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FINAL TECHNICAL MEMORANDUM FOR RESULTS OF THE STEP 1 POLYCHLORINATED BIPHENYLS SITE INSPECTION AT PENNIMAN LAKE CHEATHAM ANNEX FISC WILLIAMSBURG VA

2/29/2012

CH2MHILL

Results of the Step 1 Polychlorinated Biphenyls Site Inspection at Penniman Lake, Cheatham Annex, Williamsburg, Virginia

PREPARED FOR: Cheatham Annex Partnering Team

PREPARED BY: CH2M HILL

DATE: February 29, 2012

Introduction

This Technical Memorandum (TM) has been prepared to present the results of the Step I field sampling activities for the polychlorinated biphenyls (PCB) Site Inspection (SI) at Penniman Lake, located at Naval Weapons Station Yorktown Cheatham Annex (CAX) in Williamsburg, Virginia (**Figure 1**). The objective of the Penniman Lake SI is to identify potential source(s) of PCBs to Penniman Lake and to determine if additional investigation or action is required. The SI is being conducted using a stepped approach since the source of PCBs is not known.

This TM was prepared under the United States Navy Comprehensive Long-term Environmental Action (CLEAN) Contract N62470-08-D-1000, for submittal to the Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic Division, the United States Environmental Protection Agency (USEPA), and the Virginia Department of Environmental Quality (VDEQ). The Navy, USEPA, and VDEQ work jointly as the CAX Tier I Partnering Team.

Site Background and History

CAX is located in Williamsburg, Virginia, on the York-James Peninsula (**Figure 1**). The peninsula trends northwest-southeast and is roughly bordered to the southwest by the James River, to the northeast by the York River, and to the southeast by the confluence of the James River and the Chesapeake Bay. CAX was established in June 1943 as a satellite unit of the Navy Supply Depot to provide bulk storage facilities. Prior to 1943, CAX had been the location of the Penniman Shell Loading Plant, a large powder and shell loading facility operated by DuPont during World War I. Today the mission of CAX is supplying Atlantic Fleet ships and providing recreational opportunities to military and civilian personnel.

Penniman Lake is a 48-acre fresh water surface water body located in the southeastern portion of CAX, created in 1943 when a portion of King Creek was dammed; it is not tidally influenced (**Figure 3**). Numerous drainage channels and stormwater outfalls discharge to the lake. There is an overflow structure adjacent to the dam (Figure 4) that discharges directly to King's Creek; other major outlets are evaporation and recharge to groundwater. The historical use of the lake is unknown; however, the lake is currently used by the Department of Defense (DoD) for recreational activities. The lake is not open to the general public. Catch-and-release fishing restrictions were implemented for the lake in 2000 following identification of PCBs within lake sediment.

In January 2001, CAX was placed on the National Priorities List (NPL), which required all subsequent activities for Navy Environmental Restoration (ER) sites be conducted under CERCLA procedures. Previously conducted evaluations and investigations that helped characterize potential contamination and contaminant sources at Penniman Lake included: Penniman Shell Loading Plant Site Inspection (Weston, 1999), Pond Study (Baker, 2001), Site 11 Remedial Investigation (RI) (Baker, 2007), AOC 6 Site Inspection (CH2M HILL, 2011), and various site visits. Previous sampling locations and PCB results that exceeded a human health and/or ecological screening level are shown in **Figure 4** (designated with either a yellow, lavender, or green triangle, as noted in the Legend) .

In 1999, an SI of the former Penniman Shell Loading Plant (PSLP) was conducted to determine if contamination existed that could be attributed to the former PSLP activities. The SI included the collection of twenty-nine samples, including waste source, sediment, surface water, and drinking water near various remnants of the former PSLP. As part of this investigation, one sediment sample (PEN-SED-01) and one surface water (PEN1-SW-02) and sediment sample [PEN1-SED-02 (and –SED02A, a duplicate)] were collected from Penniman Lake, adjacent to the Ammonia Settling Pits and TNT Graining House Sump and Catch Box Ruins, respectively as part of

this investigation, at locations shown on **Figure 4**. The sediment samples were analyzed for Target Compound List (TCL) organic compounds, Target Analyte List (TAL) inorganic constituents, and explosive compounds, while the surface water sample was analyzed for TCL organic compounds, and TAL inorganic constituents. The SI concluded that the activities at the former PSLP had not affected Penniman Lake.

In 2000, a Pond Study was conducted that included the collection of eight co-located surface water and surface sediment samples from Penniman Lake that were analyzed for TCL organic compounds, TAL inorganic constituents, and explosive compounds. There were PCB concentrations (Aroclor-1260) detected above both ecological and human health screening values at a maximum concentration of 4,700 micrograms per kilogram (µg/kg). The highest concentrations of PCBs were detected within one cove in the northwestern portion of the lake (**Figure 4**). The report recommended the establishment of catch-and-release fishing restrictions and further investigations to determine the source of PCBs and potential risks to human health and the environment.

In 2002, a Remedial Investigation (RI) at Site 11, located adjacent to the northwestern portion of Penniman Lake, was conducted that consisted of the collection of 24 surface and subsurface soil, 15 surface and subsurface sediment, 13 surface water, and 8 groundwater samples from within Site 11 and adjacent areas. Samples were analyzed for TCL organic compounds, TAL inorganic constituents, and explosive compounds. PCBs were detected in the Penniman Lake sediment, with a maximum concentration of 15,000 µg/kg in the northwest cove of the lake. In addition, PCBs were detected in a sediment sample collected from a drainage channel upgradient of Site 11 at a concentration of 7,500 µg/kg (**Figure 4**). The RI concluded that Site 11 was not the source of PCB contamination in Penniman Lake (Baker, 2007). The RI recommended additional sampling from within the drainage channel upgradient of Outfall NR-029 (**Figure 3**) and in the northwest cove of Penniman Lake to determine the extent of PCB contamination and potentially identify the source(s).

Based on the RI recommendations, the northwest cove of Penniman Lake and associated drainages were the initial focus of a study to determine the source of the PCB contamination. On June 10, 2008, CH2M HILL personnel conducted a site visit to identify upgradient areas that drain to the northwest cove of Penniman Lake and to Outfalls NR-026 through NR-029 (**Figure 4**) in order to help evaluate potential source areas. The following provides a summary of the drainage patterns identified during the site visit:

- Surface water runoff enters the northwest cove of Penniman Lake from the heavily wooded slopes along this portion of the lake, as well as through Outfalls NR-026 and -027.
- Stormwater runoff originating from areas south of Building 10 is collected in drop inlets on the north and south sides of Sanda Avenue, and is channeled to Outfall NR-026.
- Outfall NR-026 discharges to the northwest cove of Penniman Lake via a drainage ditch.
- A ravine upgradient of Outfall NR-027, north of Antrim Road, channels stormwater runoff from areas south of Building 250.
- Outfall NR-027 discharges to the northwest cove of Penniman Lake via a drainage ditch.

In addition, Outfall NR-028 conveys stormwater runoff to Penniman Lake from an intermittent drainage channel that originates south of Building 132 and north of Antrim Road. Outfall NR-029 conveys stormwater runoff from two intermittent drainage channels that originate north of Antrim Road; one flows east, parallel to Antrim road, and the other flows southeast, perpendicular to Antrim Road. A sampling plan was developed and presented to the CAX Partnering Team. In subsequent discussions, the Team decided all drainages to the lake should be evaluated, not just those discharging to the northwest cove, and the focus of the study changed to include all outfalls and natural drainages around the lake.

In October 2008, samples of Penniman Lake surface water and sediment were collected from two locations adjacent to AOC 6 (CAA06-SD/SW01 and CAA06-SD/SW02 – **Figure 4**) to determine if AOC 6 has had an impact on the lake (CH2M HILL, 2011). Based on historic sample results and known site activities, the AOC 6 SI analytical parameters did not include PCBs. Thus, these samples do not contribute to the evaluation of Penniman Lake PCB contamination, but are mentioned here to complete the list of samples collected from the lake prior to the current Step 1 SI activities.

Physical Setting

The area surrounding Penniman Lake is generally forested and slopes towards the lake. The topography ranges from approximately 35 feet above mean sea level (amsl) to less than 10 feet amsl. The direction of surface water flow in the lake is unknown but likely flows to the south towards the dam. There is an overflow structure adjacent to the dam (**Figure 4**) that discharges directly to King's Creek; other major outlets are evaporation and recharge to groundwater. Surface water flow may also be influenced by the wind. The Yorktown- Eastover aquifer extends across all of CAX and ranges from 60 to 100 feet thick. The transmissivity of the aquifer ranges from 0.5 to 40 square feet per day (ft^2/day), with the general direction of groundwater flow from west-to-east. The depth to groundwater in the Yorktown-Eastover aquifer is likely shallow; this aquifer likely discharges to some extent to the lake.

Distribution of Aroclor-1260 Contamination

Based on analytical results from previous investigations, Aroclor-1260 concentrations were detected in surface soil within stormwater drainage ways that discharge to Penniman Lake and in surface sediment throughout Penniman Lake. However, the highest concentrations were detected in sediment in the northwest cove (**Figure 3**). Further investigations to identify the source of this contamination, and the distribution of contamination at this source, are being conducted as part of the SI.

Release History

The source of the PCBs within Penniman Lake is unknown. Several drainages and outfalls discharge to the lake and appear to be the pathway through which Aroclor-1260 was transported to Penniman Lake; these features and potential source areas are being investigated during this SI.

Potential Contaminant Sources and Transport Pathways

No records of PCB releases or discharges that could have contaminated Penniman Lake sediment have been identified to date. Based on what can be inferred from the historical analytical data, there are several potential mechanisms for PCB transport to Penniman Lake: oil or fluids containing PCBs may have been (1) directly released to drainage ditches that discharged through outfalls into the lake, (2) released via disposal to surface soil in areas where stormwater runoff would transport PCBs and discharge into the lake via the drainages, or (3) applied for dust control to former gravel parking areas or roads where stormwater runoff would transport PCBs and discharge into the lake via the drainages. Other potential migration pathways from the terrestrial areas into the lake, such as by wind dispersion, are not expected to be significant because the area is heavily vegetated. Since PCBs tend to bind to soil, they are not expected to migrate downward to groundwater.

At this time, the historical and current use of the buildings located between Sanda Avenue and Antrim Road, near the northwest cove of Penniman Lake, is unknown. Further research is being conducted as part of the SI to determine if historical activities at or within the vicinity of these buildings may be a potential source of the PCBs in Penniman Lake.

Potential Exposure and Receptor Pathways

Potential human receptors exposed to surface water and sediment at Penniman Lake are:

- Adult recreational user
- Child recreational user
- Current on-base workers
- Future construction workers

Recreational users and workers may be exposed to PCBs through ingestion of and dermal contact with surface water and sediment as well as ingestion of fish. It is noted that catch and release fishing restrictions are in place for Penniman Lake. However, there is no way to guarantee that all of the fish caught are released and the most conservative approach is to assume that there is a potential for some fish ingestion. Recreational users and workers may also be exposed to PCBs through dermal contact with surface water and sediment in ditches that drain to Penniman Lake.

Potential ecological receptors exposed to surface water and sediment at Penniman Lake are:

- Aquatic/Wetland Plants
- Birds
- Mammals
- Reptiles
- Amphibians
- Benthic/Aquatic Invertebrates
- Fish

Aquatic and wetland plants may be exposed to PCBs through direct contact with surface water and sediment or through root uptake from the sediment. Fish, amphibians, reptiles and benthic/aquatic invertebrates may be exposed through direct contact with surface water and sediment. Food web exposures via birds, mammals, reptiles, and amphibians include ingestion of aquatic/wetland plants, fish, and benthic/aquatic invertebrates.

Conceptual Site Model

The conceptual site model (CSM) for Penniman Lake is based on data collected as part of previous investigations. The CSM interprets the site background and history, physical setting, distribution of contamination, release history, potential contaminant sources and transport pathways, and the potential exposure and receptor pathways. Since the specific source or sources of contaminants to Penniman Lake have not been identified to date, the CSM remains incomplete. The current CSM for Penniman Lake is shown in **Figure 2**.

Step 1 Field Investigation Activities

Since the source of PCBs in Penniman Lake is not known and Penniman Lake is a receiving body and not the source, a stepped-approach SI has been implemented to identify the source. In accordance with the UFP-SAP, a field survey was conducted to verify all outfalls and identify all natural drainages to the lake. Following identification of potential drainages, 26 surface soil samples were collected from the drainage ways and 44 surface sediment samples were collected from Penniman Lake. Prior to sample collection, a site visit was conducted with a representative from the USEPA's Biological Technical Assistance Group (BTAG) to flag specific sample locations in the northwest cove and associated drainages and to get a general idea of the type of depositional area to sample. Field activities also included site reconnaissance in the wooded area upstream of and surrounding the northwest cove to look for drums and/or an obvious sign of dumping. A bucket-like container, similar in size to a 5 gallon bucket with lid, was found just downstream of sample location SS05 near Isaacson Road. A surface soil sample, SS17, was collected from immediately beneath the container. In addition, surface debris consisting of one metal container and a few sections of pipe was identified on the west bank of the drainage between locations SS10 andSS11.

Surface soil samples were collected with a hand auger, and surface sediment samples were collected with a ponar dredge. All samples were analyzed for PCBs and sediment samples were also analyzed for additional total organic carbon (TOC) and grain size analytical suites. Water quality parameters (i.e., dissolved oxygen, turbidity, temperature, specific conductivity, oxidation/reduction potential and pH) were collected from the top, middle, and bottom of the water column above each sediment sample location.

Discussion of Results

Surface soil and surface sediment data collected during the 2011 Step I field activities have been evaluated to identify or eliminate potential PCB migration pathways into Penniman Lake. **Tables 1** and **2** include the detected PCB concentrations in surface soil and surface sediment, respectively. All analytical data for all samples are provided in **Appendix A**.

Soil

In total, 25 surface soil samples plus 3 duplicate samples were collected from the drainages and outfalls leading into Penniman Lake. These locations were chosen to determine if the PCBs detected in Penniman Lake sediments originated from contaminant transport through the stormwater drainage channel network (either from a

historical or ongoing release). Surface soil samples were analyzed for TCL PCBs in accordance with EPA Method 8082.

The only PCB congener group that was detected in surface soil in the vicinity of Penniman Lake was Aroclor-1260. Aroclor-1260 concentrations ranged from below detection limits in surface soil samples SS16 and SS18 to a maximum of 63,000 µg/kg in surface soil sample SS09. The highest Aroclor-1260 surface soil concentrations were detected in the drainage ways leading to the northwest cove of Penniman Lake (**Figure 5**), including sample locations SS02 (23,000 µg/kg), SS04 (17,000 µg/kg), SS10 (17,000 µg/kg), and SS11 (30,000 µg/kg). The surface soil sample collected fromimmediately beneath the bucket-like container that was identified during the site reconnaissance of the wooded area (SS17) contained Aroclor-1260 at 140 µg/kg. Given this relatively low Aroclor-1260 concentration and the significantly higher concentrations in upstream samples, this container does not appear to represent a PCB source.

Sediment

A total of 44 surface sediment samples and 6 duplicate samples were collected from Penniman Lake. Like the surface soil samples, these locations were selected to determine if a release of PCBs to Penniman Lake originated via transport through the stormwater drainage channel network (either from a historical or ongoing release). Surface sediment samples were analyzed for TCL PCBs in accordance with EPA Method 8082.

The only PCB congener group that was detected in surface sediment samples in Penniman Lake was Aroclor-1260. Aroclor-1260 concentrations ranged from below the detection limit in surface sediment sample SD25 to a maximum of 16,000 µg/kg in sample SD22. The highest surface sediment concentrations were detected in the sediment samples collected in the northwest cove of Penniman Lake (**Figure 6**). Outside of the northwest cove area, the highest Aroclor-1260 concentration was 810 µg/kg in surface sediment sample SD60, located in the northeast finger of Penniman Lake.

Conclusions and Recommendations

Results of the Step 1 PCB sampling indicate that PCBs are distributed throughout Penniman Lake, but the highest concentrations are found in the northwest cove area, nearest the outfalls of the stormwater drainage channels in which the highest concentrations of Aroclor-1260 were detected in upstream surface soil samples. In order to continue the investigation to locate potential sources for the PCBs detected in surface soil and sediment, four areas upstream of Penniman Lake are recommended for Step 2 investigation activities. These areas are shown in **Figure 7**, and include Step 1 sampling locations SS02, SS09, SS12, and SD60, which appear to be along potential migration pathways from a potential PCB source.

In addition, a review of available historical records and information on building usage will be conducted to gather additional information regarding the use of PCBs at the base, and specifically within the four areas recommended for further investigation activities. Lastly, the historic non-PCB data from the Pond Study (Baker 2001), Site 11 RI (Baker, 2007) and AOC 6 SI (CH2M HILL, 2011), will be reviewed to help identify constituents of potential concern that may need further evaluation. The sampling strategy and approach for Step 2 will be determined by the CAX Partnering Team and documented, under separate cover, in an addendum to the UFP-SAP *Site Inspection Sampling and Analysis Plan, Penniman Lake, June 2011*.

References

Baker Environmental, Inc. (Baker) 2001. *Final Pond Study Report, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia.* August.

Baker. 2007. *Remedial Investigation, Site 11 – Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia.* April.

CH2M HILL. 2011. *Draft Site Inspection Report, Areas of Concern 1, 2, 6, 7, and 8, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*. June.

Roy F. Weston, Inc. (Weston) 1999. *Final Site Inspection Narrative Report Penniman Shell Loading Plant, Williamsburg, Virginia.* August.

Tables

TABLE 1
Surface Soil Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SS01-0811	CAPL-SS01P-0811	CAPL-SS02-0811	CAPL-SS03-0811	CAPL-SS04-0811	CAPL-SS05-0811	CAPL-SS06-0811	CAPL-SS07-0811	CAPL-SS08-0811	CAPL-SS09-0811	CAPL-SS10-0811	CAPL-SS10P-0811	CAPL-SS11-0811	CAPL-SS12-0811
Sample Date	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1260	5,600	4,300	23,000	590	17,000	4,400	2,000	73	94	63,000	13,000	17,000	38,000	1,000

Notes:

Shading indicates detection

U - The material was analyzed for, but not detected

UG/KG - Micrograms per kilogram

TABLE 1
Surface Soil Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SS13-0811	CAPL-SS14-0811	CAPL-SS15-0811	CAPL-SS16-0811	CAPL-SS17-0811	CAPL-SS18-0811	CAPL-SS18P-0811	CAPL-SS19-0811	CAPL-SS21-0811	CAPL-SS22-0811	CAPL-SS23-0811	CAPL-SS24-0811	CAPL-SS25-0811	CAPL-SS26-0811
Sample Date	8/1/11	8/1/11	8/1/11	8/2/11	8/1/11	8/1/11	8/1/11	8/1/11	8/2/11	8/2/11	8/2/11	8/2/11	8/1/11	8/1/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1260	560	340	290	18 U	140	17 U	17 U	450	49	150	30	22	390	30

Notes:

Shading indicates detection

U - The material was analyzed for, but not detected

UG/KG - Micrograms per kilogram

TABLE 2
Surface Sediment Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD18-0811	CAPL-SD19-0811	CAPL-SD20-0811	CAPL-SD20P-0811	CAPL-SD21-0811	CAPL-SD22-0711	CAPL-SD23-0711	CAPL-SD24-0711	CAPL-SD25-0711	CAPL-SD26-0811	CAPL-SD27-0711	CAPL-SD28-0711	CAPL-SD28P-0711	CAPL-SD29-0711
Sample Date	8/2/11	8/2/11	8/2/11	8/2/11	8/2/11	7/28/11	7/28/11	7/28/11	7/28/11	8/2/11	7/28/11	7/28/11	7/28/11	7/28/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1260	4,100	2,600	25 U	15 J	45	16,000	6,200	930	18 U	35	150	590	410	950
Wet Chemistry (MG/KG)														
Total organic carbon (TOC)	34,000	3,800	110,000	NS	1,300	180,000	79,000	110,000	12,000	15,000	98,000	87,000	NS	78,000
Grain Size (PCT/P)														
GS03 Sieve 3" (75 mm)	100	100	100	NS	100	100	100	100	100	100	100	100	NS	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	NS	100	100	100	100	100	100	100	100	NS	100
GS08 Sieve 0.75" (19.0 mm)	96	100	96	NS	100	100	100	100	100	99	100	100	NS	100
GS10 Sieve 0.375" (9.5 mm)	95	98	92	NS	100	98	100	100	99	95	98	100	NS	100
Sieve No. 004 (4.75 mm)	91	95	86	NS	100	91	100	98	98	92	92	100	NS	100
Sieve No. 008 (2.36-MM)	88	91	80	NS	100	73	98	74	94	89	72	90	NS	94
Sieve No. 016 (1.18-MM)	84	82	70	NS	100	49	92	46	89	86	47	58	NS	75
Sieve No. 030 (600-UM)	79	65	55	NS	99	31	75	31	82	76	30	36	NS	52
Sieve No. 040 (425 um)	72	53	47	NS	96	24	64	26	76	65	24	30	NS	44
Sieve No. 050 (300-UM)	48	30	34	NS	75	20	56	22	52	41	20	25	NS	36
Sieve No. 100 (150 um)	8.2	3.3	10	NS	4.6	13	44	15	5.6	10	12	18	NS	28
Sieve No. 200 (75 um)	3.5	1.6	4	NS	0.8	8	25	9.2	1.5	3.5	6.8	11	NS	18

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Notes:

Shading indicates detection

J - Analyte present. Value may or may not be accurate or precise
NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

TABLE 2
Surface Sediment Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD30-0711	CAPL-SD31-0711	CAPL-SD32-0711	CAPL-SD33-0711	CAPL-SD33P-0711	CAPL-SD34-0711	CAPL-SD35-0711	CAPL-SD36-0711	CAPL-SD37-0711	CAPL-SD38-0711	CAPL-SD38P-0711	CAPL-SD39-0711	CAPL-SD40-0711	CAPL-SD41-
Sample Date	7/28/11	7/28/11	7/28/11	7/28/11	7/28/11	7/27/11	7/28/11	7/28/11	7/27/11	7/27/11	7/27/11	7/27/11	7/27/11	7/28/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1260	1,100	180	210	580	1,000	760	390	110	380	41 J	91 J	220	95	430
Wet Chemistry (MG/KG)														
Total organic carbon (TOC)	75,000	68,000	110,000	80,000	NS	78,000	110,000	64,000	72,000	85,000	NS	68,000	47,000	81,000
Grain Size (PCT/P)														
GS03 Sieve 3" (75 mm)	100	100	100	100	NS	100	100	100	100	100	NS	100	100	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	100	NS	100	100	100	100	100	NS	100	100	100
GS08 Sieve 0.75" (19.0 mm)	100	100	100	100	NS	100	100	100	100	99	NS	100	100	100
GS10 Sieve 0.375" (9.5 mm)	100	100	99	100	NS	100	99	100	100	79	NS	100	100	100
Sieve No. 004 (4.75 mm)	100	100	96	100	NS	100	99	100	100	69	NS	99	100	100
Sieve No. 008 (2.36-MM)	89	92	87	92	NS	94	98	82	97	57	NS	96	96	87
Sieve No. 016 (1.18-MM)	59	72	72	60	NS	66	88	50	75	47	NS	90	83	56
Sieve No. 030 (600-UM)	38	54	57	35	NS	45	66	31	50	39	NS	84	70	35
Sieve No. 040 (425 um)	32	48	50	28	NS	38	57	26	42	36	NS	79	65	29
Sieve No. 050 (300-UM)	27	43	41	22	NS	33	47	21	34	33	NS	70	60	24
Sieve No. 100 (150 um)	20	25	20	14	NS	24	29	14	26	23	NS	62	44	17
Sieve No. 200 (75 um)	12	14	7	8.5	NS	15	17	8.4	14	12	NS	46	23	11

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Notes:

Shading indicates detection

J - Analyte present. Value may or may not be accurate or precis
NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

TABLE 2
Surface Sediment Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	0711	CAPL-SD42-0711	CAPL-SD43-0711	CAPL-SD44-0711	CAPL-SD45-0711	CAPL-SD46-0711	CAPL-SD47-0711	CAPL-SD48-0711	CAPL-SD49-0711	CAPL-SD50-0711	CAPL-SD50P-0711	CAPL-SD51-0711	CAPL-SD52-0711	CAPL-SD53-0711	CAPL-SD54-
Sample Date		7/27/11	7/28/11	7/28/11	7/28/11	7/27/11	7/27/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/27/11
Chemical Name															
Pesticide/Polychlorinated Biphenyls (UG/KG)															
Aroclor-1260		230	110	410	130	390	200	23 J	270	540	440	250	400	180	230
Wet Chemistry (MG/KG)															
Total organic carbon (TOC)		80,000	150,000	130,000	5,500	80,000	100,000	8,200	130,000	66,000	NS	70,000	58,000	63,000	83,000
Grain Size (PCT/P)															
GS03 Sieve 3" (75 mm)		100	100	100	100	100	100	100	100	100	NS	100	100	100	100
GS06 Sieve 1.5" (37.5 mm)		100	100	100	100	100	100	100	100	100	NS	100	100	100	100
GS08 Sieve 0.75" (19.0 mm)		100	100	100	99	100	100	100	100	100	NS	100	100	100	100
GS10 Sieve 0.375" (9.5 mm)		100	97	100	99	100	100	100	100	100	NS	100	100	100	100
Sieve No. 004 (4.75 mm)		100	89	88	98	100	100	98	100	100	NS	100	100	100	99
Sieve No. 008 (2.36-MM)		84	72	40	97	86	96	95	97	97	NS	98	96	98	95
Sieve No. 016 (1.18-MM)		53	51	21	92	54	72	92	83	85	NS	82	75	85	81
Sieve No. 030 (600-UM)		34	34	11	75	35	49	72	64	68	NS	55	54	67	59
Sieve No. 040 (425 um)		28	29	8.4	58	29	42	50	55	60	NS	46	47	59	51
Sieve No. 050 (300-UM)		24	23	6.2	39	24	36	29	47	52	NS	38	40	52	43
Sieve No. 100 (150 um)		18	13	3.3	19	18	28	12	34	41	NS	28	31	40	32
Sieve No. 200 (75 um)		9.4	5.8	1.4	6.4	11	18	4.5	18	26	NS	18	20	22	20

C:\Users\jhosmer\Desktop\Recent Work\CAX Penniman Lake\Tables\[Tables 1 and 2.xls

Notes:

Shading indicates detection

J - Analyte present. Value may or may not be accurate or precis
NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

TABLE 2
Surface Sediment Analytical Detections
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	0711	CAPL-SD55-0711	CAPL-SD56-0711	CAPL-SD57-0711	CAPL-SD58-0711	CAPL-SD58P-0711	CAPL-SD59-0711	CAPL-SD60-0711	CAPL-SD61-0811
Sample Date		7/27/11	7/27/11	7/27/11	7/29/11	7/29/11	7/27/11	7/29/11	8/2/11
Chemical Name									
Pesticide/Polychlorinated Biphenyls (UG/KG)									
Aroclor-1260		39	280	48 J	170	240	410	810	40
Wet Chemistry (MG/KG)									
Total organic carbon (TOC)		19,000	84,000	35,000	74,000	NS	98,000	78,000	15,000
Grain Size (PCT/P)									
GS03 Sieve 3" (75 mm)		100	100	100	100	NS	100	100	100
GS06 Sieve 1.5" (37.5 mm)		100	100	100	100	NS	100	100	100
GS08 Sieve 0.75" (19.0 mm)		100	100	100	100	NS	100	100	100
GS10 Sieve 0.375" (9.5 mm)		100	100	100	100	NS	100	100	100
Sieve No. 004 (4.75 mm)		100	100	99	100	NS	100	99	99
Sieve No. 008 (2.36-MM)		99	96	97	93	NS	94	85	98
Sieve No. 016 (1.18-MM)		96	82	93	67	NS	69	60	96
Sieve No. 030 (600-UM)		88	62	82	49	NS	46	45	90
Sieve No. 040 (425 um)		79	53	68	43	NS	39	39	83
Sieve No. 050 (300-UM)		59	46	46	38	NS	33	34	50
Sieve No. 100 (150 um)		18	36	14	29	NS	25	26	17
Sieve No. 200 (75 um)		5.5	22	4.6	18	NS	16	17	5.8

C:\Users\jhosmer\Desktop\Recent Work\CAX Penniman Lake\Tables\[Tables 1 and 2.xls

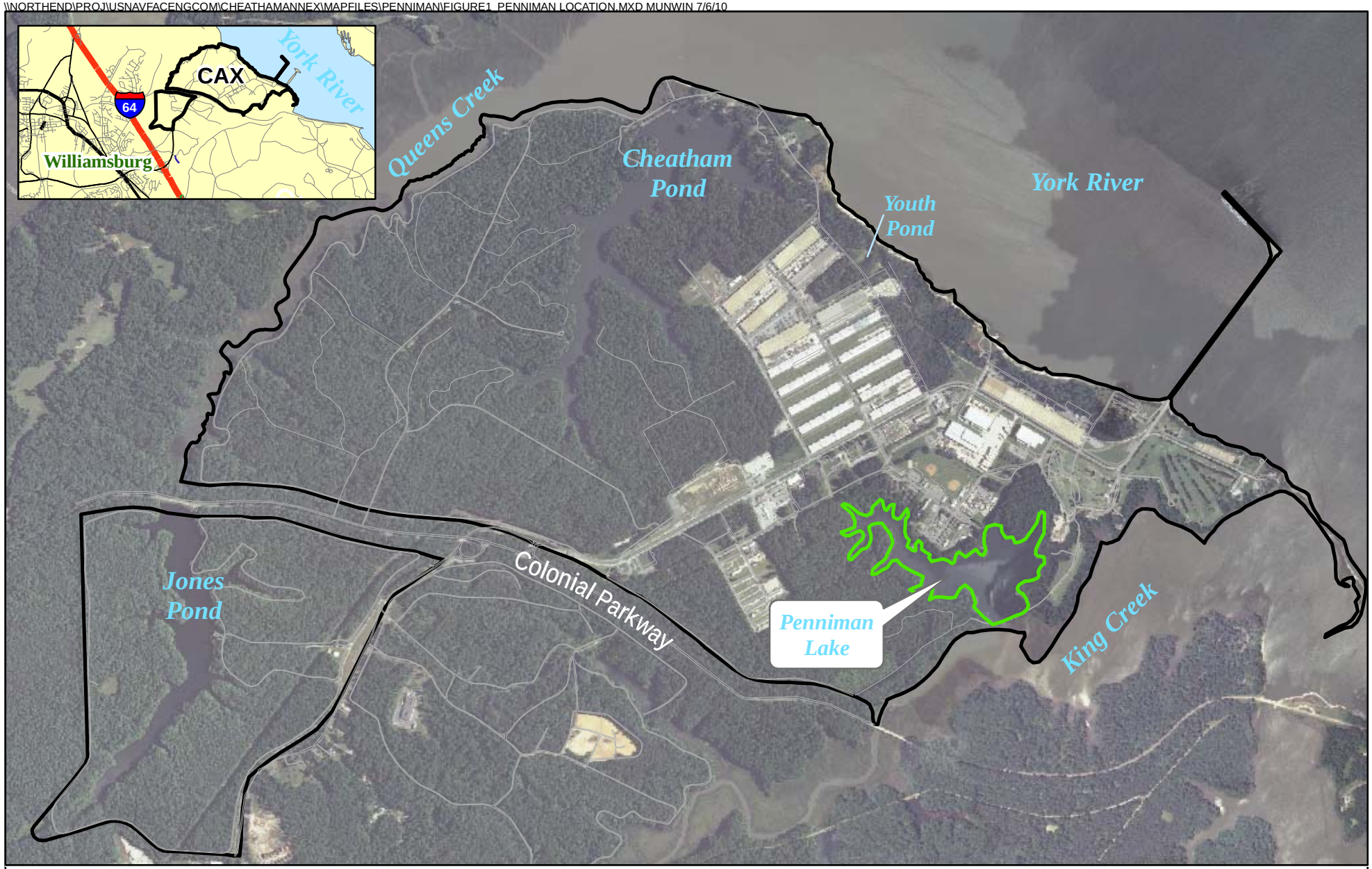
Notes:

Shading indicates detection

J - Analyte present. Value may or may not be accurate or precis
NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

Figures

\\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE1_PENNIMAN LOCATION.MXD MUNWIN 7/6/10



Legend

- Cheatham Annex Boundary
- Approximate Study Area Boundary

N
W E
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0 1,000 2,000
Feet

Figure 1
Location Map
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

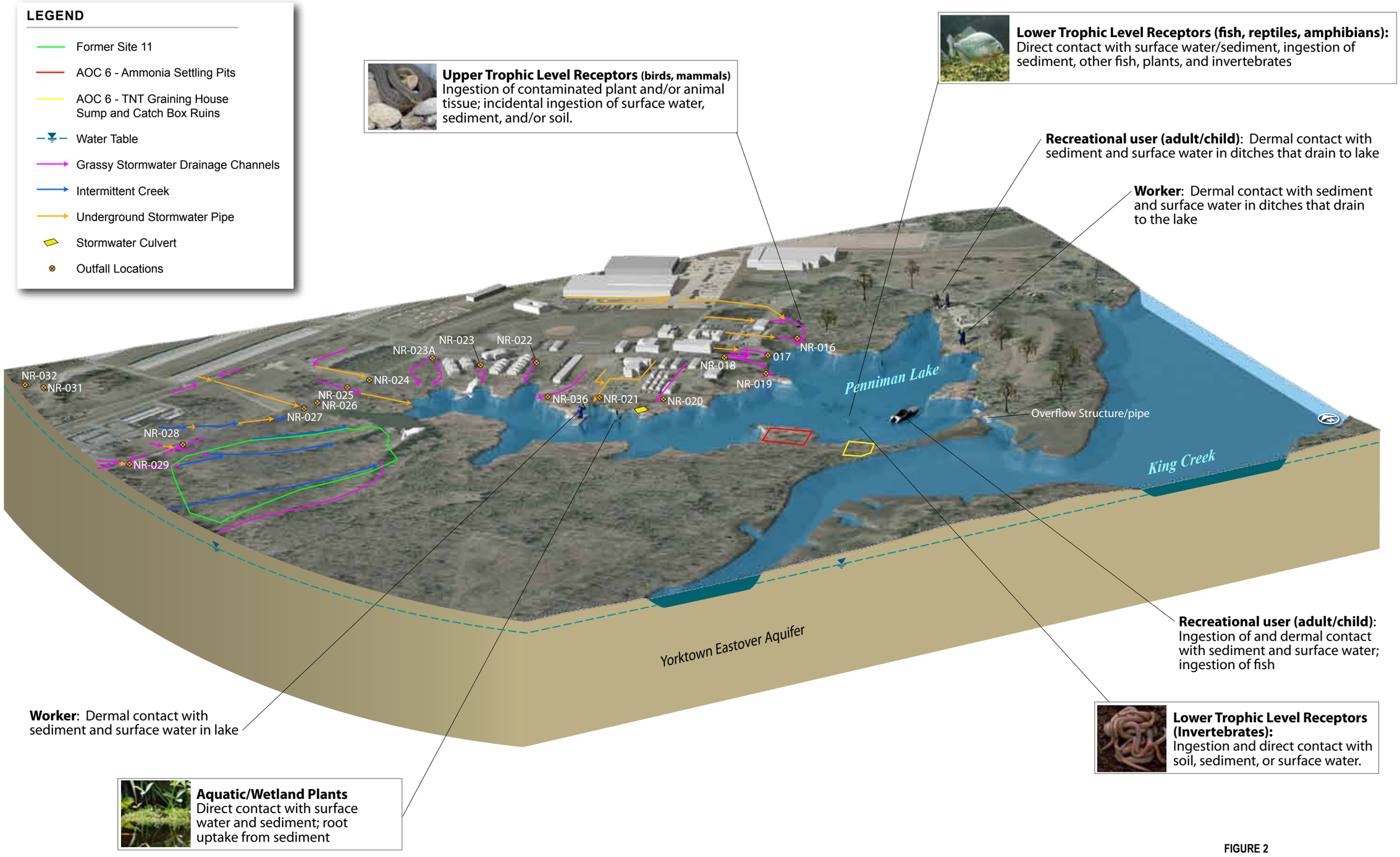
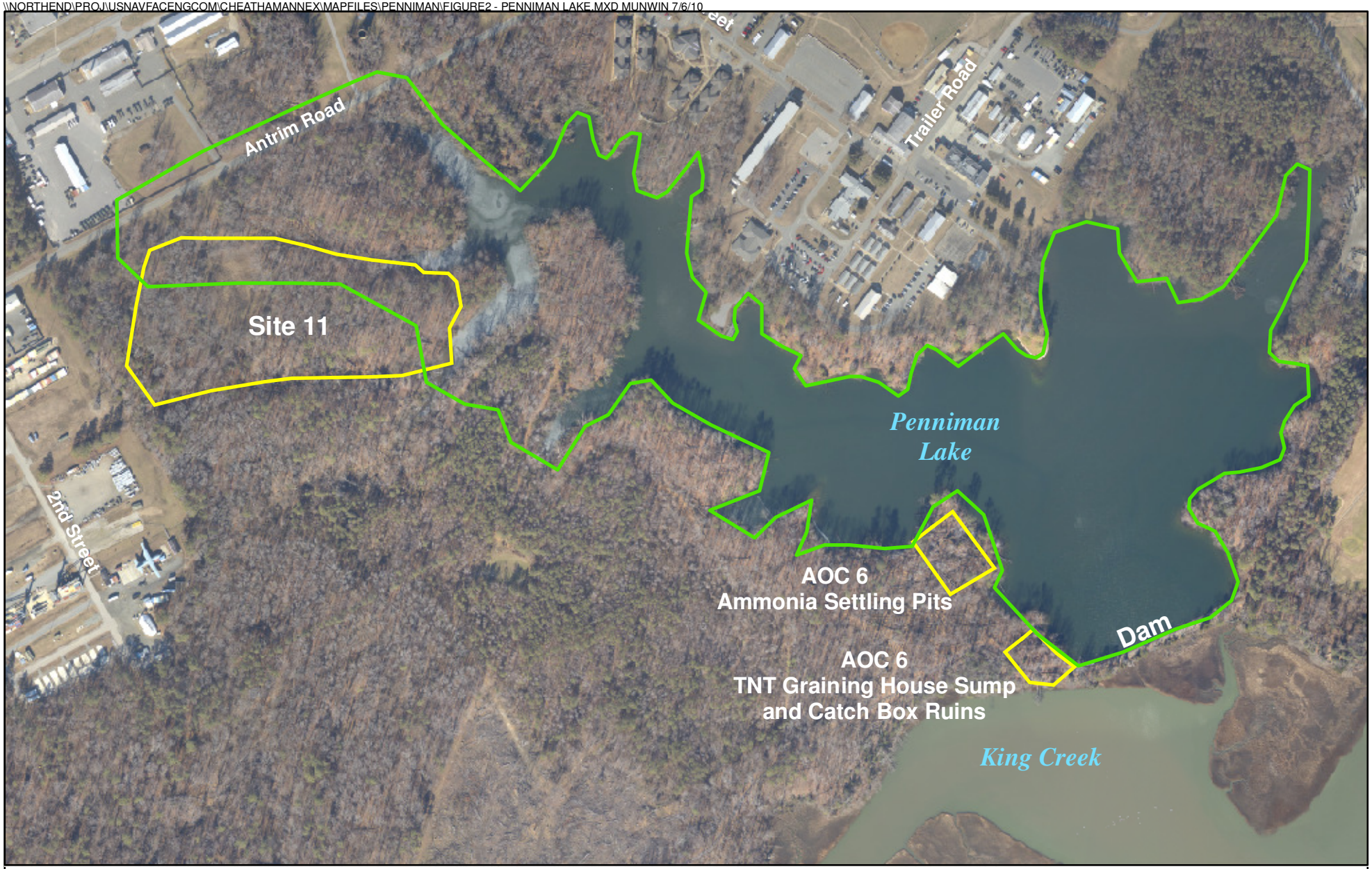


FIGURE 2
Conceptual Site Model
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

\\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE2 - PENNIMAN LAKE.MXD MUNWIN 7/6/10



Legend

- Adjacent Environmental Restoration Program Sites
- Approximate Study Area Boundary

N
W E
S

0 225 450
Feet

Figure 3
Penniman Lake
Layout Map
Cheatham Annex
Williamsburg, Virginia

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VBO \\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE4_PROPOSED_SS_SD.MXD CELEFTHE 11/22/2011 10:03:06 AM

Legend

- Proposed Surface Soil Sample Location
- Proposed Surface Sediment Sample Location
- 2002 Remedial Investigation (RI) Sediment Sample
- 2000 Pond Study Sediment Sample
- 1999 Weston SI Sediment and/of Surface Water Sample
- Stormwater Drop Inlets
- Elevation Contours (ft amsl)
- Outfall
- Road curbs
- Shoreline
- Buildings
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe
- Overflow pipe

11SD18 Aroclor 1260 5,400 ppb — Detect Exceeds Human Health Risk Screening Level (2,200 ppb for sediment)

11SD21 Aroclor 1260 99 ppb — Detect Exceeds Ecological Risk Screening Level (59.8 ppb for sediment)

N / W / E / S

0 150 300 450 600 Feet

Figure 4
Proposed Surface Soil and Surface Sediment Sample Locations and Previous Investigation Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

V:\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\CTO_WE25\FIGURE 5 - SURFACE SOIL AROCLOR.MXD CELEETHE 11/22/2011 9:45:54 AM

Sample ID	CAPL-SS11-0811
Sample Date	8/1/11
Aroclor-1260	38,000

Sample ID	CAPL-SS13-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	560

Sample ID	CAPL-SS12-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	1,000

Sample ID	CAPL-SS14-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	340

Sample ID	CAPL-SS15-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	290

Sample ID	CAPL-SS16-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	18 U

Sample ID	CAPL-SS10-0811*
Sample Date	8/1/11
Aroclor-1260 ug/kg	17,000

Sample ID	CAPL-SS09-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	63,000

Sample ID	CAPL-SS21-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	49

Sample ID	CAPL-SS06-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	2,000

Sample ID	CAPL-SS07-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	73

Sample ID	CAPL-SS23-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	30

Sample ID	CAPL-SS01-0811*
Sample Date	8/1/11
Aroclor-1260 ug/kg	5,600

Sample ID	CAPL-SS18-0811*
Sample Date	8/1/11
Aroclor-1260 ug/kg	17 U

Sample ID	CAPL-SS02-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	23,000

Sample ID	CAPL-SS19-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	450

Sample ID	CAPL-SS22-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	150

Sample ID	CAPL-SS03-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	590

Sample ID	CAPL-SS24-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	22

Sample ID	CAPL-SS04-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	17,000

Sample ID	CAPL-SS25-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	390

Sample ID	CAPL-SS05-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	4,400

Sample ID	CAPL-SS26-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	30

Sample ID	CAPL-SS17-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	140

Sample ID	CAPL-SS08-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	94

Antrim Road
4th Street
2nd Street
Site 11
Penniman Lake
AOC 6
Ammonia Settling Pits
AOC 6
TNT Graining House Sump
and Catch Box Ruins
Dam
King Creek

Legend

- Surface Soil Sample Location (July/August 2011)
- Adjacent Environmental Restoration Program Sites
- Approximate Study Area Boundary
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe
- Overflow pipe

Note:
* duplicate sample collected, most conservative presented

N
W E
S

0 200 400
Feet

Figure 5
Surface Soil Aroclor-1260 Resuts
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

V:\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\CTO_WE25\FIGURE 6 - SURFACE SEDIMENT AROCLOR.MXD CELFETHE 11/22/2011 9:48:58 AM

Sample ID	CAPL-SD21-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	45

Sample ID	CAPL-SD20-0811*
Sample Date	8/2/11
Aroclor-1260 ug/kg	15 J

Sample ID	CAPL-SD27-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	150

Sample ID	CAPL-SD61-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	40

Sample ID	CAPL-SD22-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	16,000

Sample ID	CAPL-SD26-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	35

Sample ID	CAPL-SD31-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	180

Sample ID	CAPL-SD55-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	39

Sample ID	CAPL-SD18-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	4,100

Sample ID	CAPL-SD32-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	210

Sample ID	CAPL-SD57-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	48 J

Sample ID	CAPL-SD47-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	200

Sample ID	CAPL-SD19-0811
Sample Date	8/2/11
Aroclor-1260 ug/kg	2,600

Sample ID	CAPL-SD38-0711*
Sample Date	7/27/11
Aroclor-1260 ug/kg	91 J

Sample ID	CAPL-SD60-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	810

Sample ID	CAPL-SD23-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	6,200

Sample ID	CAPL-SD39-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	220

Sample ID	CAPL-SD56-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	280

Sample ID	CAPL-SD28-0711*
Sample Date	7/28/11
Aroclor-1260 ug/kg	590

Sample ID	CAPL-SD40-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	95

Sample ID	CAPL-SD59-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	410

Sample ID	CAPL-SD29-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	950

Sample ID	CAPL-SD54-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	230

Sample ID	CAPL-SD30-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	1,100

Sample ID	CAPL-SD46-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	390

Sample ID	CAPL-SD58-0711*
Sample Date	7/29/11
Aroclor-1260 ug/kg	240

Sample ID	CAPL-SD24-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	930

Sample ID	CAPL-SD53-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	180

Sample ID	CAPL-SD33-0711*
Sample Date	7/28/11
Aroclor-1260 ug/kg	1,000

Sample ID	CAPL-SD48-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	23 J

Sample ID	CAPL-SD35-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	390

Sample ID	CAPL-SD45-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	130

Sample ID	CAPL-SD25-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	18 U

Sample ID	CAPL-SD44-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	410

Sample ID	CAPL-SD52-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	400

Sample ID	CAPL-SD34-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	760

Sample ID	CAPL-SD37-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	380

Sample ID	CAPL-SD42-0711
Sample Date	7/27/11
Aroclor-1260 ug/kg	230

Sample ID	CAPL-SD51-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	250

Sample ID	CAPL-SD36-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	110

Sample ID	CAPL-SD43-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	110

Sample ID	CAPL-SD41-0711
Sample Date	7/28/11
Aroclor-1260 ug/kg	430

Sample ID	CAPL-SD49-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	270

Sample ID	CAPL-SD50-0711*
Sample Date	7/29/11
Aroclor-1260 ug/kg	540

Antrim Road

Site 11

Penniman Lake

AOC 6
Ammonia Settling Pits

AOC 6
TNT Graining House Sump and Catch Box Ruins

Dam

King Creek

Legend

- Sediment Sample Location (July/August 2011)
- Adjacent Environmental Restoration Program Sites
- Approximate Study Area Boundary
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe
- Overflow pipe

Note:
* duplicate sample collected, most conservative presented

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0 200 400
Feet

Figure 6
Surface Sediment Aroclor-1260
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

Sample ID	CAPL-SS11-0811
Sample Date	8/1/11
Aroclor-1260	38,000

Sample ID	CAPL-SS12-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	1,000

Sample ID	CAPL-SS10-0811*
Sample Date	8/1/11
Aroclor-1260 ug/kg	17,000

Sample ID	CAPL-SS09-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	63,000

Sample ID	CAPL-SS06-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	2,000

Sample ID	CAPL-SS01-0811*
Sample Date	8/1/11
Aroclor-1260 ug/kg	5,600

Sample ID	CAPL-SS02-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	23,000

Sample ID	CAPL-SS04-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	17,000

Sample ID	CAPL-SS05-0811
Sample Date	8/1/11
Aroclor-1260 ug/kg	4,400

Sample ID	CAPL-SD60-0711
Sample Date	7/29/11
Aroclor-1260 ug/kg	810

Antrim Road
4th Street
Trailer Road
Site 11
2nd Street
Penniman Lake
AOC 6
Ammonia Settling Pits
AOC 6
TNT Graining House Sump
and Catch Box Ruins
Dam
King Creek

Legend

- Surface Soil Sample Location (July/August 2011)
- Adjacent Environmental Restoration Program Sites
- Approximate Study Area Boundary
- Areas Identified for Further Investigation
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe
- Overflow pipe

Note:
* duplicate sample collected, most conservative presented

N
W E
S

0 200 400
Feet

Figure 7
Areas of Further Investigation
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

Appendix A
Analytical Results

Appendix A.1
Surface Soil Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SS01-0811	CAPL-SS01P-0811	CAPL-SS02-0811	CAPL-SS03-0811	CAPL-SS04-0811	CAPL-SS05-0811	CAPL-SS06-0811	CAPL-SS07-0811	CAPL-SS08-0811	CAPL-SS09-0811	CAPL-SS10-0811	CAPL-SS10P-0811	CAPL-SS11-0811	CAPL-SS12-0811
Sample Date	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11	8/1/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1016	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	NS	980 U	940 U	3200 U	14 U
Aroclor-1221	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1232	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1242	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1248	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1254	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1260	5,600	4,300	23,000	590	17,000	4,400	2,000	73	94	63,000	13,000	17,000	38,000	1,000
Aroclor-1262	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U
Aroclor-1268	16 U	16 U	2000 U	17 U	1500 U	16 U	16 U	17 U	18 U	3700 U	980 U	940 U	3200 U	14 U

Notes:

NS - Not sampled

U - The material was analyzed for, but not detected

UG/KG - Micrograms per kilogram

Appendix A.1
Surface Soil Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SS13-0811	CAPL-SS14-0811	CAPL-SS15-0811	CAPL-SS16-0811	CAPL-SS17-0811	CAPL-SS18-0811	CAPL-SS18P-0811	CAPL-SS19-0811	CAPL-SS21-0811	CAPL-SS22-0811	CAPL-SS23-0811	CAPL-SS24-0811	CAPL-SS25-0811	CAPL-SS26-0811
Sample Date	8/1/11	8/1/11	8/1/11	8/2/11	8/1/11	8/1/11	8/1/11	8/1/11	8/2/11	8/2/11	8/2/11	8/2/11	8/1/11	8/1/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1016	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1221	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1232	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1242	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1248	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1254	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1260	560	340	290	18 U	140	17 U	17 U	450	49	150	30	22	390	30
Aroclor-1262	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U
Aroclor-1268	18 U	17 U	15 U	18 U	17 U	17 U	17 U	15 U	17 U	14 U	15 U	17 U	14 U	14 U

Notes:

NS - Not sampled

U - The material was analyzed for, but not detected

UG/KG - Micrograms per kilogram

Appendix A.2
Surface Sediment Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD18-0811	CAPL-SD19-0811	CAPL-SD20-0811	CAPL-SD20P-0811	CAPL-SD21-0811	CAPL-SD22-0711	CAPL-SD23-0711	CAPL-SD24-0711	CAPL-SD25-0711	CAPL-SD26-0811	CAPL-SD27-0711	CAPL-SD28-0711	CAPL-SD28P-0711	CAPL-SD29-0711
Sample Date	8/2/11	8/2/11	8/2/11	8/2/11	8/2/11	7/28/11	7/28/11	7/28/11	7/28/11	8/2/11	7/28/11	7/28/11	7/28/11	7/28/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1016	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1221	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1232	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1242	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1248	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1254	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1260	4,100	2,600	25 U	15 J	45	16,000	6,200	930	18 U	35	150	590	410	950
Aroclor-1262	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Aroclor-1268	25 U	17 U	25 U	27 U	17 U	89 U	65 U	110 U	18 U	19 U	100 U	88 U	83 U	86 U
Wet Chemistry (MG/KG)														
Total organic carbon (TOC)	34,000	3,800	110,000	NS	1,300	180,000	79,000	110,000	12,000	15,000	98,000	87,000	NS	78,000
Grain Size (PCT/P)														
GS03 Sieve 3" (75 mm)	100	100	100	NS	100	100	100	100	100	100	100	100	NS	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	NS	100	100	100	100	100	100	100	100	NS	100
GS08 Sieve 0.75" (19.0 mm)	96	100	96	NS	100	100	100	100	100	99	100	100	NS	100
GS10 Sieve 0.375" (9.5 mm)	95	98	92	NS	100	98	100	100	99	95	98	100	NS	100
Sieve No. 004 (4.75 mm)	91	95	86	NS	100	91	100	98	98	92	92	100	NS	100
Sieve No. 008 (2.36-MM)	88	91	80	NS	100	73	98	74	94	89	72	90	NS	94
Sieve No. 016 (1.18-MM)	84	82	70	NS	100	49	92	46	89	86	47	58	NS	75
Sieve No. 030 (600-UM)	79	65	55	NS	99	31	75	31	82	76	30	36	NS	52
Sieve No. 040 (425 um)	72	53	47	NS	96	24	64	26	76	65	24	30	NS	44
Sieve No. 050 (300-UM)	48	30	34	NS	75	20	56	22	52	41	20	25	NS	36
Sieve No. 100 (150 um)	8.2	3.3	10	NS	4.6	13	44	15	5.6	10	12	18	NS	28
Sieve No. 200 (75 um)	3.5	1.6	4	NS	0.8	8	25	9.2	1.5	3.5	6.8	11	NS	18

Notes:

J - Analyte present. Value may or may not be accurate or precise
NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

Appendix A.2
Surface Sediment Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD30-0711	CAPL-SD31-0711	CAPL-SD32-0711	CAPL-SD33-0711	CAPL-SD33P-0711	CAPL-SD34-0711	CAPL-SD35-0711	CAPL-SD36-0711	CAPL-SD37-0711	CAPL-SD38-0711	CAPL-SD38P-0711	CAPL-SD39-0711	CAPL-SD40-0711	CAPL-SD41-0711
Sample Date	7/28/11	7/28/11	7/28/11	7/28/11	7/28/11	7/27/11	7/28/11	7/28/11	7/27/11	7/27/11	7/27/11	7/27/11	7/27/11	7/28/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1016	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	NS	88 U	59 U	46 U	74 U
Aroclor-1221	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1232	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1242	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1248	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1254	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1260	1,100	180	210	580	1,000	760	390	110	380	41 J	91 J	220	95	430
Aroclor-1262	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Aroclor-1268	72 U	59 U	56 U	76 U	90 U	67 U	85 U	54 U	85 U	53 U	88 U	59 U	46 U	74 U
Wet Chemistry (MG/KG)														
Total organic carbon (TOC)	75,000	68,000	110,000	80,000	NS	78,000	110,000	64,000	72,000	85,000	NS	68,000	47,000	81,000
Grain Size (PCT/P)														
GS03 Sieve 3" (75 mm)	100	100	100	100	NS	100	100	100	100	100	NS	100	100	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	100	NS	100	100	100	100	100	NS	100	100	100
GS08 Sieve 0.75" (19.0 mm)	100	100	100	100	NS	100	100	100	100	99	NS	100	100	100
GS10 Sieve 0.375" (9.5 mm)	100	100	99	100	NS	100	99	100	100	79	NS	100	100	100
Sieve No. 004 (4.75 mm)	100	100	96	100	NS	100	99	100	100	69	NS	99	100	100
Sieve No. 008 (2.36-MM)	89	92	87	92	NS	94	98	82	97	57	NS	96	96	87
Sieve No. 016 (1.18-MM)	59	72	72	60	NS	66	88	50	75	47	NS	90	83	56
Sieve No. 030 (600-UM)	38	54	57	35	NS	45	66	31	50	39	NS	84	70	35
Sieve No. 040 (425 um)	32	48	50	28	NS	38	57	26	42	36	NS	79	65	29
Sieve No. 050 (300-UM)	27	43	41	22	NS	33	47	21	34	33	NS	70	60	24
Sieve No. 100 (150 um)	20	25	20	14	NS	24	29	14	26	23	NS	62	44	17
Sieve No. 200 (75 um)	12	14	7	8.5	NS	15	17	8.4	14	12	NS	46	23	11

Notes:

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NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

Appendix A.2
Surface Sediment Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD42-0711	CAPL-SD43-0711	CAPL-SD44-0711	CAPL-SD45-0711	CAPL-SD46-0711	CAPL-SD47-0711	CAPL-SD48-0711	CAPL-SD49-0711	CAPL-SD50-0711	CAPL-SD50P-0711	CAPL-SD51-0711	CAPL-SD52-0711	CAPL-SD53-0711	CAPL-SD54-0711
Sample Date	7/27/11	7/28/11	7/28/11	7/28/11	7/27/11	7/27/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/29/11	7/27/11
Chemical Name														
Pesticide/Polychlorinated Biphenyls (UG/KG)														
Aroclor-1016	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1221	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1232	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1242	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1248	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1254	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1260	230	110	410	130	390	200	23 J	270	540	440	250	400	180	230
Aroclor-1262	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Aroclor-1268	85 U	59 U	98 U	41 U	88 U	84 U	24 U	82 U	68 U	77 U	77 U	67 U	53 U	76 U
Wet Chemistry (MG/KG)														
Total organic carbon (TOC)	80,000	150,000	130,000	5,500	80,000	100,000	8,200	130,000	66,000	NS	70,000	58,000	63,000	83,000
Grain Size (PCT/P)														
GS03 Sieve 3" (75 mm)	100	100	100	100	100	100	100	100	100	NS	100	100	100	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	100	100	100	100	100	100	NS	100	100	100	100
GS08 Sieve 0.75" (19.0 mm)	100	100	100	99	100	100	100	100	100	NS	100	100	100	100
GS10 Sieve 0.375" (9.5 mm)	100	97	100	99	100	100	100	100	100	NS	100	100	100	100
Sieve No. 004 (4.75 mm)	100	89	88	98	100	100	98	100	100	NS	100	100	100	99
Sieve No. 008 (2.36-MM)	84	72	40	97	86	96	95	97	97	NS	98	96	98	95
Sieve No. 016 (1.18-MM)	53	51	21	92	54	72	92	83	85	NS	82	75	85	81
Sieve No. 030 (600-UM)	34	34	11	75	35	49	72	64	68	NS	55	54	67	59
Sieve No. 040 (425 um)	28	29	8.4	58	29	42	50	55	60	NS	46	47	59	51
Sieve No. 050 (300-UM)	24	23	6.2	39	24	36	29	47	52	NS	38	40	52	43
Sieve No. 100 (150 um)	18	13	3.3	19	18	28	12	34	41	NS	28	31	40	32
Sieve No. 200 (75 um)	9.4	5.8	1.4	6.4	11	18	4.5	18	26	NS	18	20	22	20

Notes:

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NS - Not sampled
U - The material was analyzed for, but not detected
MG/KG - Milligrams per kilogram
PCT/P - Percent Passed
UG/KG - Micrograms per kilogram

Appendix A.2
Surface Sediment Analytical Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

Sample ID	CAPL-SD55-0711	CAPL-SD56-0711	CAPL-SD57-0711	CAPL-SD58-0711	CAPL-SD58P-0711	CAPL-SD59-0711	CAPL-SD60-0711	CAPL-SD61-0811
Sample Date	7/27/11	7/27/11	7/27/11	7/29/11	7/29/11	7/27/11	7/29/11	8/2/11
Chemical Name								
Pesticide/Polychlorinated Biphenyls (UG/KG)								
Aroclor-1016	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1221	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1232	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1242	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1248	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1254	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1260	39	280	48 J	170	240	410	810	40
Aroclor-1262	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Aroclor-1268	22 U	74 U	46 U	67 U	92 U	85 U	64 U	20 U
Wet Chemistry (MG/KG)								
Total organic carbon (TOC)	19,000	84,000	35,000	74,000	NS	98,000	78,000	15,000
Grain Size (PCT/P)								
GS03 Sieve 3" (75 mm)	100	100	100	100	NS	100	100	100
GS06 Sieve 1.5" (37.5 mm)	100	100	100	100	NS	100	100	100
GS08 Sieve 0.75" (19.0 mm)	100	100	100	100	NS	100	100	100
GS10 Sieve 0.375" (9.5 mm)	100	100	100	100	NS	100	100	100
Sieve No. 004 (4.75 mm)	100	100	99	100	NS	100	99	99
Sieve No. 008 (2.36-MM)	99	96	97	93	NS	94	85	98
Sieve No. 016 (1.18-MM)	96	82	93	67	NS	69	60	96
Sieve No. 030 (600-UM)	88	62	82	49	NS	46	45	90
Sieve No. 040 (425 um)	79	53	68	43	NS	39	39	83
Sieve No. 050 (300-UM)	59	46	46	38	NS	33	34	50
Sieve No. 100 (150 um)	18	36	14	29	NS	25	26	17
Sieve No. 200 (75 um)	5.5	22	4.6	18	NS	16	17	5.8

Notes:

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UG/KG - Micrograms per kilogram