BrightFields, Inc.

Appendix 24

UP THE CREEK PROPERTY
WILMINGTON, DELAWARE

SIRB ID: DE-1384

GENERAL SITE INFORMATION

Site Name: Up the Creek Property

SIRB ID Number: DE-1384

Site Location and Description: The Up the Creek Property is located at 1195 East 7th Street in Wilmington, Delaware (Figure 1). The property has most recently been operated as a restaurant and boat marina and is bordered by property owned by CRB Broadcasting of Delaware to the north and northeast, Brandywine Creek to the east and south, and East 7th Street to the west. There is currently a restaurant (Up the Creek), a warehouse, several trailers, and a marina on the property. The River Associates Property is an approximately 4.14-acre property consisting of one tax parcel (Tax Parcel 26-052.00-004). Surrounding land is generally commercial and/or industrial.

Previous Site Uses: Based on the review of historical maps dating from 1876 to 1901, the Up the Creek Property is identified as having several property owners including a William Mc Caulley, National Dredging Company and the Atlas Dredging Company. These maps also show a bridge connecting the 7th Street Peninsula from the Up the Creek Property to 4th Street on the opposite bank of the Brandywine River. Based on the review of aerial photographs dating from 1950 to 1998, several structures existed on the property, and the property appeared to be used as part of the municipal land filling operations and for boat storage.

Much of the south side of the 7th Street Peninsula was reportedly used by the City of Wilmington as a municipal landfill from the 1940s through the 1960s. This area of the peninsula was then overlain with varying depths of coal ash from Wilmington's incinerators. Portions of the peninsula were also filled with various amounts of construction debris and fill material.

It is possible that PCBs were introduced to the site as a result of the use of the property as a municipal landfill from the 1940s through the 1960s.

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.

Southside BPA II (DNREC, 1999)

The East 7th Street Peninsula - Southside area is bounded by Fort Christina Park, the Christina River, Brandywine Creek, and Industrial Street. It consists of approximately 45 acres and it comprised 18 parcels with 10 owners at that time. The East 7th Street Peninsula – South Side BPA II report was issued by DNREC in June 1999.

The Southside BPA investigation consisted of the installation of 3 monitoring wells and the excavation of 31 test pits to facilitate the collection of 61 soil samples, 2 surface water samples, 10 sediment samples, and 3 groundwater samples. Test pit and well boring logs indicated that the study area was extensively filled with municipal waste, incinerator ash and slag, foundry sands, and construction debris (at least 10 feet thick), and is underlain by marsh deposits.

During this investigation, it appeared that four test pits were excavated on the River Associates property and one sediment sample was collected from Brandywine Creek. The locations of the test pits and sediment sample from the BPA II are presented in Figure 2. One shallow (0 to 2 feet below ground surface (bgs)) and one deep (greater than 2 feet bgs) soil sample from each test pit and the sediment sample were analyzed by for volatile organic compounds (VOCs), pesticides, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), polychlorinated biphenyls (PCBs), and metals using gas chromatography/mass spectroscopy (GC/MS), immunoassay test kits, and x-ray fluorescence (XRF). The results of this analysis indicated that 3 of the shallow soil samples (S7TP-13S, S7TP-14S, and S7TP-15S) contained more than 1 part per million (ppm) but less than 50 ppm of cPAHs. One shallow soil sample (S7TP-12S) contained more than 100 ppm but less than 200 ppm of cPAHs. All of the deep samples contained more than 1 ppm but less than 50 ppm of cPAHs. PCBs were reported as greater than 0.25 ppm but less than 10 ppm for one shallow soil sample (S7TP-12S). The remaining shallow and deep soil samples were reported as containing less than 0.25 ppm of PCBs.

One soil sample (S7TP-12S), collected from near the northwest corner of the property, was submitted for confirmatory laboratory analysis. Confirmatory analytical results for this sample are presented in Table 1. The results of this analysis indicated that this soil sample contained arsenic, iron, lead, and PCB Aroclor 1254 and Aroclor 1260 concentrations that exceed the current DNREC Unrestricted Use Uniform Risk-Based Remediation Standard (URS) concentrations (DNREC, 1999) or exceeded the Delaware background concentration for arsenic.

Phase II Site Assessment (BrightFields, 2006)

In February 2006, BrightFields Inc. (BrightFields) completed a Phase II Site Investigation (SI) Report for the River Associates Property (BrightFields, 2006). During this investigation, eight test pits were excavated and nine Geoprobe® borings were advanced to evaluate the existing soil quality around the property (Figures 2 and 3). A total of eight soil samples and four groundwater samples were collected from the Geoprobe® borings and four soil samples were collected from the test pits. These samples were analyzed at Test America Analytical Testing Corporation of King of Prussia, Pennsylvania, for the eight Resource Conservation and Recovery Act (RCRA) metals, PAHs, and volatile organic compounds (VOCs). In addition to these analyses, five soil samples were also analyzed for PCBs.

Four groundwater samples were collected and analyzed for RCRA metals (dissolved), PAHs, and VOCs.

Soil Analytical Results

Arsenic was detected in 3 of the 12 soil samples at concentrations above the Delaware background concentration of 11 mg/kg. Cadmium and lead were detected in soil sample TP6-S001 at a concentration above the unrestricted use URS level. Benzo(a)anthracene and benzo(b)fluoranthene were each detected in 3 of the 12 soil samples at concentrations above their respective unrestricted use URS. Dibenz(a,h)anthracene was detected in 2 of the 12 soil samples at concentrations above the unrestricted use URS. Indeno(1,2,3-cd)pyrene was detected in GP8-S001 at a concentration of 1.0 mg/kg, which is above the unrestricted use URS of 0.9 mg/kg. Benzo(a)pyrene was detected in soil samples GP1-S001, GP8-S001, TP3-S001, TP4-S001 and TP5-S001 at concentrations ranging from 0.18 mg/kg to 1.3 mg/kg, which are all above the unrestricted use URS of 0.09 mg/kg. The concentrations of benzo(a)pyrene in soil samples GP1-S001, GP8-S001 and TP5-S001 were also above the restricted use URS of 0.8 mg/kg. PCB Aroclors 1248 and 1260 were detected in soil sample TP6-S001 at concentrations of 2.7 mg/kg and 1.0 mg/kg, respectively, which are above the unrestricted use URS level of 0.3 mg/kg.

The Phase II data package was submitted to DNREC-SIRB and after reviewing the data, DNREC-SIRB approved the use of the data as part of the evaluation of the property. A summary of soil exceedances are presented in the following table.

	Surface Soil			Subsurface Soil		
RCRA Metals by Test America	**Total # of Samples Analyzed**	**# of Samples Exceeding Unrestricted Use**	**# of Samples Exceeding Restricted Use**	**Total # of Samples Analyze**	**# of Samples Exceeding Unrestricted Use**	**# of Samples Exceeding Restricted Use**
Arsenic*	7	1	1	5	2	2
Cadmium	7	0	0	5	1	0
Lead	7	0	0	5	1	0
PAHs by Test America				5	0	0
Benzo(a)anthracene	7	3	0	5	0	0
Benzo(b)fluoranthene	7	3	0	5	0	0
Benzo(a)pyrene	7	4	3	5	1	0
Indeno(1,2,3-cd)pyrene	7	1	0	5	0	0
Dibenz(a,h)anthracene	7	2	0	5	0	0
PCBs by Test America					0	0
Aroclor 1248	3	0	0	2	1	0
Aroclor 1260	3	0	0	2	1	0

*Exceeds Delaware background concentration (DNREC, 2007)

Groundwater Analytical Results

Arsenic was detected in two of the four groundwater samples (GP1-W001 and GP2-W001) at concentrations of 14 µg/L and 200 µg/L, respectively, which are above the revised Federal MCL criteria of 10 µg/L. All other RCRA metals, PAHs, PCB, and VOCs were either not detected or detected below the Delaware URS

Brownfield Remedial Investigation (BrightFields, 2007)

BrightFields conducted a Brownfield Remedial Investigation (BRI) for the Up the Creek property in August, 2006. The purpose of the BRI was to document existing environmental conditions at the site, identify the source(s) of contaminants if present, evaluate whether remedial action may be required at the site and obtain approval from DNREC for residential use of the property, from an environmental perspective. This was accomplished by collecting soil,

sediment, and groundwater samples to investigate the impact historic uses of the property and surrounding lands may have had on the property. All work was conducted under the Delaware Department of Natural Resources and Environmental Control (DNREC)'s Brownfield Program.

The following summarizes the significant findings of the BRI conducted in August 2006.

General:

- Portions of the former Wilmington Municipal Landfill on the 7th Street peninsula appear to extend onto the northern portion of the River Associates property to a depth of at least 11 feet bgs in the far northern portions of the property and thinning out to between 2.5 and 3.5 feet thick near the center of the property.
- Burnt metal and plastic was observed in an isolated area adjacent to the parking lot immediately under the surface.

Soil Investigation:

- Boring and test pit logs from site investigations indicate that the site is filled with municipal and industrial fill (2.5 to greater than 10 feet thick) on top of low permeability marsh deposits.

Groundwater Investigation:

- Based on the gauging data collected as part of this Investigation, groundwater is flowing southeast toward the Brandywine Creek.

Sediment Investigation and Findings:

- Based on the statistical sediment evaluation, it appears that the Brandywine Creek sediment is not being adversely impacted by the site.

Risk Assessment Findings:

Soil:

- Arsenic, lead, and benzo(a)pyrene are site contaminants of concern for surface soil under a restricted use.
- Arsenic, copper, iron, and manganese, and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and Aroclor 1260, are site contaminants of concern for surface soil under an unrestricted use. Lead is a contaminant of concern for surface soil under an unrestricted use and a contaminant of concern for surface soil under a restricted use in the area of TP14.

- Arsenic, lead, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are site contaminants of concern for subsurface soil for restricted use.

- Aluminum, arsenic, iron, lead, and manganese, and benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclor 1248, and Aroclor 1260 are site contaminants of concern for subsurface soil unrestricted use of the property.

- Exposure to either surface and or subsurface site soil may pose an unacceptable carcinogenic risk under a restricted use (commercial) scenario, but does not pose a non-carcinogenic risk.

- Exposure to either surface and or subsurface site soil may pose both unacceptable carcinogenic and also non-carcinogenic risks under an unrestricted use (residential) scenario.

- Exposure to surface/subsurface site soil does not appear to pose an unacceptable carcinogenic risk but may pose an unacceptable non-carcinogenic risk under a construction worker scenario.

Groundwater:

- Arsenic is the contaminant of concern in groundwater beneath the site.

- Existing water supply wells are located further than 2 miles from the site and the site is located within a Groundwater Management Zone (GMZ) where the use of groundwater is controlled by DNREC. No new public or domestic water supply wells are allowed or permitted in the area. Therefore, no complete pathway exists for groundwater ingestion.

- Mass loading screening calculations indicate that the groundwater discharge to Brandywine Creek surface water does not pose a potential risk to human health or the environment.

Sediment:

- Sediment contains a number of compounds that exceed Delaware URS concentrations for the Protection of the Environment, but sediment contaminant concentrations are not statistically different than the contaminant concentrations of background (upstream) sediment.

Current Regulatory Status:

The Up the Creek Property is currently in the Brownfield Investigation phase. BrightFields submitted a Brownfield Remedial Investigation Report to DNREC-SIRB on June 13, 2007.

Various comments have been issued by DNREC and responded to by BrightFields. BrightFields last responded to DNREC's comments on February 13, 2009, and SIRB approved the revised BFI Report on March 20, 2009.

SUMMARY OF SITE PCB INFORMATION

Site Investigation PCB Findings:

PCB concentrations were reported in six surficial samples ranging in total PCB concentration from 0.187 mg/kg to 1.3 mg/kg. One of these samples, S7TP-12, was reported higher than the total PCB URS criteria of 1 mg/kg.

PCB concentrations were observed in the subsurface unsaturated soil at one sample location, TP6-S001 (5.6 mg/kg) above the total PCB URS criteria of 1 mg/kg. Concentrations of PCBs were also reported in subsurface saturated soil at concentrations below the URS criteria for total PCBs at one sample location (TP11-S002).

The 95% upper confidence level of the mean for total PCBs was calculated for the surficial PCBs at the Up the Creek Property. This value (0.78 mg/kg) was then used in all overland transport calculations to determine the loading of PCBs contributed via overland flow.

There were no PCBs detected in groundwater but there are PCBs in the subsurface that are in contact with the groundwater (saturated soil). Due to the fact that there was only one detection in the subsurface saturated soil, this detection was used in the groundwater transport calculations instead of calculating the 95% UCL of the mean across the site. The saturated soil detection was evaluated through the equilibrium partitioning equation to approximate a groundwater concentration.

Concentrations of PCBs on Site			
Sample Matrix	**Corresponding Figure**	**Analytical Methods**	**Range of Total PCBs**
Surface Soil	Figure 2	Immunoassay, Screening, and Method 8082	Not detected to 1.3 mg/kg
Subsurface Soil (unsaturated)	Figure 3	Immunoassay, Screening, and Method 8082	Not detected to 5.6 mg/kg
Subsurface Soil (saturated)	Figure 4	Immunoassay, Screening, and Method 8082	Not detected to 0.24 mg/kg
Groundwater	Figure 5	Immunoassay, Screening and 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 surface soil area impacted by PCBs is 2.52 acres (Figure 6). The estimated subsurface soil non-saturated area impacted by PCBs is 0.25 acres in the vicinity of TP6 (Figure 3). The estimated saturated area impacted by PCBs is 0.43 acres in the vicinity of TP11 (Figure

PCB Remediation Status:

The BRI report was approved on March 20, 2009; however, no remedial actions have taken place on the site. No remediation for PCBs is planned.

SUMMARY OF SITE PCB INFORMATION

The PCB mass loading rate to surface water via overland flow and via groundwater transport were estimated for the Up the Creek Property. 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 factors are site-specific and require information pertaining directly to the site. A breakdown of the individual factors is presented below with a brief explanation of their selection.

Ground Cover and Canopy:

A site inspection was performed to estimate the current site ground cover and canopy on July 31, 2008. The cover/management factor (C) assigned to the site and associated flow path is 0.043 which corresponds to 40% of bare ground with little rock cover and 60% tall weeds short brush. Photographs of the site ground cover and canopy are attached.

Site Sediment and Erosion Control Practices:

There are currently no erosion and sediment controls in place at the Up the Creek Property.

Input Factors and Results:

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

RUSLE Factors	Values	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)	0.365	The soil erodibility factor was chosen based on the information provided on the native soils. This information was collected from the boring logs of the Phase II Investigation Report (2005).
LS = topographic factor (dimensionless)	0.109	The slope length was estimated to be 251 feet, which is the distance between the centroid and the Christina River along the overland flow path. The assumed slope (0.7 %) and slope length were used to calculate a topographic factor of 0.109.

RUSLE Factors	Values	Explanation of Selection
C = cover/management factor (dimensionless)	0.043	The cover/management factor (C) assigned to the site and associated flow path is 0.043 which corresponds 40% of bare ground with little rock cover and 60% tall weeds short brush.
P = support practice factor (dimensionless)	1.0	There are currently no erosion and sediment controls in place at the Up the Creek property.

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

Based on the calculations performed, the total PCB loading from the Up the Creek Property to the Christina River via erosion under current site conditions is 0.5 grams per year.

Uncertainty Analysis Associated with Overland Flow:

Specific Areas and Degree of Uncertainty for the Up the Creek

	Samples Per Acre (site)	Chemical Data Quality*	Topography	Soil Type	Site Coverage	Map Quality	Distance to Discharge Points
Site Specific Information	8.0	Screening Data	Based on the site inspection	Detailed logs that are located within the area of concern	Based on a thorough site assessment	Scaled Map	251 feet
Degree of Uncertainty	Low	High	High	Low	Low to Moderate	Moderate	Moderate to High

* Primary analysis used in the historical samples

Sources of uncertainty for the Up the Creek Property include the following: six small areas have been identified as PCB contaminated areas. For the purposes of evaluating the overland runoff calculations BrightFields assumed that a larger single contaminated area was the source of the PCBs at the Up the Creek Property. This assumption is based on reporting limits and assuming that sample locations that were reported as non-detect were in essence areas that contained PCBs at such minute concentrations that the laboratory or screening methods were unable to detect these concentrations. This approach is a more conservative approach for the site, but because there are six smaller areas of concern this allows for a more realistic evaluation.

In addition to the spot elevations distinguish several potential overland flow pathways. BrightFields determined during the site investigation that the most realistic pathway would be the low lying area surrounding the boat ramp in the southwest portion of the property. Based on

these evaluations the overall uncertainty associated with PCB mass loading from the Up the Creek property 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 0.1 to 0.3 µg/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 2006 Phase II Geoprobe® borings and from previous borings at the River Associates Property were used to evaluate the lithology beneath the site. An examination of the drilling logs shows that the groundwater unit monitored is within a moderately fine grained fill and in the underlying marsh deposit clay. The fill unit ranges in composition from silt to clayey silt, with some sand, but is primarily silt. The marsh deposits are clay and silt. The hydraulic conductivity for a medium silt ranges from approximately 1 x 10^{-5} to 1 x 10^{-4} cm/sec (Cernica, 1995).
I = Horizontal Groundwater Gradient	0.0029	0.0057	In August and December 2006, BrightFields measured depth to groundwater in all four of the River Associates Property wells. This data was used to assess the groundwater flow direction and horizontal gradient at the site.
Saturated Thickness (ft)	6.5	6.5	Based on the borings logs, the fill zone above the marsh deposits is between 2.5 and greater than 11 feet thick. Based on the well drilling logs, groundwater was encountered at depths ranging from 1.5 to 13.4 feet bgs. The average saturated thickness is approximately 6.5 feet.
Lateral Discharge Distance (ft)	150	150	The lateral discharge distance was estimated to be equal to the length of the PCB impacted area measured perpendicular to the Brandywine Creek.
A= Cross-Sectional Area (ft2)	910	910	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (ug/L)	0.1	0.3	The maximum concentration observed in the saturated subsurface soil (0.240 mg/kg) was used to determine the estimated concentration in groundwater.

Distance to Discharge point (ft)	Directly adjacent	Approximate distance from property boundary to closest surface water location.

Mass Loading Via Groundwater Transport Result:

The groundwater discharge is 2.1 to 41 L/day (attached Table A). The maximum detected PCB concentration (0.240 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 0.2 and 4 milligrams per year (attached Table C).

Uncertainty Analysis Associated with Groundwater Transport:

Specific Areas and Degree of Uncertainty for the Up the Creek

	Groundwater PCB Concentration	Sample Density	Hydraulic Conductivity	Horizontal Groundwater Gradient	Saturated Thickness	Lateral Discharge Distance	Distance to Discharge point
Site Specific Information	Partitioning based on maximum concentration observed in saturated soil	Fairly good sample distribution	Based on detailed site logs	Few points with groundwater measurements	Few good quality logs	Good groundwater gradient defined and a moderate number of samples collected on-site	Directly adjacent
Degree of Uncertainty	High	Low to Moderate	Moderate	Moderate	Moderate	Moderate	Low

Based on this evaluation the overall uncertainty associated with PCB mass loading via groundwater transport for the Up the Creek property is **moderate.**

Site References:

BrigthFields, 2007, Brownfield Remedial Investigation Report for the River Associates Property (DE-1384), June 2007.

BrightFields, 2006, Phase II Site Investigation of the Up the Creek Property, February 2006.

DNREC, 1999, Brownfield Preliminary Assessment II Wilmington, Delaware E. Seventh Street Peninsula – "Northside". September 1999.

DNREC, 1999, Brownfield Preliminary Assessment II Wilmington, Delaware E. Seventh Street Peninsula – "Southside". June 1999.

Figures

Legend

- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Tax Parcel
- Up the Creek Property Boundary

Total Site Area= 4.14 acres

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Historic Sample Locations and
Aerial Photograph (2007)
Up the Creek
Wilmington, Delaware

	By	Date	Scale:	File Name:
Drawn	SMD	7/29/08	1:1200	UTC_aerial.mxd
Checked	JPR	7/29/08	Fig. No.	
Project #	0985.26.51		Figure 1	

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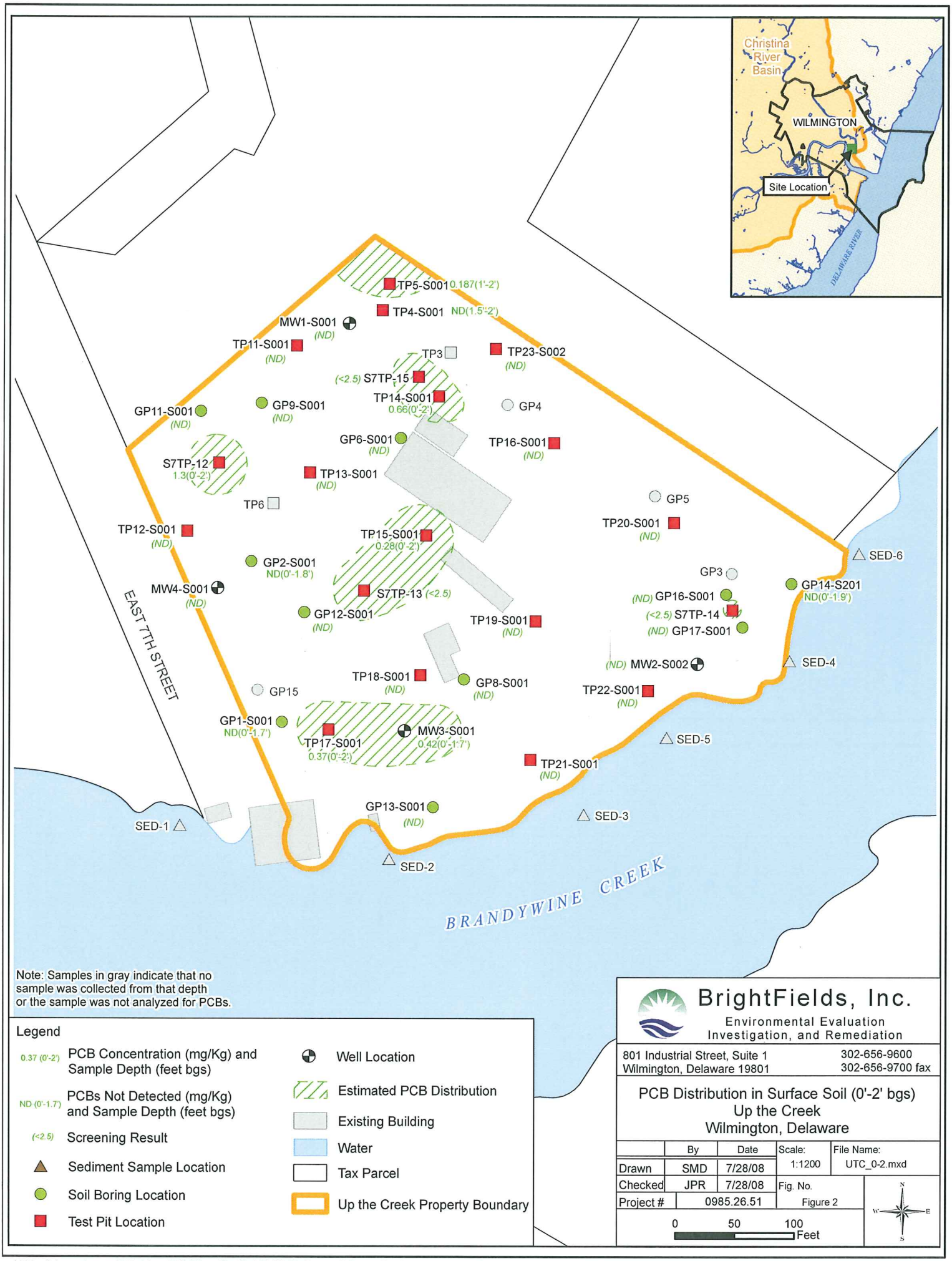

Note: Samples in gray indicate that no sample was collected from that depth or the sample was not analyzed for PCBs.

Legend

- 0.37 (0'-2') PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (0'-1.7') PCBs Not Detected (mg/Kg) and Sample Depth (feet bgs)
- (<2.5) Screening Result
- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Estimated PCB Distribution
- Existing Building
- Water
- Tax Parcel
- Up the Creek Property Boundary

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PCB Distribution in Surface Soil (0'-2' bgs)
Up the Creek
Wilmington, Delaware

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Checked	JPR	7/28/08	Fig. No.	
Project #	0985.26.51		Figure 2	

0 50 100 Feet

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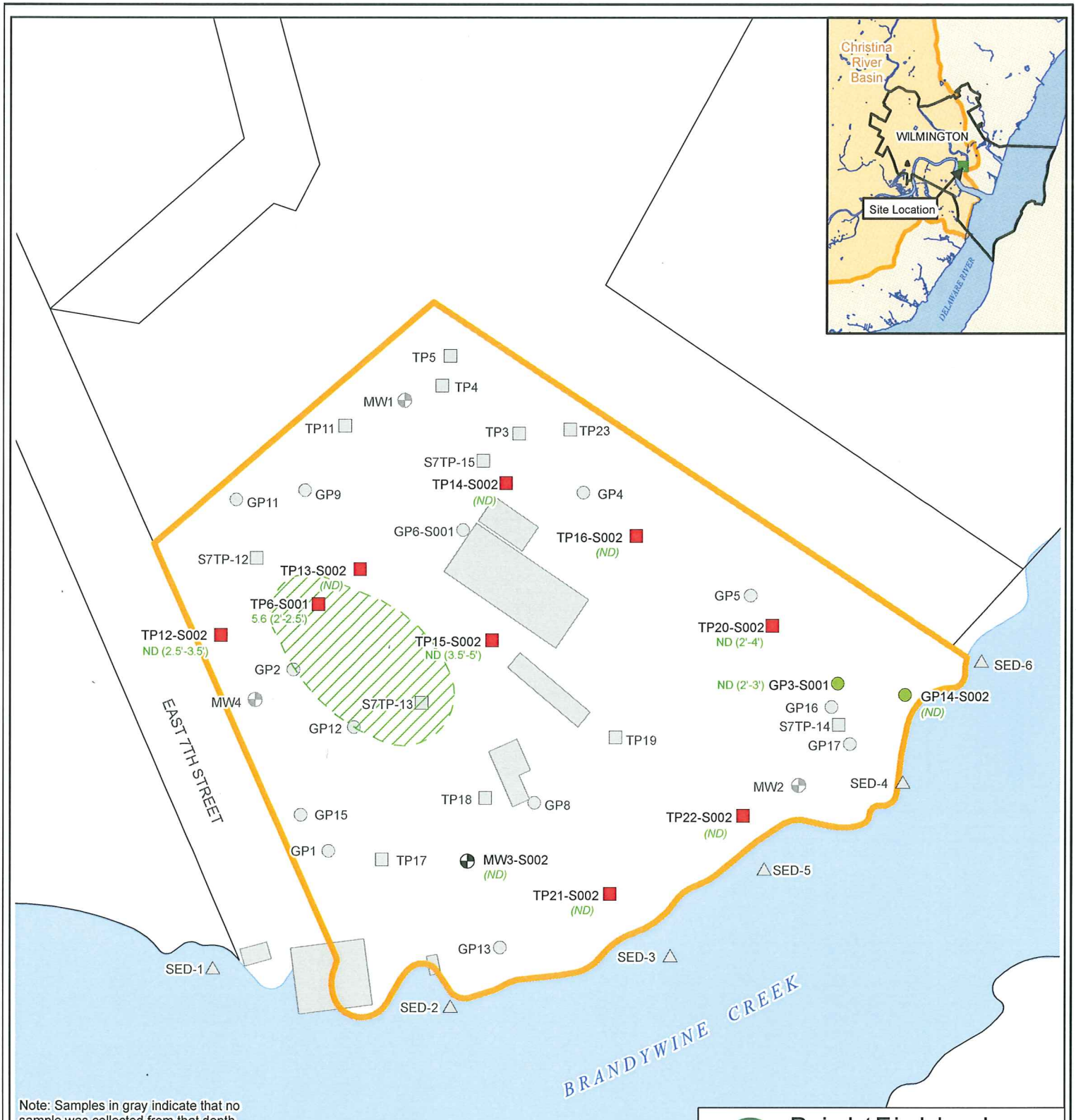

Note: Samples in gray indicate that no sample was collected from that depth or the sample was not analyzed for PCBs.

Legend

- 5.6 (2'-2.5') PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (2'-4') PCBs Not Detected (mg/Kg) and Sample Depth (feet bgs)
- (ND) Screening Result
- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Estimated PCB Distribution
- Existing Building
- Water
- Tax Parcel
- Up the Creek Property Boundary

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PCB Distribution in Subsurface Unsaturated Soil
Up the Creek
Wilmington, Delaware

	By	Date	Scale: 1:1200	File Name: UTC_unsat.mxd
Drawn	SMD	7/28/08		
Checked	JPR	7/28/08	Fig. No. Figure 3	
Project #	0985.26.51			

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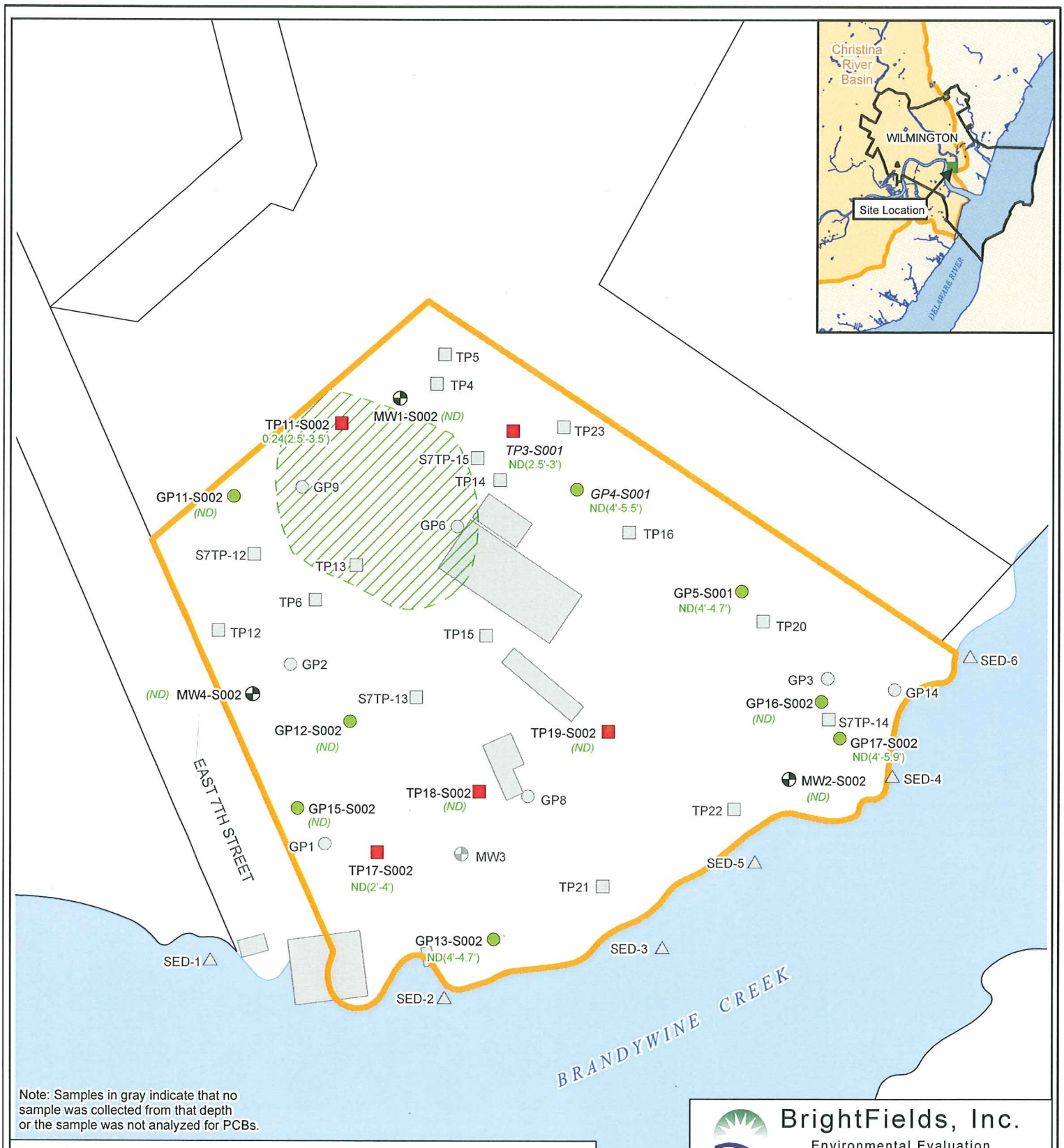

Note: Samples in gray indicate that no sample was collected from that depth or the sample was not analyzed for PCBs.

Legend

- 0.24 (2.5'-3.5') PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (0'-1.7') PCBs Not Detected (mg/Kg) and Sample Depth (feet bgs)
- (ND) Screening Result
- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Estimated PCB Distribution
- Tax Parcel
- Existing Building
- Water
- Up the Creek Property Boundary

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PCB Distribution in Subsurface Saturated Soil
Up the Creek
Wilmington, Delaware

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Checked	JPR	7/28/08	Fig. No.	
Project #	0985.26.51		Figure 4	

0 50 100 Feet

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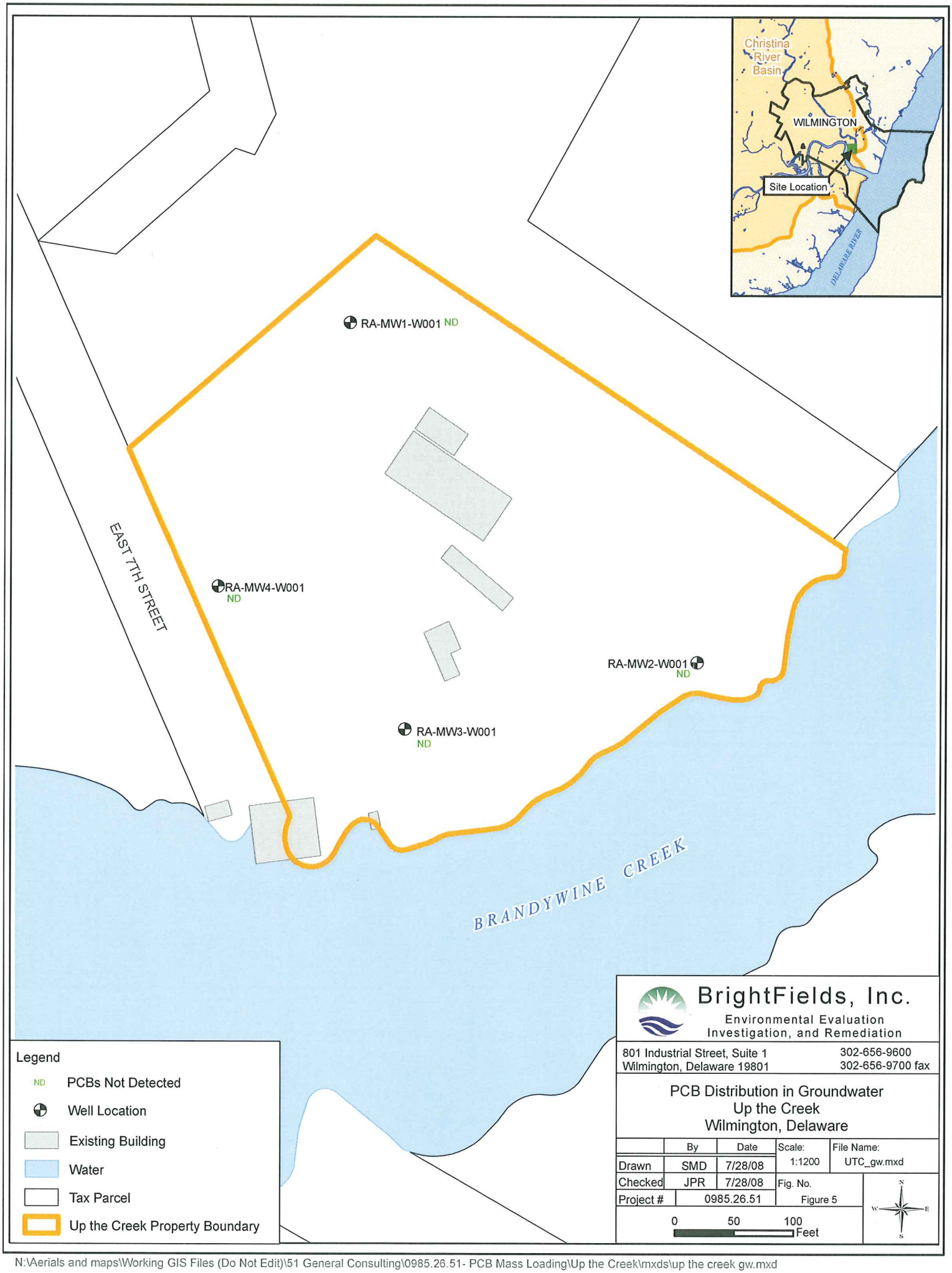

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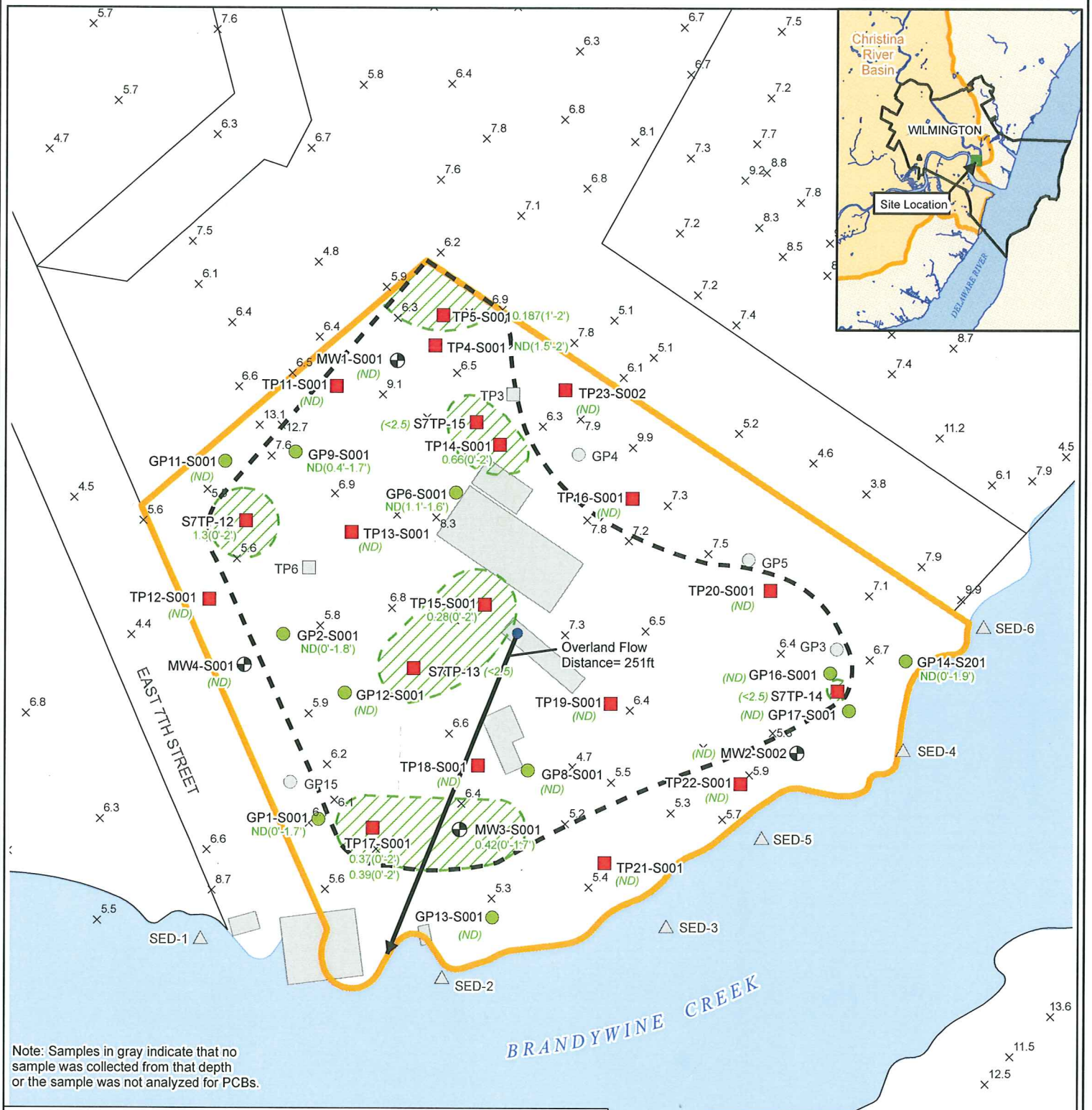


Note: Samples in gray indicate that no sample was collected from that depth or the sample was not analyzed for PCBs.

Legend

- 0.37 (0'-2') PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (0'-1.7') PCBs Not Detected and Sample Depth (feet bgs)
- (<2.5) Screening Result
- 5.5 Contour Elevation (feet)
- Overland Flow Direction
- Centroid of PCB Distribution
- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Estimated PCB Impacted Area
- Estimated PCB Contribution via Overland Flow
- Existing Building
- Water
- Tax Parcel
- Up the Creek Property Boundary

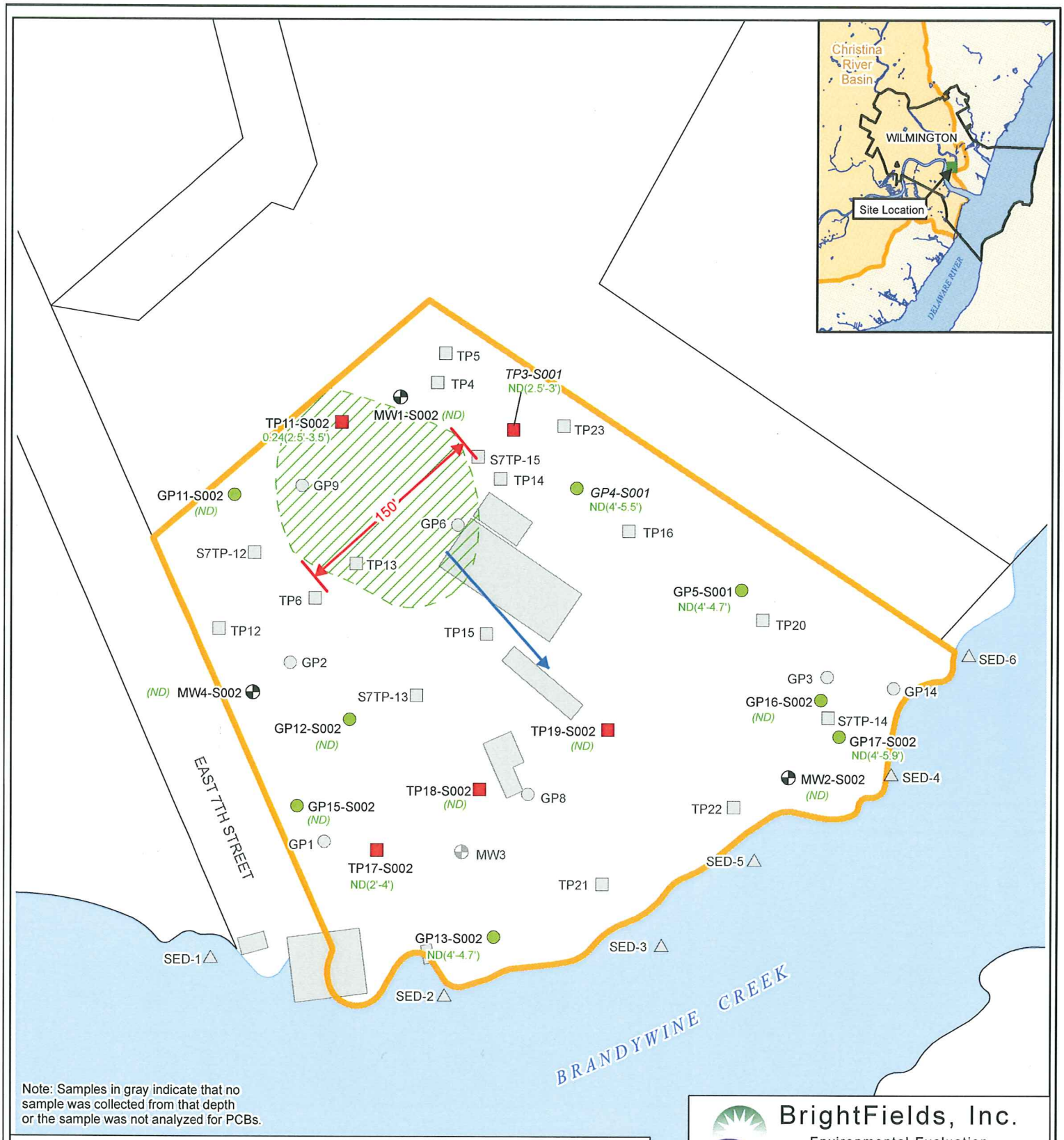
BrightFields, Inc.
Environmental Evaluation Investigation, and Remediation
801 Industrial Street, Suite 1
Wilmington, Delaware 19801
302-656-9600
302-656-9700 fax

Overland Flow Map
Up the Creek
Wilmington, Delaware

	By	Date	Scale:	File Name:
Drawn	SMD	5/11/09	1:1200	UTC_topo.mxd
Checked	JPR	5/11/09	Fig. No.	
Project #	0985.26.51		Figure 6	

0 50 100 Feet

N:\Aerials and maps\Working GIS Files (Do Not Edit)\51 General Consulting\0985.26.51- PCB Mass Loading\Up the Creek\mxds\up the creek topo.mxd



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

Legend

- 0.24 (2.5'-3.5') PCB Concentration (mg/Kg) and Sample Depth (feet bgs)
- ND (0'-1.7') PCBs Not Detected (mg/Kg) and Sample Depth (feet bgs)
- (ND) Screening Result
- Sediment Sample Location
- Soil Boring Location
- Test Pit Location
- Well Location
- Groundwater Flow Direction
- 150' Groundwater Discharge Distance (feet)
- Estimated PCB Distribution
- Tax Parcel
- Existing Building
- Water
- Up the Creek Property Boundary

BrightFields, Inc.
Environmental Evaluation Investigation, and Remediation
801 Industrial Street, Suite 1
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Groundwater Discharge Map
Up the Creek
Wilmington, Delaware

	By	Date	Scale:	File Name:
Drawn	SMD	5/4/09	1:1200	UTC_gw dis.mxd
Checked	JPR	5/4/09	Fig. No.	
Project #	0985.26.51		Figure 7	

0 50 100 Feet

N:\Aerials and maps\Working GIS Files (Do Not Edit)\51 General Consulting\0985.26.51- PCB Mass Loading\Up the Creek\mxds\up the creek grt2 dis.mxd

Tables

Table 1
PCB Laboratory Analytical Results For Soil
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

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		TP5-S001 1'-2' 1/26/2006 mg/Kg Phase II Site Investigation Report		TP4-S001 1.5'-2' 1/26/2006 mg/Kg Phase II Site Investigation Report		TP6-S001 2'-2.5' 1/26/2006 mg/Kg Phase II Site Investigation Report		GP4-S001 4'-5.5' 1/26/2006 Phase II Site Investigation Report		GP1-S001 0'-1.7' 1/26/2006 Phase II Site Investigation Report	
	Unrestricted Use	Restricted Use										
PCBs												
Aroclor-1016	5	82	0.057	U	0.065	U	1.9		0.05	U	0.05	U
Aroclor-1221	0.3	3	0.05	U	0.065	U	0.96	U	0.05	U	0.05	U
Aroclor-1232	0.3	3	0.05	U	0.065	U	0.96	U	0.05	U	0.05	U
Aroclor-1242	0.3	3	0.05	U	0.065	U	0.96	U	0.05	U	0.05	U
Aroclor-1248	0.3	3	0.13	U	0.065	U	**2.7**		0.05	U	0.05	U
Aroclor-1254	0.3	3	0.05	U	0.065	U	0.96	U	0.05	U	0.05	U
Aroclor-1260	0.3	3	0.05	U	0.065	U	**1**		0.05	U	0.05	U
Aroclor-1262	nca	nca	NR		NR		NR		NR		NR	

Phase II Site Investigation Report (BrightFields 2006)
BRI 2007 - Brownfield Remedial Investigation Report (BrightFields 2007)
Southside BPA II - Brownfield Preliminary Assessment of the 7th Street Peninsula Southside (1998)

Qualifiers
U - The compound was not detected above the indicated laboratory detection limit
NR - Not analyzed
J - Estimated Value
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 Laboratory Analytical Results For Soil
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

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		S7TP-12 0'-2' 10/1/1998 Southside BPA II		TP11-S002 2.5'-3.5' 8/10/2006 BRI Report 2007		TP14-S001 0'-2' 8/10/2006 BRI Report 2007		TP12-S002 2.5'-3.5' 8/10/2006 BRI Report 2007		TP15-S001 0'-2' 8/10/2006 BRI Report 2007	
	Unrestricted Use	Restricted Use										
PCBs												
Aroclor-1016	5	82	ND	U	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1221	0.3	3	ND	U	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1232	0.3	3	ND	U	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1242	0.3	3	ND	U	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1248	0.3	3	**0.3**	J	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1254	0.3	3	**0.56**	J	0.24		**0.66**		0.11	U	0.28	
Aroclor-1260	0.3	3	**0.44**	J	0.1	U	0.088	U	0.11	U	0.078	U
Aroclor-1262	nca	nca	NR		NR		NR		NR		NR	

Phase II Site Investigation Report (BrightFields 2006)
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Table 1
PCB Laboratory Analytical Results For Soil
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

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		TP20-S002 2'-4' 8/10/2006 BRI Report 2007		TP17-S001 0'-2' 8/10/2006 BRI Report 2007		GP14-S001 0'-1.9' 8/9/2006 BRI Report 2007		GP17-S002 4'-5.9' 8/9/2006 BRI Report 2007		GP13-S002 4'-4.7' 8/9/2006 BRI Report 2007	
	Unrestricted Use	Restricted Use										
PCBs												
Aroclor-1016	5	82	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1221	0.3	3	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1232	0.3	3	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1242	0.3	3	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1248	0.3	3	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1254	0.3	3	0.1	U	**0.37**		0.075	U	0.092	U	0.093	U
Aroclor-1260	0.3	3	0.1	U	0.076	U	0.075	U	0.092	U	0.093	U
Aroclor-1262	nca	nca	NR		0.076	U	0.075	U	0.092	U	0.093	U

Phase II Site Investigation Report (BrightFields 2006)
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Table 1
PCB Laboratory Analytical Results For Soil
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

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		GP14-S201 0'-1.9' 8/9/2006 BRI Report 2007		MW3-S001 0'-1.7' 8/10/2006 BRI Report 2007		TP17-S002 2'-4' 8/10/2006 BRI Report 2007	
	Unrestricted Use	Restricted Use						
PCBs								
Aroclor-1016	5	82	0.067	U	0.071	U	0.11	U
Aroclor-1221	0.3	3	0.067	U	0.071	U	0.11	U
Aroclor-1232	0.3	3	0.067	U	0.071	U	0.11	U
Aroclor-1242	0.3	3	0.067	U	0.071	U	0.11	U
Aroclor-1248	0.3	3	0.067	U	0.071	U	0.11	U
Aroclor-1254	0.3	3	0.067	U	**0.42**		0.11	U
Aroclor-1260	0.3	3	0.067	U	0.071	U	0.11	U
Aroclor-1262	nca	nca	0.067	U	0.071	U	0.11	U

Phase II Site Investigation Report (BrightFields 2006)
BRI 2007 - Brownfield Remedial Investigation Report (BrightFields 2007)
Southside BPA II - Brownfield Preliminary Assessment of the 7th Street Peninsula Southside (1998)

Qualifiers
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nca - no criteria available
bold - concentration is above DNREC URS unrestricted use criteria
shaded - concentration is above DNREC URS restricted use criteria

Table 2
DNREC PCB Screening Data
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

Sample ID	Sample Depth	Investigation Report	Sample Date	DNREC URS for Protection of Human Health (Non-critical Water Resource Area) Unrestricted Use (mg/kg)	Total PCBs (mg/kg)
GP9-S001	0.4'-1.7'	Phase II Site Investigation Report	1/26/2006	1	ND
GP6-S001	1.1'-1.6'	Phase II Site Investigation Report	1/26/2006	1	ND
GP8-S001	0.5'-2.0'	Phase II Site Investigation Report	1/26/2006	1	ND
TP23-S002	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP22-S002	9'-11'	BRI Report 2007	8/10/2006	1	ND
TP21-S002	3'-3.5'	BRI Report 2007	8/10/2006	1	ND
GP11-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
GP12-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
GP16-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
GP13-S001	0.3-1.7	BRI Report 2007	8/9/2006	1	ND
GP11-S002	2'-2.6'	BRI Report 2007	8/9/2006	1	ND
GP12-S002	2'-2.5'	BRI Report 2007	8/9/2006	1	ND
GP14-S002	2'-3.2'	BRI Report 2007	8/9/2006	1	ND
GP15-S002	4'-5.1'	BRI Report 2007	8/9/2006	1	ND
GP16-S002	4'-4.9'	BRI Report 2007	8/9/2006	1	ND
GP17-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
MW1-S001	0'-1.7'	BRI Report 2007	8/9/2006	1	ND
MW1-S002	4'-5.4'	BRI Report 2007	8/9/2006	1	ND
MW2-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
MW3-S002	4'-5.3'	BRI Report 2007	8/9/2006	1	ND
MW4-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
MW4-S002	2'-2.4'	BRI Report 2007	8/9/2006	1	ND
TP11-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
TP12-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
TP13-S001	0'-2'	BRI Report 2007	8/9/2006	1	ND
TP13-S002	3'-5.4'	BRI Report 2007	8/10/2006	1	ND
TP14-S002	2.5'-3.5'	BRI Report 2007	8/10/2006	1	ND
TP15-S002	3.5'-5'	BRI Report 2007	8/10/2006	1	ND
TP16-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP16-S002	4'-5.5'	BRI Report 2007	8/10/2006	1	ND
TP18-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP19-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP20-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP21-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP22-S001	0'-2'	BRI Report 2007	8/10/2006	1	ND
TP18-S002	2'-3.5'	BRI Report 2007	8/10/2006	1	ND
TP19-S002	2'-3.5'	BRI Report 2007	8/10/2006	1	ND
S7TP-13	0'-2'	Southside BPA II	10/1/98	1	<2.5
S7TP-14	0'-2'	Southside BPA II	10/1/98	1	<2.5
S7TP-15	0'-2'	Southside BPA II	10/1/98	1	<2.5
MW2-S002	4'-5.3'	BRI Report 2007	8/9/2006	1	ND

Phase II Site Investigation Report (BrightFields 2006)
BRI 2007 - Brownfield Remedial Investigation Report (BrightFields 2007)
Southside BPA II - Brownfield Preliminary Assessment of the 7th Street Peninsula Southside (1998)

Table 3
PCB Laboratory Analytical Results For Groundwater
Up the Creek Property
Wilmington, DE
SIRB ID: DE-1384

Sample ID Sampling Date Units Report Issued	DNREC URS for Protection of Human Health ug/L	RA-MW1-W001 8/21/06 ug/L BRI Report 2007	RA-MW2-W001 8/21/06 ug/L BRI Report 2007	RA-MW3-W001 8/21/06 ug/L BRI Report 2007	RA-MW4-W001 8/21/06 ug/L BRI Report 2007
PCBs					
Aroclor-1016	0.1	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1221	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1232	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1242	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1248	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1254	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1260	0.03	0.56 U	0.91 U	0.56 U	0.54 U
Aroclor-1262	nca	0.56 U	0.91 U	0.56 U	0.54 U

BRI 2007 - Brownfield Remedial Investigation Report (BrightFields 2007)

Qualifiers
U - The compound was not detected above the indicated laboratory detection limit
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

Site Photographs

BrightFields, Inc.

PCB Mass Loading Evaluation
Up the Creek

Type of cover associated with the majority of the southern portion of the site.

Type of gravel cover associated with certain southern areas of the site.

BrightFields, Inc.

PCB Mass Loading Evaluation
Up the Creek

More dense vegetation cover approaching the northern section of the property.

Surface cover associated with eastern portion of the site.

PCB Mass Loading
Up the Creek Property
SIRB ID: DE-1384
Wilmington, Delaware

BrightFields, Inc.

Overland Flow Calculations

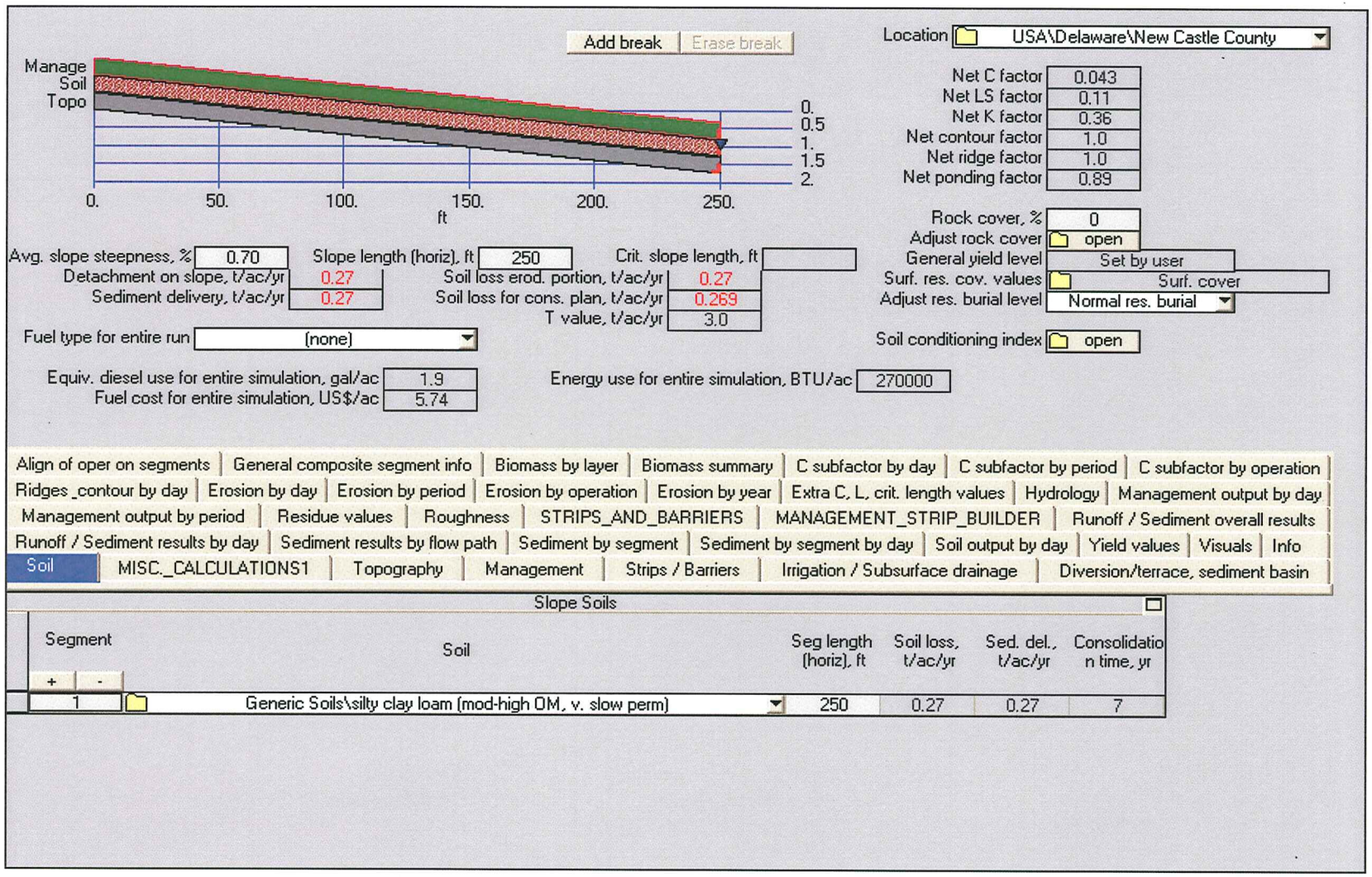
PCB Loading Calculations from the Universal Soil Loss Equation
Up the Creek Property
Wilmington, DE
DE-1384

Surface PCB Concentration | 0.78 | mg/kg

Symbol	Factor	Value	Units
R	Rainfall/Runoff Erosivity Index	170	10^2 ft-tonf in/acre hr
K	Soil Erodibility	0.365	0.01 tonf acre hr/ac ft-ton in
	Estimated Slope Length	251	Feet
	Estimated Elevation Difference	1.8	Feet
	Slope	0.7	Percent
	Erodeable Area	2.52	Acres
LS	Topographic Factor	0.109	Dimensionless
C	Cover and Management Factor	0.043	Dimensionless
P	Support Practice Factor	1	Dimensionless
	Average Annual Soil Loss	0.27	ton/ac/yr

PCB Loading via Overland Flow | 0.481 | **grams/year - PCBs**

UP THE CREEK


Add break
Erase break
Manage
Soil
Topo
0.
0.5
1.
1.5
2.
0.
50.
100.
150.
200.
250.
ft
Location
USA\Delaware\New Castle County
Net C factor 0.043
Net LS factor 0.11
Net K factor 0.36
Net contour factor 1.0
Net ridge factor 1.0
Net ponding factor 0.89
Rock cover, % 0
Adjust rock cover open
General yield level Set by user
Surf. res. cov. values Surf. cover
Adjust res. burial level Normal res. burial
Soil conditioning index open
Avg. slope steepness, % 0.70
Slope length (horiz), ft 250
Crit. slope length, ft
Detachment on slope, t/ac/yr 0.27
Sediment delivery, t/ac/yr 0.27
Soil loss erod. portion, t/ac/yr 0.27
Soil loss for cons. plan, t/ac/yr 0.269
T value, t/ac/yr 3.0
Fuel type for entire run (none)
Equiv. diesel use for entire simulation, gal/ac 1.9
Fuel cost for entire simulation, US$/ac 5.74
Energy use for entire simulation, BTU/ac 270000
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
Diversion/terrace, sediment basin
Slope Soils
Segment
Soil
Seg length (horiz), ft
Soil loss, t/ac/yr
Sed. del., t/ac/yr
Consolidation time, yr
1
Generic Soils\silty clay loam (mod-high OM, v. slow perm)
250
0.27
0.27
7

PCB Mass Loading
Up the Creek Property
SIRB ID: DE-1384
Wilmington, Delaware

BrightFields, Inc.

Groundwater Transport Calculations

PCB Loading Calculations - Groundwater Discharge to Surface Water
Up the Creek Property
Wilmington, DE
DE-1384

TABLE A
Groundwater Discharge Calculations

Location	Hydraulic Conductivity (K) (ft/day)	Horizontal Gradient (i) (ft/ft)	Cross-sectional Area (A) (ft2)	Groundwater Discharge*	
				Liters/day	Gallons/ day
TP11					
Minimum	0.028	0.0029	975	2.2	0.59
Maximum	0.28	0.0057	975	44	12

* - 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
TP11	240	0.01	0.05	0.053	0.26

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
TP11	0.263	0.0002	0.004