Prepared for:
Pepco and Pepco Energy Services
Washington, DC

Prepared by:
AECOM
Beltsville, Maryland
October 2016

TECHNICAL MEMORANDUM #2
REFINED BACKGROUND EVALUATION WORK PLAN

Benning Road Facility
3400 Benning Road, NE
Washington, DC 20019

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October 2016

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1 Introduction

This technical memorandum has been prepared by AECOM on behalf of Potomac Electric Power Company and Pepco Energy Services (collectively referred to as Pepco) for the Benning Road Facility (the Site), located at 3400 Benning Road NE, Washington, DC. The Site location is shown on Figure 1-1. Together, the Site and the adjacent segment of the River are referred to herein as the "Study Area". The Site portion of the Study Area is referred to as the "Landside Investigation Area" and the River portion of the study area is referred to as the "Waterside Investigation Area".

The purpose of this technical memorandum is to outline procedures for updating the preliminary background data evaluation, which was originally presented in the April 2015 Draft RI Report (AECOM, 2016a) and was revised in response to District of Columbia Department of Energy and Environment (DOEE) comments in February 2016.

As defined by the United States Environmental Protection Agency (USEPA, 2002a) in their document entitled "Role of Background in the CERCLA Cleanup Process", the term "background" refers to substances or locations that are not "influenced by releases from a site and are usually described as naturally occurring or anthropogenic". USEPA (2002a) indicates that there are two primary classes of background constituents or locations:

1. Naturally occurring substances are present in the environment in forms that have not been influenced by human activity; and,
2. Anthropogenic substances are natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA site in question).

The background evaluation of the Benning Road Site will consider both types of background constituents.

The objective of the background evaluation for the Benning Road Site is to develop statistically defensible estimates of the concentrations of constituents in Site media that are un-impacted by the Site or any other point source of contamination of Site constituents. The results of this background evaluation will be used to assess how concentrations of constituents detected in environmental samples collected from multiple media in the Study Area compare to background concentrations of these same constituents in these same media. The Benning Road background evaluation will be used to support the baseline human health risk assessment (BHHRA), baseline ecological risk assessment (BERA), Remedial Investigation (RI), and Feasibility Study (FS) analysis for the Site.

This background evaluation will be conducted independently from the risk assessments and will serve as a key input to the risk analysis and risk management decisions to be made at the Site.

For the purposes of this technical memorandum, two different types of background data sets have been operationally defined:

1. The term "***Regional Background***" is used to describe soil, sediment, and fish tissue data and sampling locations that have been historically collected/sampled by others, and are relevant to the Benning Road RI/FS process.

   Site data will be evaluated ***qualitatively*** relative to the Regional background data in the forthcoming RI report using visual techniques such as scatter plots, box and whisker plots, and geographic information system (GIS) presentations.

2. The term "***Site-specific background***" is used to describe soil, groundwater, and sediment data and sampling locations that have been (or will be) sampled by Pepco in support of the Landside Investigation Area or Waterside Investigation Area RI.

   Site data will be evaluated ***quantitatively*** relative to the Site-specific background data in the forthcoming RI report in accordance with USEPA guidance (USEPA 2002a,b) and the following steps, which are also presented in Volumes I (Soil) and II (Sediment) of the *Navy Guidance for Environmental Background Analysis* (NAVFAC, 2002 and 2003):

   - Develop sampling and analysis plan for the collection of Site-specific background data;
   - Analyze the Site-specific background data and Site data using prescribed comparative statistical tests; and,
   - As appropriate, determine background threshold levels for constituents of potential concern (COPCs).

   The field sampling in support of the preliminary background evaluation for soils, groundwater, and sediment was principally conducted in the period from January 2013 through December 2014. The preliminary background evaluation will be revised in conjunction with an additional round of field investigation to address data gaps and uncertainties that remain relative to these abiotic media, as described in the Draft RI Report (AECOM, 2016a).

The remainder of this memorandum presents the approach for updating the preliminary evaluation including proposed data collection activities, sample analysis, and data analysis. The details of the

field data collection and laboratory analysis will be presented in the Additional Remedial Investigation Work Plan (*to be prepared following approval of this Refined Background Evaluation Technical Memorandum #2, as well as concurrently submitted Human Health, Ecological Risk Assessment, and Conceptual Site Model (CSM) technical memoranda #1 and #3*). The refined background evaluation will be documented along with the results of the additional field investigation in a revised RI Report.

The samples to be collected for the refined background evaluation will be analyzed for the full suite of constituents (as defined in Table 4-1 of the Draft RI Report) so as to be consistent with the previously-collected data (both Study Area and Site-specific background). The refined background data analysis will be conducted independently from the human health and ecological risk assessments and will include constituents of potential concern (COPCs) and media identified in the BHHRA and BERA (presented in Table 1-1), as well as additional compounds identified during the refined background field investigations. The forensic analysis will include PCB congeners, saturated hydrocarbons, and petroleum biomarker compounds as requested by DOEE in a January 14, 2016 letter to Pepco (presented in Attachment A). DOEE also requested the full list of parent PAH and alkylated PAH homologs per Table 2 of the DOEE's January 14, 2016 letter to Pepco. As explained in Section 6 of this document and Work Plan Addendum #3, Pepco plans to use the LRMS isotope dilution method (at TestAmerica-Knoxville) to maintain comparability with the Pepco RIFS and DOEE's river wide RIFS datasets. The analyte list is consistent with the list provided in the approved Pepco RIFS Quality Assurance Project Plan (AECOM, 2012c).

This technical memorandum focuses on the elements of the background evaluation that are proposed for refinement. The methods and assumptions to be used in the refined background evaluation are the same as those in the preliminary background evaluation and were previously documented in the Risk Assessment Work Plan (AECOM, 2012b). Any refined and/or previously defined methods, assumptions, previous datasets, or other information relevant to defining background are included in this Technical Memorandum.

The remainder of this document is organized in the following manner:

- The refined soil background evaluation approach is presented in Section 2 of this technical memorandum;
- The groundwater evaluation approach is presented in Section 3;
- The refined sediment background evaluation approach is presented in Section 4;
- The approach for the refined fish tissue evaluation is presented in Section 5;
- The approach for the refined forensic analysis is presented in Section 6;

- The refined background evaluation data evaluation methodology and reporting framework is presented in Section 7; and,
- References are provided in Section 8.

2 Refined Background Evaluation for Soil

The objective of the background evaluation for soil is to develop statistically defensible estimates of the concentrations of Site constituents in surface and sub-surface soils that are un-impacted by the Site or any other point source of contamination of Site constituents. The soil background evaluation will include analysis of both Site-specific and Regional Background data and sampling locations. The background evaluation will include analysis of soils data from both the Landside Investigation Area and the National Park Service parcel located between the Landside Investigation Area and the river; these areas are illustrated on Figure 1-2.

2.1 Site-Specific Background Analysis

The data quality objectives (DQOs) for the refined Site-Specific background soil evaluation are as follows:

- To collect Site-specific background soil data to update existing background soil datasets from previous investigations; and
- To develop estimates of the concentrations of COPCs in soil from comparable soil series types that are un-impacted by the Site.

The levels of data quality defined in the Work Plan to achieve the DQOs will be applied for this evaluation and include Levels I and II for field screening and analysis using portable instruments that are calibrated to non-specific (Level I) and specific (Level II) compounds and Levels III through V for laboratory analyses for USEPA recommended performance based methodologies and/or specialty methods (e.g., forensic analysis).

The Site-specific background soil samples will be analyzed for the full suite of constituents (as defined in Section 4 [Table 4-1] of the Draft RI Report) so as to be consistent with previously-collected RI data. This evaluation will consider inorganic constituents, volatile organic constituents (VOCs), semi-volatile organic constituents (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and dioxins and furans (PCDDs/PDCFs). In addition, two subsets of samples will be analyzed for soil forensic constituents where one subset (consisting of up to 12 samples) will be analyzed for saturated hydrocarbons, parent and alkylated PAHs, plus geochemical biomarkers and the other subset (up to 12 samples) will be analyzed for PCB congeners. Results for the DRO/ORO and PCB Aroclor analyses will be used to screen appropriate samples for forensic analysis. As previously noted, this list will be subject to revision, in consultation with DOEE, pending the results of the additional field sampling and the evaluation of the refined background dataset.

To support the Site-specific background soil analysis, Pepco will collect twenty surface (0-1 foot bgs) and twenty subsurface (3-4 feet bgs) soil samples from twenty locations within the vicinity of the Site. Surface soil sampling will focus on the "A" horizon and subsurface soil sampling will focus on the "B" horizon. Based on the typical soil profile defined for each soil map unit by the United States Department of Agriculture (USDA) Natural Resource Conservation Unit (NRCS), the depth of the A horizon for soil types at the proposed soil sample locations extends down to 6 to 14 inches bgs and the subsurface or "B" soil horizon down to 60 inches bgs. It is anticipated that surface soil depths of 0 to 1 ft bgs, which are consistent with previously collected surface soil samples, will encompass the A horizon predicted by NRCS, and the subsurface soil depth of 3-4 feet bgs will be located within the B horizon. The proposed Site-specific background soil sample locations for surface and subsurface soils, including rationale for selection, are summarized in Table 2-1 and presented in Figure 2-1. These proposed sample locations were selected based on the following criteria:

- Location close to the Site - priority is given to those locations closest in proximity of the Site but also not in areas of possible Site influence (e.g., located downwind);
- Comparable soil types as determined by soil series[1] and by observations made during the field investigation – priority is given to those locations with similar soil types and soil horizon depths as Site soil; and,
- No known point sources of contamination of Site constituents.

An evaluation of each proposed sampling location has been conducted based on these criteria (Table 2-1) and will be updated in consultation with DOEE based on field observations and the analytical chemistry results to determine if individual sampling location(s) are appropriate for comparison with Study Area soils.

Consistent with USEPA (2002a) and NAVFAC (2002) guidance, the background dataset will be evaluated to determine if the background range of concentrations are consistent with known physical characteristics and are representative of natural or anthropogenic ambient conditions. It is recognized that a few sampling locations may need to be re-located based on additional evaluation of soil types and accessibility/access concerns. Any relocation of soil sampling locations will be done in co-ordination with DOEE representatives.

Six of the proposed soil sampling locations (SOBACK1 through SOBACK5 and SOBACK7[2]) were sampled in 2001 as part of the background sampling in support of the Kenilworth Park South RI

[1] Soil type is determined based on soil profile details from the USDA Natural Resource Conservation Unit online soil survey (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm).

(National Park Service (NPS), 2008, 2009), and two additional stations (SU-BK-01 and SU-BK-02) were sampled in 2006 as part of the background sampling in support of the Kenilworth Park North RI (NPS, 2008, 2009). These eight background sampling locations will be re-sampled by Pepco in support of the Site-specific background soil program. The remaining 12 proposed sampling locations were selected on the basis of proximity to the Site, evaluation of existing data relative to wind direction and groundwater flow, and presence of comparable soil types and geologic parent material. All sample locations were selected to be representative of background conditions in the Site vicinity including conditions along roadways upgradient from the Site, along the shoreline both up-and downstream of the Site, up-wind along the northern border of the Site, and in park land and golf courses on both sides of the river. One proposed sampling (SOBACK1) has been identified to support the forensic analysis as the former incinerator is an important historic source of potential contaminants to the area.

The USDA NRCS online soil survey was queried to determine soil profile details, which when available are included in Table 2-1 (see Attachment B for a map of the NRCS soil types[3]). The most common soil type is Udorthents followed by Muirkirk variant complex, Bibb sandy loam or Iuka sandy loam and Beltsville urban land complex. Most soil types are composed of sandy loam in the surface layer with clay loam and gravel loam increasing with depth. This is consistent with the predominant soil grain size of the Benning Road facility, which was composed of predominantly sand followed by silt and clay (grain size analysis data of soil samples are presented in Table 3-2 of the RI report).

The majority of the proposed background locations are located on the same geological parent material as the Benning Road facility (e.g., Quaternary terrace from the Holocene or Pleistocene), which is present along the shoreline of the river[4]. Some locations are proposed to be located on Quaternary alluvium (Holocene) or on artificial fill. The Site specific geology of the Benning Road facility (as summarized in the RI Report) is composed primarily of artificial fill and clays, silts, and graded sands of the Patapsco Formation with Arundel clay underlying the site at depths of 45 feet and 85 feet below ground surface. The background soil samples will be collected at 0-1 ft bgs (surface) and 3-4 ft bgs (subsurface), depths where the reworked alluvial deposits from river meandering and recent fill material are mixed. As stated earlier, it is anticipated that the surface soil depth of 0 to 1 ft bgs and the subsurface soil depth of 3-4 feet bgs, which are consistent with depth intervals of previously collected soil samples, will represent the A and B horizons, respectively, predicted by NRCS for the soil types at each location. Therefore, while the underlying geologic

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[2] SOBACK6 was relocated from the Langston Golf Course, per DOEE request, to a nearby location in the National Arboretum.
[3] Available at: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
[4] Based on the geologic map of the Anacostia Watershed presented in Tetra Tech (2016).

parent material may not be an exact match, the proposed background soil samples offer a range of comparable conditions to the Benning Road facility that are also representative of local soil conditions.

Study Area sampling data and Site-specific background data will be evaluated using the same methodology used in the preliminary background evaluation, as presented in AECOM (2016a), which includes evaluating the distribution of the background data, calculating descriptive summary statistics, comparing the Study Area and background datasets using a variety of graphs (boxplots, histograms, etc.), and when appropriate, conducting comparative statistical tests between Study Area and Site-specific background and calculating background threshold values. The methodology for data evaluation is further discussed in Section 7 of this document. An outlier test will also be conducted, using standard USEPA ProUCL (version 5.1; USEPA, 2016) outlier tests, on the refined Site-specific background datasets to determine if any high-end concentrations detected in background are identified as outliers. This evaluation will be conducted in accordance with USEPA guidance and ProUCL (version 5.1) software (USEPA, 2002a; 2002b; and 2016).

2.2 Regional Background Soil Data Analysis

In support of the Regional Background analysis, local and regional data from publically-available databases and site characterization reports were compiled in the preliminary soil background evaluation. These sources included Agency for Toxic Substances and Disease Registry [ATSDR] (2001); Parsons (2008); USEPA (2006); Ridolfi (2005); and, Smith et al. (2013).

For the preliminary background evaluation of inorganic COPCs, historically collected data from 84 surface soil (0-1 foot bgs) and 84 subsurface soil samples (1 to 4.2 feet bgs) representing a mix of urban and rural sample locations in Maryland and Virginia were reviewed. To provide a data set comprised of soil types that are more comparable to the Site, a sub-set of data (~20 samples) were selected to be representative of soils collected within a 50-mile radius of the Site (see Figure 2-2 and Table 2-2). Analysis of this data will include review of the criteria described in Section 2.1 for the Site-specific background soil data, including but not limited to: proximity to the Site, comparability of soil type and physical characteristics, and presence/absence of known sources of Site-related contaminants. The sample depths for the USGS background data (Smith et al., 2013) were 0-1 foot below ground surface (bgs) for surface and 1 to 4.2 feet bgs for subsurface, which is comparable to sample depths for Study Area surface (0 to 1 foot bgs) and subsurface soil (1 to 16 feet bgs) samples. The available inorganic and organic COPC data from these samples will be used to represent regional background conditions and will be qualitatively compared with Study Area data using identical methods (e.g., boxplot comparisons) presented in the preliminary background evaluation.

The regional background data will be qualitatively compared to the Study Area data using boxplots (i.e., no statistical comparisons will be conducted) to provide regional context for Site-related COPCs. The methodology for data evaluation is further discussed in Section 7 of this document.

3 Groundwater Evaluation

The refined background evaluation will include an evaluation of groundwater samples collected from locations that are upgradient of the Benning Road facility (e.g., evaluation of Site-specific background data). No evaluation of Site groundwater data vs. Regional background data will be conducted.

The purpose of this effort is to further refine and inform the nature and extent of constituents present in groundwater as it moves through the system. This groundwater evaluation will also be applicable to the current and future exposure scenarios for the recreational user of the National Park Service parcel (Figure 1-2). The DQOs for this evaluation are:

- To collect additional data to update existing groundwater datasets from previous investigations so that nature and extent of background impacts can be defined.

As detailed for the refined background evaluation for soil, the levels of data quality protocols defined in the Work Plan (AECOM, 2012b) will be adhered to for this evaluation and will include protocols for field measurements (Levels I and II) and laboratory analyses (Levels II, IV, and V).

Groundwater at the Benning Road Site generally moves in a northwestern direction towards the river (see the water table contour map presented as Attachment C). To evaluate background conditions, groundwater samples will be collected at 12 locations. Three established monitoring wells and at thirteen additional temporary locations have been identified, for a total of 16, including four contingency locations, should some of the locations be inaccessible. The temporary well points will be established using a Geoprobe (Table 3-1; Figure 3-1). Groundwater samples will be collected using low- flow procedures with a peristaltic pump and/or an inertial pump. These locations are all cross- or upgradient of the Site and will provide additional information on constituents entering the Site via groundwater from the northeast-east-southeast direction. The background locations may be adjusted in the event that they coincide with other known contaminated sites.

An Environmental Data Resources, Inc. (EDR) package was obtained for a two-mile radius around the Site, which searched numerous environmental databases (such as CERCLA, RCRA, DC Leaking Underground Storage Tanks, etc.) for sites within the radius. The search yielded over 2,000 sites. A subset of these sites considered to be the most significant source areas (i.e., those found in Leaking Underground Storage Tank [LUST] and historic dry cleaner databases) are displayed on Figure 3-1.

One sample will be collected from each of the three established wells, and the depth of sampling at the established wells will be based on the specified screen interval for each well. A Freedom of Information Act request has been submitted for information on the established wells, including construction details and previous sampling event results, but the information is not available. If

sampling at these wells is not possible, then additional temporary locations will be established using a Geoprobe. The locations of these additional temporary wells will be determined in consultation with DOEE.

Both the upper and lower aquifer will be targeted at the thirteen temporary locations for a total of two samples per location (a total of 26 samples will be collected from the temporary wells). The Patapsco Aquifer is heterogeneous, but is typically divisible into an upper and lower water-bearing zone by the presence of a silt-clay layer. Soil cores will be collected from the temp well borings and lithologically logged to identify the semi-confining layer and determine the groundwater sampling depths (above and below the layer). If no clear semi-confining layer is present, the shallow sample will be collected from within 10 feet of the water table and the deep sample be collected from the bottom of the borehole (approximately 50-60 feet bgs).

The temporary well installation will be achieved with a Geoprobe drill rig (7822 or similar). The details of the installation are as follows:

- Diameter of borehole: 3.25 inches
- Temp well: 1" PVC or screen point sampler
- Screen interval: 4 to 5 feet long
- Sand pack placement: none
- Timing from initial drilling through well installation: Drilling, well installation, sampling, and abandonment all in one day. No development.
- Sampling: Low-flow sampling with peristaltic pump and/or inertial pump
- Abandonment: tremie grout with bentonite slurry, 1.5 lbs bentonite:1 gal water mix
- Approach for surveying: GPS coordinates at conclusion of drilling

The groundwater data will be summarized and presented in a tabular format consistent with the November 2014 groundwater data presented in the RI. These data will be evaluated to determine if organic and inorganic constituents are present and possibly moving towards the Site. Study Area groundwater data and background groundwater data will be summarized and qualitatively compared using tables and graphs. The methodology for data evaluation is further discussed in Section 7 of this document.

4 Refined Background Evaluation for Sediment

The objective of the background evaluation for sediment is to develop statistically defensible estimates of the concentrations of Site constituents in surface and sub-surface sediment that are un-impacted by the Site or any other point source of contamination of Site constituents. The sediment background evaluation will include analysis of both Site-specific and Regional Background data and sampling locations.

4.1 Site-Specific Background Analysis

The data quality objectives (DQOs) for the refined Site-specific background sediment evaluation, which are consistent with those defined in the Work Plan (AECOM, 2012b), are as follows:

- To collect additional Site-specific background sediment data to update existing background sediment datasets from previous investigations; and
- To develop estimates of the concentrations of COPCs in sediment that are un-impacted by the Site.

As detailed for the background soil evaluation, the levels of data quality defined in the Work Plan to achieve the DQOs will be applied for this evaluation and include Levels I and II for field screening and analysis using portable instruments that are calibrated to non-specific (Level I) and specific (Level II) compounds and Levels III through V for laboratory analyses for USEPA recommended performance based methodologies and/or specialty methods (e.g., forensic analysis).

For the preliminary sediment background evaluation (AECOM, 2016a), Site-specific background sediment samples were collected from ten locations upstream and downstream of the Study Area during the RI. The Site-specific background surface sediment samples were analyzed for the same suite of inorganic and organic constituents that were analyzed in Study Area surface sediment samples.

To augment this earlier program, Site-specific background sediment samples (surface and subsurface) will be collected at six additional upstream locations. One upstream location (SEDBACK21) is identified to support the forensic analysis only. In addition, surface and subsurface sediment samples will be collected to a maximum depth of 10 ft at fifteen locations on site or downstream including seven locations within the Waterside Investigation Area and eight locations downstream of the Waterside Investigation Area. Two additional surface sediment samples (SDRBACK1 and SDRBACK2) will be collected from city storm drain MS4 outfall F-294-739 and city outfall F-656-309 to evaluate forensic impacts of stormwater sediments not connected to Pepco site outfalls but contributing to the background of urban runoff. This sampling location has been identified

primarily to support the forensic analysis. All sampling locations are presented in Figure 4-1 relative to the sediment sampling locations of the riverwide RI/FS (TetraTech, 2016), and in Figure 4-2 relative to the preliminary background evaluation sampling locations and upstream tributaries. The rationale for each location is presented in Table 4-1.

The six upstream locations were selected based on available physical and chemical information (e.g., sediment grain size, total organic carbon, and chemistry) from nearby Site-specific background sediment samples presented in the preliminary background evaluation (AECOM, 2016a) and the riverwide RI/FS (TetraTech, 2016). The seven locations on site and eight downstream locations were identified at the request of DOEE for the forensic evaluation.

The five upstream surficial sediment samples (SEDBACK16, 17, 18, 19 and 20) will serve as "reference" samples for consideration in the BERA. These samples will be used to compare and contrast the results of Study Area sediment toxicity, chemistry, and benthic macroinvertebrate community sampling locations with reference locations. These five upstream locations provide a comparable range of bathymetry to the Waterside Investigation Area and are located in areas of the river that were not sampled by either Pepco in 2014 or Tetra Tech in 2014 or 2015. In addition, the grain size data for nearby locations suggests comparable substrate to the Waterside Investigation Area.

It is recognized that some sampling locations may need to be re-located based on accessibility concerns. Any relocation of sampling locations will be done in co-ordination with DOEE representatives.

Surface sediment will be collected from 0 to 6 inches (0 to 15 centimeters (cm)) below river bottom (unless the Sediment Profile Imagery Study (SPI) described in the Additional Remedial Investigation Work Plan determines that a different sampling horizon best represents the biologically active zone (BAZ) in this portion of the Anacostia River). Subsurface sediments will be collected to a depth of 9 feet or refusal per the Pepco RI/FS Sampling and Analysis Plan (AECOM, 2012c). Subsurface sediment samples will be collected in discrete one-foot intervals and five depth intervals (0-1ft, 2-3ft, 4-5ft, 6-7ft, and 8-9ft) will be designated as "Tier I" samples and submitted for chemical analyses (Table 4-2). The remainder of the depth interval samples will be designated as "Tier II" samples and archived for analyses pending the results of the Tier I sample analyses. Sediment samples collected and placed on hold for potential Tier 2 analysis will be stored frozen. Holding times will be extended to one year to accommodate extraction and analysis after the default EPA SW846 holding times defined in the QAPP Table 6 have been exceeded.

Chemical analysis of the background samples will include the full suite of constituents (as defined in Section 4 of the Draft RI Report) so as to be consistent with the previously-collected data (both Study Area and Site-specific background) including metals, SVOCs, PCBs, TOC, SEM, AVS, PCDD/PCDFs, and organochlorine pesticides. If hydrocarbon contamination is present in any sediment core as indicated by field screening (FID/visual/odor), a VOC sample will be collected from the contaminated interval for immediate analysis. In addition, PCB congeners, saturated hydrocarbons, and biomarkers will be analyzed for in each background surface sediment sample to support the forensic evaluation as outlined in Table 4-2. A subset up to 12 samples of the subsurface sediment samples collected upstream (SEDBACK16 through 20) will be selected for PCB congener analysis based on the PCB Aroclor results. Another subset (up to 12 samples) of the upstream subsurface sediment samples will be selected for saturated hydrocarbon, alkylated PAH and biomarker analysis based on the results of the DRO/ORO analysis. Screening using the PCB Aroclor and DRO/ORO will focus the samples selected for additional forensic testing where it can add the most value to the forensic analysis. For example, the types of Aroclors detected and the relative abundance of each will be evaluated to determine if distinctive patterns are present or specific changes with depth are observed. A subset of samples will be selected for PCB congener analysis to represent all the significantly different patterns observed in the Aroclor results.

The refined Site-specific background sediment dataset will be compared to the Study Area sediment dataset using the same methodology presented in the preliminary background evaluation (AECOM 2016a), which includes evaluating the distribution of the background data, calculating descriptive summary statistics, comparing the Study Area and Site-specific background datasets using a variety of graphs (boxplots, histograms, etc), and when appropriate, conducting comparative statistical tests between Study Area and background and calculating background threshold values. The methodology for data evaluation is further discussed in Section 7 of this document. An outlier test will also be conducted, using standard USEPA ProUCL (version 5.1; USEPA, 2016) outlier tests, on the refined background datasets to determine if any high-end concentrations detected in background are identified as outliers. This evaluation will be conducted in accordance with USEPA guidance and ProUCL 5.1 software (USEPA, 2002a; 2016).

4.2 Revised Regional Sediment Background Dataset

The preliminary sediment background evaluation included evaluation of Site data relative to a Regional Background sediment data set obtained from the National Oceanic and Atmospheric Administration's (NOAA) Damage Assessment, Remediation, and Restoration Program (DARRP) Query Manager Database (queried March 8, 2015). As requested by DOEE in the RI Path Forward Letter, the regional background sediment dataset will be refined to include only samples collected

within the last ten years and within the lower Anacostia River (i.e., from the downstream confluence with the Potomac River to the upstream confluence with the Northeast Branch/Northwest Branch of the river).

Based on a query of the NOAA DARRP Query Manager Database (queried March 8, 2015[5]), a total of 138 surface sediment samples were collected within the lower Anacostia River within the last ten years (Table 4-3). Figure 4-3 presents the refined regional sediment dataset sampling locations. These samples were collected in three efforts: the 2006 and 2009 Washington Navy Yard Sediment studies and the 2011 CSXT Anacostia River Sediment Study. The regional background sediment data set will also include the recently collected data from the riverwide RI/FS (TetraTech, 2016), the locations of which are illustrated on Figure 4-1.

The refined regional sediment dataset will be evaluated using the identical methodology as was used in the preliminary background evaluation (i.e., graphical comparisons with Study Area and Site-specific background sediment using GIS and boxplots). The methodology for data evaluation is further discussed in Section 7 of this document.

[5] This database will be queried again and the regional sediment dataset updated as necessary for the Refined Background Evaluation.

5 Refined Background Evaluation for Fish Tissue

The objective of the background evaluation for fish tissue is to determine estimates of the concentrations of COPCs in fish tissue that are not impacted by Site-related activities. The fish tissue background analysis will rely on regional background data; no Site-specific background data are available or will be collected.

The DQOs for the refined background fish evaluation are as follows:

- To incorporate additional local fish tissue data to update the existing background fish datasets from previous investigations; and
- To develop estimates of the concentrations of COPCs in sediment that are un-impacted by the Site.

The levels of data quality protocol defined in the Work Plan to achieve the DQOs will be applied for this evaluation as well and include, when possible, Levels III through V for laboratory analyses for USEPA recommended performance based methodologies and/or specialty methods (e.g., forensic analysis).

Fish tissue data collected by TetraTech (2016) will be included in the project database and incorporated into the refined background evaluation following the same methodology used in the preliminary background evaluation (and RI) to summarize the fish tissue data by sampling area and by analyte, and to calculate summary statistics. This will include fish tissue from the three feeding guilds (forage, mid-level, and top trophic level). Total PCBs were the only fish tissue COPC evaluated in the preliminary BHHRA and BERA and in the preliminary background evaluation as well. As requested by DOEE in the RI Path Forward Letter, all organic and inorganic constituents available for fish tissue data will be included in the refined background evaluation.

Unless review of the recently collected TetraTech (2016) data suggest otherwise, the three sampling areas of the Anacostia River for fish tissue will be consistent with the preliminary RI:

- Lower Anacostia River – from confluence with Potomac to CSX Railroad Bridge (approximately 3.5 miles upriver from confluence with Potomac),
- Upper Anacostia River – from CSX Railroad Bridge to Maryland state line (approximately 6.8 miles upriver from confluence with Potomac), and
- Upstream Maryland Area - north of the D.C.-Maryland state line (covering the main stem, east, and west branches of the Anacostia River in Maryland).

As detailed in the preliminary background evaluation, while the Study Area is located within the Upper Anacostia River sampling area, it is unknown if these samples reflect conditions within the Study Area or simply reflect the conditions within the several mile long river reach that was sampled.

The refined background evaluation methodology for fish tissue will be consistent with the preliminary background evaluation. Graphical comparisons such as boxplots, as well as statistical analyses, will be used to evaluate trends of COPCs in fish tissue among the three sampling areas. The methodology for data evaluation is further discussed in Section 7 of this document.

6 Refined Forensic Analyses

As requested by DOEE in the RI Path Forward Letter, additional samples will be collected and analyzed for an expanded suite of analytes for forensic purposes as part of the site-specific background investigation. The analyte groups selected for the revised forensic analysis will include PAHs (expanded list including saturated hydrocarbons and biomarker data), PCBs (all 209 congeners, plus Aroclor data), and PCDD/PCDFs (expanded list including all 136 tetra to octa chlorinated isomers and homolog groups). The DQOs identified in the Work Plan that pertain specifically to this effort include:

- To collect additional data to update existing Landside and Waterside datasets from previous investigations so that nature and extent of impacts can be defined;
- To collect data within the Anacostia River to identify potential Site-related, near-Site and far-Site sources of COPCs in sediment and surface water; and,
- To collect data to better understand the Site storm drain system and associated discharge to the Anacostia River at various outfalls.

As detailed in the refined background soil evaluation, the five levels of data quality protocols defined in the Work Plan will be adhered to for this evaluation as well.

The expanded forensic hydrocarbon compound list will be based in part on the tables provided by DOEE (presented in Attachment A), including a new list of saturated hydrocarbons including n-alkanes and acyclic isoprenoids matching Table 1, and a new set of geochemical biomarkers matching Table 3. The saturated hydrocarbon list is provided in Table 6-1. The geochemical biomarker list is provided in Table 6-2. The parent and alkylated PAHs will be analyzed again by LRMS isotope dilution (at TestAmerica-Knoxville) to maintain comparability with the Pepco RIFS and DOEE river wide RIFS datasets. This analyte list is unchanged and was provided in the Pepco RIFS Quality Assurance Project Plan (AECOM, 2012c).

The saturated hydrocarbon and geochemical biomarker profiles will be combined with the alkylated PAH and heterocylic data to better understand the nature of the petrogenic sources both upstream in the Anacostia sediments and from specific landside urban runoff sources such as stormwater outfalls not related to the Site. A clearer understanding of the site-specific urban background sources was identified by DOEE as a data gap in the draft RI report analysis of PAH sources. Urban background sources typically include both petrogenic and pyrogenic PAH components and the additional site-specific data will help elucidate the relative contributions of each source type. Tentatively selected potential landside locations include soils south of Benning Road, soil near the intersection of Benning Road and Kenilworth Ave, and along Kenilworth Ave. north and south of the site, and soil in the area

north of the site near the former waste incinerator. A map of these and other background locations is provided in Figure 2-1. Table 2-1 provides the rationale for selection of both the risk related and forensic related background locations. Tentatively selected waterside sediment locations include the storm drain sediments within the pipe that discharges immediately south of the Benning Road bridge, points south of the confluence with Kingman Lake and Hickey Run and near Nash Run, south of the bend above Kenilworth Park and south of Nash Run, south of the confluence with Lower Beaverdam Creek, south of the confluence with Dueling Creek, and south of the Bladensburg Marina. An additional fifteen locations were identified by DOEE within the Waterside Investigation Area and downstream of the Waterside Investigation Area to support the forensic evaluation. A map of these locations is provided in Figures 4-1 and 4-2 and the rationale for the location selection is provided in Table 4-1. The details of forensic analyses of all surface and subsurface sediment samples is provided in Table 4-2. Some of these points, such as Hickey Run, are associated with known historical releases of fuels and oils, and the others drain watersheds with extensive impervious surfaces that could be significantly impacted by urban stormwater runoff. The goal is to evaluate the specific PAH and TPH patterns from these locations and provide a site-specific profile of urban background contributions to the Anacostia sediments. Results from the recent DOEE draft Phase 1 Remedial Investigation Report of the Anacostia River Sediment Project will be evaluated to determine the best locations for background sampling prior to completion of the Additional Remedial Investigation Work Plan.

Due to the relative abundance of weathering resistant acyclic isoprenoids versus normal alkanes, the shapes and carbon ranges of unresolved complex mixtures in the saturated hydrocarbon chromatograms can provide information on the general types of petroleum products present and the approximate length of time since release. Patterns of specific geochemical biomarkers are often crude oil specific and may provide clues that can distinguish between TPH sources at the various discharge points along the Anacostia. The extended PAH profiles will be evaluated using graphical and multivariate statistical methods such as cluster analysis, principal component analysis, and correlation plots to compare the patterns assigned to background locations with Site locations. Effects of environmental weathering on PAH and TPH patterns will be considered during the data evaluation, including evaluation of diagnostic ratios known to be resistant to weathering and associated primarily with pyrogenic or petrogenic sources. The potential effects of low molecular weight PAH and differential parent and alkylated PAH weathering will be evaluated using cross-plots and bar graphs. Selected weathering resistant pyrogenic diagnostic ratios in the 4-6 ring range (e.g. the C0/C2 and BC0/C2+C3 ratios), the pyrogenic index , as well as weathering resistant petrogenic source ratios (e.g. D2/P2 vs D3/P3), combined with the saturated hydrocarbon patterns, will be used to differentiate the effects of weathering from source signatures. Various PAH group sums and total TPH will be compared using box-and whisker plots combined with tests for statistical significance of

differences to determine if the site distribution of contaminants is significantly different than the new, more comprehensive background dataset. These multiple lines of evidence, plus information about geomorphology and possible transport processes, will be integrated in the revised report conclusions.

Selected Site-specific background sediment samples will be analyzed for PCB congeners. Lower Bearverdam Creek in particular has been cited as a significant source of PCBs to the Anacostia in several previous studies. Results from the recent DOEE draft Phase 1 Remedial Investigation Report of the Anacostia River Sediment Project (TetraTech, 2016) will be evaluated to avoid duplication and provide an optimized background dataset to compare with the Waterside Investigation Area site results. Results of the PCB congener and Aroclor analyses from the sediment samples collected as part of the initial Study Area RI will be integrated with the new results before data analysis. Data analysis will include graphical and multivariate statistical methods such as cluster analysis, principal component analysis, and cosine theta analysis of congener patterns. Multiple lines of evidence other than statistical chemometrics, including visual pattern analysis, homolog group ratios, diagnostic ratios, distinctive patterns of reductive dechlorination, mixing and unmixing models, and spatial-temporal distribution will be considered during data evaluation. Qualitative assignment of Aroclor types from the EPA 8082 analyses will be compared to statistical matches with reference datasets (Frame) in the congener data. Total PCBs will be compared using box-and whisker plots combined with tests for statistical significance of differences to determine if the site distribution of contaminants is significantly different than the new, more comprehensive background dataset.

Congener analysis will include all of the tetrachloro up to octachloro isomers, including all the non-2,3,7,8 isomers (Table 6-3). These additional 119 congeners, although they do no contribute to the total TEQ used in risk assessment, will add potential forensic value in the pattern analysis and assist in comparing potential local off-site and upstream sources to the on-site patterns. Locations on-site with the highest TEQ values both in surface soil (SUS11, SUS08, SUS10, SUS18, and SUS19) and near site River sediment (SED7F, SED6.5E, and SED2C) will be resampled and analyzed to provide the additional congener data for comparison to background. Data analysis will include graphical and multivariate statistical methods such as cluster analysis, principal component analysis, cosine theta analysis of congener patterns. Coincident contamination by PCBs will be evaluated to determine how much of the PCDF contamination may be attributable to Aroclors. Results from the recent DOEE draft Phase 1 Remedial Investigation Report of the Anacostia River Sediment Project (TetraTech, 2016) will be evaluated, if available for all the 17 2,3,7,8-isomers, together with the results presented in the Draft RI Report to create a combined background dataset as comprehensive as possible. Various sums of PCDD/PCDF congeners will be compared using box-and whisker plots combined with tests for statistical significance of differences to determine if the site distribution of contaminants is significantly different than the new, more comprehensive background dataset.

6.1 Graphical Analyses

Graphical analysis will include bar graphs of each complex analyte group with abundance normalized to group total concentrations. The side-by-side comparison of normalized profiles can be used to evaluate the similarity of profiles independently of absolute analyte concentration. Simple double ratio cross plots may also be used to show the separation in diagnostic ratios. Diagnostic ratios are derived from selected analytes which can provide information useful to separate possible sources in the two dimensional graph.

Box-and-whisker plots will be used to compare the relative concentration of analyte groups in aggregate between the site-specific background locations and on-site locations. Distributions of concentrations are indicated between the 25th and 75th percentiles by the "box" which contains a line for the median value. The "whiskers" above and below the box represent the largest result less than or equal to the 75th percentile plus 1.5 times the interquartile range for the upper whisker, and the lower whisker represents the smallest result greater than or equal to the 25th percentile minus 1.5 times the interquartile range. Results outside the whisker limits are represented by dots. Visual comparison of the plots will be accompanied by statistical tests for the significance of differences in the means.

6.2 Statistical Analyses

Three exploratory different multivariate statistical methods will be used to look for patterns in the complex datasets in multiple dimensions -- cluster analysis, principal component analysis, and cosine theta similarity.

Hierarchical cluster analysis can be used to analyze the mathematical dissimilarities in relative abundance patterns as a variable between samples. This technique can be used to separate and characterize differences between sample patterns which may correspond to separate sources. The typical output is a dendrogram "tree" of relationships between sample patterns. Averages of source patterns that cluster together on the dendrogram can then be compared to individual sample patterns via bar graphs or correlation cross plots. When the correlations have correlation coefficients approaching 1.0, the strength of the match between patterns is numerically and graphically confirmed. Analyte subgroups based on ring number, homolog group, etc. can be marked in the correlation plots to evaluate the effect of differences in susceptibility to weathering rates based on molecular weight.

Principal component analysis (PCA) can be used to describe the variation in analyte concentrations in terms of new variables (principal components) that are uncorrelated with each other. The first principal component is the sum of original concentrations with analyte-specific weights that describes the most variability across samples. The second principal component is the sum of original

concentrations with a different set of analyte-specific weights that describes as much as possible of the remaining variability, and so on. The first and second principal components identified will be evaluated as score plots in two dimensions, where significant separation in two dimensions may indicate meaningful differences in parts of the pattern which correspond to differences in source.

Cosine theta similarity is a statistical method for assessing numeric similarity of patterns as multidimensional vectors, where the angel between the vectors is a function of the overall similarity. A perfect match between coincident vectors yields a cosine of 1, and if the patterns have no matches (90 degrees apart) then the cosine will be 0. Cosine theta values for PCB congeners will be calculated using Stata (rev IC 11) comparing all sample patterns with each other and with the reference Aroclor patterns from the Frame dataset.

Multiple lines of evidence will be used the supplement the graphical and statistical analysis, including qualitative pattern and chromatographic profile analysis, source or analyte class specific diagnostic ratios, cross plots, mixing and unmixing models, as well as spatial-temporal analysis of contaminant distribution in light of the revised Conceptual Site Model.

7 Refined Background Evaluation Report

The refined background evaluation will be presented as an appendix to the revised RI report and will include similar graphical and statistical analyses and presentations as were included in the preliminary background evaluation (including population tests, background threshold values, and boxplot comparisons). The methodologies for the population tests, background threshold values, and boxplot comparisons were presented in the preliminary background evaluation (AECOM, 2016a) and presented below in detail. The data and analyses presented in the preliminary background evaluation will be updated and/or reproduced as necessary for the refined background evaluation report.

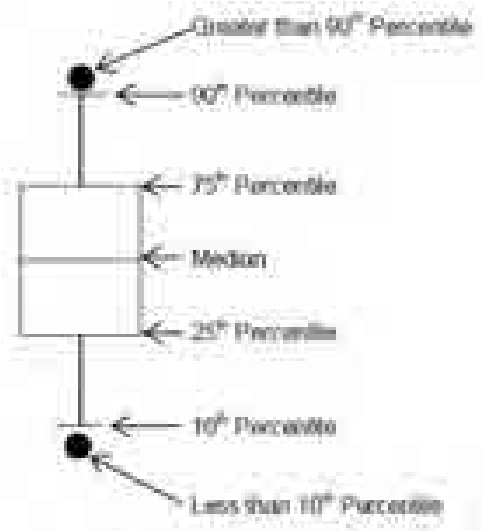
For soil and sediment, the Study Area and background concentrations will be compared using boxplots. In addition, when sufficient data are available (i.e., at least 8-10 samples in each area), Study Area and Site-specific background datasets will be compared using population statistics and background threshold values (BTVs) will be calculated in accordance with USEPA guidance and ProUCL (version 5.1) software (USEPA, 2002a; 2016). Descriptions of the box plots and population statistics applied to the data sets are presented in the following sections.

Fish tissue data evaluation will be consistent with the preliminary background evaluation. Graphical comparisons (i.e., boxplots) and summary statistics will be prepared to describe and compare fish tissue concentrations among the three sampling areas, Lower Anacostia River, Upper Anacostia River, and Upstream Maryland Area.

For groundwater, data will be summarized and presented in tables consistent with the groundwater data presentation in the RI report. Similar to fish tissue data, graphs such as boxplots and summary statistics will be prepared to described and compare groundwater data in the Study Area and at background locations.

7.1 Box Plots

Box plots will be used as a means of comparing Study Area and background data for each medium as well as showing the distribution of the data (see example figure below). The box represents the interquartile range (IQR) where the top of the box corresponds to the upper quartile or the 75th percentile and the bottom of the box is located at the lower quartile or the 25th percentile. The line between the lower and upper quartiles represents the median or the 50th percentile (where 50% of the data are greater than this value and 50% of the data are less than this value). The minimum and maximum ranges, excluding outliers, are represented by the “whiskers” above and below the box. The points above or below the whiskers are any result that is more than 90th percentile or less than the 10th percentile. The box plots are displayed on a logarithmic scale to better illustrate the range of data.



7.2 Population Tests and BTV Comparisons

COPCs considered appropriate for quantitative background statistical evaluation will be those with a minimum of eight samples in both the Study Area and Site-specific background data sets, based on best professional judgment and agency guidance (USEPA, 2002a; 2011). Decision statistics (e.g., hypotheses test statistics) are generally not considered reliable for small data sets (e.g., less than 8 samples) (USEPA, 2011), although ProUCL will compute decision statistics for data sets with as few as 5 samples, but with warnings about the potential deficiencies associated with the data set.

A two-sample hypothesis test will be conducted to compare the mean or median of the Study Area and Site-specific background data sets. The null hypothesis (H_O) and alternative hypothesis (H_A) of this test are consistent with Test Form 2 of USEPA (2002a) and put the burden of proof on determining consistency of Study Area and background data sets:

- H_O = Mean/Median of Site Data >= Site-specific Background Data + S
- H_A = Mean/Median of Site Data < Site-specific Background Data + S

The statistical factor “S” (substantial difference) will be included in the hypothesis test for this evaluation. The value of S for this evaluation is the standard deviation of the Site-specific background data set, which is identified in guidance (USEPA, 2002a) as a means of taking into account variability in background and is conservative. The value of S for each COPC will be added to the value of each background sample prior to conducting the two-sample hypothesis tests.

The statistical tests selected for each COPC and medium will be determined by the distributions of the Study Area and Site-specific background data sets. The normality of the distributions is

determined using Goodness-of-Fit statistics (Shapiro-Wilk test, significance level 0.05) in ProUCL 5.1. If both data sets are normally distributed, then a t-test is selected. If either data set are not normal, then a non-parametric test (Wilcoxon-Mann-Whitney [WMW] or Gehan) is selected. The WMW test is selected for data sets with all detected samples (with not normal distributions), or in cases of data sets with non-detected concentrations where the detection limits are equal. The Gehan test is selected for data sets that include non-detected samples with unequal detection limits.

For each test (t-test, Gehan's or WMW), if the p-value of the two-sample hypothesis test is greater than the alpha (0.05), then the null hypothesis is not rejected and it was concluded that Study Area concentrations are greater than background. If the p-value is less than alpha (0.05), then the null hypothesis is rejected and the alternative hypothesis was accepted: Study Area concentrations are less than or similar to Site-specific background.

In addition to population tests, the BTV corresponding to the 95 percent upper tolerance limit with 95 percent coverage of the background population will be calculated assuming a nonparametric distribution for this evaluation (USEPA, 2013). The results of the population comparison tests and BTV comparisons for surface sediment and surface water will be discussed for each medium and presented in the refined background evaluation report.

8 References

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Tables

Table 1-1
Proposed Analyses Per Media Type for the Refined Background Evaluation
Benning Road Facility RI/FS Project - rev Oct. 2016

Sample Location	Sample Media	Number of Samples	Parameters	Rationale
Background Surface and Subsurface Soil Sampling				
SU-BK-01	Surface (0-1 ft) and subsurface (3-4 ft) soil	2	All: PCBa, Metals, VOCs, SVOCs, PCDD/PCDFs, DRO/ORO, cyanide, pesticides Forensics Subset 1 (up to 12 samples): SHC, APAHs, GBM Forensics Subset 2 (up to 12 samples): PCBc	Collect background soil data to support the Background and Forensic Evaluations
SU-BK-02		2		
SOBACK1		2		
SOBACK2		2		
SOBACK3		2		
SOBACK4		2		
SOBACK5		2		
SOBACK6		2		
SOBACK7		2		
SOBACK8		2		
SOBACK9		2		
SOBACK10		2		
SOBACK11		2		
SOBACK12		2		
SOBACK13		2		
SOBACK14		2		
SOBACK15		2		
SOBACK16		2		
SOBACK17		2		
SOBACK18		2		
Sample total		40		
Background Monitoring Well Sampling				
SB1500325	Groundwater	1	PCBa, Dissolved and Total Metals, VOCs, SVOCs, PCDD/PCDFs, cyanide, pesticides, DRO/ORO	Collect background groundwater data
SB1300013		1		
SB1500308		1		
Sample total		3		
Background DPT Groundwater Sampling				
Geoprobe 01	Groundwater (UWZ and LWZ)	2	All: PCBa, Dissolved and Total Metals, VOCs, SVOCs, PCDD/PCDFs, cyanide, pesticides, DRO/ORO Forensics Subset 1 (up to 12 samples including Task 2 established well samples): SHC, APAHs, GBM Forensics Subset 2 (up to 12 samples including Task 2 established well samples): PCBc	Collect background groundwater data
Geoprobe 02		2		
Geoprobe 03		2		
Geoprobe 04		2		
Geoprobe 05		2		
Geoprobe 06		2		
Geoprobe 07		2		
Geoprobe 08		2		
Geoprobe 09		2		
Sample total		18		

Table 1-1
Proposed Analyses Per Media Type for the Refined Background Evaluation
Benning Road Facility RI/FS Project - rev Oct. 2016

Sample Location	Sample Media	Number of Samples	Parameters	Rationale
Background Surface and Subsurface Sediment Sampling				
6 Upstream Background Locations	Surface Sediment	6	Chemical: PCBa, metals, TOC, AVS/SEM (except SEDBACK21), VOCs, SVOCs, pesticides, PCDD/PCDFs, cyanide Forensics (all): PCBc, SHC, APAHs, GBM Physical: grain size Pore Water Analysis (except SEDBACK21): PCBc, metals, PAHs, ammonia, DOC, hardness Benthic Macroinvertebrate Survey (except SEDBACK21) Laboratory Toxicity Testing (except SEDBACK21)	Collect additional Background sediment data to support the Ecological Risk Assessment, Background and Forensic Evaluations
6 Upstream Background Locations	4 Subsurface Sediment depths (1-3, 3-5, 5-7, 7-9 ft)	24	Chemical: PCBa, metals, TOC, VOCs, SVOCs, pesticides, PCDD/PCDFs, DRO/ORO, cyanide Physical: grain size Forensic subset 1 (up to 12 samples): SHC, APAHs, GBM Forensics subset 2 (up to 12 samples): PCBc	Collect additional Background sediment data to support the Background and Forensic Evaluations
15 Forensics Sediment Sampling Locations	Surface and subsurface sediment (1-ft intervals between 0-10 ft)	150	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants3	Collect additional sediment forensics data
2 City Stormwater Outfalls (F-294-739 and F-656-309)	Storm Drain Sediment	2	Chemical: PCBa, metals, VOCs, SVOCs, pesticides, PCDD/PCDFs, cyanide Forensics (all): PCBc, SHC, APAHs, GBM	Collect storm drain sediment data to support the Background and Forensic Evaluations
Sample total		182		

Notes
PCBc - PCB congeners
PCBa - PCB aroclors
SHC - Saturated Hydrocarbons by gas chromatography/flame-ionization detection (GC/FID)
APAH - Parent and Alkylated PAHs by ID0016
GBM - Geochemical Biomarkers by 8270M

Table 2-1
Proposed Site-specific Background Soil Samples for Surface and Subsurface Soils
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale	NRCS Soil Survey		
				Soil Map Unit	Slope (%)	Typical Profile (b)
SU-BK-01	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Background sample collected from Aquatic Gardens on 3/3/2006 by Ecology and Environment, Inc. for Kenilwork Park North Remedial Investigation	Location in vicinity of site and close to river offers local background soil conditions	Bibb sandy loam (Bg) or Iuka sandy loam (Ik)	0-2 %	Sandy loam (0-14in), gravelly sandy loam (14-60in) to Sandy loam (0-60 in); poorly to moderately well drained
SU-BK-02	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Background sample collected from Aquatic Gardens on 3/3/2006 by Ecology and Environment, Inc. for Kenilwork Park North Remedial Investigation	Location in vicinity of site and close to river offers local background soil conditions	Bibb sandy loam (Bg) or Iuka sandy loam (Ik)	0-2 %	Sandy loam (0-14in), gravelly sandy loam (14-60in) to Sandy loam (0-60 in); poorly to moderately well drained
SOBACK1	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample adjacent to former trash incinerator on Benning Road	Location adjacent to site near former trash incinerator offers local background soil conditions upwind of site	Udorthents (U11B)	0 to 8%	Sandy loam (0-6 in), clay loam (6-30in), gravelly loam (30-80in)
SOBACK2	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at Fort Mahon Park	Location in vicinity of site in public park offers local background soil conditions apart from industrial or commercial land uses	Muirkirk variant complex (MvC)	8 to 15%	Loamy sand (0-11in), sandy loam (11-31in), clay (31-60in); well drained
SOBACK3	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at Fort Chaplin Park	Location in vicinity of site in public park offers local background soil conditions apart from industrial or commercial land uses	Beltsville-Urban Land complex	0 to 8%	Silt loam (0-50in), sandy loam (50-72 in); moderately well drained
SOBACK4	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at Anacostia Park and Blaine Street	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U1)	0 to 10%	Not specified
SOBACK5	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at Anacostia Park and Oklahoma Street	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U1)	0 to 10%	Not specified
SOBACK6	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at the National Arboretum	Location in vicinity of site in public park offers local background soil conditions apart from industrial or commercial land uses	Muirkirk variant complex (MvC)	8 to 15%	Loamy sand (0-11in), sandy loam (11-31in), clay (31-60in); well drained
SOBACK7	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at the National Arboretum	Location in vicinity of site in public park offers local background soil conditions apart from industrial or commercial land uses	Muirkirk variant complex (MvD)	15 to 40%	Loamy sand (0-11in), sandy loam (11-31in), clay (31-60in); well drained
SOBACK8	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample near tennis courts at Anacostia Park	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U1)	0 to 10%	Not specified
SOBACK9	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at Fort Mahon Park	Location upgradient along Kenilworth Avenue offers local background soil conditions specific to road inputs	Muirkirk variant complex (MvD)	15 to 40%	Loamy sand (0-11in), sandy loam (11-31in), clay (31-60in); well drained

Table 2-1
Proposed Site-specific Background Soil Samples for Surface and Subsurface Soils
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale	NRCS Soil Survey		
				Soil Map Unit	Slope (%)	Typical Profile (b)
SOBACK10	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample on median at Kenilworth Avenue, northeast of Benning Road facility	Location upgradient along Kenilworth Avenue offers local background soil conditions specific to road inputs	Udorthents (U6)	0 to 10%	Not specified
SOBACK11	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample on median at Kenilworth Avenue, south of Benning Road facility	Location upgradient along Kenilworth Avenue offers local background soil conditions specific to road inputs	Udorthents (U6)	0 to 10%	Not specified
SOBACK12	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample north of Benning Road facility in Fort Circle Park	Location in vicinity of site and close to river offers local background soil conditions	Iuka sandy loam (Ik)	0 to 2%	Sandy loam (0-21 in), sandy loam (21-60 in)
SOBACK13	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample in green space south of East Capitol St Bridge and east of 295	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U1)	0 to 10%	Not specified
SOBACK14	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample near right bank shoreline north of Benning Road facility	Location adjacent to site near river offers local background soil conditions upwind of site	Udorthents (U11D)	15 to 25%	Sandy loam (0-6 in), clay loam (6-30in), gravelly loam (30-80in)
SOBACK15	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample on left bank of river at the National Arboretum	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U10)	0 to 3%	Clay loam (0-2 in), clay (2-65in); well-drained
SOBACK16	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample in between rail line and Route 60	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U10)	0 to 3%	Clay loam (0-2 in), clay (2-65in); well-drained
SOBACK17	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample at the edge of tree cover near Thomas Elementary School	Location in vicinity of site offers local background soil conditions upwind of site	Udorthents (U11B)	0 to 8%	Sandy loam (0-6 in), clay loam (6-30in), gravelly loam (30-80in)
SOBACK18	Metals, VOCs, SVOCs, PCBs, PCDD/PCDFs, pesticides, DRO/ORO	Proposed sample adjacent to Anacostia Riverwalk Trail	Location in vicinity of site and close to river offers local background soil conditions	Udorthents (U1)	0 to 10%	Not specified

Notes:
bgs - Below ground surface.
NRCS - Natural Resource Conservation Service Soil Survey (available at: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)
DRO - Diesel Range Organics.
ORO - Oil Range Organics.
PAH - Polynuclear aromatic hydrocarbon.
PCB - Polychlorinated biphenyl.
PCDD/PCDF - Polychlorinated dibenzo(p)dioxin and polychlorinated dibenzofuran.
(a) Two subsets of samples will be analyzed for soil forensic constituents. One subset (consisting of up to 10 samples) will be analyzed for saturated hydrocarbons, parent and alkylated PAHs, and geochemical biomarkers. The other subset (up to 10 samples) will be analyzed for PCB congeners. Results for the DRO/ORO and PCB Aroclor analyses will be used to screen appropriate samples for forensic analysis.
(b) Based on the typical soil profile defined for each soil map unit by the NRCS, the depth of the surface or A horizon for soil types at the proposed soil sample locations extends down to 6 to 14 inches bgs and the subsurface or "B" soil horizon down to 60 inches bgs. It is anticipated that a surface soil sample depth of 0 to 1 ft bgs will encompass the A horizon predicted by NRCS and the subsurface soil sample depth of 3-4 feet bgs will be located within the B horizon. These depth intervals are consistent with previously collected soil sample depths.

Table 2-2
Proposed Regional Background Soil Sample Dataset
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Site ID	State	Latitude	Longitude	Date Collected	Land Cover	Land Cover, secondary	Depth (cm)
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	0-16
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	100-110
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	100-110
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	100-110
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	100-110
4540	MD	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	100-110
4540	VA	39.1807	-76.9614	7/6/2008	Planted/Cultivated	Row Crops	0-16
8892	MD	38.7125	-76.5707	7/10/2008	Planted/Cultivated	Urban/Recreational Grasses	0-5
8892	MD	38.7125	-76.5707	7/10/2008	Planted/Cultivated	Urban/Recreational Grasses	100-120
8892	MD	38.7125	-76.5707	7/10/2008	Planted/Cultivated	Urban/Recreational Grasses	100-120
8892	VA	38.7125	-76.5707	7/10/2008	Planted/Cultivated	Urban/Recreational Grasses	0-5
8892	VA	38.7125	-76.5707	7/10/2008	Planted/Cultivated	Urban/Recreational Grasses	0-5
12476	VA	38.7947	-77.5736	5/25/2010	Forested Upland	Mixed Forest	0-3
444	MD	39.3912	-76.829	7/6/2008	Forested Upland	Deciduous Forest	0-18
444	MD	39.3912	-76.829	7/6/2008	Forested Upland	Deciduous Forest	70-78
5564	MD	39.4226	-77.5685	7/11/2008	Planted/Cultivated	Row Crops	0-10
5564	MD	39.4226	-77.5685	7/11/2008	Planted/Cultivated	Row Crops	100-116
5564	MD	39.4226	-77.5685	7/11/2008	Planted/Cultivated	Row Crops	100-116
2492	MD	39.5936	-77.1964	7/6/2008	Planted/Cultivated	Fallow	0-20
2492	MD	39.5936	-77.1964	7/6/2008	Planted/Cultivated	Fallow	72-80

Table 3-1
Proposed Background Groundwater Monitoring Wells
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Well Location		Rationale	Analyses (a)	Location	Sampling Procedure (b)
DCRA Permit No.	SB1500325	Upgradient established monitoring wells to provide information on the nature and extent of Site-related contaminants	Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	600 Kenilworth Terrace NE	Low- flow procedures with peristaltic pump
	SB1300013		Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF,	3900 Benning Road NE	
	SB1500308		Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF,	4000 Benning Road NE	
Geoprobe 01		Upgradient locations to provide information on the nature and extent of Site-related contaminants	Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Close to background soil location SOBACK10 on Kenilworth Ave NE	
Geoprobe 02			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	East of site, Fort Mahon Park	
Geoprobe 03			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	South of site, Fort Dupont Park	
Geoprobe 04			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Southeast of site, Fort Chaplin Park	
Geoprobe 05			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Northeast of site, Thomas Elementary School, Anacostia Ave NE	
Geoprobe 06			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	West of site, close to SOBACK7 at the National Arboretum	
Geoprobe 07			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	East of site, Fort Mahon Park	
Geoprobe 08			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Southeast of site, fields of Benning Stoddart Recreation Center	
Geoprobe 09			Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Northeast of site, Fort Circle Park, Jay St NE	

Table 3-1
Proposed Background Groundwater Monitoring Wells
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Well Location	Rationale	Analyses (a)	Location	Sampling Procedure (b)
Geoprobe 10	Continued: Upgradient locations to provide information on the nature and extent of Site-related contaminants	Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Northeast of site, Fort Circle Park, Jay St NE	Continued: Low-flow procedures with peristaltic pump
Geoprobe 11		Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	Southeast of site, Fort Chaplin Park	
Geoprobe 12		Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	South of site, Anacostia Riverwalk Park	
Geoprobe 13		Metals, VOCs, SVOCs, PCB Aroclors, PCDD/PCDF, pesticides	West of site, close to SOBACK18 adjacent to Anacostia Riverwalk Trail	

Notes:
PAH - Polynuclear aromatic hydrocarbon.
PCB - Polychlorinated biphenyl.
PCDD/PCDF - Polychlorinated dibenzo(p)dioxin and polychlorinated dibenzofuran.
SVOCs - Semi-volatile Organic Compounds.
VOCs - Volatile Organic Compounds.
(a) A subset of 12 geoprobe samples will also be analyzed PCB congeners.
(b) The sampling procedures will be described in detail in the Additional Remedial Investigation Work Plan (in prep).

Table 4-1
Proposed Additional Site-specific Background Sediment Samples
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale
SEDBACK16	Metals, TOC, AVS/SEM, grain size, toxicity testing, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream in between BACK3 and BACK4 mid-channel near Bladensburg Waterfront Park	Location is downstream of NE and NW Branches; approximate elevation ranges from -0.5 m to -3.0 m; grain size of Back3 is predominantly sand (88%) and gravel (9.8%). This location will be used to evaluate both surficial ecological risk and forensic impacts of the NE and NW branches.
SEDBACK17	Metals, TOC, AVS/SEM, grain size, toxicity testing, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream in between BACK3 and BACK4 on right bank (facing upstream) opposite Colmar Manor Community Park	Location is downstream of NE and NW Branches; approximate elevation ranges from -0.5 m to -3.0 m; grain size of R7-09 (upstream on right bank) is predominantly silt (54%) and clay (29%). This location will be used to evaluate both surficial ecological risk and forensic impacts of the NE and NW branches plus the Bladensburg Marina.
SEDBACK18	Metals, TOC, AVS/SEM, grain size, toxicity testing, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream close to left bank in between BACK4 and New York Ave NE bridge	Approximate elevation ranges from -0.01m to -3 m; grain size of R7-02 (downstream on left bank) is silt (44.6%), clay (17.5%), and sand (37.9%). This location will be used to evaluate both surficial ecological risk and forensic impacts of Dueling Creek
SEDBACK19	Metals, TOC, AVS/SEM, grain size, toxicity testing, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream close to left bank in between the CSX bridge and BACK5	Approximate elevation ranges from -1 m to -3 m; grain size of R7-02 (upstream on left bank) is silt (44.6%), clay (17.5%), and sand (37.9%). This location will be used to evaluate both surficial ecological risk and forensic impacts of Lower Beaverdam Creek and upstream railroad and highway runoff.
SEDBACK20	Metals, TOC, AVS/SEM, grain size, toxicity testing, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream on right bank at the bend in the river just downstream of BACK6	Approximate elevation ranges from -1 m to -3m; grain size of R6-13 (upstream mid-channel) is sand (66%), silt (20%), clay (12%), and gravel (2%) (b). This location will be used to evaluate both surficial ecological risk and forensic impacts of Nash Run and drainage from the marsh north of the Kenilworth Landfill.

Table 4-1
Proposed Additional Site-specific Background Sediment Samples
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale
SEDBACK21	Metals, TOC, grain size, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Upstream just below confluence with Hickey Run and Kingman Lake inlet.	This location will be used for the forensic evaluation of river sediments upstream of the Pepco site.
SED7D	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area, near Outfall 013	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SED6.5D	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area, near Outfall 013	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SED5B	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SED5C	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.

Table 4-1
Proposed Additional Site-specific Background Sediment Samples
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale
SED4B	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SED4C	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SED1.5B	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SEDREF1	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.
SEDREF2	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments of the Pepco site.

Table 4-1
Proposed Additional Site-specific Background Sediment Samples
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale
SEDREF3	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.
SEDREF4	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.
SEDREF5	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.
SEDREF6	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.
SEDREF7	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.

Table 4-1
Proposed Additional Site-specific Background Sediment Samples
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Designation	Analyses (a)	Description	Rationale
SEDREF8	Tier 1: 0-1, 2-3, 4-5, 6-7, and 8-9 ft samples analyzed immediately for PAHs, PCBa, SHC Tier 2: All intervals archived for possible analysis for PCBa, PCBc, PAHs, SHC, APAH, GBM and Priority Pollutants	Downstream of Waterside Investigation Area, at CSXAR25D	This location will be used for the forensic evaluation of river sediments downstream of the Pepco site.
SDRBACK1	Metals, TOC, grain size, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Storm drain sediments from city storm drain MS4 outfall F-294-739	This location will be used to evaluate forensic impacts of stormwater sediments not connected to Pepco site outfalls but contributing to the background of urban runoff.
SDRBACK2	Metals, TOC, grain size, SVOCs, pesticides, PCDD/PCDFs, alkylated PAHs, PCB Aroclors, DRO/ORO, PCB congeners, saturated hydrocarbons, biomarkers	Storm drain sediments from city outfall F-656-309	This location will be used to evaluate forensic impacts of stormwater sediments not connected to Pepco site outfalls but contributing to the background of urban runoff.

Notes:
AVS - Acid Volatile Sulfides.
DRO - Diesel Range Organics.
ORO - Oil Range Organics.
PAH - Polynuclear aromatic hydrocarbon.
PCB - Polychlorinated biphenyl.
PCDD/PCDF - Polychlorinated dibenzo(p)dioxin and polychlorinated dibenzofuran.
SEM - Simultaneously extracted metals.
SVOCs - Semi-volatile Organic Compounds.
TOC - Total organic carbon.
VOCs - Volatile Organic Compounds.
(a) The analyses for surface sediment samples (and SDRBACK1 and 2) will include all listed except DRO/ORO. Subsurface samples will be analyzed for all listed except one subset of subsurface sediment samples (up to 12 samples) will be analyzed for saturated hydrocarbons, parent and alkylated PAHs, and geochemical biomarkers. Another subset (up to 12 samples) will be analyzed for PCB congeners. Results for the DRO/ORO and PCB Aroclor analyses will be used to screen appropriate samples for forensic analysis.

Table 4-2
Proposed Analyses of Sediment Samples for the Forensic Evaluation
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Sample Interval (a)		Tier 1 Sample Analysis (b)			Tier 2 Forensics Sample Analysis (c)		
Start Depth	End Depth	SW8270 PAH16 PAHs	USEPA 8082 PCB	USEPA 8015C SHC	USEPA 1668 PCBc	USEPA 8270M APAH	USEPA 8270M Biomarkers
0	1	Y	Y	Y	CHD	CHD	CHD
1	2	CHD	CHD	CHD	CHD	CHD	CHD
2	3	Y	Y	Y	CHD	CHD	CHD
3	4	CHD	CHD	CHD	CHD	CHD	CHD
4	5	Y	Y	Y	CHD	CHD	CHD
5	6	CHD	CHD	CHD	CHD	CHD	CHD
6	7	Y	Y	Y	CHD	CHD	CHD
7	8	CHD	CHD	CHD	CHD	CHD	CHD
8	9	Y	Y	Y	CHD	CHD	CHD
9	10	CHD	CHD	CHD	CHD	CHD	CHD

Notes
APAH - Alkylated polycyclic aromatic hydrocarbon.
CHD - Collect and Hold Discrete sample.
PAH - Polycyclic aromatic hydrocarbon.
PCB - Polychlorinated biphenyl.
PCBc - Polychlorinated biphenyl (congener analysis).
SHC - Saturated hydrocarbons.
Y - Tier 1 designated sample.
(a) Discrete samples (1 ft) will be collected to the target depth indicated in Sample Collection Interval column. Field screening (FID/visual/odor) will be conducted and recorded at all locations during the Waterside investigation.
(b) Samples with a "Y" designation are Tier 1 samples and will be submitted for the analyses indicated.
(c) Petroleum Hydrocarbon and PCB forensics will be conducted on these samples. Samples with a CHD are the discrete samples that will be archived pending the results from the Tier 1 sample analyses. Following the results from the Tier 1 sample and analysis, PEPCO will review and propose to DOEE which CHD samples will be submitted for forensics analysis (Tier 2). Sediment samples collected and placed on hold for potential Tier 2 analysis will be stored frozen. Holding times will be extended to one year to accommodate extraction and analysis after the default EPA SW846 holding times defined in the QAPP Table 6 have been exceeded.

Table 4-3
Refined Regional Background Surface Sediment Dataset
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Study Name	Sample Date	Latitude	Longitude	Upper Depth (cm)	Lower Depth (cm)
2006, 2009 Washington Navy Yard Sed/Tiss	09/26/2006	38.87062	-76.99283	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/26/2006	38.87115	-76.99188	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/27/2006	38.87282	-77	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/27/2006	38.87255	-76.99991	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/27/2006	38.87255	-76.99991	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/28/2006	38.87222	-76.9968	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/28/2006	38.872	-76.99785	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/29/2006	38.87262	-76.99872	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	09/29/2006	38.87248	-76.99782	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/02/2006	38.87197	-76.99597	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/02/2006	38.87178	-76.99518	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/02/2006	38.87167	-76.99473	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/02/2006	38.87103	-76.99423	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/02/2006	38.87103	-76.99423	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/03/2006	38.87258	-76.99835	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/03/2006	38.87152	-76.99594	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/03/2006	38.87187	-76.99065	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/04/2006	38.87157	-76.99423	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/04/2006	38.87149	-76.99416	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/04/2006	38.87121	-76.9926	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/04/2006	38.87194	-76.99127	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	10/04/2006	38.87211	-76.99059	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87222	-76.9968	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87198	-76.99598	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87151	-76.99594	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.86996	-76.99168	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87198	-76.99745	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87229	-76.99717	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87193	-76.99695	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87159	-76.99685	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87134	-76.99612	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/26/2009	38.87134	-76.99612	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87255	-76.99843	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87236	-76.99848	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87236	-76.99848	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87247	-76.99781	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87222	-76.99814	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87146	-76.99437	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87146	-76.99437	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87249	-76.99844	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87216	-76.99847	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87204	-76.99835	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/27/2009	38.87251	-76.99805	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.87127	-76.99231	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.87171	-76.99149	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.86984	-76.99939	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.86918	-76.99362	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.87209	-76.98802	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.87553	-76.98034	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/28/2009	38.87588	-76.97929	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87102	-76.99424	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87061	-76.99283	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87277	-77.00034	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87277	-76.99982	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87276	-76.99961	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87219	-76.99917	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.8723	-76.99894	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87246	-76.99882	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87177	-76.99759	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87177	-76.99759	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.8706	-76.99316	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87111	-76.99307	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87138	-76.99112	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87131	-76.99412	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87195	-76.99129	0	15.24
2006, 2009 Washington Navy Yard Sed/Tiss	08/29/2009	38.87195	-76.99129	0	15.24

Table 4-3
Refined Regional Background Surface Sediment Dataset
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Study Name	Sample Date	Latitude	Longitude	Upper Depth (cm)	Lower Depth (cm)
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88423	-76.96776	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88502	-76.96647	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88481	-76.96577	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88326	-76.96774	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88368	-76.96809	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88368	-76.96809	0	15.24
2011 CSXT Anacostia River Sediment Study	12/08/2011	38.88521	-76.9658	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88643	-76.96403	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88274	-76.97075	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88106	-76.97104	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88929	-76.96274	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88929	-76.96274	0	15.24
2011 CSXT Anacostia River Sediment Study	12/09/2011	38.88517	-76.96771	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88858	-76.96393	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.87831	-76.97266	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88147	-76.95819	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88147	-76.95819	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88151	-76.95977	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88157	-76.96066	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88123	-76.96075	0	15.24
2011 CSXT Anacostia River Sediment Study	12/10/2011	38.88154	-76.96166	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88175	-76.96268	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88175	-76.96268	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88181	-76.96288	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88191	-76.96304	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88256	-76.96445	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88256	-76.96445	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88256	-76.96445	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88262	-76.96453	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88268	-76.9646	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88274	-76.96467	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.8828	-76.96475	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88349	-76.9656	0	15.24
2011 CSXT Anacostia River Sediment Study	12/12/2011	38.88349	-76.9656	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88403	-76.96684	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88465	-76.96694	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88465	-76.96694	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.8837	-76.9672	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.8837	-76.9672	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88481	-76.96722	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88481	-76.96722	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.8828	-76.96827	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.8828	-76.96827	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88162	-76.9696	0	15.24
2011 CSXT Anacostia River Sediment Study	12/13/2011	38.88162	-76.9696	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88425	-76.96659	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88436	-76.96645	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88446	-76.96651	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88446	-76.96651	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88442	-76.96633	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88421	-76.96717	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.88421	-76.96717	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.8847	-76.96644	0	15.24
2011 CSXT Anacostia River Sediment Study	12/14/2011	38.8847	-76.96644	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88422	-76.96645	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88422	-76.96645	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88407	-76.96671	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88419	-76.9668	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88419	-76.9668	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88441	-76.96675	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88518	-76.9654	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88518	-76.9654	0	15.24
2011 CSXT Anacostia River Sediment Study	12/15/2011	38.88663	-76.96481	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.88229	-76.96373	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.88247	-76.9643	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.88248	-76.96434	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.88248	-76.96434	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.88248	-76.96434	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.8825	-76.96437	0	15.24
2011 CSXT Anacostia River Sediment Study	12/16/2011	38.8825	-76.96437	0	15.24
2011 CSXT Anacostia River Sediment Study	12/21/2011	38.88051	-76.97028	0	15.24
2011 CSXT Anacostia River Sediment Study	12/21/2011	38.8805	-76.97031	0	15.24

Table 6-1
List of Saturated Hydrocarbons , including n-Alkanes, Acyclic Isoprenoids, and Total Petroleum Hydrocarbons
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Analyte	CAS #
Total Petroleum Hydrocarbons (C9-C44)	NONE
Nonane (C9)	111-84-2
Decane (C10)	124-18-5
Undecane	1120-21-4
Dodecane (C12)	112-40-3
Tridecane	629-50-5
2,6,10-Trimethyldodecane (1380)	3891-98-3
Tetradecane (C14)	629-59-4
2,6,10-Trimethyltridecane (1470)	TMTD1470
n-Pentadecane (C15)	629-62-9
Hexadecane (C16)	544-76-3
Norpristane (1650)	3892-00-0
n-Heptadecane (C17)	629-78-7
Pristane	1921-70-6
Octadecane (C18)	593-45-3
Phytane	638-36-8
Nonadecane (C19)	629-92-5
Eicosane (C20)	112-95-8
Heneicosane (C21)	629-94-7
Docosane (C22)	629-97-0
n-Tricosane (C23)	638-67-5
Tetracosane (C24)	646-31-1
Pentacosane (C25)	629-99-2
Hexacosane (C26)	630-01-3
Heptacosane (C27)	593-49-7
Octacosane (C28)	630-02-4
Nonacosane (C29)	630-03-5
Triacontane (C30)	638-68-6
Hentatriacontane (C31)	630-04-6
Dotriacontane (C32)	544-85-4
Tritriacontane (C33)	630-05-7
Tetratriacontane (C34)	14167-59-0
Pentatriacontane (C35)	630-07-9
Hexatriacontane (C36)	630-06-8
Heptatriacontane (C37)	7194-84-5
Octatriacontane (C38)	7194-85-6
Nonatriacontane (C39)	7194-86-7
Tetracontane (C40)	4181-95-7
Total Extractable Saturated Hydrocarbons	TSATHC

Table 6-2
List of Geochemical Biomarkers
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Analyte
Hopane (T19)
C23 Tricyclic Terpane (T4)
C24 Tricyclic Terpane (T5)
C25 Tricyclic Terpane (T6)
C24 Tetracyclic Terpane (T6a)
C26 Tricyclic Terpane-22S (T6b)
C26 Tricyclic Terpane-22R (T6c)
C28 Tricyclic Terpane-22S (T7)
C28 Tricyclic Terpane-22R (T8)
C29 Tricyclic Terpane-22S (T9)
C29 Tricyclic Terpane-22R (T10)
18a-22,29,30-Trisnorneohopane-TS (T11)
C30 Tricyclic Terpane-22S
C30 Tricyclic Terpane-22R
17a(H)-22,29,30-Trisnorhopane-TM (T12)
17a/b,21b/a 28,30-Bisnorhopane (T14a)
17a(H),21b(H)-25-Norhopane (T14b)
30-Norhopane (T15)
18a(H)-30-Norneohopane-C29Ts (T16)
17a(H)-Diahopane (X)
30-Normoretane (T17)
18a(H)&18b(H)-Oleananes (T18)
Moretane (T20)
30-Homohopane-22S (T21)
30-Homohopane-22R (T22)
Gammacerane/C32-Diahopane
30,31-Bishomohopane-22S (T26)
30,31-Bishomohopane-22R (T27)
30,31-Trishomohopane-22S (T30)
30,31-Trishomohopane-22R (T31)
Tetrakishomohopane-22S (T32)
Tetrakishomohopane-22R (T33)
Pentakishomohopane-22S (T34)
Pentakishomohopane-22R (T35)
13b(H),17a(H)-20S-Diacholestane (S4)
13b(H),17a(H)-20R-Diacholestane (S5)
13b,17a-20S-Methyldiacholestane (S8)
17a(H)20SC27/C29dia
17a(H)20rc27/C29dia
Unknown Sterane (S18)
13a,17b-20S-Ethyldiacholestane (S19)
14a,17a-20S-Methylcholestane (S20)
14a,17a-20R-Methylcholestane (S24)
14a(H),17a(H)-20S-Ethylcholestane (S25)
14a(H),17a(H)-20R-Ethylcholestane (S28)
14b(H),17b(H)-20R-Cholestane (S14)
14b(H),17b(H)-20S-Cholestane (S15)
14b,17b-20R-Methylcholestane (S22)

Table 6-2
List of Geochemical Biomarkers
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Analyte
14b,17b-20S-Methylcholestane (S23)
14b(H),17b(H)-20R-Ethylcholestane (S26)
14b(H),17b(H)-20S-Ethylcholestane (S27)
C26,20R- +C27,20S-Triaromatic Steroid
C28,20S-Triaromatic Steroid
C27,20R-Triaromatic Steroid
C28,20R-Triaromatic Steroid

Table 6-3
List of Polychlorinated Dibenzodioxin and Dibenzofuran Analytes
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Chemical Name	CAS#	Analyte Type
1,2,3,4,6,7,8-HpCDD	35822-46-9	2,3,7,8-isomer
1,2,3,4,6,7,8-HpCDF	67562-39-4	2,3,7,8-isomer
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	2,3,7,8-isomer
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227-28-6	2,3,7,8-isomer
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	2,3,7,8-isomer
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653-85-7	2,3,7,8-isomer
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	2,3,7,8-isomer
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408-74-3	2,3,7,8-isomer
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	2,3,7,8-isomer
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	2,3,7,8-isomer
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321-76-4	2,3,7,8-isomer
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	2,3,7,8-isomer
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	2,3,7,8-isomer
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	2,3,7,8-isomer
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	2,3,7,8-isomer
Octachlorodibenzo-p-dioxin	3268-87-9	2,3,7,8-isomer
Octachlorodibenzofuran	39001-02-0	2,3,7,8-isomer
Total HpCDD	HPCDD	homolog group
Total HpCDF	HPCDF	homolog group
Total HxCDD	HXCDD	homolog group
Total HxCDF	HXCDF	homolog group
Total PeCDD	PECDD	homolog group
Total PeCDF	PECDF	homolog group
Total TCDD	TCDD	homolog group
Total TCDF	TCDF	homolog group
1,2,3,4,6,7,9-Heptachlorodibenzofuran	70648-25-8	non 2,3,7,8 isomer
1,2,3,4,6,7,9-Heptachlorodibenzo-p-dioxin	58200-70-7	non 2,3,7,8 isomer
1,2,3,4,6,7-Hexachlorodibenzofuran	79060-60-9	non 2,3,7,8 isomer
1,2,3,4,6,7-Hexachlorodibenzo-p-dioxin	58200-66-1	non 2,3,7,8 isomer
1,2,3,4,6,8,9-Heptachlorodibenzofuran	69698-58-4	non 2,3,7,8 isomer
1,2,3,4,6,8-Hexachlorodibenzofuran	69698-60-8	non 2,3,7,8 isomer
1,2,3,4,6,8-Hexachlorodibenzo-p-dioxin	58200-67-2	non 2,3,7,8 isomer
1,2,3,4,6,9-Hexachlorodibenzofuran	91538-83-9	non 2,3,7,8 isomer
1,2,3,4,6,9-Hexachlorodibenzo-p-dioxin	58200-68-3	non 2,3,7,8 isomer
1,2,3,4,6-Pentachlorodibenzofuran	83704-47-6	non 2,3,7,8 isomer
1,2,3,4,6-Pentachlorodibenzo-p-dioxin	67028-19-7	non 2,3,7,8 isomer
1,2,3,4,7,9-Hexachlorodibenzofuran	91538-84-0	non 2,3,7,8 isomer
1,2,3,4,7-Pentachlorodibenzofuran	83704-48-7	non 2,3,7,8 isomer
1,2,3,4,7-Pentachlorodibenzo-p-dioxin	39227-61-7	non 2,3,7,8 isomer
1,2,3,4,8,9-Hexachlorodibenzofuran	92341-07-6	non 2,3,7,8 isomer
1,2,3,4,8-Pentachlorodibenzofuran	67517-48-0	non 2,3,7,8 isomer
1,2,3,4,9-Pentachlorodibenzofuran	83704-49-8	non 2,3,7,8 isomer
1,2,3,4-Tetrachlorodibenzofuran	24478-72-6	non 2,3,7,8 isomer
1,2,3,4-Tetrachlorodibenzo-p-dioxin	30746-58-8	non 2,3,7,8 isomer
1,2,3,6,7,9-Hexachlorodibenzofuran	92341-06-5	non 2,3,7,8 isomer
1,2,3,6,7,9-Hexachlorodibenzo-p-dioxin	64461-98-9	non 2,3,7,8 isomer
1,2,3,6,7-Pentachlorodibenzofuran	57117-42-7	non 2,3,7,8 isomer
1,2,3,6,7-Pentachlorodibenzo-p-dioxin	71925-15-0	non 2,3,7,8 isomer
1,2,3,6,8,9-Hexachlorodibenzofuran	75198-38-8	non 2,3,7,8 isomer

Table 6-3
List of Polychlorinated Dibenzodioxin and Dibenzofuran Analytes
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Chemical Name	CAS#	Analyte Type
1,2,3,6,8,9-Hexachlorodibenzo-p-dioxin	58200-69-4	non 2,3,7,8 isomer
1,2,3,6,8-Pentachlorodibenzofuran	83704-51-2	non 2,3,7,8 isomer
1,2,3,6,8-Pentachlorodibenzo-p-dioxin	71925-16-1	non 2,3,7,8 isomer
1,2,3,6,9-Pentachlorodibenzofuran	83704-52-3	non 2,3,7,8 isomer
1,2,3,6,9-Pentachlorodibenzo-p-dioxin	82291-34-7	non 2,3,7,8 isomer
1,2,3,6-Tetrachlorodibenzofuran	83704-21-6	non 2,3,7,8 isomer
1,2,3,6-Tetrachlorodibenzo-p-dioxin	71669-25-5	non 2,3,7,8 isomer
1,2,3,7,9-Pentachlorodibenzofuran	83704-53-4	non 2,3,7,8 isomer
1,2,3,7,9-Pentachlorodibenzo-p-dioxin	71925-17-2	non 2,3,7,8 isomer
1,2,3,7-Tetrachlorodibenzofuran	83704-22-7	non 2,3,7,8 isomer
1,2,3,7-Tetrachlorodibenzo-p-dioxin	67028-18-6	non 2,3,7,8 isomer
1,2,3,8,9-Pentachlorodibenzofuran	83704-54-5	non 2,3,7,8 isomer
1,2,3,8,9-Pentachlorodibenzo-p-dioxin	71925-18-3	non 2,3,7,8 isomer
1,2,3,8-Tetrachlorodibenzofuran	62615-08-1	non 2,3,7,8 isomer
1,2,3,8-Tetrachlorodibenzo-p-dioxin	53555-02-5	non 2,3,7,8 isomer
1,2,3,9-Tetrachlorodibenzofuran	83704-23-8	non 2,3,7,8 isomer
1,2,3,9-Tetrachlorodibenzo-p-dioxin	71669-26-6	non 2,3,7,8 isomer
1,2,4,6,7,8-Hexachlorodibenzofuran	67562-40-7	non 2,3,7,8 isomer
1,2,4,6,7,9-Hexachlorodibenzofuran	75627-02-0	non 2,3,7,8 isomer
1,2,4,6,7,9-Hexachlorodibenzo-p-dioxin	39227-62-8	non 2,3,7,8 isomer
1,2,4,6,7-Pentachlorodibenzofuran	83704-50-1	non 2,3,7,8 isomer
1,2,4,6,7-Pentachlorodibenzo-p-dioxin	82291-35-8	non 2,3,7,8 isomer
1,2,4,6,8,9-Hexachlorodibenzofuran	69698-59-5	non 2,3,7,8 isomer
1,2,4,6,8,9-Hexachlorodibenzo-p-dioxin	58802-09-8	non 2,3,7,8 isomer
1,2,4,6,8-Pentachlorodibenzofuran	69698-57-3	non 2,3,7,8 isomer
1,2,4,6,8-Pentachlorodibenzo-p-dioxin	71998-76-0	non 2,3,7,8 isomer
1,2,4,6,9-Pentachlorodibenzofuran	70648-24-7	non 2,3,7,8 isomer
1,2,4,6,9-Pentachlorodibenzo-p-dioxin	82291-36-9	non 2,3,7,8 isomer
1,2,4,6-Tetrachlorodibenzofuran	71998-73-7	non 2,3,7,8 isomer
1,2,4,6-Tetrachlorodibenzo-p-dioxin	71669-27-7	non 2,3,7,8 isomer
1,2,4,7,8-Pentachlorodibenzofuran	58802-15-6	non 2,3,7,8 isomer
1,2,4,7,8-Pentachlorodibenzo-p-dioxin	58802-08-7	non 2,3,7,8 isomer
1,2,4,7,9-Pentachlorodibenzofuran	71998-74-8	non 2,3,7,8 isomer
1,2,4,7,9-Pentachlorodibenzo-p-dioxin	82291-37-0	non 2,3,7,8 isomer
1,2,4,7-Tetrachlorodibenzofuran	83719-40-8	non 2,3,7,8 isomer
1,2,4,7-Tetrachlorodibenzo-p-dioxin	71669-28-8	non 2,3,7,8 isomer
1,2,4,8,9-Pentachlorodibenzofuran	70648-23-6	non 2,3,7,8 isomer
1,2,4,8,9-Pentachlorodibenzo-p-dioxin	82291-38-1	non 2,3,7,8 isomer
1,2,4,8-Tetrachlorodibenzofuran	64126-87-0	non 2,3,7,8 isomer
1,2,4,8-Tetrachlorodibenzo-p-dioxin	71669-29-9	non 2,3,7,8 isomer
1,2,4,9-Tetrachlorodibenzofuran	83704-24-9	non 2,3,7,8 isomer
1,2,4,9-Tetrachlorodlbenzo-p-dioxin	71665-99-1	non 2,3,7,8 isomer
1,2,6,7,8-Pentachlorodibenzofuran	69433-00-7	non 2,3,7,8 isomer
1,2,6,7,9-Pentachlorodibenzofuran	70872-82-1	non 2,3,7,8 isomer
1,2,6,7-Tetrachlorodibenzofuran	83704-25-0	non 2,3,7,8 isomer
1,2,6,7-Tetrachlorodibenzo-p-dioxin	40581-90-6	non 2,3,7,8 isomer
1,2,6,8-Tetrachlorodibenzofuran	83710-07-0	non 2,3,7,8 isomer
1,2,6,8-Tetrachlorodibenzo-p-dioxin	67323-56-2	non 2,3,7,8 isomer
1,2,6,9-Tetrachlorodibenzofuran	70648-18-9	non 2,3,7,8 isomer

Table 6-3
List of Polychlorinated Dibenzodioxin and Dibenzofuran Analytes
Benning Road Facility RI/FS Project
3400 Benning Rd, N.E., Washington DC 20019

Chemical Name	CAS#	Analyte Type
1,2,6,9-Tetrachlorodibenzo-p-dloxin	40581-91-7	non 2,3,7,8 isomer
1,2,7,8-Tetrachlorodibenzofuran	58802-20-3	non 2,3,7,8 isomer
1,2,7,8-Tetrachlorodibenzo-p-dioxin	34816-53-0	non 2,3,7,8 isomer
1,2,7,9-Tetrachlorodibenzofuran	83704-26-1	non 2,3,7,8 isomer
1,2,7,9-Tetrachlorodibenzo-p-dioxin	71669-23-3	non 2,3,7,8 isomer
1,2,8,9-Tetrachlorodibenzofuran	70648-22-5	non 2,3,7,8 isomer
1,2,8,9-Tetrachlorodibenzo-p-dioxin	62470-54-6	non 2,3,7,8 isomer
1,3,4,6,7,8-Hexachlorodibenzofuran	71998-75-9	non 2,3,7,8 isomer
1,3,4,6,7,9-Hexachlorodibenzofuran	92341-05-4	non 2,3,7,8 isomer
1,3,4,6,7-Pentachlorodibenzofuran	83704-36-3	non 2,3,7,8 isomer
1,3,4,6,8-Pentachlorodibenzofuran	83704-55-6	non 2,3,7,8 isomer
1,3,4,6,9-Pentachlorodibenzofuran	70648-15-6	non 2,3,7,8 isomer
1,3,4,6-Tetrachlorodibenzofuran	83704-27-2	non 2,3,7,8 isomer
1,3,4,7,8-Pentachlorodibenzofuran	58802 16-7	non 2,3,7,8 isomer
1,3,4,7,9-Pentachlorodibenzofuran	70648-20-3	non 2,3,7,8 isomer
1,3,4,7-Tetrachlorodibenzofuran	70648-16-7	non 2,3,7,8 isomer
1,3,4,8-Tetrachlorodibenzofuran	92341-04-3	non 2,3,7,8 isomer
1,3,4,9-Tetrachlorodibenzofur an	83704-28-3	non 2,3,7,8 isomer
1,3,6,7,8-Pentachlorodibenzofuran	70648-21-4	non 2,3,7,8 isomer
1,3,6,7-Tetrachlorodibenzofuran	57117-36-9	non 2,3,7,8 isomer
1,3,6,8-Tetrachlorodibenzofuran	71998-72-6	non 2,3,7,8 isomer
1,3,6,8-Tetrachlorodibenzo-p-dioxin	33423-92-6	non 2,3,7,8 isomer
1,3,6,9-Tetrachlorodibenzofuran	83690-98-6	non 2,3,7,8 isomer
1,3,6,9-Tetrachlorodibenzo-p-dioxin	71669-24-4	non 2,3,7,8 isomer
1,3,7,8-Tetrachlorodibenzofuran	57117-35-8	non 2,3,7,8 isomer
1,3,7,8-Tetrachlorodibenzo-p-dioxin	50585-46-1	non 2,3,7,8 isomer
1,3,7,9-Tetrachlorodibenzofuran	64560-17-4	non 2,3,7,8 isomer
1,3,7,9-Tetrachlorodibenzo-p-dioxin	62470-53-5	non 2,3,7,8 isomer
1,4,6,7,8-Pentachlorodibenzofuran	83704-35-2	non 2,3,7,8 isomer
1,4,6,7-Tetrachlorodibenzofuran	66794-59-0	non 2,3,7,8 isomer
1,4,6,8-Tetrachlorodibenzofuran	82911-58-8	non 2,3,7,8 isomer
1,4,6,9-Tetrachlorodibenzofuran	70648-19-0	non 2,3,7,8 isomer
1,4,6,9-Tetrachlorodibenzo-p-dioxin	40581-93-9	non 2,3,7,8 isomer
1,4,7,8-Tetrachlorodibenzofuran	83704-29-4	non 2,3,7,8 isomer
1,4,7,8-Tetrachlorodibenzo-p-dioxin	40581-94-0	non 2,3,7,8 isomer
1,6,7,8-Tetrachlorodibenzofuran	83704-33-0	non 2,3,7,8 isomer
2,3,4,6,7-Pentachlorodibenzofuran	57117-43-8	non 2,3,7,8 isomer
2,3,4,6,8-Pentachlorodibenzofuran	67481-22-5	non 2,3,7,8 isomer
2,3,4,6-Tetrachlorodibenzofuran	83704-30-7	non 2,3,7,8 isomer
2,3,4,7-Tetrachlorodibenzofuran	83704-31-8	non 2,3,7,8 isomer
2,3,4,8-Tetrachlorodibenzofuran	83704-32-9	non 2,3,7,8 isomer
2,3,6,7-Tetrachlorodibenzofuran	57117-39-2	non 2,3,7,8 isomer
2,3,6,8-Tetrachlorodibenzofuran	57117-37-0	non 2,3,7,8 isomer
2,4,6,7-Tetrachlorodibenzofuran	57117-38-1	non 2,3,7,8 isomer
2,4,6,8-Tetrachlorodibenzofuran	58802-19-0	non 2,3,7,8 isomer
3,4,6,7-Tetrachlorodibenzofuran	57117-40-6	non 2,3,7,8 isomer

Figures

AECOM

Source:
USGS 7.5 Minute Topographic Map
Washington East Quadrangle

0 1000 2000 4000
SCALE IN FEET

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Site Location Map

DATE: 07/09/2012	DRAWN BY: LAD	CHECKED BY: RD	FIGURE 1-1

\\uschl1fp001\Data\Projects\Jobs\Indl Service\Project Files\Pepco Benning Road RI FS\GIS\MXD\2016\SitePlanAndInvestigationArea

Legend

- INVESTIGATION AREA
- BENNING ROAD FACILITY PROPERTY BOUNDARY
- PROPERTY BOUNDARY
- POTENTIAL FUTURE PARK LAND/GREEN SPACE

N

Feet

0 420 840 1,680

AECOM

Benning Road Facility RI/FS Project
3400 Benning Rd., NE
Washington, DC 20019

Site Plan And Investigation Areas

DATE: 07/5/2016 | DRAWN BY: KNS | FIGURE 1-2

\\usch1fp001\data\Projects\Jobs\Indl Service\Project Files\Pepco Benning Road RI FS\GIS\MXD\2016\Figure2-1

N
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S

Figure 2-1
Proposed Site-specific Background Surface and Subsurface Soil Sample Locations
Pepco - Benning Road Facility
Washington, DC

0 0.15 0.3 0.6 Miles

Legend

- Proposed Site Specific Background Soil Sample Location
- Waterside Investigation Area
- Benning Road Landside Investigation Area

AECOM

P:\Indl_Service\Project Files\Pepco Benning Road RI_FS\GIS\MXD\Reg_Bckgrnd_Soil_Locs.mxd

Maryland

Virginia

District of Columbia

Anacostia River

Potomac River

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

W E

S

Regional Conditions Surface and Subsurface Inorganic Soil Sample Locations
Pepco – Benning Road Facility
Washington, DC

0 5 10 20 Miles

Waterside Investigation Area

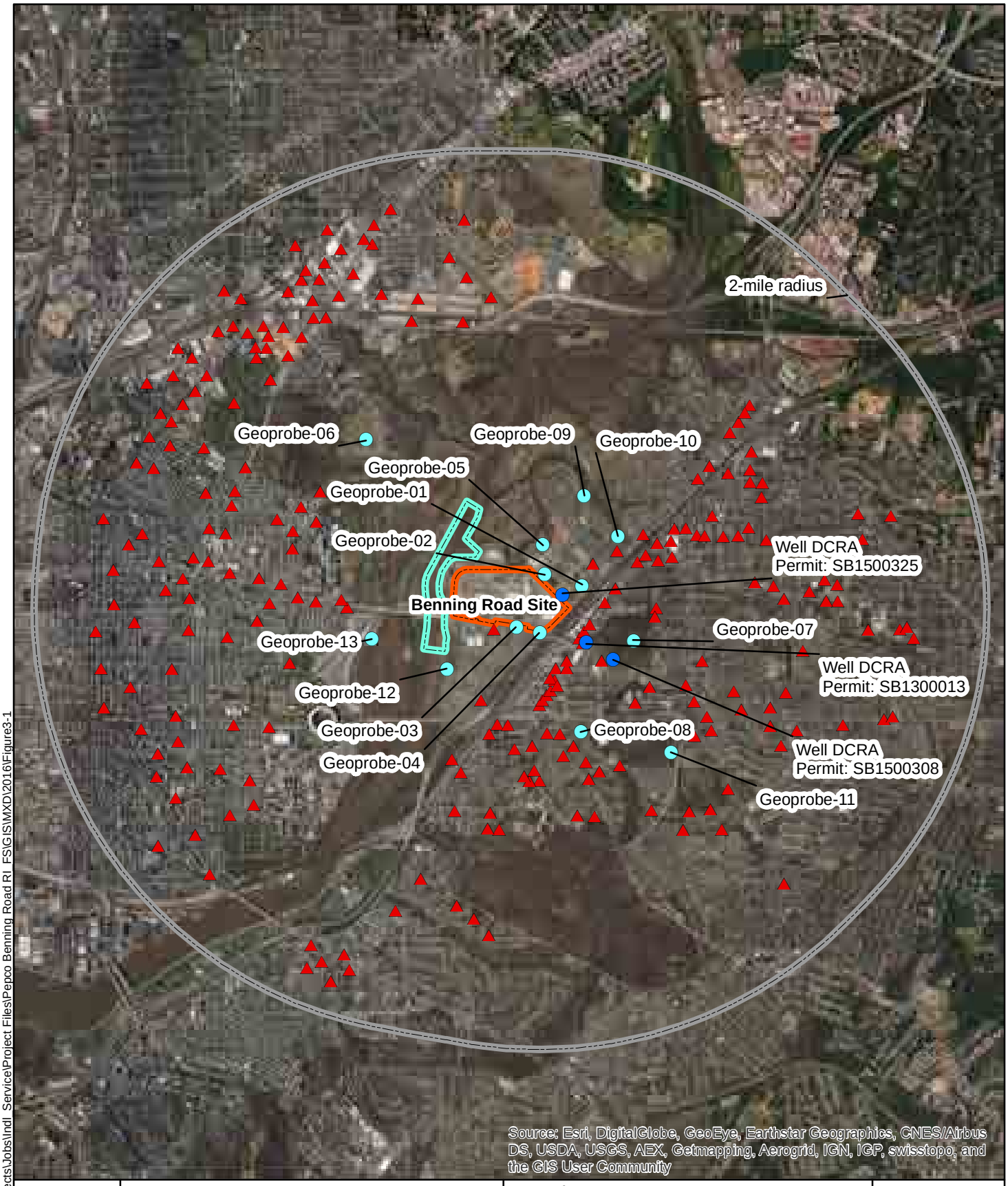
Benning Road Facility

Background Surface and Subsurface Soil Sample Locations

Note: In general, multiple samples were collected at each location.

AECOM

Figure 2-2



\\usch1fp001\data\Projects\Jobs\Indl_Service\Project Files\Pepco Benning Road RI_FS\GIS\MXD\2016\Figure3-1

N
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Figure 3-1
Proposed Site-specific Background Groundwater Sample Locations
Pepco - Benning Road Facility
Washington, DC

0 0.3 0.6 1.2 Miles

Legend

- Background Groundwater Well Location
- Background Groundwater Geoprobe Location
- LUST and Historic Cleaner Sites*
- Waterside Investigation Area
- Benning Road Landside Investigation Area
- 2 Mile Site Radius

* Information obtained from EDR Lightbox.
One symbol may represent more than one Site.

AECOM

P:\Indl_Service\Project Files\Pepco Benning Road RI_FS\GIS\MXD\Proposed_BckgrndSedv2.mxd

Back 2
Back 3
Back 4
Back 5
Back 9
District of Columbia
Maryland
Kennilworth Landfill
PEPCO Benning Road
CSX Railroad Bridge
Washington Gas
SE Federal Center
Washington Navy Yard
Poplar Point
District of Columbia
Maryland

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N
W E
S

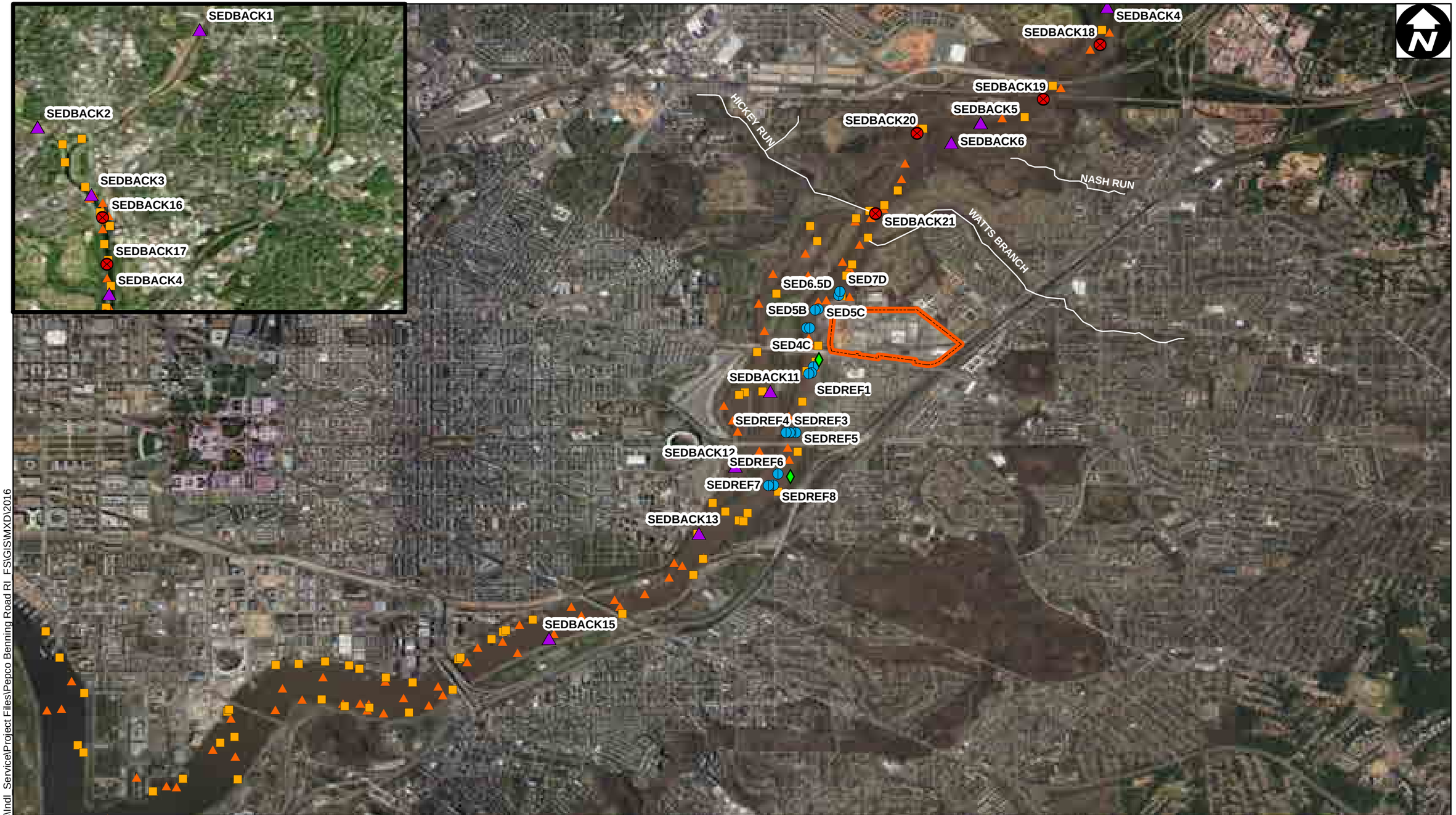
Site-specific Upstream Reference Sediment Sample Locations
Pepco – Benning Road Facility
Washington, DC

0 0.5 1 2 Miles

Property Boundaries
Waterside Investigation Area
Benning Road Facility
Upstream Reference Sediment Location

AECOM

Figure 3-2



Legend

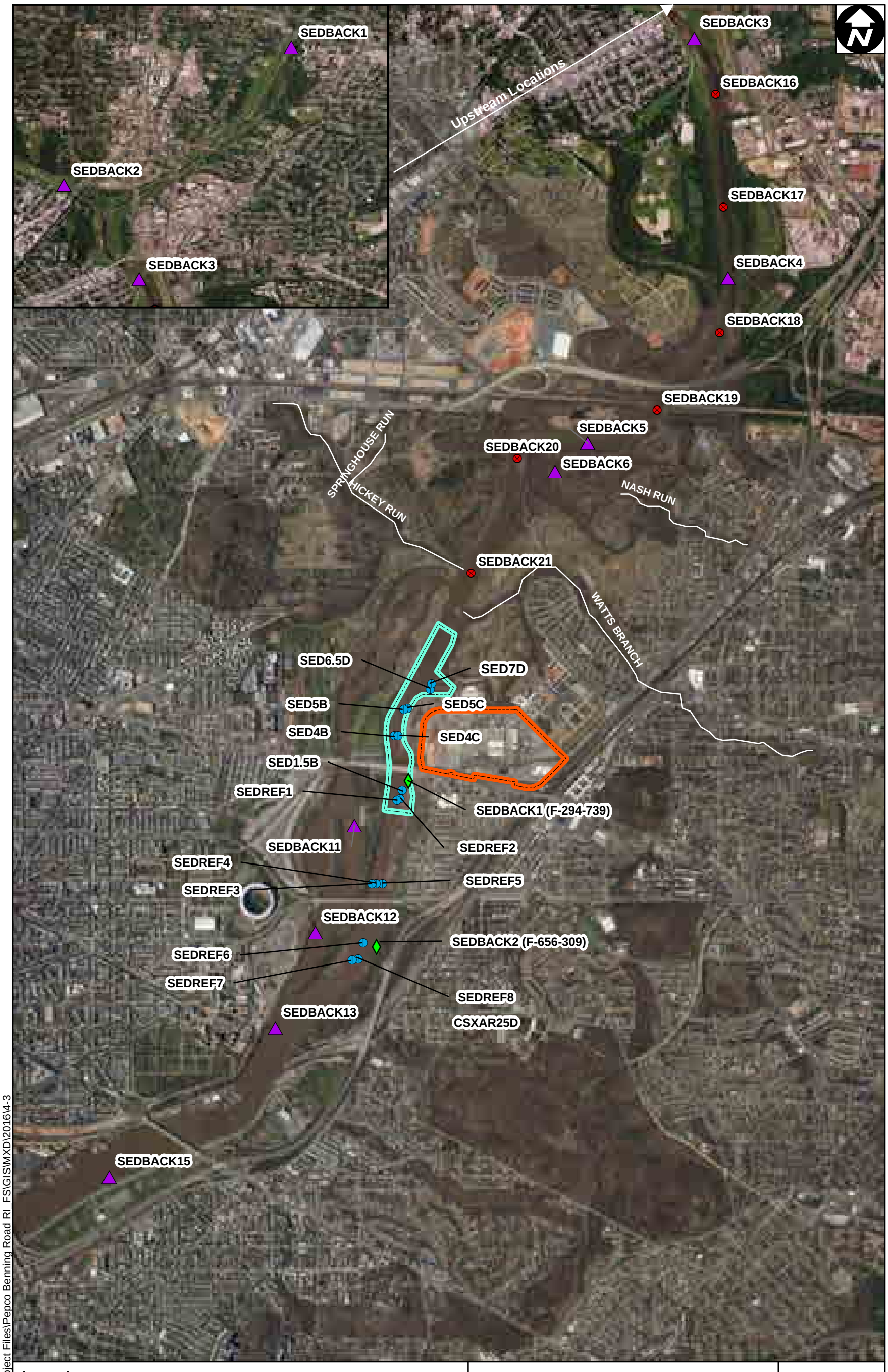
- Proposed In-River Background Sediment Sample Location
- Proposed Forensics Sediment Sample Location
- 2014 Background Co-located Sediment and Surface Water Sample Location
- 2014-2015 Tetra Tech Tox Testing Sample Locations
- Storm Sewer Outfall
- Benning Road Landside Investigation Area
- Waterside Investigation Area
- 2014-2015 Tetra Tech Sediment Sample Locations

0.3 0.15 0 0.3 Miles

Figure 4-1
Site-Specific Background Surface Sediment Sample Locations
Pepco - Benning Road Facility
Washington, DC

AECOM

Path: Data\Projects\Jobs\Indl_Service\Project Files\Pepco Benning Road RI_FS\GIS\MXD\2016



P:\Jobs\Indl_Service\Project Files\Pepco Benning Road RI_FS\GIS\MXD\2016\4-3

Legend

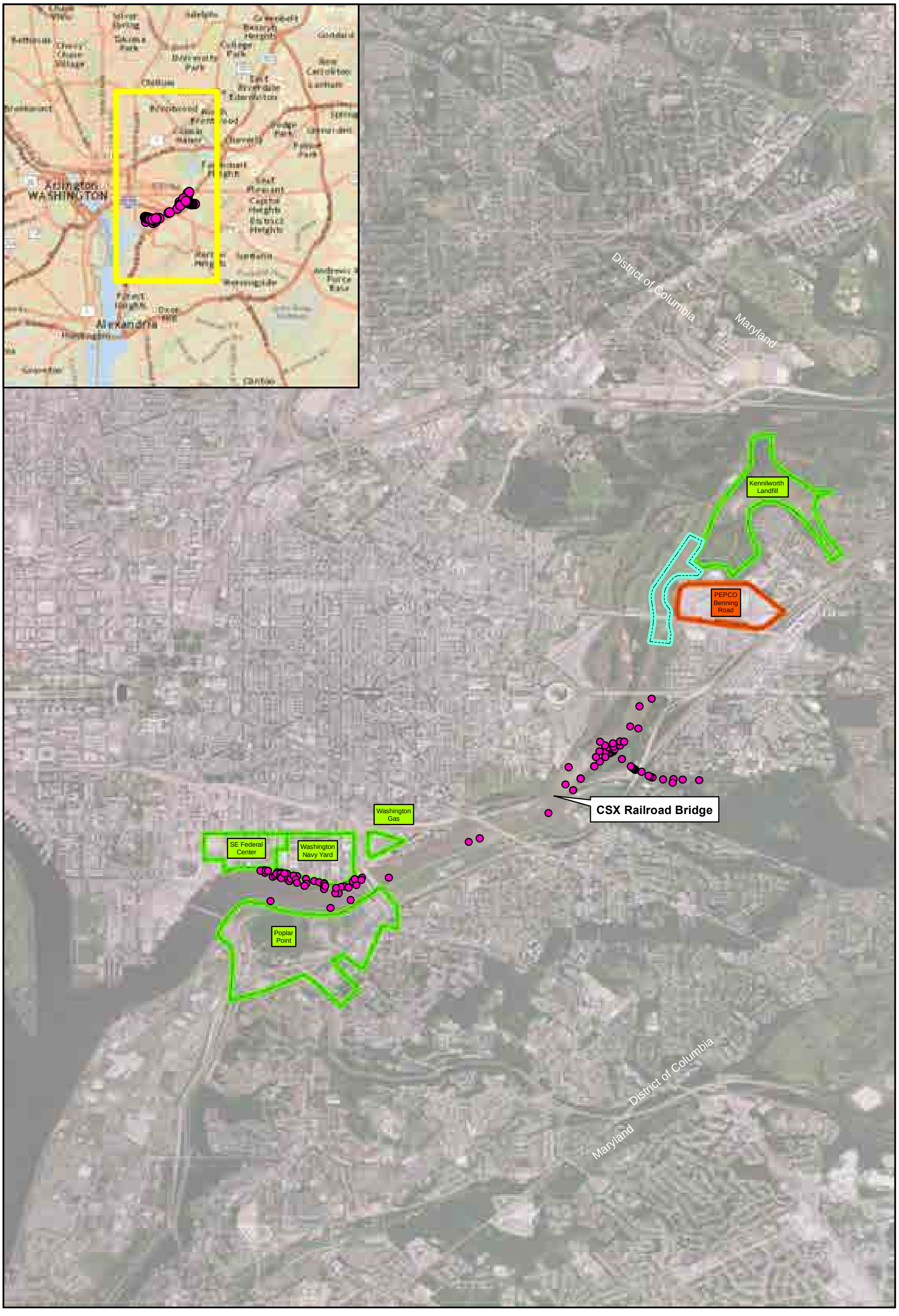
- Proposed In-River Background Sediment Sample Location
- Proposed Forensics Sediment Sample Location
- 2014 Background Co-located Sediment and Surface Water Sample Location
- Storm Sewer Outfall
- Benning Road Landside Investigation Area
- Waterside Investigation Area

0 0.25 0.5 1 Miles

Figure 4-2
Site-Specific Background Sediment Sample Locations
Pepco - Benning Road Facility
Washington, DC

Oct. 2016

AECOM



Revised Regional Background Surface Sediment Locations
Pepco – Benning Road Facility
Washington, DC

0 0.5 1 2 Miles

Property Boundaries
Waterside Investigation Area
Benning Road Facility
Sample included in Regional data set

AECOM

Figure 4-3

Attachment A

Analyte lists to be included for forensic purposes provided by DOEE

Table 1. Saturated Hydrocarbons (Alkanes/Isoprenoids Compounds) and Total Extractable Hydrocarbons

Abbr.	Analyte	Abbr.	Analyte
nC9	n-Nonane	nC23	n-Tricosane
nC10	n-Decane	nC24	n-Tetracosane
nC11	n-Undecane	nC25	n-Pentacosane
nC12	n-Dodecane	nC26	n-Hexacosane
nC13	n-Tridecane	nC27	n-Heptacosane
1380	2,6,10 Trimethyldodecane	nC28	n-Octacosane
nC14	n-Tetradecane	nC29	n-Nonacosane
1470	2,6,10 Trimethyltridecane	nC30	n-Triacontane
nC15	n-Pentadecane	nC31	n-Hentriacontane
nC16	n-Hexadecane	nC32	n-Dotriacontane
nPr	Norpristane	nC33	n-Tritriacontane
nC17	n-Heptadecane	nC34	n-Tetratriacontane
Pr	Pristane	nC35	n-Pentatriacontane
nC18	n-Octadecane	nC36	n-Hexatriacontane
Ph	Phytane	nC37	n-Heptatriacontane
nC19	n-Nonadecane	nC38	n-Octatriacontane
nC20	n-Eicosane	nC39	n-Nonatriacontane
nC21	n-Heneicosane	nC40	n-Tetracontane
nC22	n-Docosane	TRH	$\Sigma(C_9\text{-}C_{44})$ (All resolved peaks above the UCM over the entire hydrocarbon range from n-C9 to n-C44 after silica gel cleanup)
		TEH	$\Sigma(C_9\text{-}C_{44})$ (Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 after silica gel cleanup)
		TEM	$\Sigma(C_9\text{-}C_{44})$ (Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 no silica gel cleanup)

NOTE: TRH = Total Resolvable Hydrocarbons; TEH = Total Extractable Hydrocarbons with silica gel "clean-up"; TEM = Total Extractable Matter with no extract "clean-up"

Matrix	Target Method Detection Limit
Sediment (Alkanes) =	0.01 µg/g dry weight
Sediment (TEH) =	1 µg/g dry weight
Water (Alkanes) =	0.8 µg/L

Table 2. Extended PAH (Parent and Alkyl Homologues) and Other Related Compounds

	Compound
D0	**cis/trans-Decalin**
D1	**C1-Decalins**
D2	**C2-Decalins**
D3	**C3-Decalins**
D4	**C4-Decalins**
BT0	**Benzothiophene**
BT1	**C1-Benzo(b)thiophenes**
BT2	**C2-Benzo(b)thiophenes**
BT3	**C3-Benzo(b)thiophenes**
BT4	**C4-Benzo(b)thiophenes**
N0	*Naphthalene*
N1	*C1-Naphthalenes*
N2	*C2-Naphthalenes*
N3	*C3-Naphthalenes*
N4	*C4-Naphthalenes*
B	**Biphenyl**
DF	**Dibenzofuran**
AY	*Acenaphthylene*
AE	*Acenaphthene*
F0	*Fluorene*
F1	*C1-Fluorenes*
F2	*C2-Fluorenes*
F3	*C3-Fluorenes*
A0	*Anthracene*
P0	*Phenanthrene*
PA1	*C1-Phenanthrenes/Anthracenes*
PA2	*C2-Phenanthrenes/Anthracenes*
PA3	*C3-Phenanthrenes/Anthracenes*

	Compound
PA4	*C4-Phenanthrenes/Anthracenes*
RET	**Retene**
DBT0	*Dibenzothiophene*
DBT1	*C1-Dibenzothiophenes*
DBT2	*C2-Dibenzothiophenes*
DBT3	*C3-Dibenzothiophenes*
DBT4	*C4-Dibenzothiophenes*
BF	**Benzo(b)fluorene**
FL0	*Fluoranthene*
PY0	*Pyrene*
FP1	*C1-Fluoranthenes/Pyrenes*
FP2	**C2-Fluoranthenes/Pyrenes**
FP3	**C3-Fluoranthenes/Pyrenes**
FP4	**C4-Fluoranthenes/Pyrenes**
NBT0	**Naphthobenzothiophenes**
NBT1	**C1-Naphthobenzothiophenes**
NBT2	**C2-Naphthobenzothiophenes**
NBT3	**C3-Naphthobenzothiophenes**
NBT4	**C4-Naphthobenzothiophenes**
BA0	Benz[a]anthracene
C0	*Chrysene/Triphenylene*
BC1	*C1-Chrysenes*
BC2	*C2-Chrysenes*
BC3	*C3-Chrysenes*
BC4	*C4-Chrysenes*
BBF	*Benzo[b]fluoranthene*
BJKF	*Benzo[j]+[k]fluoranthene*
BAF	**Benzo[a]fluoranthene**

	Compound
BEP	Benzo[e]pyrene
BAP	Benzo[a]pyrene
PER	Perylene
IND	Indeno[1,2,3-cd]pyrene
DA	Dibenz[a,h]anthracene
GHI	Benzo[g,h,i]perylene
4MDT	**4-Methyldibenzothiophene**
2MDT	**2/3-Methyldibenzothiophene**
1MDT	**1-Methyldibenzothiophene**
3MP	**3-Methylphenanthrene**
2MP	**2Methylphenanthrene**
2MA	**2-Methylanthracene**
49MP	**4/9-Methylphenanthrene**
1MP	**1-Methylphenanthrene**
	2-Methylnaphthalene
	1-Methylnaphthalene
	2,6-Dimethylnaphthalene
	1,6,7-Trimethylnaphthalene
	Carbazole

Matrix	**Target Method Detection Limit Range**
Sediment/Soil =	0.1 – 0.5 ng/g dry weight
Tissue =	0.2 – 1.0 ng/g wet weight
Water =	1 – 5 ng/L

Table 3. Petroleum Biomarkers for Quantitative Analysis

Compound *	Quant Ion m/z
C23 Tricyclic Terpane (T4)	191
C24 Tricyclic Terpane (T5)	191
C25 Tricyclic Terpane (T6)	191
C24 Tetracyclic Terpane (T6a)	191
C26 Tricyclic Terpane-22S (T6b)	191
C26 Tricyclic Terpane-22R (T6c)	191
C28 Tricyclic Terpane-22S (T7)	191
C28 Tricyclic Terpane-22R (T8)	191
C29 Tricyclic Terpane-22S (T9)	191
C29 Tricyclic Terpane-22R (T10)	191
18a-22,29,30-Trisnorneohopane-Ts (T11)	191
C30 Tricyclic Terpane-22S (T11a)	191
C30 Tricyclic Terpane-22R (T11b)	191
17a(H)-22,29,30-Trisnorhopane-Tm (T12)	191
17a/b,21b/a 28,30-Bisnorhopane (T14a)	191
17a(H),21b(H)-25-Norhopane (T14b)	191
30-Norhopane (T15)	191
18a(H)-30-Norneohopane-C29Ts (T16)	191
17a(H)-Diahopane (X)	191
30-Normoretane (T17)	191
18a(H)&18b(H)-Oleananes (T18)	191
Hopane (T19)	191
Moretane (T20)	191
30-Homohopane-22S (T21)	191
30-Homohopane-22R (T22)	191
T22a-Gammacerane/C32-diahopane	191
30,31-Bishomohopane-22S (T26)	191
30,31-Bishomohopane-22R (T27)	191
30,31-Trishomohopane-22S (T30)	191

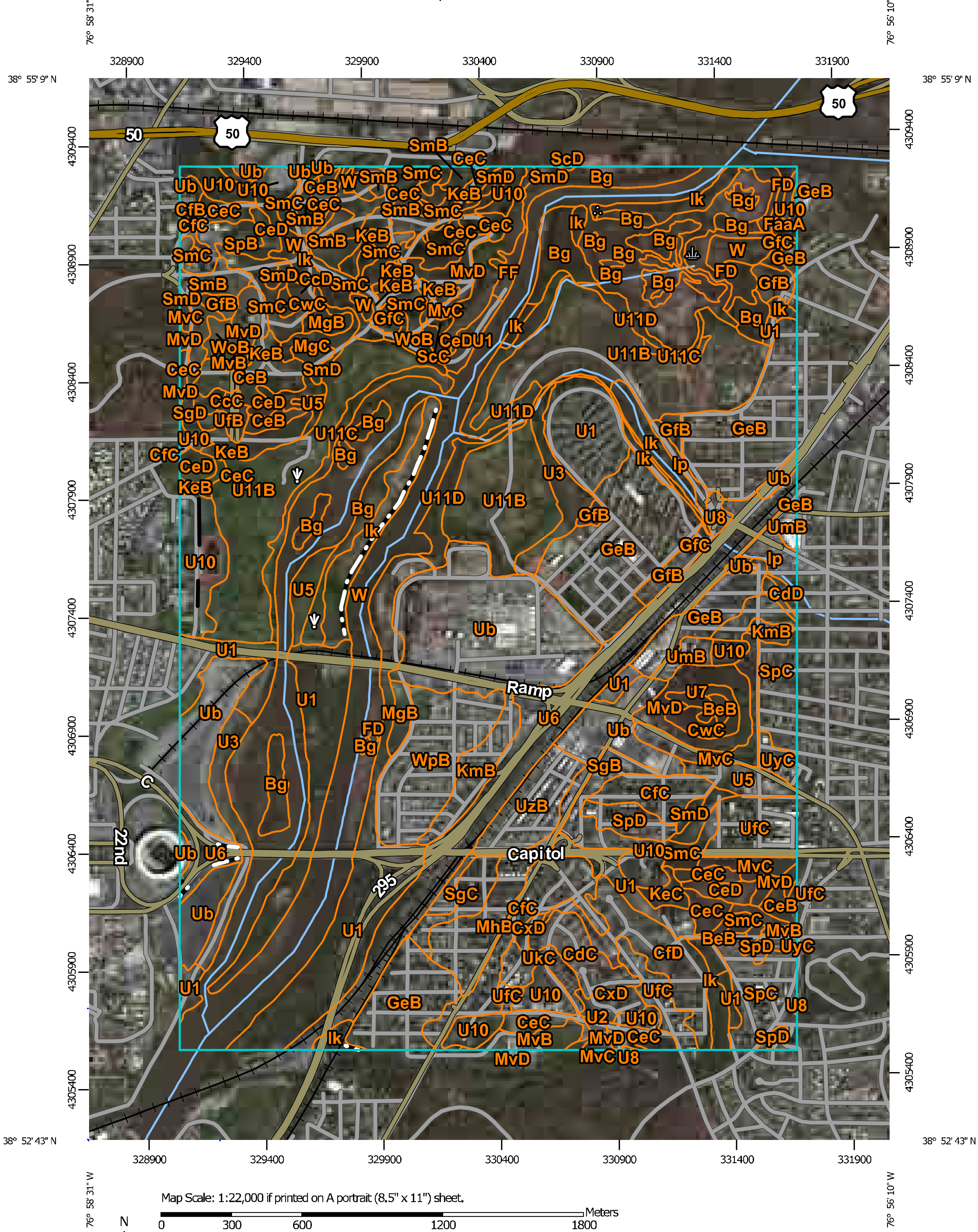
* Peak identification provided in parentheses.

Compound	Quant ion m/z
30,31-Trishomohopane-22R (T31)	191
Tetrakishomohopane-22S (T32)	191
Tetrakishomohopane-22R (T33)	191
Pentakishomohopane-22S (T34)	191
Pentakishomohopane-22R (T35)	191
13b(H),17a(H)-20S-Diacholestane (S4)	217
13b(H),17a(H)-20R-Diacholestane (S5)	217
13b,17a-20S-Methyldiacholestane (S8)	217
14a(H),17a(H)-20S-Cholestane/ 13b(H).17a(H)-20S-Ethyldiacholestane (S12)	217
14a(H),17a(H)-20R-Cholestane 13b(H),17a(H)-20R-Ethyldiacholestane (S17)	217
Unknown sterane(S18)	217
13a,17b-20S-Ethyldiacholestane (S19)	217
14a,17a-20S-Methylcholestane (S20)	217
14a,17a-20R-Methylcholestane (S24)	217
14a(H),17a(H)-20S-Ethylcholestane (S25)	217
14a(H),17a(H)-20R-Ethylcholestane (S28)	217
14b(H),17b(H)-20R-Cholestane (S14)	218
14b(H),17b(H)-20S-Cholestane (S15)	218
14b,17b-20R-Methylcholestane (S22)	218
14b,17b-20S-Methylcholestane (S23)	218
14b(H),17b(H)-20R-Ethylcholestane (S26)	218
14b(H),17b(H)-20S-Ethylcholestane (S27)	218
C26,20R- +C27,20S- triaromatic steroid(TAS1)	231
C28,20S-triaromatic steroid(TAS2)	231
C27,20R-triaromatic steroid(TAS3)	231
C28,20R-triaromatic steroid(TAS4)	231
Sesquiterpane EICPs	123

* selected diagnostic compounds with alternate method performance criteria

Attachment B

NRCS Soil Survey Map



Map Scale: 1:22,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 300, 600, 1200, 1800

Feet: 0, 1000, 2000, 4000, 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: District of Columbia
Survey Area Data: Version 9, Sep 29, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

District of Columbia (DC001)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BeB	Beltsville-Urban land complex, 0 to 8 percent slopes	3.7	0.2%
Bg	Bibb sandy loam	89.9	3.7%
CcC	Chillum silt loam, 8 to 15 percent slopes	2.5	0.1%
CcD	Chillum silt loam, 15 to 40 percent slopes	2.5	0.1%
CdC	Chillum-Urban land complex, 8 to 15 percent slopes	19.4	0.8%
CdD	Chillum-Urban land complex, 15 to 40 percent slopes	1.5	0.1%
CeB	Christiana silt loam, 0 to 8 percent slopes	24.8	1.0%
CeC	Christiana silt loam, 8 to 15 percent slopes	46.2	1.9%
CeD	Christiana silt loam, 15 to 40 percent slopes	33.0	1.4%
CfB	Christiana-Urban land complex, 0 to 8 percent slopes	2.9	0.1%
CfC	Christiana-Urban land complex, 8 to 15 percent slopes	55.6	2.3%
CfD	Christiana-Urban land complex, 15 to 40 percent slopes	34.9	1.4%
CwC	Croom very gravelly sandy loam, 8 to 15 percent slopes	10.0	0.4%
CxD	Croom-Urban land complex, 15 to 25 percent slopes	9.6	0.4%
FaaA	Fallsington sandy loams, 0 to 2 percent slopes, Northern Coastal Plain	1.1	0.0%
FD	Fluvaquents, ponded	13.1	0.5%
FF	Fluvaquents-Udifluvents complex, frequently flooded	4.6	0.2%
GeB	Galestown-Urban land complex, 0 to 8 percent slopes	179.7	7.4%
GfB	Galestown and Rumford soils, 0 to 8 percent slopes	18.5	0.8%
GfC	Galestown and Rumford soils, 8 to 15 percent slopes	5.4	0.2%
Ik	Iuka sandy loam	85.9	3.5%
Ip	Iuka-Urban land complex	12.4	0.5%

District of Columbia (DC001)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KeB	Keyport fine sandy loam, 0 to 8 percent slopes	28.5	1.2%
KeC	Keyport fine sandy loam, 8 to 15 percent slopes	4.6	0.2%
KmB	Keyport-Urban land complex, 0 to 8 percent slopes	21.3	0.9%
MgB	Matapeake silt loam, 0 to 8 percent slopes	9.8	0.4%
MgC	Matapeake silt loam, 8 to 15 percent slopes	3.3	0.1%
MhB	Matapeake-Urban land complex, 0 to 8 percent slopes	30.7	1.3%
MvB	Muirkirk variant complex, 0 to 8 percent slopes	11.2	0.5%
MvC	Muirkirk variant complex, 8 to 15 percent slopes	28.4	1.2%
MvD	Muirkirk variant complex, 15 to 40 percent slopes	52.4	2.1%
SaC	Sassafras sandy loam, 8 to 15 percent slopes	1.9	0.1%
ScC	Sassafras gravelly sandy loam, 8 to 15 percent slopes	1.3	0.1%
ScD	Sassafras gravelly sandy loam, 15 to 40 percent slopes	0.2	0.0%
SgB	Sassafras-Urban land complex, 0 to 8 percent slopes	15.7	0.6%
SgC	Sassafras-Urban land complex, 8 to 15 percent slopes	11.9	0.5%
SgD	Sassafras-Urban land complex, 15 to 40 percent slopes	3.2	0.1%
SmB	Sunnyside fine sandy loam, 0 to 8 percent slopes	34.2	1.4%
SmC	Sunnyside fine sandy loam, 8 to 15 percent slopes	56.8	2.3%
SmD	Sunnyside fine sandy loam, 15 to 40 percent slopes	22.8	0.9%
SpB	Sunnyside-Urban land complex, 0 to 8 percent slopes	10.5	0.4%
SpC	Sunnyside-Urban land complex, 8 to 15 percent slopes	56.1	2.3%
SpD	Sunnyside-Urban land complex, 15 to 25 percent slopes	14.1	0.6%
U1	Udorthents	204.3	8.4%
U2	Udorthents, gravelly	1.4	0.1%

District of Columbia (DC001)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
U3	Udorthents, sandy	33.9	1.4%
U5	Udorthents, clayey	21.7	0.9%
U6	Udorthents, smoothed	111.7	4.6%
U7	Udorthents, gravelly, smoothed	3.2	0.1%
U8	Udorthents, sandy, smoothed	4.4	0.2%
U10	Udorthents, clayey, smoothed	76.8	3.1%
U11B	Udorthents, deep, 0 to 8 percent slopes	212.4	8.7%
U11C	Udorthents, deep, 8 to 15 percent slopes	15.7	0.6%
U11D	Udorthents, deep, 15 to 25 percent slopes	32.2	1.3%
Ub	Urban land	176.2	7.2%
UfB	Urban land-Christiana complex, 0 to 8 percent slopes	1.9	0.1%
UfC	Urban land-Christiana complex, 8 to 15 percent slopes	38.2	1.6%
UkC	Urban land-Croom complex, 8 to 15 percent slopes	10.7	0.4%
UmB	Urban land-Galestown complex, 0 to 8 percent slopes	9.6	0.4%
UyC	Urban land-Sunnyside complex, 8 to 15 percent slopes	5.7	0.2%
UzB	Urban land-Woodstown complex, 0 to 8 percent slopes	25.6	1.0%
W	Water	317.8	13.0%
WoB	Woodstown sandy loam, 0 to 8 percent slopes	7.8	0.3%
WpB	Woodstown-Urban land complex, 0 to 8 percent slopes	54.5	2.2%
Totals for Area of Interest		**2,441.6**	**100.0%**

Attachment C

Regional Water Table Contours and Generalized Direction of Groundwater Flow for the Surficial Aquifer of the Lower Anacostia River (presented in Koterba et al., 2010)

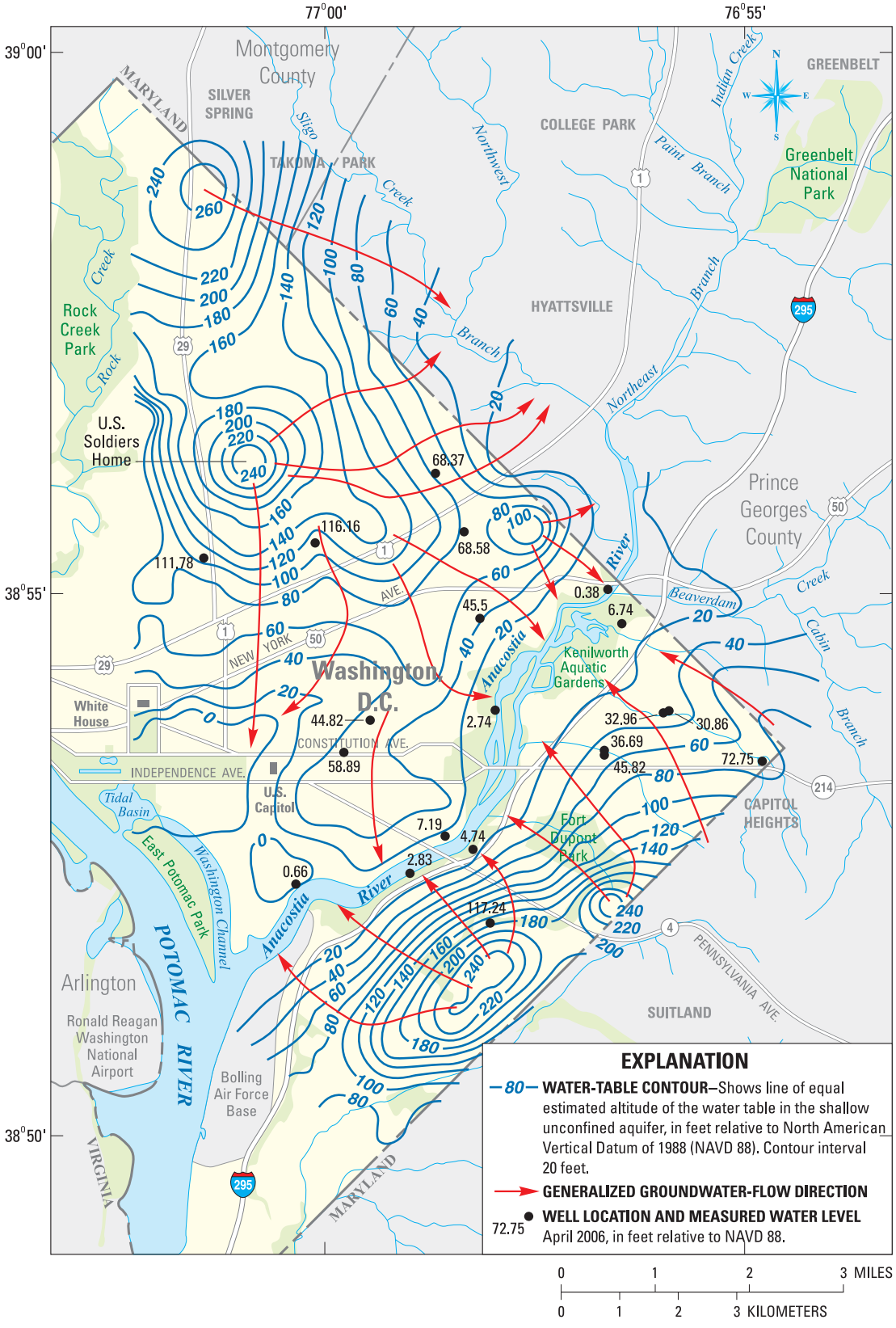
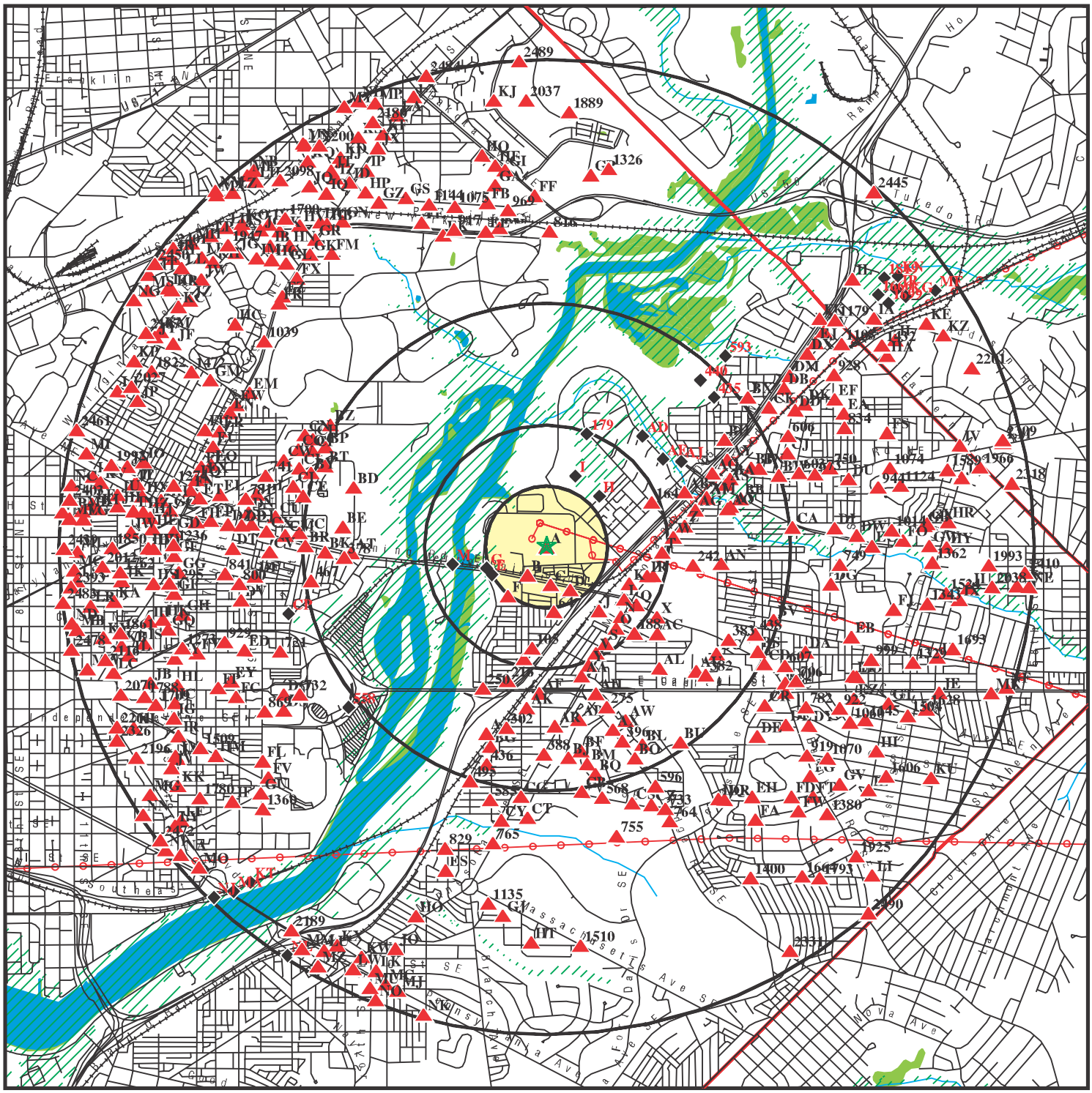


Figure 5. Estimated altitude of the regional water table and generalized direction of groundwater flow in the surficial aquifer, lower Anacostia River watershed, Washington, D.C., April 2006 (S.W. Ator, U.S. Geological Survey, written commun., 2010).

Attachment D
EDR Two-mile Radius Map

OVERVIEW MAP - 4717486.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Pepco Benning Road	CLIENT:	AECOM
ADDRESS:	3400 Benning Road NE WASHINGTON DC 20019	CONTACT:	Ben Daniels
LAT/LONG:	38.8983 / 76.955612	INQUIRY #:	4717486.2s
		DATE:	September 02, 2016 10:02 am

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