BrightFields, Inc.

Appendix 16

HOWARD STREET PROPERTY
WILMINGTON, DELAWARE

SIRB ID: DE-1401

BrightFields, Inc.

GENERAL SITE INFORMATION

Site Name: Howard Street Property

SIRB ID Number: DE-1401

Site Location and Description: The Howard Street Property is located in Wilmington and is bordered by commercial properties to the north and south, Walnut Street to the east, and Market Street to the west (Figure 1). The site was bisected by the former Howard Street. In November 2007 Howard Street was closed and removed in preparation for remediation which took place through February 2008 and redevelopment which is almost complete.

The site has been redeveloped into a Shoprite grocery store and associated retail stores, and consists of one approximately 9.77 acre parcel (tax parcel ID# 26-050.00-069) and one approximately 0.8 acre parcel (tax parcel ID# 26-050.00-028) (total approximately 10.57 acres). Surrounding land is generally commercial and/or industrial.

Previous Site Uses:

The Howard Street Property was historically maintained as a mixed commercial and industrial use area reportedly with an on-site landfill, a junk yard, a scrap yard, a mill work facility and possibly a gas station and an oil company. Historical usage of the southeastern portion of the Howard Street Property included a metals salvage yard (the former location of Penn Del Recycling Company). The Operations Yard or Scrap Yard was used from the 1950s through 2005 for the processing of scrap metal. The processing consisted primarily of mechanical sorting, but also included torch cutting. A large `Baler,' or car crusher, was used at the site from 1955 through 1987 to crush metal objects and equipment, including electrical transformers and other equipment that historically may have contained PCBs. The Operations Yard area is where the primary source of elevated concentrations of PCBs were detected in soil on the property. PCBs were present at highest concentrations (up to 5,300 ppm) in the vicinity of the baler area which was inside the Operations Yard. PCB concentrations decreased fairly rapidly with increasing distance from this area.

Other areas of the site, such as the former 310 S. Market St property, Wooded Lot and the Corner Lot, were not used for salvage yard operations and were relatively unimpacted by PCBs, but appeared to contain elevated concentrations of lead and arsenic, especially within a fill layer

composed of incinerator ash or slag. Primary contaminants of concern for the Howard Street Site are PCBs, arsenic, lead, and to a lesser extent, polycyclic aromatic hydrocarbons (PAHs).

The majority of metal scrap, equipment, and other materials were removed from the Operations Yard as a part of a prior real estate transaction between the Salvage Yard owner and the current property owner, the Riverfront Development Corporation (RDC) of Delaware. However, there were several scrap piles which contained PCBs which were disposed of as part of the PCB remediation effort. One to six feet of clean fill is currently located on top of the original land surface of the site.

Site Regulatory Status: The site has been investigated under Delaware Department of Natural Resources and Environmental Control Site Investigation and Restoration Branch (DNREC-SIRB) oversight since 1995 and under USEPA TSCA oversight since early 2007 and numerous reports have been submitted to DNREC and USEPA. This section briefly summarizes in chronological order from oldest to most recent previous investigations performed on the site through the SIRB and TSCA program. A current SIRB and TSCA regulatory status is also included.

Chronology of Investigations and Regulatory Actions

Investigation or Regulatory Action	Dates	Description
South Wilmington Environmental Assessment Quadrants 3 and 4	1996	DNREC completed the South Wilmington Environmental Assessment (DE-286) which consisted of a large investigation effort performed by DNREC-SIRB to collect samples from various properties, including the Penn-Del Salvage Yard. On July 24, 1995, two test pits (TP-22 and TP-23/18) were excavated and one shallow and one deep soil sample was collected from each test pit and five additional shallow soil samples (SS-23-27) were collected from within the active salvage yard. A monitoring well (SWA-MW-8) was installed between August 4 and 8, 1995. Results concluded that there were high levels of lead and elevated levels of PCBs and polycyclic hydrocarbons (PAHs) on the Penn Del Property. According to DNREC, approximately 179 tons of material from Penn Del Salvage was deposited at the Cherry Island Landfill during the period from February 22-29, 1996 (DNREC 1996).
Voluntary Cleanup Program Agreement	June 1999	Penn Del Recycling Corp. entered into the Voluntary Cleanup Program (VCP) with DNREC in June 1999.

Chronology of Investigations and Regulatory Actions (continued)

Investigation or Regulatory Action	Dates	Description
Penn Del Salvage (DE-1057) Health Risk Evaluation	Nov. 1999	The report was based upon DNREC-SIRB data analyzed at National Environmental Testing, Inc in March 1996. They concluded that there could be an increased cancer risk over a lifetime due to concentrations of benzo(a)pyrene and lead. They recommended creating a surface barrier over contaminated soil, increasing hand washing and showering, and changing clothes before leaving the site (Department of Health and Social Services 1999).
Preliminary Environmental Evaluation	April 2000	The investigation involved excavation and sampling of 7 test pits (TP-1 through 7) with a backhoe and trackhoe. Six of the seven samples collected from these test pits contained concentrations of PAHs that were above the DNREC unrestricted use (residential settings) Uniform Risk-based Remediation Standards (URS). Three of the seven soil samples contained detectable levels of PCBs. TP-7 contained PCB Aroclor 1248 at a concentration of 3.5 mg/kg. Three samples contained arsenic at concentrations greater than 10 mg/kg. Duffield concluded that the site could contain 75,000 cubic yards of historic fill and that the bulk of the soil outside the Operations Yard may not require remediation under the Delaware Hazardous Substance Cleanup Act (HSCA). Duffield concluded that elevated concentrations of contaminants warranted further investigation in the Operations Yard and that the groundwater did not appear to have been impacted by soil contaminants and did not pose a risk to contaminant loading to the Christina River (Duffield 2000).
Phase I Remedial Investigation Sampling and Analysis Plan	May 2001	The objective of this plan was to search for potential environmental "hot spots" within the Operations Yard (Duffield 2001).
Phase I Remedial Investigation (RI)	Jan. 2002	The RI focused on the Operations Yard. Nine boring locations (GP-1 through 9) were drilled in the Operations Yard based on a grid 500 feet long and 80 feet to160 feet wide. Soil samples were collected at a depth of 0-1 feet, 1-2 feet, and 3-4 feet from each boring. There were a total of 27 soil samples taken from the borings. The results indicated that PCBs were detected at eight of the nine boring locations, and at each of the sampling depths between the ground surface and 4 feet below the surface. Duffield stated that the source of the PCBs was unknown (Duffield 2002).

Chronology of Investigations and Regulatory Actions (continued)

Investigation or Regulatory Action	Dates	Description
Transmittal letter of Analytical Results for BPA II for the Penn Del Corner Lot (DE-0317 and the Penn Del Wooded Area (DE-0318)	Nov. 2004	Investigation of the corner lot and wooded lot on the Penn Del Property that was not investigated during Duffield's Phase I Remedial Investigation (DNREC 2004)
Modified Phase I Environmental Site Assessment (ESA) With Limited Sampling, 310 South Market Street	Jan. 2005	The purpose of this ESA was to evaluate the approximately 0.9 acre property (tax parcel 26-050.00-016) for the presence of recognized environmental conditions (RECs). The ESA included a "walking reconnaissance" of the Property to observe site conditions and a review of historical and regulatory records for the site and nearby properties. In addition, four surface soil samples were collected (GS-1 through 4) and analyzed for PAHs, PCBs, and petroleum hydrocarbons. Laboratory analysis of the surface soil samples indicated that numerous PAH compounds, some PCBs, diesel range organics (DRO), and various metals (lead and arsenic) were detected above DNREC-URS values for both unrestricted and restricted use. (Duffield 2005)
Targeted Brownfield Assessment (TBA) for the Penn Del Corner Lot (DE-0317)	Jan. 2005	Based upon the information collected, DNREC submitted the report to EPA with recommendations that additional investigation be performed in order to further delineate the extent of elevated concentrations of inorganic compounds (lead) and organic compounds (PAHs) in site soil and MTBE in groundwater. DNREC also recommended that a groundwater to surface water mass loading calculation be performed in order to assess what potential impacts the site could pose to the environmental health of the Christina River (DNREC 2005).
Targeted Brownfield Assessment for the Penn Del Wooded Lot	Feb. 2005	Based upon the information collected, DNREC submitted the report to EPA with recommendations that an additional investigation be performed in order to further delineate the extent of elevated concentrations of inorganic compounds (lead and arsenic) and organic compounds in site soil, particularly in the western half of the site. DNREC also recommended that groundwater be further evaluated because of the petroleum constituents detected in the vicinity of the former warehouse and office and beneath the former landfill. They also recommended that a surface water mass loading calculation be performed in order to assess the potential impacts the site could pose to the environmental health of the Christina River. (DNREC 2005)

Chronology of Investigations and Regulatory Actions (continued)

Investigation or Regulatory Action	Dates	Description
Preliminary Supplemental Remedial Evaluation for Penn Del/Riebman Properties	June 2005	Nine test pits were completed in the wooded lot area to further delineate the possible extents of the landfill. Twelve test pits (P-1 through 12) were excavated to 2.5 to 3.5 feet below ground surface (bgs) in the area of the crusher to evaluate the presence of PCBs. Samples were collected from the surface, and at depths of 1 foot and 2 feet bgs at each test pit location. The excavations were backfilled with the soil after sample collection. Thirty-six soil samples were submitted to STL Edison for laboratory analysis. PCBs were detected in 35 of 36 samples ranging from 1.1 mg/kg to 5,300 mg/kg. Based on this sampling effort, approximately 150 to 200 cubic yards of potentially PCB-impacted soil above the 50 mg/kg TSCA PCB remediation waste criteria were estimated to be present. Four groundwater monitoring wells (MW-6, MW-7, MW-8 and MW-9) were constructed and groundwater samples were collected and analyzed for full Target Analyte List/ Target Compound List (TAL/TCL) parameters. No VOCs or pesticides/PCBs were detected above the URS values for groundwater. Certain SVOCs were detected above URS criteria. Certain TAL metals were detected above URS criteria in groundwater; however they were not detected in site soil at concentrations of regulatory concern. No lead above the URS value was detected in any of the groundwater samples. Duffield concluded that this analysis and the low lead leachate of the "fluff" suggest that the lead present in on-site soil has no detrimental impact on groundwater quality (Duffield 2005).
Phase I/II Environmental Site Assessment	July 2006	Soil analytical results indicated that arsenic and lead were detected in the soil above the Unrestricted-Use URS concentrations during the investigation. The highest concentration of arsenic detected was 152 mg/kg, and the highest concentration of lead detected was 1,670 mg/kg. PAHs were detected above the Unrestricted-use URS criteria in several samples and PCBs were detected above the Unrestricted-use URS concentration of 0.3 mg/kg in one sample at 0.62 mg/kg. Groundwater analytical results for metals indicated numerous URS exceedances, reportedly most likely because the groundwater samples were not filtered. No VOCs or pesticide/PCBs were detected in any of the groundwater samples (Tetra Tech, 2006).

Chronology of Investigations and Regulatory Actions (continued)

Investigation or Regulatory Action	Dates	Description
Draft Site Characterization Report (March 2007) Christina Landing Retail Center	March 2007	The conclusion from this investigation was that results show that PCBs are primarily located in shallow soil in the Operations Yard and decrease in concentration with depth and with distance from the Operations Yard (Ten Bears 2007).
Groundwater Fluctuation Assessment	March 2007	The conclusions of this evaluation was that recent average groundwater elevations are slightly above normal, but do not correlate with PCB impacts to groundwater (Ten Bears 2007).
Assessment of PCB loading from the Christina Landing Retail Center to the Tidal Christina	May 2007	The results of this assessment indicate that potential PCB mass loading from overland flow is much greater than the PCB mass loading from groundwater discharge. It also indicates that potential loading to the Christina River from overland flow (assuming that there would be a pathway) is sufficient to cause PCB exceedances in water quality criterion in the tidal Christina River, while the current loading from groundwater discharge is not. (DNREC Watershed Management Branch 2007).
UST Removal Report for Christina Landing Retail Center Site	May 2007	This report summarizes the removal of two 2,000-gallon gasoline USTs located at the former Penn Del Corner Lot, and one 1,000 gallon heating oil UST located at 310 S. Market Street. The post-removal sampling indicated that soil in the vicinity of the gasoline USTs was marginally impacted. (Ten Bears, 2007).

Chronology of Investigations and Regulatory Actions (continued)

Investigation or Regulatory Action	Dates	Description
Risk Based Disposal Approval Application #1 (RBDAA #1)	July 2007	Eleven Geoprobe® borings (GLR-1 through 11) were drilled in the area of the future 12-inch gas transmission line and six borings (COW-1 through 6) were drilled in the area of the future stormwater management facility. Borings were drilled to depths of 12 to 16 feet bgs with soil samples collected every 4 feet. Seventeen soil samples from the uppermost sample interval (0-4 feet bgs) and one soil sample from 8 to 12 feet were sent to DNREC-SIRB laboratory for screening analyses. PCBs were not detected in any of the samples. Fifty-two soil samples were analyzed for PCBs at STL Laboratory in Edison, NJ using EPA Method 8082. Total PCBs were not detected above 1 mg/kg in any sample. All soil samples along the gas line and stormwater management facility contained total PCBs concentrations less than 1 mg/kg; therefore, no cleanup was proposed for PCBs in these areas. Soil excavated during construction of the gas line and the stormwater management facility will be managed according to the DNREC-approved Contaminated Material Management Plan for the site. BrightFields requested that the EPA grant approval to proceed with the installation of the gas line and stormwater utility while PCB remedial activities are planned for the remainder of the site. U.S. EPA responded with their RBDAA #1 approval letter on July 26, 2007 (BrightFields 2007)
Draft Risk Based Disposal Approval Application #2 (RBDAA #2)	July 2007	The debris pile disposal will be included with overall PCB remediation of the site (BrightFields 2007).
Draft Risk Based Disposal Approval Application #3 (RBDAA #3)	Aug. 2007	RBDAA #3 outlined a soil remediation plan including off-site disposal of PCBs greater than 100 ppm, on-site excavation and relocation under a cap of PCB soil between 10 and 100 ppm in low occupancy areas, and capping soil with PCB concentrations between 1 and 10 ppm in high occupancy areas. It also presented plans for excavation, dewatering, water treatment, backfilling, cap design, and confirmation sampling (BrightFields 2007).
Final Plan of Remedial Action	Nov. 2007	The DNREC Final Plan of Remedial Action is summarized below.

Regulatory Status:

The Howard Street Site is currently in the remedial action phase. DNREC published a Final Plan of Remedial Action in November 2007. Clean up actions to address PCB contamination were included in the October 2007 Self-implementing On-Site Cleanup and Disposal of PCB Remediation Waste/Risk Based Disposal Approval Plan ("Hybrid Plan", or "Plan"), and the January 23, 2008 Addendum #2 to the Hybrid Plan. The Self-implementing On-Site Cleanup and Disposal of PCB Remediation Waste portion of the Hybrid Plan and Addendum #2 was approved by USEPA in October 2007 and February 2008, respectively.

These clean up plans included excavation and off-site disposal of soil with PCB concentrations greater than 100 mg/kg, on-site consolidation of soil with PCB concentrations greater than 10 mg/kg but less than 100 mg/kg and capping with a low permeability soil cover, and placing a low permeability soil cover over soil with PCBs greater than 1 mg/kg where future buildings are planned. Clean up actions proposed for other contaminants of concern at the site are: 1) placement of a marker fabric over current surface soil; 2) placement of a two foot cover or cap, or DNREC approved equivalent, over the marker fabric; 3) implementation of an environmental oversight program during redevelopment to protect workers and properly dispose of excavated soil and recovered groundwater; 4) instituting environmental covenants consistent with the Uniform Environmental Covenant Act that restrict future development to commercial use only and require DNREC notification prior to any soil disturbance; and 5) restrict the use of groundwater through the existing Groundwater Management Zone (GMZ).

The Risk Based Disposal Approval portion of the Hybrid Plan addresses the cleanup for groundwater, surface water and sediment. An Addendum #3 to the Hybrid Plan was submitted to the USEPA on March 28, 2008 and accepted by the USEPA.

The soil remedial actions have all been completed for the Howard Street site and a long-term groundwater monitoring plan has been submitted to the USEPA for approval.

The PCB remediation was completed in February 2008. The site redevelopment and capping is also substantially complete.

SUMMARY OF SITE PCB INFORMATION

Site Investigation PCB Findings (Pre-Remediation):

Using the existing analytical data, BrightFields performed a sampling effort in June and July 2007 in the Operations Yard to fill data gaps in order to delineate the vertical and horizontal extent of PCB contamination. A total of 67 soil samples from the June 11, 12 and 13, 2007 Geoprobe sampling events were sent to DNREC-SIRB laboratory for screening analyses. PCBs were detected in 42 of the samples in relative concentrations ranging from low to very high. A total of 184 soil samples collected during all three sampling events were analyzed at STL for PCBs using SW 846 extraction method 3541 and analysis method 8082.

Prior to remediation the distribution of PCB contamination was evaluated using all historical data plus the new data collected by BrightFields in June and July 2007. This data indicates that PCB concentrations greater than or equal to 10 ppm were limited to an area adjacent to Howard Street within the former Operations Yard area (Figure 1). Generally, the PCB contamination was surficial, with the deepest detection at nine feet bgs. The largest area of contamination was in the surface layer. The analytical results indicated that as the depth below ground surface increases the areas of contamination decrease in size and the magnitude of contamination decreases. The highest analytical result for total PCBs was 5,300 ppm, which was in the surface layer within the center of the Operations Yard. The concentrations decreased rapidly to less than 1 ppm outside of the Operations Yard.

Site Investigation PCB Findings (Post-Remediation):

PCBs ranging from non-detect to 100 ppm remain on site depending on their location both horizontally and vertically. The remediation efforts included consolidating the remaining PCB impacted soil and capping so that it is no longer in contact with the surface or with the groundwater. In addition the site has been capped by buildings, pavement, or a minimum of two feet of clean fill in landscaped areas as part of the site redevelopment.

Due to the remediation activities that have taken place on the site there is no longer any PCB contamination in the surface soil. Therefore overland flow is no longer a mechanism of transport for mass loading of PCBs. The site groundwater had been adversely affected from site contamination, but has not been re-evaluated since the remediation activities have taken place. BrightFields determined that the groundwater discharge would be more appropriate utilizing

partitioning equations from the soil concentrations known to exist currently on the site than to use pre-remediation groundwater data.

Concentrations of PCBs Remaining on Site			
Sample Matrix	**Corresponding Figure**	**Analytical Methods**	**Range of Total PCBs**
Surface Soil	Figure 2a, 2b, 2c	Method 8082 and 3541	Not detected
Subsurface Soil (unsaturated)	Figure 3a, 3b, 3c	Method 8082 and 3541	Not detected to 100 ppm
Subsurface Soil (saturated)	Figure 4a, 4b, 4c	Method 8082 and 3541	Not detected to 10 ppm
Groundwater	Figure 5	Method 8082/Method 680	Not detected to 2.6 µg/L

Please find attached tables for all historical sample data

Acreage where PCBs detected:

Due to the PCB remediation activities that have taken place on site, there is no longer any PCB impacted surface soil. The estimated area associated with subsurface non-saturated soil impacted by PCBs is 3.22 acres. The estimated area associated with subsurface saturated soil impacted by PCBs is 2.76 acres.

PCB Remediation Status:

PCB remediation activities took place from November 2007 through February 2008. A total of 2,831 tons (3,217 tons including lead amended soil) with PCB concentrations greater than 100 ppm was excavated, stockpiled and ultimately disposed of at Model City Hazardous Waste Facility in New York.

A total of 2,400 cubic yard of soil with PCB concentrations between 10 and 100 ppm were excavated and consolidated on site. This remedy raised the elevation of the PCB-contaminated soil from a lower elevation to a higher elevation, reducing the likelihood that this material will be in contact with groundwater.

A total of five low-permeability clay cap areas were created, two in conjunction with the consolidated soil and three in conjunction with PCB soil left in place under future building pads.

Over 800 confirmation samples were analyzed to ensure that the proper excavation depth and area was achieved. After excavation of PCB soil, over 800 confirmatory samples were collected. After confirmation samples were collected 1 to 6 feet of fill was placed over the entire project area to bring the site up to grade.

In addition to the PCB remediation activities the site has been capped by buildings, pavement, or a minimal two feet of clean fill in landscaped areas as part of the site redevelopment.

PCB MASS LOADING SUMMARY

PCB mass loading via overland flow is estimated to be zero because of the remedial activities that have taken place on the property (as of November 2008). The PCB mass loading rate to surface water via groundwater transport was estimated for the Howard Street Site. A summary of the results is included below and the details of the calculations are included as attachments to this Appendix.

Historical Groundwater Mass Loading Information

An Assessment of PCB loading from the Christina Landing Retail Center to the Tidal Christina was prepared by DNREC Watershed Assessment Branch (May 2007) for EPA and DNREC-SIRB. The objective of this assessment was to evaluate whether residual PCBs left in the ground at depth have the potential to be transported to the Christina River via subsurface groundwater flow and whether the resulting mass loading represents a threat to water quality in the Christina River. The results of this assessment indicate that potential PCB mass loading from overland flow (as of May 2007) is much greater than the PCB mass loading from groundwater discharge. It also indicates that potential loading to the Christina River from overland flow (assuming that there would be a pathway) is sufficient to cause PCB exceedances in water quality criterion in the tidal Christina River, while the current loading from groundwater discharge is not.

OVERLAND FLOW:

Due to the remedial activities that took place at the Howard Street site there are no longer any surface soils impacted by PCBs.

Ground Cover and Canopy:

A site inspection was performed on November 2008 to estimate the current site ground cover and canopy. Photographs of the site ground cover and canopy are attached.

Site Sediment and Erosion Control Practices:

As of November 2008 the site contained a silt fence around the perimeter of the property to help prevent the off site migration of soil. The site also contained five stone construction entrances to

minimize the amount of soil migrating off site. Photographs of these sediment and erosion control techniques in use at the site are attached.

Groundwater Transport:

Groundwater Discharge Calculation Approach

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.

The site groundwater is proposed to be monitored, however as of November 2008, there have not been any groundwater samples collected from the site post remediation efforts. Therefore BrightFields determined that the mass loading via groundwater discharge would be more appropriate utilizing partitioning equations from the subsurface saturated soil concentrations existing currently on the site. Three areas of discharge were identified for evaluation based on contaminant distribution (Figure 6).

In July 2007, BrightFields collected and analyzed two soil samples for Aroclor compounds (method 8082) and through a leachate analytical test. The leachate test was the Synthetic Precipitation Leaching Procedure (SPLP). This evaluation was conducted to estimate a leaching factor that could be used to assess the impact of future on site soil concentrations on groundwater concentrations. In order to provide the most accurate interpretation of the mass loading via groundwater discharge BrightFields used this leaching factor instead of the partitioning equation based on the fraction of organic carbon to estimate the groundwater concentration. The subsurface saturated soil arithmetic mean concentration for each zone identified on Figure 6 was used in each of the three zones. The calculations are shown in the attached groundwater discharge calculations as Table B.

Input Factors:

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

Area A

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	70	70	Slug tests were performed in four of the wells on the Howard Street Property. The measured horizontal hydraulic conductivity ranged from 1.04 x 10^{-2} to 5.85 x 10^{-2} cm/sec. This is equivalent to 29.5 to 166 ft/day. The average conductivity was 2.6 x 10^{-2} cm/second (approximately 70 ft/day). The groundwater model that was completed for the Howard Street Property used a value of 70 ft/day for the water table water-bearing unit and it was found to adequately reflect the site characteristics.
I = Horizontal Groundwater Gradient	0.0083	0.0083	The horizontal hydraulic gradient was calculated from groundwater elevation contours that were generated by the groundwater model for the site - post remediation.
Saturated Thickness (ft)	3.5	8.5	Based on the logs, the saturated thickness was approximately 3.5 to 8.5 feet.
Lateral Discharge Distance (ft)	30	30	The lateral discharge distance was estimated to be equal to the length the PCB impacted area measured perpendicular to the groundwater flow.
A= Cross-Sectional Area (ft2)	120	300	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg/L)	0.5		The arithmetic mean for saturated soil in this zone (6.2 mg/kg) was used to determine the estimated concentration in groundwater based on the leaching factor determined for the site.
Distance to Discharge point (ft)	820 to 1,115		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area A is between 0.05 to 0.1 grams per year. Please see attached tables for specific variables.

Area B

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	70	70	Slug tests were performed in four of the wells on the Howard Street Property. The measured horizontal hydraulic conductivity ranged from 1.04 x 10^{-2} to 5.85 x 10^{-2} cm/sec. This is equivalent to 29.5 to 166 ft/day. The average conductivity was 2.6 x 10^{-2} cm/second (approximately 70 ft/day).
I = Horizontal Groundwater Gradient	0.0083	0.0083	The horizontal hydraulic gradient was calculated from groundwater elevation contours that were generated by the groundwater model for the site - post remediation.
Saturated Thickness (ft)	3.5	8.5	Based on the logs, the saturated thickness was approximately 3.5 to 8.5 feet.

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
Lateral Discharge Distance (ft)	90	90	The lateral discharge distance was chosen to be equal to the length the PCB impacted area measured perpendicular to the groundwater flow.
A= Cross-Sectional Area (ft2)	315	770	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg/L)	0.8		The arithmetic mean for saturated soil in this zone (39 mg/kg) was used to determine the estimated concentration in groundwater based on the leaching factor determined for the site.
Distance to Discharge point (ft)	820 to 1,115		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area B is between 0.9 to 2.0 grams per year. Please see attached tables for specific variables.

Area C

Groundwater Transport Factors	Value Used		Justification/Derivation of Value Used
	min	max	
K = Hydraulic Conductivity (ft/day)	70	70	The measured horizontal hydraulic conductivity ranged from 1.04×10^{-2} to 5.85×10^{-2} cm/sec. This is equivalent to 29.5 to 166 ft/day. The average conductivity was 2.6×10^{-2} cm/second (approximately 70 ft/day).
I = Horizontal Groundwater Gradient	0.0083	0.0083	The horizontal hydraulic gradient was calculated from groundwater elevation contours that were generated by the groundwater model for the site - post remediation.
Saturated Thickness (ft)	3.5	8.5	Based on the logs, the saturated thickness was approximately 3.5 to 8.5 feet.
Lateral Discharge Distance (ft)	85	85	The lateral discharge distance was chosen to be equal to the length the PCB impacted area measured perpendicular to the groundwater flow.
A= Cross-Sectional Area (ft2)	300	720	Calculated from the saturated thickness and lateral discharge distance.
Groundwater PCB Concentration (µg//L)	0.0002		The arithmetic mean for saturated soil in this zone (0.019 mg/kg) was used to determine the estimated concentration in groundwater based on the leaching factor determined for the site.
Distance to Discharge point (ft)	820 to 1,115		Approximate distance from property boundary to closest surface water location.

The PCB loading via groundwater discharge for Area C is between 0.0004 to 0.001 grams per year. Please see attached tables for specific variables.

Mass Loading Via Groundwater Transport Result:

The most appropriate statistical method was used to determine the soil concentrations from each zone, which were 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. As previously described, these calculations are highly conservative (protective), and they overestimate the actual mass loading because they assume that there are no contaminant losses due to degradation, dispersion, sorption, volatilization, etc.

The total PCB loading via groundwater discharge is between 0.96 and 2.3 grams per year (attached Table C).

Uncertainty Analysis Associated with Groundwater Transport:

Specific Areas and Degree of Uncertainty for the Howard Street

	Groundwater PCB Concentration	Hydraulic Conductivity	Horizontal Groundwater Gradient	Saturated Thickness	Lateral Discharge Distance	Distance to Discharge point
Site Specific Information	Based on Aroclor data in saturated soil (multiple samples)	Conductivity based on Aquifer Testing - Slug test and groundwater modeling techniques	Based on the groundwater contour map developed post remediation	High quality logs with consistent saturated thickness	High sample control/quality, good groundwater flow data	820 to 1,115 feet
Degree of Uncertainty	Low to Moderate	Low	Low	Low	Low	High

Based on this evaluation the overall uncertainty associated with the Howard Street is **low to moderate**.

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Figures