Appendix I. Water Quality Assessment Report and River Sediment Quality Assessment Report
Water Quality Assessment Report
THE DISTRICT OF COLUMBIA
WATER QUALITY ASSESSMENT

2008 INTEGRATED REPORT TO THE ENVIRONMENTAL PROTECTION AGENCY
AND U.S. CONGRESS PURSUANT TO
SECTIONS 305(b) AND 303(d) CLEAN WATER ACT (P.L. 97-117)

District Department of the Environment
Natural Resources Administration
Water Quality Division

Government of the
District of Columbia
Adrian M. Fenty, Mayor
# Detail Report for POTOMAC DC

**ID:** DCPMS00E_01  
**State:** DC - 2008  
**Single Cat.(User Cat.):** 5(N/A)

## Water Information

- **Location:** HAINES POINT TO WOODROW WILSON BRIDGE (PRINCE GEORGE'S COUNTY MARYLAND LINE) (FMS29 TO FMS44), TIDAL FRESHWATER. RIVER PASSES THROUGH AN URBAN AREA OF COMMERCIAL BUILDINGS, MILITARY BASES AND MUNICIPAL FACILITIES.
- **Water Type:** ESTUARY
- **Size:** 3.05 SQUARE MILES
- **Next Scheduled Monitoring Date:** N/A

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|                   | Secondary Contact Recreation and Aesthetic Enjoyment |
| Not Supporting    | Primary Contact Recreation  
|                   | Protection of Human Health related to Consumption of Fish and Shellfish |

## Types of Assessment

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<td>Separate Storm Sewer Systems</td>
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74
Overall Assessment

THE POTOMAC ESTUARY SEGMENT UNDER REVIEW EXTENDS FROM HAINS POINT TO WOODROW WILSON BRIDGE. THIS SEGMENT IS AFFECTED BY HIGH FECAL COLIFORM LEVELS, BLUE PLAINS OUTFALL LOADINGS, AND OCCASIONAL MAINTENANCE ACTIVITIES AT WOODROW WILSON BRIDGE. AMBIENT MONITORING DATA FROM 2003 TO 2007 WERE ANALYZED FOR THE USE SUPPORT DETERMINATIONS.

FOR THE PERIOD UNDER STUDY, TEMPERATURE, DISSOLVED OXYGEN, AND PH OBSERVATIONS MET AQUATIC LIFE USE SUPPORT CRITERIA. A REVIEW OF THE DATA FOR THIS SEGMENT SHOWED THAT 9.6% OF THE TIME PH OBSERVATIONS WERE IN VIOLATION OF ITS AQUATIC LIFE SUPPORT STANDARD. ELEVATED PH COULD BE_attributed TO EITHER ITS SEASONAL PATTERN OR THE INTERACTION OF ELEVATED TEMPERATURES AND INCREASED PHYTOPLANKTON ACTIVITY. DISSOLVED OXYGEN AND TEMPERATURE OBSERVATIONS WERE GENERALLY IN FULL COMPLIANCE WITH WATER QUALITY STANDARDS.

SIMILARLY, 26.5% OF FECAL COLIFORM BACTERIA LEVELS WERE IN VIOLATION OF THE STANDARD FOR THE PRIMARY CONTACT RECREATION USE (SWIMMABLE) 200 MPN/100 ML, AND 2.6% IN VIOLATION OF THE SECONDARY CONTACT RECREATION STANDARD OF 1000 MPN/100ML. AS A RESULT THIS POTOMAC SEGMENT DID NOT SUPPORT ITS SWIMMABLE USE AND FULLY SUPPORTED ITS SECONDARY CONTACT RECREATION USE. EVENTS THAT COULD ACCOUNT FOR THE NON-COMPLIANCE IN FECAL COLIFORM BACTERIA INCLUDE COMBINED SEWER OVERFLOWS AND URBAN RUNOFF.

EVENTS DURING THE REVIEW PERIOD WITH POTENTIAL INFLUENCE ON THIS WATERBODY SEGMENT OF THE POTOMAC WATER QUALITY INCLUDE: THE BNR IMPLEMENTATION AT BLUE PLAINS, AND MARINA ACTIVITIES.

DETERMINATION OF THE FISH CONSUMPTION USE WAS BASED ON A PUBLIC HEALTH ADVISORY ISSUED ON NOVEMBER 15, 1994, BY THE D.C. COMMISSIONER OF PUBLIC HEALTH. THE ADVISORY URGES NON-CONSUMPTION OF CATFISH, CARP OR EEL AND LIMITED CONSUMPTION OF OTHER FISH CAUGHT IN ALL DISTRICT OF COLUMBIA WATERS.

BECAUSE OF THE ABOVE USE SUPPORT DECISIONS, THIS SEGMENT OF THE POTOMAC DID NOT SUPPORT ITS OVERALL USE FOR WATERS WITH MULTIPLE USES.

REPORTS WITH MORE INFORMATION INCLUDE:

* IMPACT OF DREDGING, ICPRB, FISH TISSUE SURVEY, ICPRB, SEDIMNET TOXICITY SURVEY, ICPRB; WETLAND ASSESSMENT, MWCOG, PETROLEUM OIL SPILL, VERSAR

* A DISSOLVED OXYGEN STUDY OF THE UPPER POTOMAC ESTUARY-FINAL REPORT, MWCOG; POTOMAC RIVER WATER QUALITY 1982-1986 - TRENDS AND ISSUES IN THE METROPOLITAN WASHINGTON AREA, MWCOG.

* AWRC. 1997. DRAFT ANACOSTIA WATERSHED RESTORATION PROGRESS AND
CONDITIONS REPORT 1990-1996. DEPT. OF ENVIRONMENTAL PROGRAM, MWCOG.
WASH., DC.
* SEDIMENT CONTAMINATION STUDIES OF THE POTOMAC AND ANACOSTIA RIVER
* FISH TISSUE SURVEY, ICPRB, VELINSKY, 1993.
* EMERGENT WETLAND ESTABLISHMENT UNDER DIFFERING HABITAT CONDITIONS
IN THE ANACOSTIA AND POTOMAC RIVER BASIN, HORN POINT ENVIRONMENTAL
# Detail Report for POTOMAC DC

**ID:** DCPMS00E_02  
**State:** DC - 2008  
**Single Cat.(User Cat.):** 5(N/A)

## Water Information

**Location:** KEY BRIDGE, GEORGETOWN, TO HAINS POINT (PMS10 TO PMS 29), TIDAL FRESHWATER. RIVER PASSES THROUGH AN URBAN AREA OF COMMERCIAL AND RESIDENTIAL BUILDINGS AND NATIONAL PARK SERVICE LAND.

**Water Type:** ESTUARY  
**Size:** 1.38 SQUARE MILES  
**Next Scheduled Monitoring Date:** N/A

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<td>Discharges from Municipal</td>
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<td>Separate Storm Sewer Systems</td>
<td>Fecal Coliform</td>
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**Overall Assessment**

THE MID-TIDAL POTOMAC WATERBODY SEGMENT EXTENDS FROM KEY BRIDGE TO HAINES POINT. THIS SEGMENT OF THE POTOMAC IS INFLUENCED BY HIGH FECAL COLIFORM BACTERIA LEVELS, OCCASIONAL HIGH PH LEVELS, AND CONTAMINATED FISH TISSUE. FECAL AMBIENT MONITORING DATA FROM 2003 TO 2007 WERE ANALYZED TO MAKE USE SUPPORT DETERMINATIONS FOR THE PERIOD UNDER REVIEW.

THIS SEGMENT OF THE POTOMAC IS NOT SUPPORTING ITS AQUATIC LIFE USE. DIURNAL MONITORING DATA COLLECTED DURING 2003-2007 WAS USED TO DETERMINE USE SUPPORT. pH WAS VIOLATED 14.5%, D.O AND TEMPERATURE WERE NOT VIOLATED AND DURING THE ASSESSMENT PERIOD.

23.7% OF FECAL COLIFORM LEVELS WERE IN VIOLATION OF THE PRIMARY CONTACT RECREATION (SWIMMABLE) STANDARD OF 200 MPN/100 ML, AND 8.8% WERE IN VIOLATION OF THE SECONDARY CONTACT RECREATION STANDARD OF 1000 MPN/100 ML. SECONDARY CONTACT USE IS SUPPORTED.

THIS POTOMAC SEGMENT DID NOT SUPPORT THE FISH CONSUMPTION USE. DETERMINATION OF THE FISH CONSUMPTION USE WAS BASED ON A PUBLIC HEALTH ADVISORY ISSUED ON NOVEMBER 15, 1994, BY THE D.C. COMMISSIONER OF PUBLIC HEALTH. THE ADVISORY URGES NON-CONSUMPTION OF CATFISH, CARP OR EEL AND LIMITED CONSUMPTION OF OTHER FISH CAUGHT IN ALL DISTRICT OF COLUMBIA WATERS.

SEGMENT #2 FULLY SUPPORTED ITS NAVIGATION USE.

BECAUSE OF THE ABOVE USE SUPPORT DECISIONS, THE MID-TIDAL POTOMAC DID NOT SUPPORT ITS OVERALL SUPPORT USE CLASSIFICATION.

SIMILARLY, SURVEYS CONDUCTED DURING THE PERIOD UNDER REVIEW REVEAL THE PRESENCE OF TOXICS IN SEDIMENTS. FISH TISSUE SAMPLES OF CERTAIN SPECIES SHOW ELEVATED LEVELS OF CONTAMINANTS, INCLUDING CHLORDANE AND PCBs. BIOLOGICAL SAMPLES FROM THE SITE SUGGEST A SEVERELY STRESSED BENTHIC COMMUNITY. STRESSED CONDITIONS COULD BE ATTRIBUTED TO URBAN RUNOFFS FROM UPSTREAM AND POLLUTED STREAMS, CSO EVENTS AND IMPACT FROM ADJACENT INDUSTRIAL FACILITIES.

REPORTS CONTAINING MORE INFORMATION INCLUDE: POTOMAC RIVER WATER QUALITY 1982-1986 - TRENDS AND ISSUES IN THE METROPOLITAN WASHINGTON, D.C.; IMPACT OF DREDGING, ICPRB; FISH TISSUE SURVEY, ICPRB; SEDIMENT TOXICITY SURVEY, ICPRB; WETLAND ASSESSMENT, MWCOG; PETROLEUM OIL SPILL, VERSAR.

REPORTS WITH MORE INFORMATION INCLUDE:
* SEDIMENT CONTAMINATION STUDIES OF THE POTOMAC AND ANACOSTIA RIVER
* FISH TISSUE SURVEY, ICPRB, VELINSKY, 1993.
# Detail Report for POTOMAC DC

**ID:** DCPMS00E_03  
**State:** DC - 2008  
**Single Cat.(User Cat.):** 5(N/A)

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| **Location:** CHAIN BRIDGE (MONTGOMERY COUNTY MARYLAND LINE), JUST BELOW FALL LINE, TO KEY BRIDGE (PMS01 TO PMS10), TIDAL FRESHWATER, BORDERED BY NATIONAL PARK SERVICE LAND. | **Water Type:** ESTUARY  
**Size:** 0.4 SQUARE MILES  
**Next Scheduled Monitoring Date:** N/A |

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Secondary Contact Recreation and Aesthetic Enjoyment |
| **Not Support**    | Primary Contact Recreation  
Protection and Propagation of Fish, Shellfish and Wildlife  
Protection of Human Health related to Consumption of Fish and Shellfish |

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<td>PHYSICAL/CHEMICAL</td>
<td>Protection and Propagation of Fish, Shellfish and Wildlife</td>
<td>GOOD</td>
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</table>
| PATHOGEN INDICATORS   | Primary Contact Recreation  
Secondary Contact Recreation and Aesthetic Enjoyment | GOOD                  |

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<th>Associated Uses</th>
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<th>Confidence</th>
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<td>Fecal Coliform</td>
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<tr>
<td>Combined Sewer Overflows</td>
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<td>Municipal (Urbanized High Density Area)</td>
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Comments On:

Overall Assessment

THIS WATERBODY SEGMENT INCLUDES THE UPPER TIDAL POTOMAC FROM CHAIN BRIDGE, D.C. BORDER, TO KEY BRIDGE (GEORGETOWN). THIS SEGMENT IS AFFECTED BY HIGH COLIFORM BACTERIA LEVELS, TOXICS IN SEDIMENTS, AND FISH CONTAMINATED WITH TOXICS. FECAL AMBIENT WATER QUALITY DATA FROM 2003 TO 2007 WERE ANALYZED FOR USE SUPPORT DETERMINATIONS.

A REVIEW OF THE DATA FOR THIS SEGMENT SHOWED THAT 13.7% OF THE TIME PH OBSERVATIONS WERE IN VIOLATION OF ITS AQUATIC LIFE SUPPORT STANDARD. ELEVATED PH COULD BE ATTRIBUTED TO EITHER ITS SEASONAL PATTERN OR THE INTERACTION OF ELEVATED TEMPERATURES AND INCREASED PHYTOPLANKTON ACTIVITY. DISSOLVED OXYGEN AND TEMPERATURE OBSERVATIONS WERE IN FULL COMPLIANCE OF WATER QUALITY STANDARDS.

FECAL COLIFORM BACTERIA OBSERVATIONS DID NOT SUPPORT THE PRIMARY CONTACT RECREATION (SWIMMABLE) USE OF 200 MPN/100ML BECAUSE IT VIOLATED THIS STANDARD 15.7% OF THE TIME. THIS SEGMENT SUPPORTED ITS SECONDARY CONTACT RECREATION USE OF 1000 MPN/100ML AT 3.9%. ELEVATED FECAL COLIFORM BACTERIA LEVELS COULD BE THE RESULT OF URBAN RUNOFF AND COMBINED SEWER OVERFLOWS.

SEGMENT #3 DID NOT SUPPORT THE FISH CONSUMPTION USE. DETERMINATION OF THE FISH CONSUMPTION USE WAS BASED ON A PUBLIC HEALTH ADVISORY ISSUED ON NOVEMBER 15, 1994, BY THE D.C. COMMISSIONER OF PUBLIC HEALTH. THE ADVISORY URGES NON-CONSUMPTION OF CATFISH, CARP OR EEL AND LIMITED CONSUMPTION OF OTHER FISH CAUGHT IN ALL DISTRICT OF COLUMBIA WATERS.

SURVEYS CONDUCTED OVER THE PERIOD OF REVIEW REVEAL THE PRESENCE OF TOXICS IN SEDIMENT. FISH TISSUE OF SAMPLES OF CERTAIN SPECIES SHOWED ELEVATED LEVELS OF CONTAMINANTS INCLUDING CHLORDANE AND PCBs. BIOLOGICAL SAMPLES FROM SELECTED SITES SUGGEST A SEVERELY STRESSED BENTHIC COMMUNITY. THE STRESSED CONDITION COULD BE ATTRIBUTED TO URBAN STORM WATER RUNOFFS FROM UPSTREAM AND POLLUTED STREAMS, CSO EVENTS AND IMPACT FROM ADJACENT INDUSTRIAL FACILITIES.

REPORTS WITH MORE INFORMATION INCLUDE:

* FISH TISSUE SURVEY, ICPRB, VELINSKY, 1993.
River Sediment Quality Assessment Report
Runway 15-33 and 4-22 Safety Area Study
Ronald Reagan Washington National Airport
Arlington County, Virginia

Prepared for:
Metropolitan Washington Airports Authority

Prepared by:

9135 Guilford Road, Suite 100
Columbia, Maryland 21046

In Association with:

Ricondo & Associates, Inc.
277 S. Washington Street, Suite 120
Alexandria, Virginia 22314

Revised July 2007
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1 INTRODUCTION

1.1 PROJECT DESCRIPTION AND PURPOSE

The Metropolitan Washington Airports Authority (MWAA) is studying possible Runway Safety Area (RSA) improvements at Ronald Reagan Washington National Airport (DCA), which is shown on Figure 1-1 (Site Vicinity). Crosswind runways 15-33 and 4-22 do not currently meet Federal Aviation Administration (FAA) design standards for RSAs (FAA Order 5200.8, Runway Safety Area Program, October 1, 1999). The design standards specify RSA dimensions beyond the runway ends to ensure the safety of airplanes which undershoot, overrun, or veer off the runway, and it provides greater accessibility for firefighting and rescue equipment during such incidents.

Straughan Environmental Services, Inc. (SES), under contract to Ricondo & Associates, Inc., conducted a sediment sampling study in the area of two of the four runway ends where possible RSA improvements could occur in the water. The purpose of this study is to assist MWAA in determining potential impacts to water quality in the Potomac River or potential difficulties in disposal of dredged sediment associated with construction.

1.2 STUDY AREA DESCRIPTION

The Airport is located on a peninsula in the Potomac River in Arlington County, Virginia and operates three runways. The Airport is surrounded by the Potomac River to the east and south. Roaches Run and Roaches Run Waterfowl Sanctuary are to the north. Four Mile Run is located south of the study area and reaches its confluence with the Potomac River in the vicinity of Runway 4. The Potomac River is a tributary to the Chesapeake Bay and receives tidal influences in the reach abutting the Airport. The airport contains a large amount of impervious surface, including parking lots, airport terminals, office buildings, aircraft ramps, and the runway/taxiway system. Figure 1-2 (Study Area) illustrates the conditions described.

2 METHODS

SES conducted a sediment sampling study in the Potomac River at the eastern end of two of the runways, Runways 15-33 and 4-22. The runway ends in the Potomac are referred to in this report as either Runway End 33 or 22, depending on the runway nearest the area of interest. Runway End 22 is upstream and north of Runway End 33, as shown on Figure 1-2.

Thomas L. Brown Associates (TLB), in conjunction with MWAA, determined a total of eight borehole locations in the Potomac River, at Runway Ends 22 and 33 (Figure 2-1), for initial geotechnical analysis. Sediment samples were collected from the top 15 feet of six of the eight boreholes and provided to SES for laboratory analysis. SES accompanied TLB and conducted a field investigation on August 31, 2006, to collect ambient water quality information from the Potomac River and to measure for Volatile Organic Compounds (VOC's) levels in the sample collected at boring location B-33-4. VOC's for the other five sediment samples were measured by TLB. As described in the following paragraphs, a complete chemical analysis was performed on two of the six samples, a partial chemical analysis was performed on one (due to improper...
storage of sample) and the remaining three were analyzed for grain size.

2.1 Ambient Water Quality Assessment Methods

2.1.1 Water Quality Data Collection

SES measured the following parameters on August 31, 2006:

**Dissolved Oxygen and Temperature.** Dissolved oxygen is the amount of oxygen in surface water available to aquatic life. The amount of dissolved oxygen decreases as the water temperature rises. SES used a YSI, Inc., Model 55 dissolved oxygen meter to measure the dissolved oxygen content in milligrams per liter (mg/l) and temperature in degrees Celsius (°C). The instrument was calibrated in accordance with the manufacturer’s specifications.

**Conductivity, Salinity, and TDS.** Conductivity is the measurement of electrical current that can be carried by water. It is an environmental indicator of the amount of total dissolved solids (TDS) present. TDS includes all solids dissolved in water, and these solids are usually mineral salts. A greater concentration of salts leads to greater conductivity. Pure water has a very low electrical conductivity when absent of salts and minerals. High levels of total dissolved solids in water can cause aquatic plant mortality and corrode metals (such as pipes). SES used a Hach CO150 Model 50150 conductivity meter to measure conductivity and temperature at each sample station. The instrument measures conductivity, or the ability of the water to carry an electric current, as MicroSiemens per centimeter (µS/cm) and temperature in degrees Celsius (°C). The instrument was calibrated in accordance with the manufacturer’s specifications. The conductivity meter also measures salinity in parts per thousand (ppt or ‰) and converts conductivity to TDS in milligrams per liter (mg/L).

**Additional Observations and Physical Characterizations.** Concurrent with instrument measurements, SES recorded additional physical characterization and observations. Weather conditions during the sampling event were recorded because they may have had an impact on water quality. For example, recent storm events may increase the turbidity of some streams. Other parameters recorded include water sampling depth and depth to river bottom.

2.1.2 Water Quality Criteria

SES compared water quality field data to the Water Quality Criteria for Class III Waters defined in the Code of Virginia, Water Quality Standards, and for Class C Waters defined in the District of Columbia Municipal Regulations, to evaluate current water quality in the Potomac River. These standards are shown in Table 2-1.

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<th>Virginia Class III Waters</th>
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<td>Minimum Daily Average of 5.0 mg/l</td>
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<tr>
<td>Temperature</td>
<td>Maximum Temperature of 32°C</td>
<td>Maximum Temperature of 32.2°C</td>
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River Sediment Quality Assessment Report
Runway 15/33 and 4/22 Safety Area Study

Straughan Environmental Services, Inc.
Revised July 2007
Figure 1-1: Site Vicinity

Ronald Reagan Washington National Airport
Arlington County, Virginia

Legend:

- Ronald Reagan Washington National Airport

Approximate Scale:

1 inch = 3 miles

2.2 SEDIMENT SAMPLING METHODS

Sediment samples were collected by TLB and transferred to SES for processing and analysis. A split spoon drill collected the sediment borings into several 2-foot long plastic tubes. Each Split Spoon Tube was labeled with location and depth. Following the VOC's grab sample collection, the sediment from all of the tubes collected at one sampling location were combined in a stainless steel bowl and mixed with stainless steel utensils to create one composite sample for that location. Stainless steel bowls and utensils were thoroughly washed with distilled water before and after mixing each composite sample. Composite samples were subdivided and placed into jars for laboratory analysis. Sample jars were kept on ice in coolers during transport to the lab. Severn Trent Laboratories, Inc. (STL) performed all of the grain size and chemical analyses. Details about sample collection and transmittal are displayed in Table 2-2. Boring locations are shown on Figure 2-1.

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<th>Sample ID</th>
<th>Depth Intervals Below Surface of River Bottom (feet)</th>
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<tr>
<td>Composite-5</td>
<td>0-2; 3-5; 8-10; 13-15</td>
<td>B-33-1</td>
<td>9/6/06</td>
<td>Grain Size</td>
<td>9/8/06</td>
</tr>
<tr>
<td>Composite-6</td>
<td>0-2; 3-5; 8-10; 13-15</td>
<td>B-33-3</td>
<td>9/7/06</td>
<td>Full Chemical</td>
<td>9/8/06</td>
</tr>
</tbody>
</table>

2.2.1 Sediment Grain Size Methods

Three of the six composite samples were placed into plastic bags for grain size analysis. These samples were not thermally preserved. The three samples were sent to STL Laboratories in Colchester, Vermont for American Society for Testing and Materials international standards grain size analysis (ASTM D422). In addition to the standards specified by ASTM D422, sieve number 230 was added to the analysis of the samples as per U.S. Army Corps of Engineers (USACE) standards, due to potential dredging/disposal permit requirements.

2.2.2 Sediment Chemical Analysis Methods

Two of the six composite samples (B-33-4, and B-33-3) were submitted to STL Laboratories in Pittsburgh, Pennsylvania and Burlington, Vermont for full chemical analysis, including:

- **Dioxins/Furans** – toxic substances created as byproduct of manufacturing and combustion
- **TS** – total inorganic residue as percent solids
- **TPH** – petroleum hydrocarbons (diesel and gasoline)
- **Metals** – priority pollutant metals [arsenic, chromium (III), copper, nickel, antimony, thallium, zinc, and mercury]
Boring Locations

Boring B-22-1
Boring B-22-2
Boring B-22-3
Boring B-22-4
Boring B-33-1
Boring B-33-2
Boring B-33-3
Boring B-33-4

LOCATION   LATITUDE   LONGITUDE

Boring B-22-1   38°51.408968' N   77°01.9721965' W
Boring B-22-2   38°51.4294267' N  77°01.9107989' W
Boring B-22-3   38°51.3085826' N  77°01.9247040' W
Boring B-22-4   38°51.4074687' N  77°01.8521746' W

DMT -22-1  38°51.4370211' N  77°01.9293508' W
DMT -22-2  38°51.3565966' N  77°01.9467951' W

Boring B-33-1  38°50.8640577' N  77°01.7001800' W
Boring B-33-2  38°50.9517988' N  77°01.8280372' W
Boring B-33-3  38°50.8891717' N  77°01.8621421' W
Boring B-33-4  38°50.7803247' N  77°01.8417844' W

DMT -33-1  38°50.8560196' N  77°01.7181407' W
DMT -33-2  38°50.9002598' N  77°01.8254880' W

Source: Base Drawing DCA-ALP, Aerial Photograph-AllPhoto USA

Figure 2-1
- **Hexavalent Chromium** – a carcinogen found in pigments and dyes that binds to soil particles
- **Pesticides** – toxic substances that may impact human health at high concentrations
- **Organophosphate (OP) Pesticides** – toxic substances present in about half of the insecticides used in the United States (CDC, 2005).
- **Polychlorinated biphenyls (PCB)** – persistent chemical that bioaccumulates in fish, birds and animals and was used as a fire retardant, coolant, and lubricant in various electrical products between 1930 and 1970
- **SVOC** – organic compounds with a boiling point higher than water, and which may vaporize at temperatures above room temperature
- **Cyanide (CN)** – a highly poisonous chemical used to make synthetic fibers and herbicides
- **Toxicity Characteristic Leaching Procedure (TCLP) for Metals** – the concentration of metals that are leached from the sample, used to determine if the material is hazardous per the Resource Conservation and Recovery Act. TCLP metals tested include silver, arsenic, barium, cadmium, chromium (III), lead, and selenium
- **TriButyl Tin (TBT)** – a highly toxic biocide that has been used as a paint additive to protect ship hulls

A limited chemical analysis was performed for the composite sample from location B-22-1. Because the sample had not been preserved on ice after removal, this sample was tested for Metals, Cr (VI), TCLP Metals and TriButyl Tin only.

2.2.3 **Volatile Organic Compounds (VOC’s) Methods**

SES took four spot measurements to detect the presence of VOC’s with a 2020 Pro Photovac VOC meter at the top and bottom of sediment sample tubes from location B-33-4 as they were pulled out of the drill hole. All four spot measurements for VOC’s were zero. Additionally, a grab sample from sediment at the 10-foot depth interval of B-33-4 was collected in a jar and placed on ice during transfer to the STL Laboratories in Pittsburgh for VOC analysis.

TLB used the same VOC meter on other sample tubes at the time of sample collection and consistently obtained measurements of zero.

3 **FINDINGS**

The results of this study provide information regarding the pre-construction condition of streambed sediments in the Potomac River. In addition to establishing existing conditions, sediment quality parameters are compared to established standards to determine the probability of surface water contamination from disturbed riverbed sediments.

3.1 **AMBIENT WATER QUALITY ASSESSMENT**

SES collected dissolved oxygen, temperature, conductivity, salinity and TDS data from the Potomac River at boring location B-33-4 on August 31, 2006. Table 3-1 shows the baseline water quality conditions for location B-33-4. Water quality parameters for dissolved oxygen and
temperature at B-33-4 are within Code of Virginia standards for Class III waters and the D.C. Municipal Regulations for Class C waters.

Table 3-1
WATER QUALITY ASSESSMENT, POTOMAC RIVER
August 31, 2006

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Class III Water Quality Criteria</th>
<th>Class C Water Quality Criteria</th>
<th>Location B-33-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved oxygen (mg/L)</td>
<td>&gt;4</td>
<td>&gt;5</td>
<td>5.30</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>&lt;32</td>
<td>&lt;32.2</td>
<td>26.9</td>
</tr>
<tr>
<td>Conductivity (μS/cm)</td>
<td>N/A</td>
<td>N/A</td>
<td>398</td>
</tr>
<tr>
<td>Salinity (‰)</td>
<td>N/A</td>
<td>N/A</td>
<td>0.2</td>
</tr>
<tr>
<td>Total Dissolved Solids (mg/L)</td>
<td>N/A</td>
<td>N/A</td>
<td>189</td>
</tr>
</tbody>
</table>

Note: While pH is a typical indicator of water quality, it was not field measured as part of this study.

Legend:
°C - degrees Celsius
mg/L - milligrams per liter
‰ - parts per thousand
μS/cm - MicroSiemens per centimeter
N/A - Not applicable

Table 3-2 summarizes the additional observations and physical characterizations recorded at boring location B-33-4.

Table 3-2
ADDITIONAL OBSERVATIONS AND PHYSICAL CHARACTERIZATIONS AT B-33-4
August 31, 2006

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather Conditions</td>
<td>Cloudy, Windy, 72°F</td>
</tr>
<tr>
<td>Time</td>
<td>12:28 PM</td>
</tr>
<tr>
<td>Total Water Depth</td>
<td>16 Feet</td>
</tr>
<tr>
<td>Depth of Water Quality Sampling</td>
<td>2 Feet</td>
</tr>
</tbody>
</table>
3.2 SEDIMENT QUALITY ASSESSMENT

3.2.1 Sediment Grain Size

Grain size analysis was completed for three of the sediment samples. A summary of the grain size analysis is presented in Table 3-3, and detailed reports are included in Appendix A.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Location</th>
<th>% Gravel</th>
<th>% Sand</th>
<th>% Silt</th>
<th>% Clay</th>
<th>(D_{10}) (mm)</th>
<th>(D_{50}) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite-1</td>
<td>B-22-4A</td>
<td>4.4</td>
<td>42.8</td>
<td>30.4</td>
<td>22.5</td>
<td>0.04</td>
<td>0.38</td>
</tr>
<tr>
<td>Composite-2</td>
<td>B-22-2</td>
<td>24.9</td>
<td>44.3</td>
<td>15.7</td>
<td>15.2</td>
<td>0.28</td>
<td>7.25</td>
</tr>
<tr>
<td>Composite-5</td>
<td>B-33-1</td>
<td>0.0</td>
<td>37.0</td>
<td>44.7</td>
<td>18.3</td>
<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>Grain Size (mm)</td>
<td></td>
<td>2-64</td>
<td>0.0625-2</td>
<td>0.0039-0.0625</td>
<td>&lt;0.0039</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The U.S. Geological Survey (USGS) monitors stream velocity and discharge at gaging station 01646500 on the Potomac River near the Little Falls Pumping Station in Washington, D.C. Since 1980, the USGS has recorded a maximum velocity of 6.85 ft/sec and discharge of 183,000 ft³/sec (recorded March 6, 1993) for the cross section at that gage station. Based on the Hjulström diagram for sediment mobility (Figure 3-1) it is likely that streambed sediment less than 1 mm in size (i.e. smaller than very coarse sand) will be mobile at a stream velocity of 6.85 ft/sec. The Hjulström diagram assumes that the streambed is uniform and stream depth is one meter. Channels like the Potomac River, with depths greater than one meter and non-uniform beds, may carry particles larger than indicated in the diagram due to the increased turbulence of the stream flow.

![Hjulström Diagram](image)

**Figure 3-1. Hjulström Diagram**

Total inorganic content as percent solids was measured as part of the chemical analysis for boring locations B-33-3 and B-33-4. Inorganic content was 65% and 60% for the two sites, respectively.
3.2.2 Priority Pollutant Metals

The EPA regulates thirteen priority pollutant metals in surface waters. These include Arsenic, Selenium, Cadmium, Chromium, Copper, Lead, Antimony, Silver, Thallium, Zinc, Beryllium, Mercury, and Nickel [As, Se, Cd, Cr (III and VI), Cu, Pb, Sb, Ag, Tl, Zn, Be, Hg and Ni]. Three metals – cadmium, lead, and mercury – are on the EPA priority chemicals list and subject to the Resources Conservation and Recovery Act (RCRA). The EPA has Maximum Contaminant Levels (MCL’s) for drinking water, which include most of the thirteen metals. High concentrations of metals can be toxic to aquatic organisms.

Sediment samples from boring sites B-33-3, B-33-4, and B-22-1 were tested in the laboratory for pollutant metals using the Toxicity Characteristic Leaching Procedure (TCLP). The Land Disposal Restrictions (LDR) program allows use of TCLP test when measuring compliance with the treatment standards for 39 contaminants ([55 Final Rule 22660, June 1, 1990] Land Disposal Restrictions for Third Scheduled Wastes: Final rule). Low concentrations of chromium (III), copper, nickel, and zinc were detected in samples from all three locations, but the concentrations did not exceed EPA Risk-Based Concentrations for Region III (Mid-Atlantic) Residential Soil (Environmental Protection Agency, 2006). However, arsenic concentrations exceed the EPA Risk-Based concentrations for all three locations. Barium TCLP and chromium TCLP were detected at low concentrations at both boring locations. Arsenic TCLP and lead TCLP amounts detected at both locations were approaching the threshold to exceed concentrations for Virginia Water Quality Standards (Virginia State Water Control Board, 2005). Hexavalent chromium, mercury, antimony, thallium, silver, cadmium, and selenium were not detectable in any of the sediment samples. Individual analyte data results, laboratory reporting limits, and quality control information are presented in the laboratory reports in Appendix B and Table 3-4.

3.2.3 Volatile Organic Compounds (VOC’s)

Field and laboratory testing for VOC’s was conducted at boring site B-33-4. No detectable concentrations of VOC’s were identified in the field. In the laboratory, methylene chloride (typically a lab contaminant) was detected at a concentration below the reporting limit. Other VOC’s analyzed in the laboratory were not present in detectable concentrations. Individual analyte data results, laboratory reporting limits, and quality control information are presented in the laboratory reports in Appendix B.
3.2.4 Semivolatile Organic Compounds

Laboratory testing for semivolatile organic compounds (SVOC’s) was conducted on sediments from boring sites B-33-3 and B-33-4. Trace amounts of SVOC’s were present in samples from both locations. The concentration of benzo(a)pyrene in the sediment sample from boring location B-33-4 exceeded the EPA Risk-Based Concentration for that compound (U.S. EPA, 2006). Concentrations of other SVOC’s detected in the two samples were well below the U.S. EPA Risk-Based Concentrations (U.S. EPA, 2006). Individual analyze data results, laboratory reporting limits, and quality control information for SVOC’s are presented in the laboratory reports in Appendix B.

3.2.5 Dioxins/Furans

Laboratory testing for dioxin was conducted on sediments from boring site locations B-33-3 and B-33-4. Both samples contained only trace amounts of dioxin congeners. Only 2 of the congeners of HxCDD (Hexachlorodibenzo-P-Dioxin) were detected above reporting limits. The EPA does not include dioxins in the list of Risk-Based Concentrations. Individual analyze data results, laboratory reporting limits, and quality control information are presented in the laboratory reports in Appendix B and Table 3-4.

3.2.6 Pesticides and PCB’s

Laboratory testing for pesticides and PCB’s was conducted on sediments from boring sites B-33-3 and B-33-4. Both sites showed trace amounts of DDD and DDE. Site B-33-3 also showed trace amounts of DDT, Dieldrin, and Endrin aldehyde. All pesticide concentrations detected were below the laboratory reporting limit and below EPA Risk-Based Concentrations. Neither boring site had detectible concentrations of PCB’s present in the sediments. Organophosphorous compounds were not detected in sediment from boring location B-33-4, but a low concentration of Azinphos-methyl was detected at location B-33-3. Individual analyze data results, laboratory reporting limits, and quality control information are presented in the laboratory reports in Appendix B.

3.2.7 Petroleum Hydrocarbons

Laboratory testing for TPH as diesel and gasoline was conducted on sediments from boring locations B-33-3 and B-33-4. Diesel was detected in sediments from both boring locations, with B-33-4 having a higher concentration of diesel. Gasoline was detected in sediments from boring site B-33-4 at levels below the laboratory reporting limit. The EPA does not include petroleum hydrocarbons in the list of Risk-Based Concentrations. The Virginia DEQ level for residential clean up is 230 parts per million (ppm). Individual analytical data results, laboratory reporting limits, and quality control information for petroleum hydrocarbons are presented in the laboratory reports in Appendix B and Table 3-4.

3.2.8 TriButyl Tin

TriButyl Tin (TBT) has been used as an anti-fouling biocide and as a fungicide in paints. It is a restricted-use pesticide in the United States.
Laboratory testing for TBT was conducted on sediments from boring locations B-22-1, B-33-3, and B-33-4. Concentrations of TBT were measured at 2.5 µg/Kg for all three samples. The EPA water quality criteria for aquatic life in freshwater requires that concentrations of TBT be less than 0.072 µg/l (U.S. EPA, 2003). The EPA does not have a standard for TBT in soils. Individual analyte data results, laboratory reporting limits, and quality control information are presented in the laboratory reports in Appendix B and Table 3-4.

<table>
<thead>
<tr>
<th>Component</th>
<th>Composite-3 B-33-4</th>
<th>Composite-4 B-22-1</th>
<th>Composite-6 B-33-3</th>
<th>Regulatory limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPH (as diesel)</td>
<td>230 mg/kg</td>
<td>Not Measured</td>
<td>57 mg/kg</td>
<td>230 ppm¹</td>
</tr>
<tr>
<td>1,2,3,6,7,8-HxCDD²</td>
<td>14 pg/g</td>
<td>Not Measured</td>
<td>3.7 pg/g</td>
<td>N/A²</td>
</tr>
<tr>
<td>1,2,3,4,6,7,8-HpCDD</td>
<td>350 pg/g</td>
<td>Not Measured</td>
<td>95 pg/g</td>
<td>N/A²</td>
</tr>
<tr>
<td>OCDD</td>
<td>10,000 pg/g</td>
<td>Not Measured</td>
<td>3300 pg/g</td>
<td>N/A²</td>
</tr>
<tr>
<td>1,2,3,4,6,7,8-HpCDF</td>
<td>76 pg/g</td>
<td>Not Measured</td>
<td>17 pg/g</td>
<td>N/A²</td>
</tr>
<tr>
<td>OCDF</td>
<td>130 pg/g</td>
<td>Not Measured</td>
<td>30 pg/g</td>
<td>N/A²</td>
</tr>
<tr>
<td>2,3,7,8-TCDF⁴</td>
<td>2.4 pg/g</td>
<td>Not Measured</td>
<td>1.3 pg/g</td>
<td>N/A³</td>
</tr>
<tr>
<td>Arsenic</td>
<td>7.1 mg/kg</td>
<td>2.2 mg/kg</td>
<td>3.2 mg/kg</td>
<td>0.43 mg/kg⁵</td>
</tr>
<tr>
<td>TCLP Arsenic⁶</td>
<td>0.21 mg/L</td>
<td>0.16 mg/L</td>
<td>0.15 mg/L</td>
<td>0.150 mg/L (chronic) 0.340 mg/L (acute)⁶</td>
</tr>
<tr>
<td>Chromium</td>
<td>30 mg/kg</td>
<td>11.6 mg/kg</td>
<td>15.1 mg/kg</td>
<td>120,000 mg/kg⁴</td>
</tr>
<tr>
<td>Copper</td>
<td>40.6 mg/kg</td>
<td>14.5 mg/kg</td>
<td>20.3 mg/kg</td>
<td>3100 mg/kg⁴</td>
</tr>
<tr>
<td>Nickel</td>
<td>32.7 mg/kg</td>
<td>12.2 mg/kg</td>
<td>18.9 mg/kg</td>
<td>1600 mg/kg⁴</td>
</tr>
<tr>
<td>Zinc</td>
<td>418 mg/kg</td>
<td>65.1 mg/kg</td>
<td>121 mg/kg</td>
<td>23,000 mg/kg⁴</td>
</tr>
<tr>
<td>TCLP Lead⁷</td>
<td>ND</td>
<td>0.015 mg/L</td>
<td>0.015 mg/L</td>
<td>0.0023 mg/L (chronic) 0.0204 mg/L (acute)⁶,⁸</td>
</tr>
<tr>
<td>n-Hexane Extractable Material</td>
<td>372 mg/kg</td>
<td>Not Measured</td>
<td>Not Detected</td>
<td>N/A³</td>
</tr>
<tr>
<td>Tributyltin</td>
<td>2.5 µg/kg</td>
<td>2.5 µg/kg</td>
<td>2.5 µg/kg</td>
<td>0.072 µL⁹</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>140 µg/kg</td>
<td>Not Measured</td>
<td>80 µg/kg</td>
<td>87 µg/kg⁸</td>
</tr>
</tbody>
</table>

Unit Conversions: 1 mg/kg = 1 ppm = 1 µg/L ; 1 µg/kg = 1 µg/L = 1 ppb

¹ Virginia DEQ threshold for residential clean up.
² Some measured results are less than the reporting limit of 7.7 pg/g.
³ The EPA does not include dioxins in the list of Risk-Based Concentrations.
⁴ Some measured results are less than the reporting limit of 1.5 pg/g.
⁵ EPA Risk-Based Concentrations for Region III (Mid-Atlantic) Residential Soil (Environmental Protection Agency, 2006).
⁷ Measured results are less than the reporting limit of 0.50 mg/L.
⁸ Regulatory values for lead depend on water hardness. These values assume a water hardness of 25 mg/L.
⁹ EPA Ambient Aquatic Life Water Quality Criteria.
¹⁰ Measured results are less than the reporting limit of 550 µg/kg.
CONCLUSIONS

The purpose of this study is to assist MWAA in determining potential impacts to water quality in the Potomac River or potential difficulties in disposal of dredged sediment associated with construction. One possible destination being investigated for placement of dredge material is transportation of the material to Dominion Virginia Power station at Possum Point for beneficial re-use as part of the plant’s managed coal combustion waste initiative.

The Potomac River sediments in the proposed Runway Safety Areas for Runway Ends 33 and 22 consist primarily of sand and silt with a high organic content. Arsenic was the only pollutant detected in the sediments that clearly exceeded human health risk criteria for residential soils. The TCLP extracts for arsenic and lead are at the threshold of exceeding Virginia water quality limits for freshwater, however, the TCLP test gives a maximum extractable concentration. A standard elutriate test would be expected to give lower concentrations and is a more appropriate comparator to water quality standards. Therefore, the sediments would not be likely to fail to meet Virginia water quality limits. Low concentrations of metals, pesticides, and SVOC’s were detected but do not exceed applicable risk-based criteria. Dioxins and petroleum hydrocarbons are also present.

The small grain size of the streambed sediments indicates that contaminated sediment will likely become mobile and be transported downstream if disturbed in the construction process.

Laboratory results were compared to established threshold levels for dredge disposal at the Possum Point location (Appendix C). These initial results indicate organic and inorganic compounds are present, but are not present in sufficient concentrations to warrant special treatment of dredged material from this area during disposal based on comparison with the Virginia Department of Environmental Quality (VDEQ) Permit Number VA0002017 issued to Possum Point for previous use of Dredge Spoils (see Appendix C). Of some concern for disposal at Possum Point would be low but detectable levels of TPH. The environmental manager for Possum Point indicated that TPH requirements are “nearly zero” (Jeff Marcellas, Personal Communication, May 15, 2006). During an additional conversation (April 13, 2007), Mr. Marcellas clarified that TPH levels equal to or in excess of 100 parts per million (equivalent to 100 mg/kg) are not accepted for disposal at Possum Point. He also explained that measurements of dried sediment would reduce TPH levels in the material due to evaporation, so it is uncertain whether dredged sediments will meet the Possum Point threshold when dried.

Because of the limited sample size, it is possible that additional testing would be requested by the permitting agencies to conclusively determine the suitability of the dredged material for disposal as cover material for ash drying basins at Possum Point. However, initial results indicate that there is little cause for concern. Furthermore, additional testing may be necessary during design and permitting phases of the project to assure that dredging activities would not pose an environmental threat or hazard to aquatic or human life. Initial results indicate that dredging activities would release sediment for transport, and that the sediment contains arsenic and lead in addition to low levels of other contaminants.
REFERENCES


