

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

Appendix 15

HOLLY OAK SUBSTATION WILMINGTON, DELAWARE

SIRB ID: DE-1200



GENERAL SITE INFORMATION

Site Name: Former Holly Oak Substation

SIRB ID Number: DE-1200

Site Location and Description: The Former Holly Oak Substation Site covers an area of approximately 0.38-acre and is located at the northwest corner of Delaware Avenue and Governor Printz Boulevard, in the Holly Oak section of Wilmington, Delaware (tax parcel number 06-116.00-132). The site is currently owned by Danielle Sitaras and is used for storage of equipment and supplies.

Previous Site Uses: Delmarva Power & Light Company (DP&L) acquired the property in 1937 from David Anderson for use as a substation. The site remained an active substation until sometime prior to the 1990s. Based on the historical information, 11 concrete structures supported 5 transformers, 2 capacitor banks, and 6 oil-filled circuit breakers at the site. The property was sold to Mr. and Mrs. Michael Sitaras on December 13, 1999 to use as a commercial storage facility for their landscaping business. Based on conversations with Mr. Sitaras during the Remedial Investigation conducted by WIK Associates, approximately 1.5 to 4 feet of fill was brought onto the site after he purchased the property, and many of the concrete structures and pads remain in the ground. In 2005 the property transferred ownership solely to Danielle Sitaras.

During BrightFields June 2008 surface assessment of the property, conditions indicated that the property is used solely for storage and appears to be rarely accessed.

Site Regulatory Status: This section briefly summarizes previous investigations performed on the site through the SIRB program. A current SIRB regulatory status is also included.

Phase II Environmental Assessment (Tetra Tech, 1994)

Soil sampling and analysis for polychlorinated biphenyls (PCBs) was conducted on the site by DP&L in 1990. Based on this sampling, a 20 by 18 foot area in the northwest portion of the property was identified as having soil PCB concentrations above the EPA Region III unrestricted use clean-up standard of 10 parts per million (ppm). In addition, soil containing PCBs at a concentration greater than 3 ppm but less than 10 ppm was detected at two other locations. In 1990, approximately one foot of soil was removed from the area containing PCBs above 10 ppm



and confirmatory samples indicated that PCBs still remained in this area at concentrations above 10 ppm. This area is shown on attached Figure 2 of this report.

In September 1994, Tetra Tech performed a sampling program based on the analyses performed by DP&L in 1990. A PCB remedial action level of 10 ppm and a TPH action level of 100 ppm were used. A site layout map containing Tetra Tech's sampling locations is included as Figure 3.

The Tetra Tech sampling program assessed both the horizontal and vertical extent of any remaining PCBs in the previously excavated area. Field screening for PCBs was performed using an immunoassay kit to assess the need for additional sampling. The field screening test kits were calibrated to indicate the presence or absence of PCBs at two user-defined detection levels (2.5 and 10 ppm).

If no PCBs were detected by the kit above the action level of 10 ppm, then the sample was sent to an off-site laboratory for confirmatory analysis for PCBs (EPA SW-846 Method 8080) and TPH (EPA Method 418.1).

Vertical Delineation

Four soil borings (sample locations 1, 2, 3, and 4) were advanced in the previously excavated area to delineate the vertical extent of contamination remaining. Discrete samples were analyzed at 12-inch intervals until clean soil or refusal was encountered. If the sample screening results were above 10 ppm, another round of samples was collected.

Concentrations of PCBs in the screening samples collected in the area of sample locations 1 and 2 were below the action level at a depth of 18 inches. In the area of sample location 3, PCB screening results were above the 10 ppm action level at a depth of 18 inches, but PCBs were not detected above the action level at a depth of 30 inches. In the area of sample location 4, the soil contained PCB concentrations above 10 ppm down to a depth of 40 inches, where auger refusal was encountered.

Horizontal Delineation

Surface soil samples (locations 5, 6, 7, and 8) were collected from each corner and one foot beyond the previously excavated area (Figure 3). In each area of potential concern, soil samples were collected from four discrete locations and combined into one composite sample. The discrete soil samples were labeled 5 A-D, 6 A-D, 7 A-D, and 8 A-D as shown on Figure 3.

If the composite sample screening results were greater than or equal to 2.5 ppm, then each individual sample that made up the composite was field screened for PCBs above 10 ppm. If the concentrations detected were above 10 ppm, another round of samples was collected.

Screening results indicated that composite sample areas 5 and 7 were below 2.5 ppm PCBs; area 6 was above 2.5 ppm PCBs and below 10 ppm PCBs; and sample area 8 was above 10 ppm. The discrete samples at areas 6 and 8 were then field-screened. All discrete samples at sample area 6 and samples 8A and 8C were below 2.5 ppm PCBs. Sample 8B was above 2.5 and below 10 ppm and sample 8D was above 10 ppm.

Sample location 8D was further delineated by additional samples collected two feet to the south (8D'S), east (8D'E), and west (8D'W) and approximately 24 inches below surface at 8D. Only sample 8D-24 inches was above 10 ppm. In the area of sample 8D, PCB screening results were above the 10 ppm action level down to the sample depth of 30 inches below ground surface (bgs) and PCBs were not detected above the action level at the sample depth of 42 inches.

Laboratory Analytical Summary

During the investigation, a total of 34 PCB-screening samples were collected. All except one sample was collected to evaluate the presence of PCBs; the other sample was a background sample collected as a field quality control check to evaluate any unexpected background interference that could have affected the screening process.

A total of seven composite soil samples, one catch basin water sample, and two rinseate samples were sent to RECRA Environmental, Inc. laboratory for PCB and TPH analysis. Aroclors 1254 and 1260 were detected in the composite samples from areas 1, 2, and 3 at a maximum concentration of 0.89 ppm, which was well below the action level of 10 ppm. Aroclors 1254 and 1260 were detected in the sample from area 8D at a concentration of 2.72 ppm, which is also below the action level of 10 ppm. Two samples and the duplicate contained TPH at a maximum concentration of 39 ppm, well below the action level of 100 ppm. PCBs and TPH were not detected in the catch basin water sample or in the rinseate samples.

Subsequent Removal Action

After reviewing the results of the site assessment, Tetra Tech concluded that 28 cubic yards of soil with PCBs above the 10 ppm action level were located in area 1 (Figure 2). On October 26, 1994 the 28 cubic yards of soil were excavated and placed into trucks for offsite disposal at a



certified landfill. According to the November 1994 Tetra Tech report, six confirmatory samples were collected and PCB analysis indicated that there was no further soil contamination within the soil removal area. Buried wood and wires were encountered in the southeastern part of the excavation and were removed. Tetra Tech determined that this wood and wire was the cause of auger refusal in areas 4 and 6.

Remedial Investigation Report (WIK, 2003)

In May 2000, the Delaware Department of Natural Resources and Environmental Control Site Investigation and Restoration Branch (DNREC-SIRB) issued a request to Delmarva Power & Light (DP&L), the prior owner of the former Holly Oak Substation, for information regarding past site uses, activities, and environmental conditions of the property.

In July 2000, based on previous information that a PCB release occurred while Delmarva owned the property, DNREC requested that an environmental investigation be performed at the site. SIRB also contacted the current owner (Mr. and Mrs. Michael Sitaras) in September 2000 to obtain information about their activities and disposal practices on the site. WIK Associates, Inc. (WIK) was retained by Conectiv (formerly and currently DP&L) to conduct a Remedial Investigation (RI) at the site.

Ten Geoprobe[®] soil borings were advanced across the site to facilitate collection of subsurface soil and groundwater samples. Twenty soil samples were collected; 16 were analyzed for VOCs, PAHs, PCBs, and RCRA metals, and 4 were analyzed for PCBs only. Based on the screening results and site coverage, three shallow and two deep subsurface soil samples were selected for confirmatory HSCA analysis of TCL VOCs, TCL SVOCs, TCL pesticides, PCBs, TAL metals, and cyanide. In addition, DNREC collected 13 surface soil samples to analyze the imported fill on the property. The DNREC screening process did not indicate the presence of any PCBs.

Results presented in this Remedial Investigation indicated that the soil at the site is suitable for both restricted and unrestricted use and no further investigation or remedial action activities were necessary. However, a groundwater management zone (GMZ) was recommended to restrict contact with the groundwater beneath the site, which contained the pesticide, dieldrin.

Current Regulatory Status:

The Remedial Investigation prepared by WIK in 2003 was approved by DNREC and a Final Plan of Remedial Action was published in December 2003. This Plan required that a deed

restriction be placed on the property to limit it to commercial use and to limit groundwater withdrawal through a GMZ. Based on review of DNREC's site files, it appears that the GMZ was implemented but there is no record of a deed restriction being filed for the property.

Currently the site is stabilized with 1.5 to 4 feet of imported fill and approximately two inches of stone. During the June 2008 site surface assessment BrightFields determined that the site was still being used as storage facility, but was not being accessed on a regular basis.

SUMMARY OF SITE PCB INFORMATION

Site Investigation PCB Findings:

Screening samples collected from the perimeter of the remediation area mentioned above reported concentrations in surface soil samples at greater than 2.5 mg/kg to less than 10 mg/kg.

PCBs (Aroclor-1254) were detected in two subsurface non-saturated soil samples (GP04 and GP09) and one subsurface saturated sample (GP09) at concentrations below both the unrestricted use and restricted use Uniform Risk-Based Remediation Standard (URS) values for human health for total PCBs during the initial laboratory analysis performed as part of the Remedial Investigation performed by WIK Associates (WIK 2003). Five confirmatory samples were sent to a HSCA certified laboratory, including GP04. GP04 was determined to have concentrations of Aroclor-1254 and Aroclor -1268 below the unrestricted and restricted URS values.

Due to the fact that there was only one detection in the subsurface saturated soil, this detected value was used in the calculations instead of calculating the 95% UCL of the mean across the site for sub-surface saturated concentrations. Concentrations were observed in the subsurface non-saturated zone, but because these samples are not in a mobile phase, no statistics were completed.

Concentrations of PCBs on Site			
Sample Matrix	Corresponding Figure	Analytical Methods	Range of Total PCBs
Surface Soil	Figure 2	Immunoassay and Method 8082	Not detected to >2.5<10 mg/kg
Subsurface Soil (unsaturated)	Figure 3	Immunoassay and Method 8082	Not detected to 0.530 mg/kg
Subsurface Soil (saturated)	Figure 4	Method 8082	Not detected to 0.056 mg/kg
Groundwater	Figure 5	Method 8082	Not detected

A summary of all samples collected for PCBs are presented in the attached Tables 1 through 4.

Acreage where PCBs detected:

The estimated unsaturated subsurface soil area impacted by PCBs is 0.068 acres in the vicinity of the former removal area. The estimated unsaturated subsurface soil area impacted by PCBs is 0.03 acres in the vicinity of the former removal area, including GP04 and GP09. The estimated saturated subsurface soil area impacted by PCBs is 0.05 acres in the vicinity of GP09 (Figure 4).

PCB Remediation:

In 1990, approximately one foot of soil was removed from the area depicted on Figure 2. Confirmatory samples indicated that PCBs still remained in this area at concentrations above the remediation goal of 10 ppm.

On October 26, 1994, 28 cubic yards of soil were excavated and placed into trucks for offsite disposal at a certified landfill from the same area as the 1990 removal. According to the November 1994 Tetra Tech report, six confirmatory samples were collected and PCB analysis indicated that there was no further soil contamination within the soil removal area. Buried wood and wires were encountered in the southeastern part of the excavation and were removed. Tetra Tech determined that this wood and wire was the cause of auger refusal in areas 4 and 6.

In addition, at some point between 1999 and 2002 the owners of the property brought fill onto the property to raise some of the low lying areas.

PCB Mass Loading Summary

The PCB mass loading rate to surface water via overland flow and groundwater transport are discussed below. A summary of the results is included below and the details of the calculations are included as attachments to this Appendix.

OVERLAND FLOW:

Overland flow has been determined on this site by using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE predicts the long term average annual rate of erosion on an area based on rainfall patterns, soil type, topography, cover/canopy factors and support management practices. These specific factors are site specific and rely on local information of the site.

Ground Cover and Canopy:

A site inspection was performed on June 23, 2008 to estimate the current site ground cover and canopy. The surface cover was composed of primarily a stone cover (~85%) with weeds penetrating the through the surface. Photographs of the site ground cover and canopy are attached.

Site Sediment and Erosion Control Practices:

Currently there are no sediment and erosion controls in place on the Holly Oak Site.

Input Factors and Results:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

RUSLE Factors	Values Provided	Explanation of Selection
R = rainfall-runoff erosivity index (10 ² ft-tonf-in/ac-hr)	170	An appropriate value for R for the site was determined from plots of Rainfall patterns for the Eastern U.S. (Wischmeier and Smith, 1978).
K = soil erodibility (0.01 tonf acre hr/acre ft-ton in)	0.24	The soil erodibility factor was chosen based on the information provided by the boring log for GP04 in the Remedial Investigation Report for the Former DP&L Holly Oak Substation (WIK, 2002). The USGS model selected the value based on generalized soil type of a sandy clay loam.

RUSLE Factors	Values Provided	Explanation of Selection
Is = topographic factor (dimensionless)	0.24	The slope length was estimated to 52 feet, which is the distance between the site and the closest storm water discharge location along the overland flow path. The assumed slope (1.9%) and slope length were used to calculate a topographic factor of 0.24.
C = cover/management factor (dimensionless)	0.046	The cover/management factor C assigned to the site by the USGS windows based application was 0.046, which corresponds to at least bare ground with approximately 85% cover of stone mulch at least 5 inches thick.
P = support practice factor (dimensionless)	1.0	There are no controls in place on the site that impeded the flow of surface runoff.

The average annual erosion rate is based on the windows based RUSLE2 program (RUSLE2 License, version 2006-Jul-24).

The total PCB loading via overland flow for the site is 0.2 grams per year. Please see attached table for specific variables.

Uncertainty Analysis Associated with Overland Flow:

Specific Areas and Degree of Uncertainty for the Holly Oak Substation Site

	Samples Per Acre (site)	Samples Per Acre (hot spot area)	Chemical Data Quality*	Topography	Soil Type	Site Coverage	Map Quality	Distance to Discharge Points
Site Specific Information	88	2,500	Immunoassay	Estimated based off of a visual inspection	Detailed logs that are located within the area of concern	Based on a thorough site assessment	Scaled Map	52
Degree of Uncertainty	Low	Low	Moderate to High	High	Low	Low	Medium to High	Low to Moderate

* Primary analysis used in the historical samples

Sources of uncertainty for the Holly Oak Substation site include the following: the topography in this area is not well defined, so the slope of the overland flow path had to be estimated based on the site inspection. There are several factors that increase the uncertainty factor associated with Holly Oak Substation. During the Removal Action by Tetra Tech confirmatory samples were collected from Areas 1-4, but data could only be tracked down for RA-2 and RA-4. Prior to the

removal action, Tetra Tech completed on site screening of soil to assess the horizontal and vertical extent of PCB contamination, which was completed within an 18 foot by 20 foot area based on the initial investigation by DP&L in 1990. The sample locations are clear, but actual sample depths or boring logs were not presented in the report. BrightFields inferred that the soil in all locations where soil samples indicated elevated PCB concentrations during the delineation effort were removed with the exception of the screening samples around the perimeter of the area that were within the action levels of 10 ppm of total PCBs. In addition, this removal area was sampled again by BrightFields in 2002.

The most important factor associated with overland flow is associated with the placement of fill on the property some time from 1999 to 2002. DNREC collected surface samples to analyze the fill placed on the property in 2002. PCBs were not detected within the fill material, but since BrightFields could not distinguish what regions of the property the fill was imported onto BrightFields had to assume that the concentrations remaining after the remedial action in the southwest corner remained. Based on these findings the overall uncertainty associated with the Holly Oak Substation site is **moderate**.

GROUNDWATER DISCHARGE ANALYSIS

Groundwater discharge is based on the hydraulic conductivity of the soil, the groundwater gradient, and the cross-sectional area of the aquifer. A breakdown of the individual factors used in the Darcy equation is presented below.

Because PCBs were detected in saturated soil, but not in groundwater, the calculated concentration of PCBs in pore water, based on partitioning, was used to calculate the mass loading. The calculated PCB concentration in the pore water ranges from 0.012 to 0.061 $\mu\text{g/L}$. The calculations are presented in Table B in the groundwater transport calculations attachment.

Input Factors:

A breakdown of the individual factors is presented below with a brief explanation of their choice.

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	0.028	0.28	Drilling logs from 2002 BRI Geoprobe [®] borings were used to evaluate the lithology beneath the site. An examination of the drilling logs shows that the groundwater unit monitored is within a medium-grained silt unit above the weathered bedrock surface. The hydraulic conductivity for a medium silt ranges from approximately 1×10^{-5} to 1×10^{-4} cm/sec (Cernica, 1995).
I = Horizontal Groundwater Gradient (ft/ft)	0.018	0.018	Because no groundwater wells were installed at the site, the horizontal hydraulic gradient could not be directly calculated. However, because the groundwater surface frequently mimics topography, an estimate of the gradient can be made based on surface slope. Based on measurements, the ground surface elevation decreases approximately 10 feet over the course of 570 feet. Using this as the gradient would yield a gradient of approximately 0.018 ft/ft (Table A).
Saturated Thickness (ft)	4	9	Based on the borings logs, the sediment thickness above the bedrock is between 10.6 and 21 feet thick. Groundwater was encountered at depths ranging from 8 to 13 feet bgs. The saturated thickness ranged from 4 to 9 feet.
Lateral Discharge Distance (ft)	32	32	As a conservative estimate, the lateral discharge distance was chosen to be equal to the width of the remediation area at the site, which includes boring GP09, where PCBs were detected. This distance is approximately 32 feet.
A= Cross-Sectional Area (ft ²)	128	288	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (ug/L)	0.012	0.061	The maximum concentration observed in the saturated subsurface soil (0.056 mg/kg) was used to determine the estimated concentration in groundwater.
Distance to Discharge point (ft)	295		Approximate distance from property boundary to closest surface water location.

Mass Loading Via Groundwater Transport Result:

The groundwater discharge is 1.8 to 40 L/day (attached Table A). The maximum detected PCB concentration (0.056 mg/kg) was used to calculate the groundwater concentrations for the loading estimate. The estimated minimum and maximum contaminant mass loading contributions are shown in the Table C in the groundwater transport calculations attachment, assuming that there are no contaminant losses due to degradation, dispersion, sorption, volatilization, etc.

The total PCB loading via groundwater discharge is between 0.00004 and 0.0009 grams per year (attached Table C).

Uncertainty Analysis Associated with Groundwater Transport:

Specific Areas and Degree of Uncertainty for the Holly Oak Substation Site

	Groundwater PCB Concentration	Hydraulic Conductivity	Horizontal Groundwater Gradient	Saturated Thickness	Lateral Discharge Distance	Distance to Discharge point
Site Specific Information	Groundwater concentration based on Aroclor data in saturated soil	Conductivity based on good quality logs	Gradient based on topography	Few logs, inconsistent saturated thickness	Laboratory sample data, acceptable ground-water flow data	490 feet
Degree of Uncertainty	Moderate - High	Moderate	High	Moderate	Moderate	High

Based on this evaluation the overall uncertainty associated PCB mass loading via groundwater transport at the Holly Oak Substation is **moderate to high**.

Site References:

Tetra Tech, November 1994, Phase II Environmental Site Assessment & Removal Action Close-Out Report, Holly Oak Substation.

Tetra Tech, October 1994, Addendum 1 (Removal Action Plan) to the Phase II Environmental Site Assessment, Holly Oak Substation.

Tetra Tech, September 1994, Letter to Delmarva Power and Light RE: Holly Oak Substation Removal Action Estimate and Project Update, September 14, 1994.

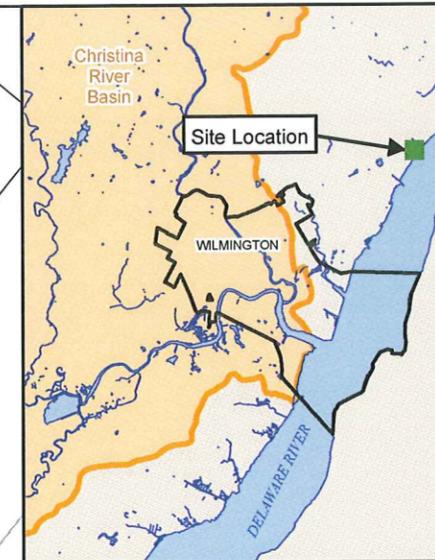
WIK Associates, Inc (WIK), April 2003, Remedial Investigation Report, The Former DP&L Holly Oak Substation, Wilmington, Delaware (DE-1200).

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

Figures



Legend

- ND (0.0'-2.0') PCBs Not Detected and Sample Depth (feet bgs)
- <2.5 Screening Result
- ⊗ Soil Boring Location Where Soil Location
- Soil Boring Location
- ⊕ Surface Soil Sample Location
- Historic Transformer Pad
- ▨ Area Previously Removed
- ▨ Estimated PCB Distribution
- Existing Building
- Tax Parcel
- ▭ Holly Oak Substation Property Boundary

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

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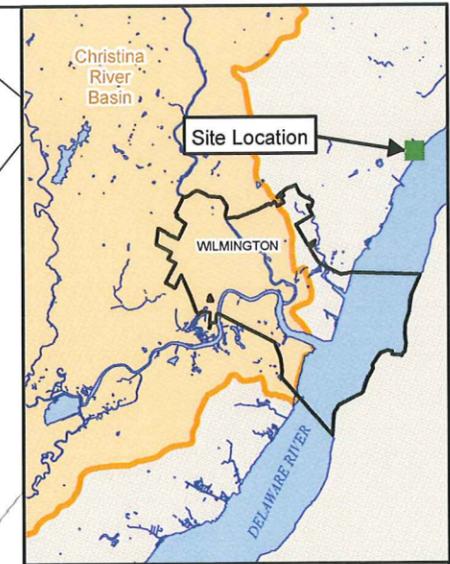
801 Industrial Street, Suite 1
 Wilmington, Delaware 19801

302-656-9600
 302-656-9700 fax

PCB Distribution in Surface Soil (0'-2' bgs)
 Holly Oak Substation
 Wilmington, Delaware

By	Date	Scale:	File Name:
SMD	8/22/08	1:240	holly oak 0-2.mxd
Checked	JPR	8/22/08	Fig. No.
Project #	0985.26.51	Figure 2	

0 10 20 Feet



Legend

- 0.53 (4'-6') Total PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (4.0'-6.0') PCBs Not Detected and Sample Depth (feet bgs)
- ⊗ Soil Boring Location Where Soil Removed
- Soil Boring Location
- ⊕ Surface Soil Sample Location
- Historic Transformer Pad
- ▨ Area Previously Removed
- ▨ Estimated PCB Distribution
- Existing Building
- Tax Parcel
- ▭ Holly Oak Substation Property Boundary

AWARE AVENUE

GOVERNOR PRINTZ BL

GOVERNOR PRINTZ BL

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

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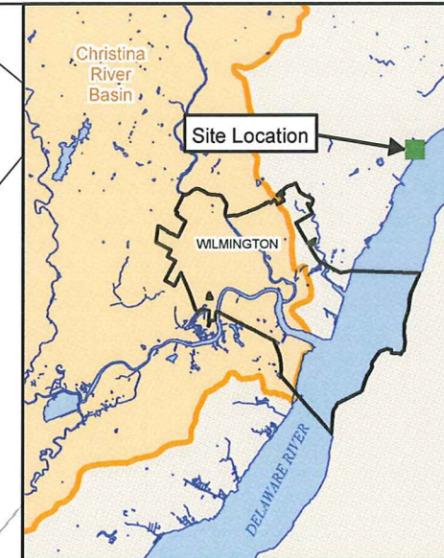
801 Industrial Street, Suite 1
 Wilmington, Delaware 19801

302-656-9600
 302-656-9700 fax

**PCB Distribution in Subsurface Unsaturated Soil
 Holly Oak Substation
 Wilmington, Delaware**

By	Date	Scale:	File Name:
Drawn SMD	8/22/08	1:240	hollyoak grt2 unsat.mxd
Checked JPR	8/22/08	Fig. No.	
Project #	0985.26.51	Figure 3	

0 10 20 Feet



Legend

- 0.056 (10'-12') Total PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (6.0'-8.0') PCBs Not Detected
- ⊗ Soil Boring Location Where Soil Removed
- Soil Boring Location
- ⊕ Surface Soil Sample Location
- ▨ Area Previously Removed
- ▨ Estimated PCB Distribution
- ▭ Existing Building
- ▭ Historic Building
- ▭ Tax Parcel
- ▭ Holly Oak Substation Property Boundary

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

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 Environmental Evaluation
 Investigation, and Remediation

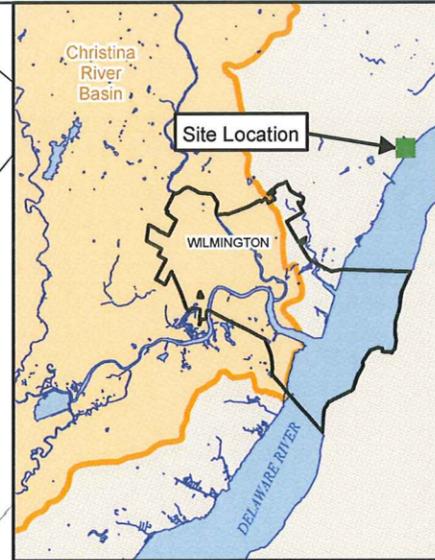
801 Industrial Street, Suite 1
 Wilmington, Delaware 19801

302-656-9600
 302-656-9700 fax

**PCB Distribution in Subsurface Saturated Soil
 Holly Oak Substation
 Wilmington, Delaware**

By	Date	Scale:	File Name:
SMD	8/22/08	1:240	hollyoak grt2 sat.mxd
Checked	JPR	8/22/08	Fig. No.
Project #	0985.26.51	Figure 4	

0 10 20 Feet



Legend

- ND PCBs Not Detected
- Soil Boring Location with Groundwater Sample
- Historic Transformer Pad
- Existing Building
- Tax Parcel
- Holly Oak Substation Property Boundary

DELAWARE AVENUE

Catch Basin

GOVERNOR PRINTZ BL

GOVERNOR PRINTZ BL

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

BrightFields, Inc.
Environmental Evaluation
Investigation, and Remediation

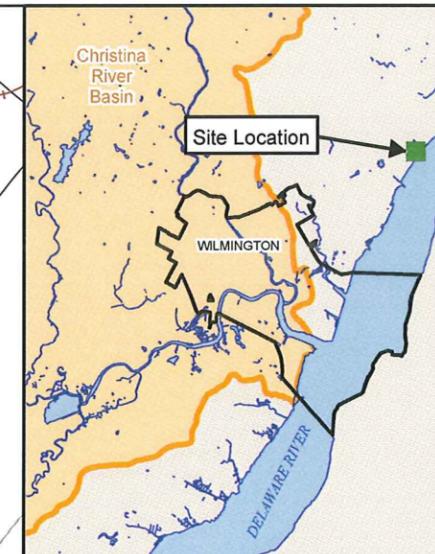
801 Industrial Street, Suite 1
Wilmington, Delaware 19801

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302-656-9700 fax

**PCB Distribution in Groundwater
Holly Oak Substation
Wilmington, Delaware**

	By	Date	Scale:	File Name:
Drawn	SMD	5/12/09	1:240	hollyoak grt2 sat.mxd
Checked	JPR	5/12/09	Fig. No.	
Project #	0985.26.51		Figure 5	

0 10 20
Feet



Legend

- ND (0.0'-2.0') PCBs Not Detected and Sample Depth (feet bgs)
- <2.5 Screening Result
- 10- Topographic Contour (feet)
- Centroid of PCB Distribution
- ⊗ Soil Boring Location Where Soil Location
- Soil Boring Location
- ⊕ Surface Soil Sample Location
- Overland Flow Direction
- Historic Transformer Pad
- ▨ Area Previously Removed
- ▨ Estimated PCB Contribution via Overland Flow
- Existing Building
- Tax Parcel
- ▭ Holly Oak Substation Property Boundary

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

GOVERNOR PRINTZ BL
GOVERNOR PRINTZ BL
DELAWARE AVENUE

Overland Flow Distance = 52.14ft

Catch Basin

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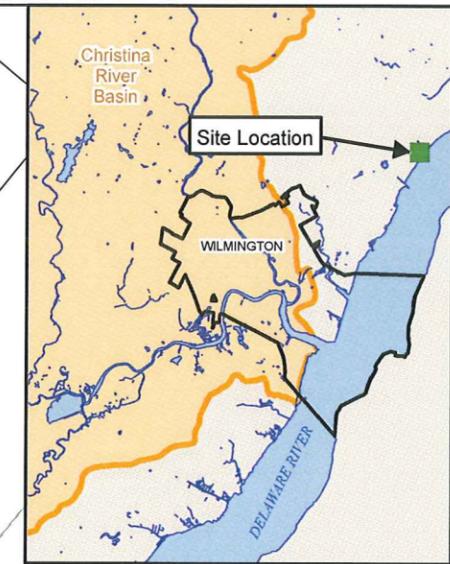
801 Industrial Street, Suite 1
Wilmington, Delaware 19801

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302-656-9700 fax

Overland Flow Map
Holly Oak Substation
Wilmington, Delaware

By	Date	Scale	File Name
Drawn SMD	12/30/08	1:240	holly oak topo.mxd
Checked JPR	12/30/08	Fig. No.	
Project #	0985.26.51	Figure 6	

0 10 20 Feet



Legend

- 0.056 (10'-12') Total PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (6.0'-8.0') PCBs Not Detected
- Groundwater Flow Direction
- ↔ 32' ↔ Groundwater Discharge Distance (feet)
- ⊗ Soil Boring Location Where Soil Removed
- Soil Boring Location
- ⊕ Surface Soil Sample Location
- ▭ Existing Building
- ▭ Historic Building
- ▨ Estimated PCB Distribution
- ▭ Holly Oak Substation Property Boundary
- ▭ Tax Parcel
- ▭ Area Previously Removed

Note: Samples in gray indicate that no sample was collected from this depth or the sample was not analyzed for PCBs.

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Groundwater Discharge Map
 Holly Oak Substation
 Wilmington, Delaware

By	Date	Scale:	File Name:
SMD	5/19/09	1:240	hollyoak gw dis.mxd
Checked	JPR	5/19/09	Fig. No.
Project #	0985.26.51	Figure 7	

0 10 20 Feet

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

Tables

Table 1
 PCB Analytical Results For Soil - HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		GP01-S02 6.0-8.0 4/25/02 mg/Kg WIK RI Report	GP03-S01 1.5-4.0 4/25/02 mg/Kg WIK RI Report	GP04-S01 4.0-6.0 4/25/02 mg/Kg WIK RI Report	GP06-S02 10-12.0 4/25/02 mg/Kg WIK RI Report	GP07-S01 3.0-4.0 4/25/02 mg/Kg WIK RI Report
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBS							
Aroclor-1016	5	82	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1221	0.3	3	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1232	0.3	3	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1242	0.3	3	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1248	0.3	3	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1254	0.3	3	0.082 U	0.082 U	0.320	0.087 U	0.079 U
Aroclor-1260	0.3	3	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1262	nca	nca	0.082 U	0.082 U	0.082 U	0.087 U	0.079 U
Aroclor-1268	nca	nca	0.082 U	0.082 U	0.21	0.087 U	0.079 U

RI (WIK 2002) - Remedial Investigation Report for Holly Oak Substation
 DNREC - Supplemental surface samples collected by DNREC during RI
 completed by WIK.

Qualifiers

- U - The compound was not detected above laboratory detection limits
- NR - Not analyzed.
- nca - no criteria available
- bold - concentration is above DNREC URS unrestricted use criteria
- shaded - concentration is above DNREC URS restricted use criteria

Table 1
 PCB Analytical Results For Soil - HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report Issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		DSS3 0.0-2.0 4/26/02 mg/Kg DNREC	DSS7 0.0-2.0 4/26/02 mg/Kg DNREC	DSS8 0.0-2.0 4/26/02 mg/Kg DNREC
	Unrestricted Use	Restricted Use			
PESTICIDES/PCBs					
Atroclor-1016	5	82	0.083 U	0.079 U	0.086 U
Atroclor-1221	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1232	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1242	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1248	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1254	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1260	0.3	3	0.083 U	0.079 U	0.086 U
Atroclor-1262	nca	nca	0.083 U	0.079 U	0.086 U
Atroclor-1268	nca	nca	0.083 U	0.079 U	0.086 U

RI (WIK 2002) - Remedial Investigation Report for Holly Oak Substation
 DNREC - Supplemental surface samples collected by DNREC during RI
 completed by WIK.

Qualifiers

- U - The compound was not detected above laboratory detection limits
- NR - Not analyzed
- nca - no criteria available
- bold - concentration is above DNREC URS unrestricted use criteria
- shaded - concentration is above DNREC URS restricted use criteria

Table 2
 PCB Analytical Results For Soil - non-HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		GP01-S01 2.0-4.0 4/25/02 mg/Kg WIK RI Report (2002)	GP01-S02 6.0-8.0 4/25/02 mg/Kg WIK RI Report (2002)	GP02-S01 1.5-2.0 4/25/02 mg/Kg WIK RI Report (2002)	GP02-S02 6.0-8.0 4/25/02 mg/Kg WIK RI Report (2002)	GP03-S01 1.5-4.0 4/25/02 mg/Kg WIK RI Report (2002)
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBs							
Atroclor-1016	5	82	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1221	0.3	3	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1232	0.3	3	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1242	0.3	3	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1248	0.3	3	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1254	0.3	3	0.012 U	0.012 U	0.012 U	0.013 U	0.012 U
Atroclor-1260	0.3	3	0.010 U	0.010 U	0.010 U	0.011 U	0.010 U

No other PCB aroclors were analyzed by the laboratory
 RI (WIK 2002) - Remedial Investigation Report for Holly Oak
 Substation, WIK 2002

DNREC - Supplemental surface samples collected by DNREC during RI
 completed by WIK.
 (Tetra Tech Phase II ESA 1994) - Phase II Environmental Site
 Assessment & Removal Action Close-Out Report Holly Oak Substation

Qualifiers

- U - The compound was not detected above laboratory detection limits
- NR - Not analyzed.
- nca - no criteria available
- bold - concentration is above DNREC URS unrestricted use criteria
- shaded - concentration is above DNREC URS restricted use criteria

Table 2
 PCB Analytical Results For Soil - non-HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report Issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		GP03-S02 8.0-10.0 4/25/02 mg/Kg WIK RI Report (2002)	GP04-S01 4.0-6.0 4/25/02 mg/Kg WIK RI Report (2002)	GP04-S02 12-13.0 4/25/02 mg/Kg WIK RI Report (2002)	GP05-S01 4.0-6.0 4/25/02 mg/Kg WIK RI Report (2002)	GP05-S02 12-13.0 4/25/02 mg/Kg WIK RI Report (2002)
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBS							
Atroclor-1016	5	82	0.013 U	0.012 U	0.012 U	0.012 U	0.013 U
Atroclor-1221	0.3	3	0.013 U	0.012 U	0.012 U	0.012 U	0.013 U
Atroclor-1232	0.3	3	0.013 U	0.012 U	0.012 U	0.012 U	0.013 U
Atroclor-1242	0.3	3	0.013 U	0.012 U	0.012 U	0.012 U	0.013 U
Atroclor-1248	0.3	3	0.013 U	0.012 U	0.012 U	0.012 U	0.013 U
Atroclor-1254	0.3	3	0.013 U	0.16 U	0.012 U	0.012 U	0.013 U
Atroclor-1260	0.3	3	0.011 U	0.012 U	0.010 U	0.010 U	0.011 U

No other PCB aroclors were analyzed by the laboratory
 RI (WIK 2002) - Remedial Investigation Report for Holly Oak
 Substation: WIK 2002
 DNREC - Supplemental surface samples collected by DNREC during RI
 completed by WIK.
 (Tetra Tech Phase II ESA 1994) - Phase II Environmental Site
 Assessment & Removal Action Close-Out Report Holly Oak Substation

Qualifiers
 U - The compound was not detected above laboratory detection limits
 NR - Not analyzed.
 nca - no criteria available
 bold - concentration is above DNREC URS unrestricted use criteria
 shaded - concentration is above DNREC URS restricted use criteria

Table 2
 PCB Analytical Results For Soil - non-HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report Issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		GP06-S01 4.0-6.0 4/25/02 mg/Kg WIK RI Report (2002)	GP06-S02 10-12.0 4/25/02 mg/Kg WIK RI Report (2002)	GP07-S01 3.0-4.0 4/25/02 mg/Kg WIK RI Report (2002)	GP07-S02 7.0-8.0 4/25/02 mg/Kg WIK RI Report (2002)	GP08-S01 2.5-4.0 4/25/02 mg/Kg WIK RI Report (2002)
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBs							
Atoclor-1016	5	82	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1221	0.3	3	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1232	0.3	3	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1242	0.3	3	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1248	0.3	3	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1254	0.3	3	0.012 U	0.013 U	0.012 U	0.012 U	0.012 U
Atoclor-1260	0.3	3	0.01 U	0.011 U	0.010 U	0.010 U	0.010 U
No other PCB aroclors were analyzed by the laboratory							

RI (WIK 2002) - Remedial Investigation Report for Holly Oak Substation.WIK 2002
 DNREC - Supplemental surface samples collected by DNREC during RI completed by WIK.
 (Tetra Tech Phase II ESA 1994) - Phase II Environmental Site Assessment & Removal Action Close-Out Report Holly Oak Substation

Qualifiers
 U - The compound was not detected above laboratory detection limits
 NR - Not analyzed.
 nca - no criteria available
 bold - concentration is above DNREC URS unrestricted use criteria
 shaded - concentration is above DNREC URS restricted use criteria

Table 2
 PCB Analytical Results For Soil - non-HSCA
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report Issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		GP08-S02 6.0-8.0 4/25/02 mg/Kg WIK RI Report (2002)	GP09-S01 4.0-6.0 4/25/02 mg/Kg WIK RI Report (2002)	GP09-S02 10-12.0 4/25/02 mg/Kg WIK RI Report (2002)	GP10-S01 4.0-5.0 4/25/02 mg/Kg WIK RI Report (2002)	GP10-S02 12-13.0 4/25/02 mg/Kg WIK RI Report (2002)
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBs							
Atoclor-1016	5	82	0.014 U	0.012 U	0.012 U	0.012 U	0.012 U
Atoclor-1221	0.3	3	0.014 U	0.012 U	0.012 U	0.012 U	0.012 U
Atoclor-1232	0.3	3	0.014 U	0.012 U	0.012 U	0.012 U	0.012 U
Atoclor-1242	0.3	3	0.014 U	0.012 U	0.012 U	0.012 U	0.012 U
Atoclor-1248	0.3	3	0.014 U	0.012 U	0.012 U	0.012 U	0.012 U
Atoclor-1254	0.3	3	0.014 U	0.027	0.056	0.012 U	0.012 U
Atoclor-1260	0.3	3	0.011 U	0.010 U	0.010 U	0.010 U	0.010 U

No other PCB aroclors were analyzed by the laboratory RI (WIK 2002) - Remedial Investigation Report for Holly Oak Substation.WIK 2002

DNREC - Supplemental surface samples collected by DNREC during RI completed by WIK.
 (Tetra Tech Phase II ESA 1994) - Phase II Environmental Site Assessment & Removal Action Close-Out Report Holly Oak Substation

Qualifiers

- U - The compound was not detected above laboratory detection limits
- NR - Not analyzed.
- nca - no criteria available
- bold - concentration is above DNREC URS unrestricted use criteria
- shaded - concentration is above DNREC URS restricted use criteria

Table 2
PCB Analytical Results For Soil - non-HSCA
Holly Oak Substation
Wilmington, DE
SIRB ID: DE-1200

Sample ID Sampling Depth (feet bgs) Sampling Date Units Report Issued	DNREC URS for Protection of Human Health Non-critical Water Resource Area mg/Kg		DSS3 0.0-2.0 4/26/02 mg/Kg DNREC	DSS8 0.0-2.0 4/26/02 mg/Kg DNREC	DSS9 0.0-2.0 4/26/02 mg/Kg DNREC	RA-2 1/3/00 10/26/94 mg/Kg Tetra Tech	RA-4 1/3/00 10/26/94 mg/Kg Tetra Tech
	Unrestricted Use	Restricted Use					
PESTICIDES/PCBs							
Atroclor-1016	5	82	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1221	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1232	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1242	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1248	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1254	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
Atroclor-1260	0.3	3	0.083 U	0.079 U	0.086 U	0.079 U	0.079 U
No other PCB aroclors were analyzed by the laboratory							

RI (WIK 2002) - Remedial Investigation Report for Holly Oak Substation, WIK 2002
 DNREC - Supplemental surface samples collected by DNREC during RI completed by WIK.
 (Tetra Tech Phase II ESA 1994) - Phase II Environmental Site Assessment & Removal Action Close-Out Report Holly Oak Substation

Qualifiers
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 NR - Not analyzed.
 nca - no criteria available
 bold - concentration is above DNREC URS unrestricted use criteria
 shaded - concentration is above DNREC URS restricted use criteria

Table 3
 DNREC PCB Screening Data
 Holly Oak Substation
 Wilmington, DE
 SIRB ID: DE-1200

Sample ID	Sample Depth	Investigation Report	Sample Date	DNREC URS for Protection of Human Health (Non-critical Water Resource Unrestricted Use (mg/kg)	Total PCBs (mg/kg)
DSS1	Surface	DNREC Report	4/26/02	1	ND
DSS2	Surface	DNREC Report	4/26/02	1	ND
DSS3	Surface	DNREC Report	4/26/02	1	ND
DSS4	Surface	DNREC Report	4/26/02	1	ND
DSS5	Surface	DNREC Report	4/26/02	1	ND
DSS6	Surface	DNREC Report	4/26/02	1	ND
DSS7	Surface	DNREC Report	4/26/02	1	ND
DSS8	Surface	DNREC Report	4/26/02	1	ND
DSS9	Surface	DNREC Report	4/26/02	1	ND
DSS10	Surface	DNREC Report	4/26/02	1	ND
3	2.5'	Phase II ESA	9/6/94	1	<2.5
4	3.5'	Phase II ESA	9/6/94	1	<2.5
4	3.33'	Phase II ESA	9/6/94	1	>10
8D (42")	3.5'	Phase II ESA	9/6/94	1	2.7
1	1'	Phase II ESA	9/6/94	1	<2.5
2	1'	Phase II ESA	9/6/94	1	<2.5
1	1.5'	Phase II ESA	9/6/94	1	<2.5
2	1.5'	Phase II ESA	9/6/94	1	<2.5
4	1'	Phase II ESA	9/6/94	1	>10
3	1.5'	Phase II ESA	9/6/94	1	>10
3	1'	Phase II ESA	9/6/94	1	>2.5<10
4	2'	Phase II ESA	9/6/94	1	>2.5<10
8D'E	surface	Phase II ESA	9/6/94	1	<10
5A	surface	Phase II ESA	9/6/94	1	<2.5
5B	surface	Phase II ESA	9/6/94	1	<2.5
5C	surface	Phase II ESA	9/6/94	1	<2.5
5D	surface	Phase II ESA	9/6/94	1	<2.5
6A	surface	Phase II ESA	9/6/94	1	<2.5
6B	surface	Phase II ESA	9/6/94	1	<2.5
6C	surface	Phase II ESA	9/6/94	1	<2.5
6D	surface	Phase II ESA	9/6/94	1	<2.5
7A	surface	Phase II ESA	9/6/94	1	<2.5
7B	surface	Phase II ESA	9/6/94	1	<2.5
7C	surface	Phase II ESA	9/6/94	1	<2.5
7D	surface	Phase II ESA	9/6/94	1	<2.5
8A	surface	Phase II ESA	9/6/94	1	<2.5
8C	surface	Phase II ESA	9/6/94	1	<2.5
8D'W	surface	Phase II ESA	9/6/94	1	<2.5
8D'S	surface	Phase II ESA	9/6/94	1	>2.5<10
8B	surface	Phase II ESA	9/6/94	1	>2.5<10
8D	surface	Phase II ESA	9/6/94	1	<2.5
RA-6	3.5'	Phase II ESA	10/26/94	1	<2.5
RA-5	3.5'	Phase II ESA	10/26/94	1	<2.5
RA-3	3.5'	Phase II ESA	10/26/94	1	<2.5
RA-1	3.5'	Phase II ESA	10/26/94	1	<2.5

Table 4
PCB Analytical Results for Groundwater
HSCA Protocol
Holly Oak Substation
Wilmington, DE
SIRB ID: DE-1200

Sample ID Sampling Date Units Report Issued	DNREC URS for Protection of Human ug/L		GP02-WGL 4/25/02 ug/L WIK RI Report (2002)	GP06-WGL 4/25/02 ug/L WIK RI Report (2002)	GP08-WGL 4/25/02 ug/L WIK RI Report (2002)
	Unrestricted Use	Restricted Use			
PESTICIDES/PCBs					
Aroclor-1016		0.1	0.50 U	0.62 U	0.67 U
Aroclor-1221		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1232		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1242		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1248		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1254		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1260		0.03	0.50 U	0.62 U	0.67 U
Aroclor-1268		nca	0.50 U	0.62 U	0.67 U

RI (WIK 2003) - Remedial Investigation Report for
Holly Oak Substation

Qualifiers

- U - The compound was not detected above laboratory detection limits
- NR - Not analyzed.
- nca - no criteria available
- bold** - concentration is above DNREC URS unrestricted use criteria
- shaded - concentration is above DNREC URS restricted use criteria

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

Site Photographs



**PCB Mass Loading Evaluation
Holly Oak Substation**



Behind former control house located on property.



$\frac{1}{4}$ " to $\frac{1}{2}$ " Stone fill as top layer of site (approximately 2" thick).

**PCB Mass Loading Evaluation
Holly Oak Substation**



North side of the site displaying vegetation protruding through stone fill.



Elevated area of site directly adjacent to southern entrance.

**PCB Mass Loading Evaluation
Holly Oak Substation**



Overland pathway from location of former PCB contaminated area.

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

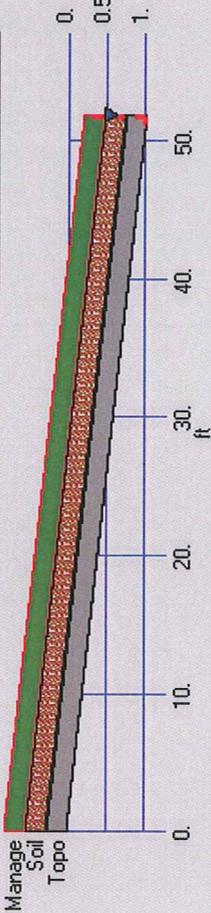
Overland Flow Calculations

(Not Applicable)

Holly Oak Substation

Location: USA\Delaware\New Castle County

Add break | Erase break



Net C factor	0.046
Net LS factor	0.24
Net K factor	0.24
Net contour factor	1.0
Net ridge factor	1.0
Net ponding factor	0.95

Rock cover, %
 Adjust rock cover
 General yield level
 Surf. res. cov. values
 Adjust res. burial level

Soil conditioning index

Avg. slope steepness, % Slope length (horiz) ft Crit. slope length, ft
 Detachment on slope, t/ac/yr Soil loss erod. portion, t/ac/yr
 Sediment delivery, t/ac/yr Soil loss for cons. plan, t/ac/yr
 T value, t/ac/yr

Fuel type for entire run

Equiv. diesel use for entire simulation, gal/ac
 Fuel cost for entire simulation, US\$/ac

Energy use for entire simulation, BTU/ac

Align of oper on segments | General composite segment info | Biomass by layer | Biomass summary | C subfactor by day | C subfactor by period | C subfactor by operation
 Ridges_contour by day | Erosion by day | Erosion by period | Erosion by operation | Erosion by year | Extra C, L, crit. length values | Hydrology | Management output by day
 Management output by period | Residue values | Roughness | STRIPS_AND_BARRIERS | MANAGEMENT_STRIP_BUILDER | Runoff / Sediment overall results
 Runoff / Sediment results by day | Sediment results by flow path | Sediment by segment | Sediment by segment by day | Soil output by day | Yield values | Visuals | Info
Soil | MISC_CALCULATIONS1 | Topography | Management | Strips / Barriers | Irrigation / Subsurface drainage | Division/terrace, sediment basin

Slope Soils

Segment	Soil	Seg length (horiz), ft	Soil loss, t/ac/yr	Sed. del., t/ac/yr	Consolidation n time, yr
+ 1	Generic Soils\sandy clay loam (high DM)	52	0.42	0.42	7

PCB Mass Loading
Holly Oak Substation
SIRB ID: DE-1200
Wilmington, Delaware



BrightFields, Inc.

Groundwater Transport Calculations

**PCB Loading Calculations - Groundwater Discharge to Surface Water
Former Holly Oak Substation
Wilmington, DE
DE-1200**

**TABLE A
Groundwater Discharge Calculations**

Location	Hydraulic Conductivity (K) (ft/day)	Horizontal Gradient (i) (ft/ft)	Cross-sectional Area (A) (ft ²)	Groundwater Discharge*	
				Liters/day	Gallons/day
GP09					
Minimum	0.028	0.018	128	1.8	0.5
Maximum	0.28	0.018	288	40	11

* - Groundwater Discharge (Q) = KiA

**TABLE B
Potential Groundwater PCB Concentration Calculation**

Location	Maximum Soil PCB (µg/kg)	f _{oc} (fraction of organic carbon)		Pore Water PCB (µg/L)	
				Minimum	Maximum
GP09	56	0.01	0.05	0.012	0.061

**TABLE C
Estimated Mass Loadings of PCBs in Groundwater to Surface Water**

Location	Subsurface Soil Concentration/ Converted to Pore Water Concentration (µg/L)	Estimated PCB Mass Loading (g/yr)	
		Minimum	Maximum
GP09	0.061	4.0E-05	9.1E-04