The water depth at each sample location was verified by a Lowrance depth sounder and SCUBA divers to ensure the presence of shoaled material prior to sample collection (Refer to Figure 2 for sample locations).

2.1.2.3 Sample Collection and Processing

Cores were advanced manually by turning the tee-handle of the tube auger; when resistance was experienced (generally at locations with coarser sand), a pole pounder was used to achieve the desired sediment sampling depth. Multiple cores were pulled at each sample location to provide adequate sample volume for sediment and elutriate analysis. All sediment samples were collected as discrete samples for each proposed sample location. Collected sediment was placed in individual five-gallon buckets and homogenized and then transferred to the appropriate labeled glass sample containers and then placed on ice in coolers and stored at a maximum temperature of 4 degrees Celsius. Sediments samples were processed and packaged for chemical, geotechnical, and elutriate analyses. Chain-of-custody forms were completed and sealed in the coolers prior to transport. Samples were transported by truck to Universal Laboratories in Hampton, VA on April 22, 2024; PCB and Grain size analysis was conducted by Katahdin

Analytical Services – samples were shipped to them overnight by Federal Express and were received on April 23, 2024, in Scarborough, Maine. All chain-of-custody protocols were followed and samples arrived at the laboratory intact and at proper storage temperature.

2.1.3 Sample Identification Protocol

All samples collected during the field investigation were identified and labeled with a site-specific sample identification code. The site-specific sample code was based on the following system:

Sample ID: 24-XX-YY-#
2024- Fiscal Year
XX- BC - Project Designation, where BC = Broad Creek
YY- Sample Type: Two letter code, where SS = Sediment Sample, SW = Site Water, EL = Elutriate Sample, FD = Field Duplicate, EB = Equipment Blank, and TB = Trip Blank.
- Sample Number: Sample number will be designated 1, 2, and 3 for each sediment sample and elutriate sample location from each discrete site.

Example sample ID for discrete sediment sample collected at location 1 at the Broad Creek project, 24-BC-SS-1. Example sample ID for site water sample collected from Broad Creek project, 24-BC-SW-1. Example sample ID for discrete elutriate sample collected at location 1 at the Broad Creek project, 24-BC-EL-1.

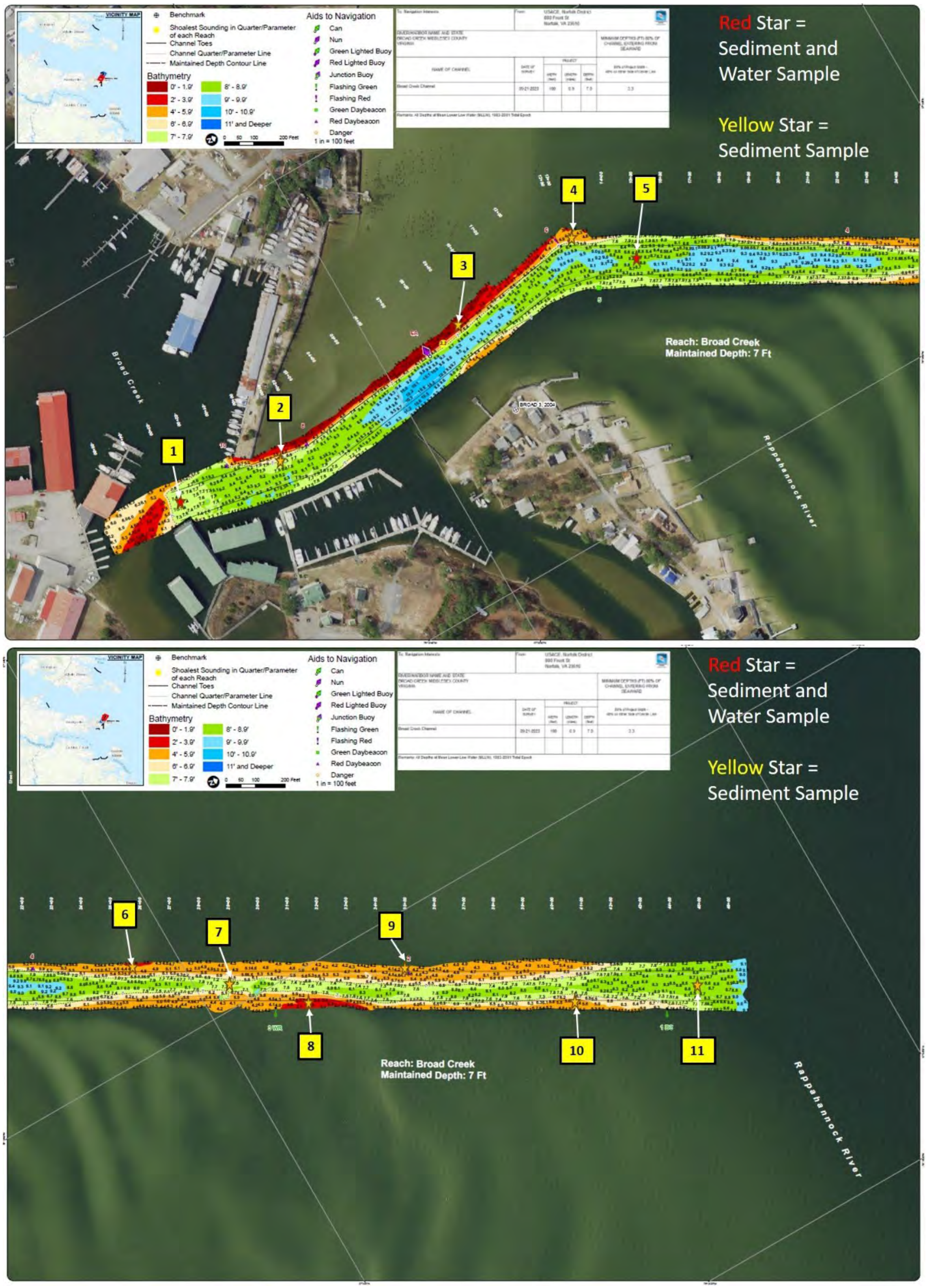

Figure 2. Broad Creek Federal Navigation Channel sediment and water sampling locations (selected April 2024) overlaid on a bathymetric survey map (Survey Date: September 21, 2023) produced by the USACE – Norfolk District, using revised benchmarks (updated on August 14, 2014).

3.0 Laboratory Results

3.1 General Description

The following sections provide both descriptive summaries and laboratory result summaries of the chemical and geotechnical analyses of sediment and elutriate testing from the Broad Creek Federal Navigation Project (samples collected in April 2024).

3.2 Laboratory Results

The following summaries of laboratory results provide a description of the contaminant concentrations in the sediment and elutriate samples and the general distribution of the contaminants throughout the Broad Creek Federal Navigation Project (samples collected in April 2024).

3.2.1 Sediment Results

3.2.1.1 Metals

The metals copper and zinc were detected throughout the project sediments at low concentrations generally well below published sediment screening guidelines. The concentration range for detected metals in the sediment samples were as follows:

- Copper was detected at sites 1 through 5, but not at sites 6 through 11.
  - Where detected, copper concentrations ranged from 0.926 mg/kg (Site 4) to 36.1 mg/kg (Site 1). The average of the concentrations was 6.0 mg/kg.
  - For the sites inside of the federal channel, the average copper concentration was 12.4 mg/kg, while outside of the channel, the average was 0.5 mg/kg.
- Zinc was detected at all eleven (11) sample locations.
  - The concentrations ranged from 2.66 mg/kg to 51.7 mg/kg. The average of the concentrations was 15.6 mg/kg.
  - For the sites inside of the federal channel, the average zinc concentration was 29.0 mg/kg, while outside of the channel, the average was 4.4 mg/kg.

3.2.1.2 Total PCBs

Total PCBs were determined by the summation of congeners following Federal guidance in the EPA/USACE “Inland Testing Manual” referencing the NOAA, 1989, Status and Trends. PCB congeners were not detected at any sediment sampling locations.

3.2.1.3 General Chemistry

Total organic carbon (TOC) concentrations were determined at each sample location. The TOC concentrations ranged from 670 mg/kg to 18,000 mg/kg. The average of the concentrations was 5,525 mg/kg. For the sites inside of the federal channel, the average TOC concentration was 10,500 mg/kg, while outside of the channel, the average was 1,378 mg/kg.

The percentage of solids in the samples ranged from 41.4% to 72.2% in the Universal Laboratories (UL) analyses, and 51% to 77% in the Katahdin Analytical Services (KAS) analyses. Both labs measured higher average percentage of solids outside of the channel (UL: 65.5%; KAS: 74.3%) than inside of the channel (UL: 57.7%; KAS: 61.0%)

3.2.1.4 Geotechnical

Standard sieve and hydrometer analyses were performed to determine grain size distribution at each sample location at Broad Creek. The grain size analyses indicate that the sediments are predominately sand with all but two sample locations (sites 1 and 2) containing at least 90% sand and gravel. Sample location SS-2 exhibited the highest percentage of fine-grained sediments, containing 67% sand and 33% silt and clays. For the sites inside of the federal channel, ~90% of the sediment was sand and gravel (~10% fines), while outside of the channel, 100.0% of the sediment was sand and gravel, with no silt and clays detected.

3.2.2 Elutriate Results

3.2.2.1 Metals

Analyses for the metals copper and zinc were performed in both unfiltered (total concentration) and filtered (dissolved concentration) elutriate samples. Both copper and zinc were detected in the unfiltered elutriate samples. The concentration range for copper and zinc in the unfiltered elutriate samples were as follows:

- Copper was detected in 4 of the 11 unfiltered elutriate samples. Copper concentrations ranged from <5 to 2,781 µg/L; the average copper concentration was 50 µg/L.
    - A subsequent analysis of a subset of sediment samples (for site 1, 2, 3, 5, 6, and 10) that was conducted fully in the lab revealed more consistent copper concentrations than the original analysis (which had certain steps conducted in the field), ranging from 12 to 26 µg/L.
- Zinc was detected in all of the unfiltered elutriate samples. Zinc concentrations ranged from 146 to 4,154 µg/L; the average zinc concentration was 93 µg/L.
    - A subsequent analysis of a subset of sediment samples (for site 1, 2, 3, 5, 6, and 10) that was conducted fully in the lab revealed more consistent zinc concentrations than the original analysis (which had certain steps conducted in the field), ranging from 30 to 75 µg/L.

The laboratory affixed a qualifier to each zinc result indicating that this analyte was positively detected above the method detection limit but was below the reporting limit.

3.2.2.2 Total PCBs

Total PCB was determined by the summation of congeners following Federal guidance in the EPA/USACE “Inland Testing Manual” referencing NOAA, 1998, Status and Trends.

- PCB Congeners were not detected in any of the unfiltered or filtered elutriate samples at inside or outside of the federal navigation channel.

3.2.3 Site Water Results

Laboratory results show that there were no detectable levels of PCB congeners or the metals copper (0.013 mg/L) and zinc (0.012 mg/L) in the surface water at the Broad Creek project site. General chemistry results for the two aqueous grabs (sites 1 and 5) were an average total organic carbon of 3.5 mg/L and average total suspended solids of 11.7 mg/L.

Table 2. Sediment results for the Broad Creek Federal Navigation Channel (April 2024).

Target Compound	CAS Number	Units	MDL	RL	24-BC-SS-1	24-BC-SS-2	24-BC-SS-3	24-BC-SS-4	24-BC-SS-5	24-BC-SS-6	24-BC-SS-7	24-BC-SS-8	24-BC-SS-9	24-BC-SS-10	24-BC-SS-11	24-BC-SS-10FD
Penetration Depth (in ft) of Sediment Core Sample					3	3	5	4	2	4	3	4	4	4	2	4
Metals by ICP (SW-846 Method: EPA 6010C)																
Copper	7440-50-8	mg/kg		0.5	36.1	22.6	2.25	0.926	3.52	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	7440-66-6	mg/kg		2	51.7	41.2	5.04	5.51	44.4	4.46	3.99	2.66	4.45	4.46	3.47	8.04
Polychlorinated Biphenyls (SW-846 Method: 8082A)																
PCB 8 (2,4'-Dichlorobiphenyl)	34883-43-7	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 18 (2,2',5-Trichlorobiphenyl)	37680-65-2	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 28 (2,4,4'-Trichlorobiphenyl)	7012-37-5	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)	35693-99-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 49 (2,2',4,5'-Tetrachlorobiphenyl)	41464-40-8	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 44 (2,2',3,5'-Tetrachlorobiphenyl)	41464-39-5	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 66 (2,3'4,4'-Tetrachlorobiphenyl)	32598-10-0	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl)	37680-73-2	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 87 (2,2',3,4,5'-Pentachlorobiphenyl)	38380-02-8	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 81 (3,4,4',5-Tetrachlorobiphenyl)	70362-50-4	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 77 (3,3',4,4'-Tetrachlorobiphenyl)	32598-13-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 123 (2',3,4,4',5-Pentachlorobiphenyl)	65510-44-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)	31508-00-6	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)	74472-37-0	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 184 (2,2',3,4,4',6,6'-Heptachlorobiphenyl)	74472-48-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)	35065-27-1	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)	32598-14-4	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl)	35065-28-2	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 187 (2,2',3,4',5,5',6-Heptachlorobiphenyl)	52663-68-0	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 183 (2,2',3,4,4',5',6-Heptachlorobiphenyl)	52663-69-1	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)	57465-28-8	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 128 (2',3,3',4,4'-Hexachlorobiphenyl)	38380-07-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 167 (2,3',4,4',5,5'-Hexachlorobiphenyl)	52663-72-6	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)	38380-08-4	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 157 (2,3,3',4,4',5'-Hexachlorobiphenyl)	69782-90-7	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)	35065-29-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 170 (2,2',3,3',4,4',5-Heptachlorobiphenyl)	35065-30-6	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 169 (3,3',4,4',5,5'-Hexachlorobiphenyl)	32774-16-6	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 189 (2,3,3',4,4',5,5'-Heptachlorobiphenyl)	39635-31-9	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 195 (2,2',3,3',4,4',5,6-Octachlorobiphenyl)	52663-78-2	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl)	40186-72-9	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl)	2051-24-3	µg/kg DW			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	1336-36-3	µg/kg DW														
Total Suspended Solids - TSS (SM2540G (2011)) - TSS (SM 3540C) run by KAS		%		0.1	55.8	57.8	68.7	62.5	41.4	72.2	63.5	68.0	65.6	55.8	70.1	61.8
Total Organic Carbon - TOC (Method: Lloyd Kahn) -Method: SM5310B (for Aqueous Analysis)		µg/g DW			16000	18000	1300	1400	15000	1300	1600	670	2100	1500	1900	1300
Water Content (ASTM D2216)		%			49.166	46.020	25.508	26.883	45.006	22.605	26.848	24.555	25.754	27.100	27.651	27.344
Specific Gravity (ASTM D5057-90)				0.1	1.453	1.418	1.868	1.823	1.322	1.945	1.886	1.926	1.833	1.877	1.865	1.847
Particle Size (ASTM D422)																
%Gravel					1.08	4.33	0.25	0.30	36.66	0.00	0.00	1.27	0.30	0.09	0.19	0.22
%Sand					86.71	62.65	99.75	99.71	57.35	100.00	99.99	98.73	99.69	99.90	99.81	97.65
%Silt, Clay, Colloids					12.21	33.03	0.00	0.00	5.99	0.00	0.00	0.00	0.00	0.00	0.00	2.12

RL - Reporting Limit
MDL - Method Detection Limit
Cells in Yellow indicate sites that do not meet VMRC's requirements regarding shoreline placement for material containing less than 10 percent fines
Note: Total PCBs to be determined by summation of the listed congeners following the approach in the ITM, (EPA, 1998)

Table 3. Site water and elutriate results for the Broad Creek Federal Navigation Channel (April 2024).

			VA WATER QUALITY STANDARDS											
			VA Aquatic Life	VA Aquatic Life	All Other									
Target Compound	CAS Number	Units	Saltwater Acute	Saltwater Chronic	Surface Waters	MDL	RL	24-BC-SW-1	24-BC-EL-1	24-BC-EL-1(F)	24-BC-EL-2	24-BC-EL-2(F)	24-BC-EL-3	24-BC-EL-3(F)
Metals by ICP (SW-846 Method: EPA 6010C)														
Copper (Analyzed in April 2024)	7440-50-8	µg/L	9.3	6			0.5	14	2781	11	2300	10	75	20
Zinc (Analyzed in April 2024)	7440-66-6	µg/L	90	81	69,000		2	15	4154	1156	3166	595	146	432
Copper (Analyzed in October 2024)	7440-50-8	µg/L	9.3	6			0.5		14	12	14	12	23	13
Zinc (Analyzed in October 2024)	7440-66-6	µg/L	90	81	69,000		2		35	31	26	26	72	67
Polychlorinated Biphenyls (SW-846 Method: 8082A)														
PCB 8 (2,4'-Dichlorobiphenyl)	34883-43-7	µg/kg DW				0.042	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 18 (2,2',5-Trichlorobiphenyl)	37680-65-2	µg/kg DW				0.017	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 28 (2,4,4'-Trichlorobiphenyl)	7012-37-5	µg/kg DW				0.026	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)	35693-99-3	µg/kg DW				0.0025	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 49 (2,2',4,5'-Tetrachlorobiphenyl)	41464-40-8	µg/kg DW				0.0065	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 44 (2,2',3,5'-Tetrachlorobiphenyl)	41464-39-5	µg/kg DW				0.0061	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 66 (2,3'4,4'-Tetrachlorobiphenyl)	32598-10-0	µg/kg DW				0.0033	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl)	37680-73-2	µg/kg DW				0.0076	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 87 (2,2',3,4,5'-Pentachlorobiphenyl)	38380-02-8	µg/kg DW				0.0081	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 81 (3,4,4',5-Tetrachlorobiphenyl)	70362-50-4	µg/kg DW				0.0039	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 77 (3,3',4,4'-Tetrachlorobiphenyl)	32598-13-3	µg/kg DW				0.003	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 123 (2',3,4,4',5-Pentachlorobiphenyl)	65510-44-3	µg/kg DW				0.009	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)	31508-00-6	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)	74472-37-0	µg/kg DW				0.0015	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 184 (2,2',3,4,4',6,6'-Heptachlorobiphenyl)	74472-48-3	µg/kg DW				0.0075	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)	35065-27-1	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)	32598-14-4	µg/kg DW				0.0028	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl)	35065-28-2	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 187 (2,2',3,4',5,5',6-Heptachlorobiphenyl)	52663-68-0	µg/kg DW				0.0069	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 183 (2,2',3,4,4',5',6-Heptachlorobiphenyl)	52663-69-1	µg/kg DW				0.0089	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)	57465-28-8	µg/kg DW				0.015	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 128 (2',3,3',4,4'-Hexachlorobiphenyl)	38380-07-3	µg/kg DW				0.0052	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 167 (2,3',4,4',5,5'-Hexachlorobiphenyl)	52663-72-6	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)	38380-08-4	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 157 (2,3,3',4,4',5'-Hexachlorobiphenyl)	69782-90-7	µg/kg DW				0.0029	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)	35065-29-3	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 170 (2,2',3,3',4,4',5-Heptachlorobiphenyl)	35065-30-6	µg/kg DW				0.002	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 169 (3,3',4,4',5,5'-Hexachlorobiphenyl)	32774-16-6	µg/kg DW				0.0066	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 189 (2,3,3',4,4',5,5'-Heptachlorobiphenyl)	39635-31-9	µg/kg DW				0.012	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 195 (2,2',3,3',4,4',5,6-Octachlorobiphenyl)	52663-78-2	µg/kg DW				0.0094	0.093	ND	ND	ND	ND	ND	ND	ND
PCB 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl)	40186-72-9	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND
PCB 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl)	2051-24-3	µg/kg DW				0.0023	0.019	ND	ND	ND	ND	ND	ND	ND
Total PCBs	1336-36-3	µg/kg DW			0.0017									
Total Organic Carbon - TOC (Method: SM5310B)		µg/g DW				0.35	1	3.6	17		19		7.9	
Total Suspended Solids - TSS (SM 2540G (2011))		%					0.1	9.5	37060		32900		3360	

RL - Reporting Limit
MDL - Method Detection Limit
Note: Total PCBs to be determined by summation of the listed congeners following the approach in the ITM, (EPA, 1998)

			VA WATER QUALITY STANDARDS													
			VA Aquatic Life	VA Aquatic Life	All Other											
Target Compound	CAS Number	Units	Saltwater Acute	Saltwater Chronic	Surface Waters	MDL	RL	24-BC-EL-4	24-BC-EL-4(F)	24-BC-SW-5	24-BC-EL-5	24-BC-EL-5(F)	24-BC-EL-6	24-BC-EL-6(F)	24-BC-EL-7	24-BC-EL-7(F)
Metals by ICP (SW-846 Method: EPA 6010C)																
Copper	7440-50-8	µg/L	9.3	6			0.5	99	10	12	180	10	<5	12	<5	10
Zinc	7440-66-6	µg/L	90	81	69,000		2	559	220	9	1801	747	687	676	354	211
Copper (Analyzed in October 2024)	7440-50-8	µg/L	9.3	6			0.5				16	15	19	17		
Zinc (Analyzed in October 2024)	7440-66-6	µg/L	90	81	69,000		2				71	66	34	30		
Polychlorinated Biphenyls (SW-846 Method: 8082A)																
PCB 8 (2,4'-Dichlorobiphenyl)	34883-43-7	µg/kg DW				0.042	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 18 (2,2',5-Trichlorobiphenyl)	37680-65-2	µg/kg DW				0.017	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 28 (2,4,4'-Trichlorobiphenyl)	7012-37-5	µg/kg DW				0.026	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)	35693-99-3	µg/kg DW				0.0025	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 49 (2,2',4,5'-Tetrachlorobiphenyl)	41464-40-8	µg/kg DW				0.0065	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 44 (2,2',3,5'-Tetrachlorobiphenyl)	41464-39-5	µg/kg DW				0.0061	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 66 (2,3'4,4'-Tetrachlorobiphenyl)	32598-10-0	µg/kg DW				0.0033	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl)	37680-73-2	µg/kg DW				0.0076	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 87 (2,2',3,4,5'-Pentachlorobiphenyl)	38380-02-8	µg/kg DW				0.0081	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 81 (3,4,4',5-Tetrachlorobiphenyl)	70362-50-4	µg/kg DW				0.0039	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 77 (3,3',4,4'-Tetrachlorobiphenyl)	32598-13-3	µg/kg DW				0.003	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 123 (2',3,4,4',5-Pentachlorobiphenyl)	65510-44-3	µg/kg DW				0.009	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)	31508-00-6	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)	74472-37-0	µg/kg DW				0.0015	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 184 (2,2',3,4,4',6,6'-Heptachlorobiphenyl)	74472-48-3	µg/kg DW				0.0075	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)	35065-27-1	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)	32598-14-4	µg/kg DW				0.0028	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl)	35065-28-2	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 187 (2,2',3,4',5,5',6-Heptachlorobiphenyl)	52663-68-0	µg/kg DW				0.0069	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 183 (2,2',3,4,4',5',6-Heptachlorobiphenyl)	52663-69-1	µg/kg DW				0.0089	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)	57465-28-8	µg/kg DW				0.015	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 128 (2',3,3',4,4'-Hexachlorobiphenyl)	38380-07-3	µg/kg DW				0.0052	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 167 (2,3',4,4',5,5'-Hexachlorobiphenyl)	52663-72-6	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)	38380-08-4	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 157 (2,3,3',4,4',5'-Hexachlorobiphenyl)	69782-90-7	µg/kg DW				0.0029	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)	35065-29-3	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 170 (2,2',3,3',4,4',5-Heptachlorobiphenyl)	35065-30-6	µg/kg DW				0.002	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 169 (3,3',4,4',5,5'-Hexachlorobiphenyl)	32774-16-6	µg/kg DW				0.0066	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 189 (2,3,3',4,4',5,5'-Heptachlorobiphenyl)	39635-31-9	µg/kg DW				0.012	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 195 (2,2',3,3',4,4',5,6-Octachlorobiphenyl)	52663-78-2	µg/kg DW				0.0094	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl)	40186-72-9	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl)	2051-24-3	µg/kg DW				0.0023	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	1336-36-3	µg/kg DW			0.0017											
Total Organic Carbon - TOC (Method: SM5310B)		µg/g DW				0.35	1	9.6		3.4	11		7.4		5.7	
Total Suspended Solids - TSS (SM 2540G (2011))		%					0.1	4860		13.8	38660		21700		6520	

RL - Reporting Limit
MDL - Method Detection Limit
Note: Total PCBs to be determined by summation of the listed congeners following the approach in the ITM, (EPA, 1998)

Table 3 continued.

			VA WATER QUALITY STANDARDS															
Target Compound	CAS Number	Units	VA Aquatic Life Saltwater Acute	VA Aquatic Life Saltwater Chronic	All Other Surface Waters	MDL	RL	24-BC-EL-8	24-BC-EL-8(F)	24-BC-EL-9	24-BC-EL-9(F)	24-BC-EL-10	24-BC-EL-10(F)	24-BC-EL-11	24-BC-EL-11(F)	24-BC-EL-10FD	24-BC-EL-10FD(F)	24-BC-EL-EB(F)
Metals by ICP (SW-846 Method: EPA 6010C)																		
Copper	7440-50-8	µg/L	9.3	6			0.5	14	10	<5	10	26	10	<5	11	17	11	14
Zinc	7440-66-6	µg/L	90	81	69,000		2	175	228	287	217	268	353	342	378	241	270	104
Copper (Analyzed in October 2024)	7440-50-8	µg/L	9.3	6			0.5					26	18					<5
Zinc (Analyzed in October 2024)	7440-66-6	µg/L	90	81	69,000		2					75	69					<5
Polychlorinated Biphenyls (SW-846 Method: 8082A)																		
PCB 8 (2,4'-Dichlorobiphenyl)	34883-43-7	µg/kg DW				0.042	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 18 (2,2',5-Trichlorobiphenyl)	37680-65-2	µg/kg DW				0.017	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 28 (2,4,4'-Trichlorobiphenyl)	7012-37-5	µg/kg DW				0.026	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)	35693-99-3	µg/kg DW				0.0025	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 49 (2,2',4,5'-Tetrachlorobiphenyl)	41464-40-8	µg/kg DW				0.0065	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 44 (2,2',3,5'-Tetrachlorobiphenyl)	41464-39-5	µg/kg DW				0.0061	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 66 (2,3'4,4'-Tetrachlorobiphenyl)	32598-10-0	µg/kg DW				0.0033	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl)	37680-73-2	µg/kg DW				0.0076	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 87 (2,2',3,4,5'-Pentachlorobiphenyl)	38380-02-8	µg/kg DW				0.0081	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 81 (3,4,4',5-Tetrachlorobiphenyl)	70362-50-4	µg/kg DW				0.0039	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 77 (3,3',4,4'-Tetrachlorobiphenyl)	32598-13-3	µg/kg DW				0.003	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 123 (2',3,4,4',5-Pentachlorobiphenyl)	65510-44-3	µg/kg DW				0.009	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)	31508-00-6	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)	74472-37-0	µg/kg DW				0.0015	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 184 (2,2',3,4,4',6,6'-Heptachlorobiphenyl)	74472-48-3	µg/kg DW				0.0075	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)	35065-27-1	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)	32598-14-4	µg/kg DW				0.0028	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl)	35065-28-2	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 187 (2,2',3,4',5,5',6-Heptachlorobiphenyl)	52663-68-0	µg/kg DW				0.0069	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 183 (2,2',3,4,4',5',6-Heptachlorobiphenyl)	52663-69-1	µg/kg DW				0.0089	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)	57465-28-8	µg/kg DW				0.015	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 128 (2',3,3',4,4'-Hexachlorobiphenyl)	38380-07-3	µg/kg DW				0.0052	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 167 (2,3',4,4',5,5'-Hexachlorobiphenyl)	52663-72-6	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)	38380-08-4	µg/kg DW				0.0012	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 157 (2,3,3',4,4',5'-Hexachlorobiphenyl)	69782-90-7	µg/kg DW				0.0029	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)	35065-29-3	µg/kg DW				0.0045	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 170 (2,2',3,3',4,4',5-Heptachlorobiphenyl)	35065-30-6	µg/kg DW				0.002	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 169 (3,3',4,4',5,5'-Hexachlorobiphenyl)	32774-16-6	µg/kg DW				0.0066	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 189 (2,3,3',4,4',5,5'-Heptachlorobiphenyl)	39635-31-9	µg/kg DW				0.012	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 195 (2,2',3,3',4,4',5,6-Octachlorobiphenyl)	52663-78-2	µg/kg DW				0.0094	0.093	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 206 (2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl)	40186-72-9	µg/kg DW				0.0022	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PCB 209 (2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl)	2051-24-3	µg/kg DW				0.0023	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Total PCBs	1336-36-3	µg/kg DW			0.0017													
Total Organic Carbon - TOC (Method: SM5310B)		µg/g DW				0.35	1	6.2		7		11		5.4		9.5		
Total Suspended Solids - TSS (SM 2540G (2011))		%					0.1	1560		22660		12440		6020		3560		
RL - Reporting Limit																		
MDL - Method Detection Limit																		
Note: Total PCBs to be determined by summation of the listed congeners following the approach in the ITM, (EPA, 1998)																		

4.0 Discussion

4.1 Overview – Screening Assessments Under Section 404

The USACE conducts Civil Works dredging and dredged material discharge activities in accordance with Section 404 of the Clean Water Act (CWA). Section 404 further requires that discharge sites be specified through the application of the Section 404(b)(1) Guidelines developed by EPA in conjunction with the USACE. Section 404 requires that the guidelines be based upon criteria comparable to the criteria applicable to the territorial seas, contiguous zone, and the ocean". Additionally, Section 401 of the CWA requires that discharges of dredged material into waters of the United States be certified as complying with applicable State water quality standards. The joint EPA and USACE ITM and UTM testing manuals provide procedures applicable to determining the potential for contaminant-related environmental impacts associated with the discharge of dredged material. The ITM and UTM testing procedures are intended to provide sufficient data to make factual determinations under Section 404 of the CWA (USACE 2008).

4.2 Tiered Assessment (Testing)

A tiered approach to testing (I-IV) is used by the EPA and USACE to evaluate the suitability of dredged material for various placement options. The following is a brief description of the tiers in the ITM:

a. The initial tier (Tier I) uses readily available, existing information (including all previous testing).

b. Tier II is concerned solely with sediment and water chemistry.
c. Tier III is concerned with well-defined, nationally-accepted toxicity and bioaccumulation testing procedures.
d. Tier IV allows for case-specific laboratory and field-testing, and is intended for use in unusual circumstances.

Because the procedures in the ITM and UTM are arranged in a series of tiers, or levels of intensity (and cost) of investigation, the tiered testing results in environmental protection in the context of more efficient completion of necessary evaluations and reduced costs, especially to low-risk operations. It is necessary to proceed through the tiers only until information sufficient to make factual determinations has been obtained (USACE 2008).

4.3 Tier 1 – Project Assessment

The first step in the evaluation process is the determination of the need for contaminant evaluations based on the "reason to believe" contaminants of concern (COC) may be present in the dredged material. The decision not to test is based on available information that provides a reasonable assurance that the proposed discharge of dredged material is not a carrier of contaminants. The reason to believe no testing is required is based on the type of dredged material and its potential to be contaminated. No further evaluation is needed if any one of the following criteria is met:

a. The dredged material is excavated from a site far removed from existing and historical sources of contaminants, so as to provide a reasonable assurance that the dredged material does not contain them.
b. The dredged material is composed predominantly of sand, gravel, and/or rock.
c. The dredged material is composed of previously undisturbed geological materials that have not been exposed to modern sources of pollution.

Tier I evaluations utilize readily available, existing information for making factual determinations about testing exclusions, identifying contaminants of concern in dredged material, and to aid in the overall decision-making process. In the Tier I decision sequence; the first possibility is that more information is required to make a factual determination.

4.3.1 Contaminants of Concern

The COC for this sampling event were provided by the VA DEQ in 2007. That year, a sediment sampling point in the upstream reaches of Broad Creek indicated the presence of copper and zinc at or above the Effects Range – Median (ER-M) screening guideline published as part of the National Sediment Quality Survey. Additionally, VA DEQ had found accumulation of PCBs in fish tissues in the Rappahannock River system for which a source has not been identified. And, though there were no PCBs detected in any of the samples taken within the Broad Creek federal navigation channel in October 2007, the VA DEQ indicated in April 2024 that it would favor that the same analytical standards be maintained for this survey – thus, the County, MPPDC, Seaward, and BSC coordinated to maintain the same standards set by the USACE (2008) during the last assessment of water and sediment samples at Broad Creek.

4.3.2 Pathways of Concern

The effluent pathway will be the focus of this investigation to determine if it will meet requirements for Section 401 State Water Quality Certification and to ensure compliance with Section 404 requirements. The effluent pathway involves movement of large masses of water for hydraulically filled sites. Thus, the effluent pathway has the potential to act as a pathway for the migration of contaminants, if present, as a result of dredged material placement operations (USACE 2008).

4.3.3 Tier 1 Decisions

The rationale for decision-making presented in the ITM for the Tier I evaluation will be either:

a. Existing information does not provide a sufficient basis for making factual determinations. In this case, further evaluation in higher tiers is appropriate.
b. Existing information provides a sufficient basis for making factual determinations. In this case, one of the following decisions is reached:
   - The material meets the exclusion criteria.
   - The material does not meet exclusion criteria but information concerning the potential impact of the material is sufficient to make factual determinations.

4.3.4 Tier 1 Conclusions for Broad Creek Channel

Historically, the Broad Creek channel sediments has been comprised of predominantly >90% sands. Additionally, the project location is far removed from industrial sources of anthropogenic contamination. Generally, the project conditions would meet exclusion criteria. However, in 2007, the VA DEQ required testing of the project sediments to demonstrate compliance with State requirements when dredged; the VA DEQ indicated an interest in seeing similar testing done in 2024 as well. Therefore, the Tier I decision was by-passed and the investigation moved directly to Tier II evaluations.

4.4 Tier 2 – Sediment and Water Chemistry

Tier II utilizes sediment and water chemistry as well as conservative screening evaluations and elutriate testing procedures to evaluate the potential for a water column impact and compliance with 40 CFR Section 230.10(b)(1).

4.4.1 Screen Relative to Water Quality Standards (WQS)

This conservative screen is based on the assumption that all of the contaminants in the dredged material are completely released to the water column during the discharge operation. This screen is conservative because, in virtually all cases, most of the contaminants remain within the dredged material. If the screen predicts that all concentrations of all the COC after consideration of mixing are less than the applicable WQS then the dredged material complies with WQS. If the screen predicts that the WQS will be exceeded, the elutriate analysis should be utilized.

Application of the conservative screen relative to WQS at Broad Creek indicates the assumption that a complete release of all COC to the water column would result in WQS being exceeded after consideration of mixing. Therefore, the elutriate analysis approach was employed to make a factual determination of compliance with WQS.

4.4.2 Elutriate Analysis Relative to WQS

The modified elutriate test (MET) conservatively predicts effluent water quality based on laboratory elutriate simulation of the dredged material discharge. The results reflect the predicted concentrations of COC in the effluent discharge from the CDF (i.e. over the weir structure). The appropriate unfiltered or filtered MET results should be compared directly to available numeric water quality standards considering dilution in a mixing zone in the immediate vicinity of the CDF discharge. Water quality standards must be met at the boundary of a state approved mixing zone. Comparisons of predicted concentrations from MET results to water quality standards should consider background concentrations in the receiving water. If the background concentrations exceed the standards, then the dredged material discharge will not comply with water quality standards regardless of dilution in a mixing zone.

As in 2007/2008, the 2024 MET results indicate that the proposed dredged material discharge at Broad Creek will comply with applicable WQS for the COC analyzed. And though, in 2024, filtered elutriate results for copper slightly exceeded the “Aquatic Life, Saltwater Chronic” criteria (6.0 ug/l) at the end-of-pipe, this appears to be more of an issue of detection limit than anything else – irrespective of the potential cause of these values exceeding the aforementioned criteria, these values are very close to the thresholds and are likely not problematic. Upon reanalysis of the sediment for zinc (in October 2024), all filtered elutriate values were notably below the published thresholds of 81 and 90 µg/L for chronic and acute exposure, respectively; thus, it appears that zinc contamination is not a significant concern within, or outside of, the Broad Creek channel. The filtered elutriate was evaluated against WQS for metals since it represents the dissolved fraction of the contaminant. The dissolved fraction is fraction of the contaminant that is considered bio-available to aquatic life and exposure to concentrations above the WQS may result in acute impacts.

4.4.3 Tier 2 Decisions

Based on the findings of this report, the available WQS requirements are met. Thus, the potential water column impacts of the proposed dredged material discharge are acceptable.

4.4.4 Tier 2 Conclusions for Broad Creek Channel

Based on the evaluation of elutriate analysis relative to WQS, all available WQS requirements will be met for the proposed Broad Creek Federal Navigation Channel dredged material discharge – as was the case in 2007/2008. Based on the evaluation of dredged material testing results (summarized in this report, with raw data available in the appendices). the Broad Creek Channel project dredged material discharge will comply with 404(b)(1) requirements and meets requirements for state Section 401 certification.

5.0 References

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Appendices can be found as standalone documents from Universal Labs (42 pages, from May 2024), Katahdin Analytical Services (634 pages), and Universal Labs (14 pages, from October 2024).