RECORD OF DECISION

LOWER DARBY CREEK AREA SUPERFUND SITE OPERABLE UNIT 1 – CLEARVIEW LANDFILL SOILS & WASTE

PHILADELPHIA AND DARBY TOWNSHIP, PHILADELPHIA AND DELAWARE COUNTIES PENNSYLVANIA

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 3, PHILADELPHIA, PENNSYLVANIA

September 2014

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I. DECLARATION

LOWER DARBY CREEK AREA SUPERFUND SITE
OPERABLE UNIT 1 – CLEARVIEW LANDFILL SOILS & WASTE

PHILADELPHIA AND DARBY TOWNSHIP, PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA

AR306893

RECORD OF DECISION
LOWER DARBY CREEK AREA SUPERFUND SITE
OPERABLE UNIT 1 – CLEARVIEW LANDFILL SOILS & WASTE

DECLARATION

Site Name and Location

Lower Darby Creek Area Superfund Site
Operable Unit 1 – Clearview Landfill Soils & Waste
City of Philadelphia and Darby Township, Philadelphia and Delaware Counties, Pennsylvania
CERCLIS ID Number PASFN0305521

Statement of Basis and Purpose

This decision document presents the Selected Remedy for the waste, soil and shallow leachate contamination associated with the Clearview Landfill (Landfill), which is known as Operable Unit 1 (OU1) of the Lower Darby Creek Area (LDCA Site or Site) Superfund Site located in the City of Philadelphia and Darby Township, Philadelphia and Delaware Counties, Pennsylvania, (see Figure 1) which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act 42 USC §§ 9601 et seq., as amended, ("CERCLA"), and the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision document explains the factual and legal basis for selecting the remedial action for this OU1. The information supporting this decision is contained in the Administrative Record for this Site.

The Pennsylvania Department of Environment Protection ("PADEP") concurred with the selected remedy in a letter dated September 17, 2014.

Assessment of the Site

Pursuant to Section 106 of CERCLA, 42 U.S.C. § 9606, the response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Pollutants or contaminants from this Site may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Remedy

The remedial action described herein comprises the final action for OU1, i.e., the waste, soil, and shallow leachate associated with the Landfill. Historic waste disposal activities at the Landfill have resulted in organic and inorganic contamination in surface and subsurface soils, leachate and groundwater. This remedy will control the source (Landfill waste and soil) to prevent human and ecological receptors from contacting with Site waste and contaminants, reduce contaminant migration (shallow leachate) to groundwater and surface water, prevent erosion and transport of soils and waste into nearby surface water bodies and residential areas, and mitigate all principal threat wastes. The remedial action for OU3 will address remaining contamination in groundwater, surface water and sediment, associated with the Clearview Landfill, if necessary, upon completion of the OU3 RI/FS. The Folcroft Landfill (OU2) will be addressed under a separate response action pending completion of the

OU2 RI/FS. The selected remedy for OU1 is Alternative 7, the Evapotranspiration Cover. The estimated cost is $23,955,276.

The selected remedy includes:

1. Pre-design investigation (PDI) activities to delineate waste and contaminated soil boundaries.

2. Installation, maintenance and monitoring of an evapotranspiration (ET) Cover System over approximately 50 acres, including relocation of on-site business and demolition of all structures within the ET Cover boundary, Site grading, storm water controls and erosion controls along the east bank of Darby Creek.

3. Removal and off-site disposal of PCB principal threat wastes.

4. Excavation and consolidation of wastes and contaminated soils above cleanup levels within and beneath the ET Cover.

5. Construction and maintenance of a leachate collection trench along the Landfill creek banks down to the mean high tide elevation of the creeks and construction, maintenance, and monitoring of engineered wetlands to treat contaminants to surface water discharge requirements.

6. Long-term monitoring of groundwater, leachate, landfill gas, surface water and sediment, to evaluate remedy performance and effectiveness.

7. Land and groundwater use restrictions to be implemented and maintained through institutional controls (ICs) and engineering controls to protect the integrity of the selected remedy including the ET Cover, leachate collection trench, engineered wetlands, and prevent exposure to soils outside of the ET Cover above cleanup levels. Additional fishing advisories may also be required. Signs will be placed along the stream bank to warn fisherman of all fishing advisories and the potential risks from fish consumption. An Institutional Control Implementation and Assurance Plan (ICIAP) will be developed for OU1 during the remedial design (RD) to ensure appropriate land and groundwater use restrictions are implemented, and monitored and maintained against future land owners.

The selected remedy will attain, and in one instance waive, all applicable or relevant and appropriate requirements (ARARs), which are identified as a performance standard in **Section 11.2** and specified in **Table 41** of this ROD. The applicable requirement in 40 C.F.R. § 258.60(a)(1) requires that a final cover for a MSW landfill, "have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1.0×10^{-5} cm/sec, whichever is less." This requirement is being waived using the "Equivalent Standard of Performance" criterion under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). As discussed under the **Evaluation of Alternatives** section, a conventional landfill cover built to attain a permeability of 1×10^{-5} cm/sec should result in a percolation/drainage rate through the cover system that is no greater than 1×10^{-5} cm/sec, which equates to 9,237 gallons/day/acre (461,837 gallons/day over 50 acres), assuming there are no construction flaws. The ET Cover shall provide an Equivalent Standard of Performance to achieve the relevant and appropriate requirement in 40 C.F.R. § 258.60(a)(1) by ensuring the drainage rate from the bottom of the ET Cover is no greater than the value, which results from multiplying the total final acreage of the ET Cover by 9,237 gallons/day.

Statutory Determinations

The selected remedial action is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (with the exception of the ARAR waiver described above), is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment) as it treats the collected leachate along the eastern creek bank. If practicable, PCB principal threat wastes excavated will be shipped off-site and treated prior to disposal.

Because the OU1 remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years to ensure that the selected remedy is, or will be, protective of human health and the environment pursuant to CERCLA Section 121(c) and the NCP, 40 C.F.R. § 300.430(f)(5)(iii)(C). The first review will be conducted five years after the initiation of remedial action at the Site and will continue every five years after that.

Data Certification Checklist

The following information is included in the Decision Summary of this ROD. Additional information can be found in the Administrative Record for this Site.

ROD CERTIFICATION CHECKLIST	
Information	Location/Page Number
Chemicals of concern and respective concentrations	Section 5.2, page 13 Section 7.1.1, page 28 Tables 2.1-2.9 and 7
Baseline risk	Section 7.0, p. 27
Clean-up levels and the basis for these levels	Section 8.1, page 48 Table C, page 50
How source materials constituting principal threat are addressed	Section 5.4, page 26 Section 9.1, page 53
Current and reasonably anticipated future land use assumptions and potential future beneficial uses of groundwater	Section 6.0, p. 27
Potential future land and groundwater use that will be available at the Site as a result of the selected remedy	Section 11.4, p. 85
Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected	Section 11.3, p. 85 Table 42
Key factors that led to selecting the remedy	Section 11.1, p. 75

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Cecil Rodrigues, Director
Hazardous Site Cleanup Division
EPA Region III

SEP 26 2014
Date

II. DECISION SUMMARY

LOWER DARBY CREEK AREA SUPERFUND SITE
OPERABLE UNIT 1 – CLEARVIEW LANDFILL SOILS & WASTE

PHILADELPHIA AND DARBY TOWNSHIP, PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA

AR306898

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Lower Darby Creek Area (LDCA) Superfund Site (LDCA Site or Site) is located north of the Philadelphia International Airport (**Figure 1**) in an industrialized portion of southwestern Philadelphia and southeastern Delaware Counties, Pennsylvania. The LDCA Site was placed on the National Priorities List (NPL) on June 14, 2001 due to potential releases of hazardous substances to nearby surface water, posing a threat to human health, ecological receptors, and other sensitive environments, such as the John Heinz National Wildlife Refuge (NWR) at Tinicum. The LDCA Site includes two landfills: 1) the Clearview Landfill (Landfill) and 2) the Folcroft Landfill and Annex. Five additional properties were initially proposed (proposed properties) for the LDCA Site but were not included in the final LDCA Site listing because no direct releases of hazardous substances from those properties had been observed during the time of evaluation for listing. At the time of listing, remedial work had been completed or was ongoing at several of the proposed properties and Notices of Intent to Remediate under the Pennsylvania Land Recycling and Environmental Remediation Standards Act ("Act 2") for several proposed properties were also provided during the listing process.

The Clearview Landfill is located along the eastern banks of Darby and Cobbs Creeks, at 83rd Street and Buist Ave. in Philadelphia, PA. The historic Clearview Landfill footprint resided partially in Delaware County (Darby Township) and partially in Philadelphia County (City of Philadelphia) including the Eastwick City Park east of the current Site and a portion of the Eastwick residential neighborhood (Eastwick Neighborhood). During the mid-1970s when development of the Eastwick residential neighborhood began, a considerable amount of waste was excavated and moved from the City of Philadelphia portion of the Site to the Delaware County portion, where excavated materials were subsequently placed, graded and partially covered with fill. As a result, the present areal extent of the Clearview Landfill lies almost entirely within Delaware County. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number for the LDCA Site is PASFN0305521.

The U.S. Environmental Protection Agency (EPA) is the lead agency for Site activities and the Pennsylvania Department of Environmental Protection (PADEP) is the support agency.

This action addresses waste, soil and shallow leachate contamination associated with the Operable Unit 1 (OU1) of the LDCA Site, known as Clearview Landfill. This action is intended to be the final action for OU1. The Folcroft Landfill is OU2 for the LDCA Site; impacted groundwater associated with the Clearview Landfill is known as OU3. The remedial action for OU3 will address remaining contamination in groundwater, surface water and sediment, associated with the Site, if necessary, upon completion of the Remedial Investigation/Feasibility Study (RI/FS). The Folcroft Landfill (OU2), including surface water, sediment, fish tissue, leachate and groundwater related to OU2, will also be addressed under a separate response action as well pending completion of the RI/FS.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Clearview Landfill was privately owned and operated without a permit from the 1950s to the 1970s by the Clearview Land Development Corporation, Inc. (CLDC) and used for the disposal of municipal and industrial waste collected from the City of Philadelphia, other parties, and portions of Delaware County. Landfilling activities at Clearview Landfill started by 1953 and covered

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approximately 3 acres. At that time, the area was surrounded by wetlands and several unnamed streams. By 1965, the Clearview Landfill had expanded significantly to approximately 55 acres. Former wetlands and streams had been filled, and junked automobiles, large piles of dark-toned material, and a deep pit containing dark standing liquid were present. By the time of the Clearview Landfill's ordered closure in 1973, the Clearview Landfill covered approximately 65 acres. The Pennsylvania Department of Environmental Resources (PADER), now known as PADEP, ordered the cessation of all waste disposal and proper closure of the Clearview Landfill due to several violations of state regulations related to land disposal. The Court of Common Pleas of Delaware County upheld this order and officially ordered the closure of the Clearview Landfill on August 7, 1973. A closure plan was developed and some covering and grading of the Clearview Landfill was completed in 1976. However, the Clearview Landfill was never closed or maintained properly in accordance with the closure order or plan. Although it was no longer operating as a landfill, the property continued to be used as a base of operations for various waste collection and disposal businesses as well as other operations as described in brief below.

Post-Closure Activities at Clearview Landfill and State Actions

ROMA Associates, Inc. was granted a permit by PADER to operate a batch asphalt plant on the southern portion of the Clearview Landfill in 1973. In 1976, the Philadelphia Redevelopment Authority (PRA) covered and seeded a portion of the Clearview Landfill. Several businesses both historically and currently have utilized the southern portion of the Clearview Landfill for industrial/commercial activities such as trash removal, automobile repair and towing, drum recycling, asphalt paving equipment and white goods (refrigerators) storage. Several Notices of Violation (NOVs) were issued to various businesses, including Richard M. Heller, CLDC and City Wide Services, Inc. (CWS), between 1980 and 1998 for disposal of various solid wastes (e.g., automobiles, trash, construction debris, scrap metal, household appliances, recyclable materials, yard waste, etc.) on "tipping floors" and the ground surface which violated the Pennsylvania Solid Waste Management Act, Pennsylvania Clean Streams Law and other Commonwealth regulations. The non-compliant parties typically did not comply with orders for abatement of the violations.

In 2001, PADEP obtained an injunction against Richard Heller, CLDC and CWS to cease all processing, disposing, dumping, or burning of solid wastes at the Site and remove all the solid wastes from the Site property. Civil penalties were also issued to these parties in 2001 in the amount of $59,500. These orders were upheld in 2003 by the Commonwealth of Pennsylvania Environmental Hearing Board.

Investigations

In 1982, a PADER Site Inspection (SI) reported that a leachate pond was present on the Clearview Landfill near Darby Creek and a foul odor was detected in the stream. EPA Region III's Field Investigation Team (FIT3) conducted site investigations in 1983 and 1984 which indicated that polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) were present in leachate samples, PAHs in soil samples, and PCBs in both stream and soil samples. In September 1990, additional samples collected by EPA contained volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and PAHs in the leachate seeps and downstream sediments.

In May 1998, EPA conducted a Hazard Ranking System (HRS) sampling investigation at the LDCA Site to identify possible threats to human health and the environment posed by waste sources along Darby Creek, and to evaluate the potential placement of the LDCA Site on the National Priorities

List (NPL). During this investigation, signs of erosion on the Clearview Landfill cover along the creek banks, exposed debris piles, and leachate seeps were observed. Soil and waste samples collected showed contamination with elevated levels of heavy metals, PAHs, and PCBs. Sediment samples in the creeks adjacent to the Clearview Landfill indicated elevated levels of PCBs. Sample results did not indicate any imminent and substantial risk to human health that would warrant any emergency actions for the Clearview Landfill or the properties covered in the HRS investigation at that time.

In 2000, EPA conducted additional sampling on the Clearview Landfill to further characterize the nature and extent of contamination associated with the Site and to address citizen concerns that extensive flooding from Hurricane Floyd in September 1999 may have caused hazardous substances to migrate from the Site into their homes. Samples of surface and subsurface soil (including some on residential properties and the Eastwick Recreation Center), soil gas, shallow groundwater, residential tap water and creek sediment were collected. Samples related to the Clearview Landfill indicated the presence of several VOCs, SVOCs, PCBs, heavy metals, and one pesticide at elevated levels in soils and groundwater. Several groundwater samples also contained high levels of arsenic. Residential soil samples indicated several SVOCs, metals, and one type of PCB mixture above screening levels. No contaminants were detected above federal drinking water standards in the tap water samples. Overall, a very limited number of samples exceeded EPA's emergency response guidelines for one or more compounds; all of these samples were in groundwater with the exception of one in soil gas on the Site. As a result, none of the findings warranted any emergency removal actions but they were used to plan the RI scope for the Site. EPA provided and discussed the results with each of the residences that were sampled and a public meeting was held to discuss the overall findings. Areas sampled during this investigation did not include the area that was addressed as part of the recent time critical removal action.

In 2000, the Agency for Toxic Substances and Disease Registry (ATSDR) issued the *Health Consultation, Lower Darby Creek Area: Clearview Landfill* which evaluated the analytical results from the 2000 sampling and concluded that the substances associated with the Site did not pose a public health threat.

In 2002, the *Independent Third Party Review of Results of EPA's Preliminary Risk Assessment for the Eastwick Neighborhood of Philadelphia, PA* was issued by two physicians from the University of Pennsylvania's School of Medicine. This report discussed community concerns regarding EPA's approach to addressing the Clearview Landfill, evaluated the EPA risk assessment that was conducted based on the 2000 sampling results and provided recommendations for future work at the Site. The report concluded that EPA's risk assessment was accurate but that the risks should be recalculated after additional sampling was conducted as part of the RI. It was also recommended that EPA consider a study of cancer incidences in the Eastwick area and that the other community questions put forth in the report as the result of interviews be addressed by EPA.

In 2008, the ATSDR issued a second *Health Consultation* (HC) for the Clearview Landfill. Analytical data from the RI were not available for this HC. The HC classified the Site as a public health hazard for recreational users due to physical hazards present on the Site. However, there were insufficient data to evaluate potential health hazards attributable to contaminants in various media associated with the Site. The ATSDR HC recommended that EPA address the physical hazards by posting signs and/or barriers on-site and continue monitoring Site groundwater.

In 2012, the Pennsylvania Department of Health (PADOH), with support from ATSDR, issued a

Letter Health Consultation (LHC) which evaluated cancer incidence for Zip Code 19153, which includes the Eastwick Neighborhood. The review concluded that there is a 6% increase in the incidence of cancer in Zip Code 19153 when compared to the rest of Pennsylvania. However, this increase is less than the 10% increase in cancer incidence that is seen in the rest of Philadelphia County. The report concluded that, "*there is not an exposure or risk that is unique to Zip Code 19153 that is contributing to the rates or patterns of cancer observed in the residents of this area.*"

Also in 2012, PADOH, with support from ATSDR, issued another LHC which evaluated potential indoor air vapor intrusion (VI) risks for the Eastwick Neighborhood utilizing analytical results from EPA's residential VI investigation conducted in 2010-2011 (see the **Site Characteristics** section for detailed description of the VI investigation findings). This LHC concluded that levels of VOCs in Eastwick homes and the Eastwick City Park Recreation Center were low and exposures to these VOCs in indoor air are not expected to harm people's health. Further, based on sampling data, PADOH concluded that gases and vapors from the Site are not accumulating underneath homes or the recreation center in the Eastwick City Park.

Removal Action

Sampling conducted as part of the Remedial Investigation (RI) identified the presence of numerous contaminants in various media within the Site and Darby and Cobbs Creeks, including PCBs and PAHs (see the **Site Characteristics** section for detailed description of RI findings). An area located in the southern portion of the Site, referred to as the Southern Industrial Area (SIA) was found to contain high concentrations of PCBs and PAHs in the surface and subsurface soils. Maximum concentrations of PCBs in the SIA were 280 milligrams/kilograms (mg/kg) in the surface soil and greater than 2,100 mg/kg in deeper soils. Maximum concentrations of total PAHs in the SIA were 27 mg/kg (surface) and 325 mg/kg (deeper soils). A Removal Site Evaluation (RSE) was conducted by EPA in July-August 2011 to evaluate the need for response action. Due to the presence of PCBs and PAHs in surface soils to which workers in the SIA and others who may access the Site could be exposed and the proximity of habitat used by sensitive ecological receptors, an Action Memorandum was signed by EPA on September 27, 2011 which determined that a Time-Critical Removal Action (TCRA) was necessary to mitigate the release and threatened potential release of these PCBs and PAHs from the Site.

In November 2011, the TCRA was initiated to remove high concentrations of these contaminants and prevent their further migration into the environment. Cleanup goals for the action are listed in **Table A** below. The TCRA focused primarily on PCBs, however, threats potentially posed by the PAHs were addressed as well as they were excavated and disposed along with PCBs.

To address additional contamination discovered at greater depths, the scope of the Removal Action was modified on April 12, 2012 to 1) excavate and remove off-site all soils and waste containing PCBs greater than 50 mg/kg (rather than the previously established goal of 100 mg/kg), 2) remove restrictions for the depth of the excavation and, 3) specify that the Removal Action was not to extend under areas used by businesses at the Site. The Removal Action was completed on September 26, 2012. As a result of the action, 3,955 tons of PCB containing soils and waste were excavated and disposed of at an off-site facility licensed to accept such wastes.

Table A. Time Critical Removal Action Cleanup Goals

Soil Depth (feet bgs)	PCB Concentration (mg/kg)	Action Taken
0-.5'	0-10	No Action
0-.5'	10-25	Grade and install appropriate cover
0-.5'	> 25	Excavate and dispose of off-site
.5'-8' or water table (whichever encountered first)	0-100	Cap/cover pursuant to 40 C.F.R. 761.61*
.5'-8' or water table (whichever encountered first)	> 100	Excavate and dispose of off-site

* - 40 C.F.R. Section 761.61(a)(7) covers PCB remediation waste and establishes cap requirements as, *"a uniform placement of concrete, asphalt, or similar material of minimum thickness spread over the area where remediation waste was removed or left in place in order to prevent or minimize human exposure, infiltration of water, and erosion."*

Enforcement Activities

The 39-acre Clearview Landfill property (Clearview Property) was owned by the now defunct CLDC from the early 1950s until December 2010. EPA believes that CLDC and its officers, Edward I. Heller and his son, Richard R. Heller, operated the Clearview Landfill beginning in 1953. In the 1960s, dumping expanded from the Clearview Property onto a 27-acre adjacent parcel owned initially by the City of Philadelphia Redevelopment Authority and later by the City of Philadelphia (City Property). The City Property is currently owned by the City of Philadelphia and houses a park and recreational area. The Clearview Property is currently owned by Steve Fitzgerald LLP which acquired the 39-acre parcel from a tax sale held in May 2007. Steve Fitzgerald LLP was unable to take immediate title to the Clearview Property due to ongoing litigation filed by Richard R. Heller on behalf of CLDC to set aside the tax sale. The litigation was ultimately resolved and the Clearview Property was conveyed to Steve Fitzgerald LLP by deed dated December 10, 2010. The lawsuit was not resolved until May 31, 2012, when a settlement agreement was reached whereby the Petition filed on behalf of Mr. Heller and CLDC to set aside the judicial tax sale was dismissed with prejudice. The Court entered an order confirming the sale. The precise terms of the agreement are unknown and EPA has requested a copy of the agreement from Steve Fitzgerald LLP's attorney.

On June 11, 2002, EPA issued Notice of Potential Liability and Waiver of Special Notice Procedures for the RI/FS ("RI/FS Waiver") letters to five parties, including the City of Philadelphia, CLDC, the Estate of Edward I. Heller, and Richard Heller. EPA also issued an RI/FS Waiver to the U.S. Department of the Navy who may have arranged for the disposal of hazardous substances at the Site. On March 4, 2013, EPA issued Notice of Potential Liability letters to twenty-five parties, including: the current owners, Steve Fitzgerald LLP and the City of Philadelphia, prior owners and operators, CLDC and Richard Heller, and the following parties who may have arranged for disposal of hazardous substances at the Site: ABB, Inc.; Cargill, Inc.; City of Philadelphia Redevelopment Authority; CBS Corporation; Delaware County Solid Waste Authority; E.I. duPont De Nemours and Company; FMC Corporation; General Electric Company; Gould Electronics, Inc.; Kimberly-Clark Corporation; PECO; Rohm and Haas Company; Sunoco, Inc.; The Sherwin-Williams Company, Inc.; ThyssenKruppBudd Company; the United States Mint; the United States Department of the Navy; and Wyeth. EPA also issued Notice of Potential Liability letters to BFI Waste Systems of North America, Inc.; Waste Management of Delaware, Inc.; and Waste Management Disposal Services of Pennsylvania, Inc. which may have transported hazardous substances to the Site for disposal.

EPA is continuing to investigate the potential responsible parties ("PRPs") at the Site with the goal of identifying additional PRPs who may have owned or operated the Site or who contributed hazardous substances to the Site.

3.0 COMMUNITY PARTICIPATION

The Clearview Landfill Remedial Investigation, Feasibility Study, Proposed Plan and other Administrative Record documents relating to the Site, were made available to the public. They are located in the Administrative Record, which can be viewed at http://www.epa.gov/arweb, or at the Administrative Record link on the sidebar of the U.S. EPA Region 3 Hazardous Site Cleanup Division Homepage at http://www.epa.gov/reg3hscd or at the Lower Darby Creek Area Superfund Site website at http://www.epa.gov/reg3hwmd/npl/PASFN0305521.htm. In addition, the detailed Administrative Record can be examined at the following locations:

Free Library of Philadelphia
2851 Island Avenue
Philadelphia, PA 19153
(215) 685-4170

US EPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3157
(Please call for an appointment.)

The notice of availability of these documents was published in the *Southwest Globe Times,* a local Philadelphia newspaper, and the *Delaware County Times*, a Delaware County newspaper, on August 1, 2013. In addition, EPA delivered a fact sheet summarizing the Agency's preferred remedial alternative for the Site to residences and businesses near the Site in August 2013.

From August 1, 2013 to August 31, 2013 EPA held a 30-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study, the Proposed Plan and the other documents contained within the Administrative Record for the Site. As a result of several requests, the comment period was extended an additional 30 days to September 30, 2013. On August, 18, 2013, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision.

Numerous community meetings have been hosted by EPA since the proposal and final listing of the LDCA Site to the NPL. The meetings included public hearings when the LDCA Site was proposed as well as numerous information sessions and briefings of local organizations and elected officials. Fact sheets providing updates on the Site status were issued in August 1999, December 2006, May 2007, February 2009, April 2010, January 2011, July 2011, November 2011, and August 2012. An independent third party review of EPA's preliminary risk assessment associated with the Site was conducted in 2002. EPA issued a response to community questions posed in this independent review in 2003. In September 2012, EPA issued an additional Clearview Landfill Questions and Answers

document. This was done in concert with an LDCA Community Open House and Information Exchange on September 19, 2012 at which numerous experts from EPA and other federal, state and local agencies were on hand to hear and respond to the community member's questions and concerns.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

As with many Superfund Sites, the problems at the LDCA Superfund Site are complex. As a result, EPA has organized the work into three operable units (OUs):

- Operable Unit 1: Clearview Landfill – Waste, soil and shallow leachate
- Operable Unit 2: Folcroft Landfill – All impacted media
- Operable Unit 3: Clearview Landfill – Groundwater

Both of the landfills that comprise the LDCA Site historically and currently are contributing to releases of contaminants into the environment. EPA's approach for addressing former municipal waste landfills is to contain the waste via some type of cap or cover plus any additional response actions necessary to address contaminants that may be migrating outside the landfill boundary, as well as known principal threat wastes. Potential impacts to the aquatic environments surrounding the Clearview and Folcroft landfills are still being evaluated. Attribution of contamination in an aquatic setting to any source becomes more difficult as distance from the contaminant source, e.g., the landfills, increases. The issue is further complicated by the surrounding urban environment and likely non-site related sources of contamination. If necessary, potential response actions will be evaluated and proposed once the evaluation of contaminants and potential risks in the aquatic environment is complete.

This response action is the second planned action at the Landfill. As discussed in further detail under the **Site History and Enforcement Activities** section, a Time-Critical Removal Action (TCRA) was conducted at the Landfill from November 2011 to September 2012 to mitigate potential threats to human and ecological receptors from the threat of exposure or the release of PCBs and PAHs in soil. The TCRA mitigated these potential threats by addressing PCBs in the SIA portion of the Landfill. Several areas with PCBs greater than 50 mg/kg in the subsurface soils could not be addressed under the TCRA due to the presence of current Site occupants (**Figure 2**). These remaining areas will be addressed by this ROD.

The remedial action in this Record of Decision will be a final action for OU1. This remedy will control the source (Landfill waste and soil) to prevent human and ecological receptors from contacting Landfill waste and contaminants, reduce contaminant migration (shallow leachate) to groundwater and surface water, prevent erosion and transport of soils and waste into nearby surface water bodies and residential areas, and mitigate all principal threat wastes. The remedial action for OU3 will address remaining contamination in groundwater and potential unacceptable risks to surface water and sediment from groundwater, associated with the Clearview Landfill, if necessary, upon completion of the OU3 RI/FS. The Folcroft Landfill (OU2), including surface water, sediment, fish tissue, leachate and groundwater related to OU2, will be addressed under a separate response action pending completion of the OU2 RI/FS.

5.0 SITE CHARACTERISTICS

5.1 Surface Features, Soil and Geology, Hydrogeology, Surface Hydrology, Ecology and Sensitive Environments

5.1.1 Surface Features and Resources

The Site is located in both Delaware and Philadelphia Counties. The closest cross-street intersection to the main Site entrance is 84th Street and Lindbergh Blvd., Philadelphia, PA. **Figure 3** presents surface features near the Site. The majority of the Clearview Landfill is located in Darby Township (Delaware County); however, the Site is physically separated from the rest of the Township by Darby and Cobbs Creeks. The Clearview Landfill is geographically closer to Philadelphia, PA, and a portion of the Site wastes and impacted soils are known to be present in Eastwick City Park which is within Philadelphia County. Residents in nearby Philadelphia communities can directly access City Park and Clearview Landfill. The Site encompasses approximately 44 acres in Darby Township and 20 acres in Philadelphia. It is bounded by Darby and Cobbs Creeks to the west, 84th Street to the South, and the Eastwick Neighborhood to the southeast, east, and northeast.

The LDCA Site is located in an industrial section of Darby Township, Delaware and Philadelphia Counties in Pennsylvania. In 2000, there were approximately 9,600 people in Darby Township with a population density of 6,739 per square mile in a total area of 1.43 square miles (U.S. Census, 2000). Of these, approximately 3,500 people live within a 0.25-mile radius of the Site. Residential properties are situated east of the Site with population density increasing northeast toward Philadelphia. All residential properties in the Eastwick neighborhood are located within the City of Philadelphia boundary, while the majority of the Site is located in Delaware County.

The year 2000 census data show that there are about 2,300 people living immediately adjacent to Clearview Landfill and 755 homes in the area between the Landfill, S. 84th and S. 78th Streets, and Lindbergh Blvd. In general, land use within the study area is urban residential mixed with commercial, industrial, and natural area uses. Land use reported during the 1983 study of the Clearview Landfill using the Anderson Classification System indicated the land uses of Clearview Landfill as Commercial/Light Industrial, Vacant Urban Lands, and Dump, although the entire land has been used for dumping waste. Residential land use is predominant in close proximity to the east of Clearview Landfill.

Information obtained by EPA suggests that two historic cultural resources, including a tunnel for transportation of slaves as part of the Underground Railroad and a graveyard dating back to the 18th century, could be present near or on the Site. As a result, in 2011, EPA conducted a Phase 1A archaeological literature review and field reconnaissance survey to identify and evaluate potential cultural resources that might be affected by future remedial activities at OU1. No evidence aside from the initial information provided to EPA regarding the slave tunnel could be located. However, this portion of Darby Township was reported to be a center of Underground Railroad activity. It was concluded that the potential location of the tunnel, based on a hand drawn map, had likely been disturbed by activities related to the widening of 84th Street and the replacement of the bridge over Darby Creek in the 1970s. The original existence of the graveyard, identified as Elliott's graveyard, was confirmed and traced via published maps to the abandoned portion of Buist Ave. near its intersection with 84th St. No visual evidence of the graveyard currently exists on the surface and no records were found that documented the excavation or reinterment of a cemetery from this area. Based on the survey, it was concluded that, if still present, Elliott's graveyard lies under the abandoned portion of Buist Ave. near

the intersection of 84th St. As part of the Phase 1A survey, EPA established two Areas of Potential Effect (APE) for both of these potential cultural resources (**Figure 4**). The purpose of the APE's is to define an area(s) in which cultural or historical resources may be affected by the undertaking of any future activities related to the Site or other non-Site related activities. The APE associated with the potential slave tunnel is outside the historic boundaries of the Site and was utilized as part of the installation of the monitoring well 13 cluster in 2011 (see **Figure 5** for this well location) to ensure no potential intact cultural resources were disturbed. The APE associated with the graveyard lies within the current Site boundaries. Any future remedial activities that may occur in that APE may require additional archaeological investigation.

5.1.2 Soils and Geology

Soils in the vicinity of the Clearview Landfill have been heavily disturbed through many years of urban land use and are generally described as "Made Land" by the U. S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Surficial geology in the area is generally unconsolidated sedimentary deposits that consist of gravelly sand with some interbedded clay and silt. In addition, part of the area has been extensively filled with fine-grained sediment, dredge spoils, and flood deposits.

The soil types mapped by NRCS (Web Soil Survey) near the Site are described briefly below:

- Made Land, Sanitary Landfill (Mf) – Soils under this map unit consist primarily of Udorthents, sanitary landfill, and similar soils, and are typically found in areas of cut and fill. The material is typically similar in the subsoil or substratum of adjacent soils. In fill or disposal areas, the soil material has more variable characteristics because it usually consists of varying amounts of material from the subsoil and substratum of nearby soils. Slope is reported to vary from 0 to 15 percent. Soils in Clearview Landfill, Industrial Drive, and northeast of Sun Oil Tank Farm (located between the Clearview and Folcroft Landfills) are shown to be this type.

- Urban Land (Ub) – This soil type represents approximately 85% of land in Philadelphia County. Its typical setting includes 0 to 8% slope and parent materials consisting of pavement, buildings and other artificially covered areas. This soil type resides in City Park of the Clearview Landfill.

- Urban Land – Howell Complex (Uh): This soil type is typically mixed with urban land, and Howell and similar soil. In addition to typical urban land setting, this unit has Howell, of which parent material is unconsolidated sediments residuum, consisting of silt loam, sandy clay loam, and clay. It has 0 to 15% slope. This soil type is dominant in the Eastwick neighborhood east of Clearview Landfill.

- Wehadkee Silt Loam (We) – This type consists primarily of Wehadkee and similar soils. This soil type has 0 to 3% slope and does not drain well. It is typically found in flood plains and profiled as silt loam, silty clay loam, and stratified clay. This soil type is located in the west side of Darby Creek near Clearview Landfill.

- Glenelg Channery Silt Loam (GeB2) – This soil type is found further west of Darby Creek near Clearview Landfill and west of Industrial Drive. It drains well and has a slope of 3 to 8 percent. Its typical profile has 0 to 8 inches of Channery silt loam; 8 to 29 inches of Channery silt loam;

and 29 to 50 inches of very channery loam.

The Site is situated on unconsolidated Coastal Plain sediments (Quaternary Trenton Gravel at the surface) overlying bedrock of the Wissahickon Formation. Bedrock was encountered at depths ranging from approximately 18 feet in the Eastwick neighborhood to as deep as about 44 feet at the southern part of the Landfill during the RI.

The area is predominantly underlain by the Quaternary Age Trenton Formation in thicknesses of up to 40 feet, which consists primarily of medium- to coarse-grained gravelly sand interstratified with clayey silt and sand layers. Beneath the Trenton Formation lie the Pennsauken and Bridgeton Formations, which consist of cross-bedded, cemented sands with interbedded coarse-grained gravel. These formations have a maximum thickness of 30 feet and are present as outcrops in the general surrounding area, but their existence below the Clearview Landfill is unknown.

Beneath the units described above lie the Cretaceous Age Potomac Group (silts and clays with inter-bedded sands and some gravel) and the Raritan Formation (containing various clays, sand, and gravel members); however, neither can be confirmed below Clearview Landfill.

The Precambrian Age Wissahickon Schist Formation is present beneath the layers described above. This formation consists primarily of oligoclase-mica schist, a group of metamorphic rocks containing parallel layers of flaky minerals such as mica. Because of the intense folding of this unit, its exact thickness is unknown, but is estimated to range from 8,000 to 10,000 feet. The Wissahickon Formation is present within the study area as outcrops in nearby stream channels, including Darby, Cobbs, and Hermesprota Creek valleys, and underlies the northern end of the Clearview Landfill. This formation was also identified in both Darby and Cobbs Creek upstream of Clearview Landfill during the RI.

5.1.3 Hydrogeology and Surface Hydrology

In general, groundwater regionally flows from the northeast to the southwest direction toward the Delaware River. The southern portion of the Clearview Landfill is underlain by Trenton Aquifer and the northern part of the Landfill is underlain by the Wissahickon Aquifer. Both are water table aquifers (i.e., an aquifer which is not confined under pressure; therefore, the water level in a well is the same as the water table outside the well.) Locally, groundwater in the Coastal Plain sediments aquifer flows towards nearby surface water bodies including the Darby, Cobbs, and Hermesprota Creeks. Groundwater within the Landfill is mounded and as a result flows radially outward from the center (**Figure 5**). Groundwater in the bedrock aquifer(s) flows in an eastward direction. Groundwater gradients are typically low in this type of aquifer (e.g., hydraulic gradient of about 10 feet per mile or less). According to the USEPA Aquifer Classification System in the *Guidelines for Ground-Water Classification Under the [1984] EPA Ground-Water Protection Strategy, Final Draft* (USEPA, 1986), the aquifers underlying the Clearview Landfill are classified as Class I aquifers due to the presence of the John Heinz NWR within 2 miles of the Landfill. As per Section 3.3.1 of the guidelines, the aquifer is classified as Class I when the groundwater is "ecologically vital," and supports a sensitive ecological system and a unique habitat such as the John Heinz NWR.

All known residents in the Delaware and Philadelphia Counties are supplied with potable water by a public water supplier, the City of Philadelphia Water Department. No drinking water wells are known to exist in this area on the Pennsylvania side of the Delaware River. On the New Jersey side of

the Delaware River, drinking water wells are known to exist for Gibbstown and the Borough of Paulsboro (located 5.5 and 4 miles south of Clearview Landfill, respectively).

Surface water features associated with the LDCA Site consist of streams and marsh areas. Streams in the area include Darby, Cobbs, and Hermesprota Creeks. The main stem of Darby Creek originates in Easttown Township, Chester County and is joined by a number of tributaries as it flows downstream. Cobbs Creek, the major tributary of Darby Creek, converges with Darby Creek north of Clearview Landfill. Darby Creek is then joined by Hermesprota Creek near marsh area in John Heinz NWR at Tinicum. Water from Darby Creek and the marsh ultimately flows into the Delaware River. The confluence of Darby Creek and the Delaware River is approximately 3.5 miles downstream of Clearview Landfill. An impoundment and tidal wetlands exist within the John Heinz NWR.

Darby, Cobbs, and Hermesprota Creeks were listed as impaired waters under Section 303(d) of the Clean Water Act, 33 U.S.C. §1313(d). Portions of Darby and Cobbs Creeks in the vicinity of the Clearview Landfill were listed as requiring a Total Maximum Daily Load (TMDL), which specifies the maximum amount of a pollutant that a water body can receive, while meeting state water quality standards. Both Darby and Cobbs Creeks are considered for impaired aquatic life (cause unknown and siltation) and fish consumption use (PCBs). Cobbs Creeks is also considered impaired for recreational use due to pathogens. No TMDLs have been established for Darby or Cobbs Creek at this time. A small portion of Cobbs Creek is listed as not requiring a TMDL, but still needs to be addressed because of pollution levels. A TMDL for PCBs has been established by EPA for the Delaware River Estuary. The Landfill is situated within this estuary. Tidal influence exists throughout the lower portion of Darby Creek and upstream as far as Clearview Landfill. On average, Darby Creek is tidal up to the confluence of Darby Creek and Cobb Creek, located near the northern portion of the landfill, but the extent of tidal influence changes depending on climate conditions.

Flood plains encroach significantly onto the Landfill RI study area. As an example of a historical event, Hurricane Floyd in 1999 caused significant flooding throughout the Cobbs and Darby Creeks, including the Eastwick neighborhood and surrounding area, inundating many homes. Based on the mapping of the flood plain, the ground surface elevation, and other information, it appears that flooding could be a more common event than indicated by the 100-year flood plain mapping alone.

5.1.4 Ecology and Sensitive Environments

John Heinz NWR (the Refuge) at Tinicum is the primary sensitive environment in the vicinity of Clearview Landfill. Birdwatchers have recorded more than 280 species of birds in and around the Refuge. The Refuge is one of the few places in Pennsylvania where the state-endangered red-bellied turtle and southern leopard frog can be found. It is located on the Atlantic Coastal Plain, which is only present in the extreme southeastern corner of the state and has been highly impacted by industrial activity. Other sensitive areas include wetland areas along the banks and flood plains of Darby Creek. In addition, Clearview Landfill is located on a major waterfowl migration route that is part of the Atlantic Flyway. Numerous waterfowls are observed on the waterways near Clearview Landfill. Within the general study area, wetlands that serve as resting areas for migrating waterfowl are located in the Refuge. Water from upstream areas of the City of Philadelphia and portions of Delaware County eventually enters the Refuge via Darby Creek. Moreover, Cobbs and Darby Creeks are listed as warm-water fishing streams by the Pennsylvania Fish and Boat Commission (PFBC).

The John Heinz NWR consists of approximately 1,200 acres of wetlands within two miles of

Darby Creek near the LDCA Site (USFWS, 2001). Darby Creek and its downstream portion are classified as riverine, tidal, emergent wetlands. Two wetlands, including one near Clearview Landfill and the other near the Sun Oil Tank Farm, are classified as palustrine, emergent wetlands.

During the RI, biological and ecological information on the LDCA Site was collected with particular emphasis on identifying sensitive environments, endangered species and their habitats, and those species consumed by humans or found in human food chains. Investigation on the presence of threatened and/or endangered species at the LDCA Site was conducted by contacting several state and federal agencies, including the U.S. Fish and Wildlife Service (USFWS), Pennsylvania Department of Conservation and Natural Resources (PADCNR) Bureau of Forestry, Pennsylvania Fish and Boat Commission (PFBC), and the Pennsylvania Game Commission (PGC). Information from response letters provided by these agencies were originally discussed in the RI. In 2014, EPA obtained updated letters from these agencies regarding threatened and/or endangered species. The details of these letters are summarized below:

- Federally Listed Species: The USFWS reported that there are no federally listed or proposed threatened and/or endangered species under its jurisdiction, based on a review of the LDCA Site location.

- State-Listed Plant Species: The 2014 PADCNR letter indicated that species or resources under PADCNR's jurisdiction are located in the vicinity of the Site. PADCNR requested that further coordination if any disturbance is planned or more detailed project information becomes available. The previous PADCNR letter provided initially during the RI reported that potential impact of the project to plant, terrestrial invertebrates, natural communities, and geologic features of concern under DCNR's responsibility is anticipated. There are plant species of special concern within the LDCA Site, including waterhemp ragweed (*Amaranthus cannabinus*) in uppermost zone of freshwater intertidal marsh; field dodder (*Cuscuta pentagona*), which is parasitic on many hosts, in old field, thickets and wet banks; Walter's barnyard grass (*Echinochloa walteri*) in tidal marshes and mudflats; E*upatorium rotundifolium* in sandy or clayey fields and open thickets; forked rush (*Juncus dichotomus*) in moist, sandy old field, open woods and gravel pits; velvety panic-grass (*Panicum scoparium*) in moist meadows and swales; shrubby camphor weed (*Pluchea odorata*) in tidal wetlands, wet ditches, and railroad ballasts; river bulrush (*Schoenoplectus fluviatilis*) in moist sandy shores, and tidal and non-tidal marshes; wild senna (*Senna marilandica*) in dry roadsides and thickets; and Indian wild rice (*Zizania aquatica*) in tidal and non-tidal marshes.

- State-Listed Animal Species: The PFBC reported that several state-listed rare or protected animal species are known to exist in the vicinity of the Site according to their records and the Pennsylvania Natural Diversity Inventory (PNDI) database. The Eastern Redbelly turtle (*Pseudemys rubriventris*) is a threatened species, while the Southern Leopard frog (*Lithobates sphenocephalus utricularius*), New Jersey Chorus frog (*Pseudacris feriarum kalmi*), and Threespine Stickleback (*Gasterosteus aculeatus*) are endangered species expected to occur in the vicinity of the Site. The Eastern Mudminnow (*Umbra pygmaea*) is a candidate species.

- State-Listed Species of Concern: The PGC reported that species or resources of concern are located in the vicinity of LDCA, but that no impact is likely.

5.2 NATURE AND EXTENT OF CONTAMINATION

An extensive investigation has been conducted by EPA at the Clearview Landfill to identify the various types, locations, and concentrations of contaminants that are present as a result of the Landfill and the potential risks that they present to human and ecological receptors. Several phases of investigation activities were conducted between 2003 and 2006 to evaluate various potentially impacted media including, Landfill wastes, surface and sub-surface soils, groundwater/leachate, surface water, sediment and soil gas. During the RI, field activities were conducted in several distinct areas of interest associated with the Site:

- Zone 1 - Clearview Landfill within Delaware County;
- Zone 2 - City Park within the historical Landfill footprint;
- Zone 3 - Eastwick Neighborhood;
- Darby and Cobbs Creeks; and,
- John Heinz NWR

The field investigation included the following major elements in chronological order:

- Aerial mapping, surveying, and geographic information system (GIS) within the study area (Spring 2002).
- Sediment and surface water sampling in Cobbs and Darby Creeks, upstream and downstream of Clearview Landfill (Spring/Summer 2002).
- Leachate seep sampling from the bank of Clearview Landfill along Darby Creek (Summer 2002).
- Installation of soil borings in City Park and Eastwick neighborhood, and monitoring wells in City Park, followed by soil, soil/landfill gas, and groundwater sample collection (first round - Winter/Spring 2003).
- Installation of staff gauges along Darby and Cobbs Creeks for the tidal study (January 2003).
- Sampling of stormwater and ponded water in City Park (Spring 2003).
- Installation of additional soil borings in City Park and Eastwick neighborhood, and permanent vapor monitoring wells in City Park, followed by soil, soil/landfill gas, and groundwater sample collection (second round - Summer 2004).
- Collection of earthworm, and sediment and surface water sampling performed in City Park, and Darby and Cobbs Creeks for ecological assessment (Fall 2005).
- Installation of soil borings and groundwater monitoring wells in Clearview Landfill. Samples of soil, soil/landfill gas, and groundwater were collected. (Winter 2005/2006).
- Landfill leachate seep sampling from the banks of Clearview Landfill along Darby Creek (Spring 2006).
- Groundwater sampling from all permanent monitoring wells (second round – Summer 2006).
- Conducted residential indoor air monitoring as part of Phase 1 of the vapor intrusion investigation (Spring 2010)
- Conducted Phase 1A archaeological resource survey (Winter 2010)
- Collected residential indoor, outdoor and subslab air sampling as part of Phase 2 of the vapor intrusion investigation (Winter 2011)
- Installation of monitoring wells outside the historic landfill boundary (Winter/Spring 2011)
- Groundwater sampling from all permanent monitoring wells (third and fourth rounds – Spring and Summer 2011, respectively)

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- Collected surface and subsurface soil samples in the City Park and Southern Industrial Area of the landfill as part of the Removal Site Evaluation

The nature and extent of contamination were determined in each area. EPA was not granted access to the main portion of the Landfill that sits in Delaware County/Darby Township until 2006. As a result, focused investigation efforts prior to 2006 were conducted in the Eastwick Recreational City Park and neighborhood as well as Darby Creek, Cobbs Creek and the John Heinz NWR. The information gathered from the activities conducted up through 2006 are discussed in the 2011 RI Report. Supplemental investigation activities were conducted between 2010 and 2012 to further evaluate groundwater impacts and the potential for VI. The potential presence of two historic and culturally significant areas in the vicinity of the Clearview Landfill was also researched. The information gathered from these activities is discussed in the 2012 RI Report Addendum.

The following technical data was obtained as part of these RI activities.

5.2.1 Landfill Stratigraphy and Waste

Figure 6 identifies both the historical extent of Landfill activities (based on historic aerial photograph analysis) as well as the current estimated extent of waste based on the findings from the RI. There is an estimated 2,847,467 to 3,000,000 cubic yards of waste present in the Landfill. Approximately 33.5% of the waste sits below the natural water table and is permanently saturated. Waste consists of a variety of materials including municipal waste, construction debris, scrap metal, soils, etc. The Landfill ranges in thickness from 8 to 75 feet with the thickest areas being in Zone 1 and thinning out to the east. In Zone 3, demolition debris is common (bricks, wood, etc.) and appears to be a relic of demolition of structures that pre-dated the existing Eastwick townhouses constructed in the mid-1970s.

Based on soil boring and monitoring well drilling logs, seven geologic cross-sections of Clearview Landfill were generated to depict general stratigraphy of the Site. **Figures 7 through 9** show cross-sections near the southern industrial area (in west-to-east direction); northern part (in west-to-east direction), and central and western areas (in the north-to-south direction) of the landfill, respectively.

Clearview Landfill is situated on unconsolidated coastal plain sediments overlying bedrock of the Wissahickon Formation. Bedrock was encountered at depths ranging from approximately 18 feet below ground surface (bgs) in the Eastwick neighborhood to as deep as approximately 44 feet bgs at monitoring well MW04 (see **Figure 5**) located in the southern industrial area of the landfill near the Darby Creek stream channel.

The geology and stratigraphy in each investigative zone of the Site are described briefly below (from the surface layer downward):

<u>Clearview Landfill</u>

- Fill soil, concrete, and construction debris up to approximately 20 feet thick at ground surface, consistent with construction and miscellaneous waste disposal that occurred up to at least 2001 (visible on the 2002 aerial photography and during site visits for RI).
- Landfill wastes up to 75 feet thick at the highest point (center) of Clearview Landfill, including undifferentiated garbage, miscellaneous wastes, and fill soils.

- A discontinuous peat layer (an organic-rich marsh deposit) present in many boreholes, with a thickness of 1 to 3 feet.
- 10- to 15-foot thick layers (in total) of sand, gravel, silt, and clays, similar in description to natural Trenton Gravel deposits, but often difficult to distinguish from overlying fill soils.
- Wissahickon Formation rock, consisting of micaceous schist (with distinctive muscovite mica). The Wissahickon Formation typically showed a highly-weathered upper rock zone grading into harder, less-weathered deeper bedrock. Monitoring wells MW04, MW05D, and MW07D encountered Wissahickon Formation rock during drilling (**see Figure 5 for locations**).

City Park

- 1- to 2-foot thick (thicker in places) fill soil at ground surface. In some areas, particularly the northern open field of City Park, there is only a very thin soil fill cover, and wastes visibly protrude at ground surface. Aerial photographs indicate that the City Park area was largely covered with thick landfill waste and re-graded.
- Landfill wastes with 8 to 12 feet thickness (at least) in the formerly existed marshland below the current City Park area. **Figure 10** shows the extent of marsh and stream channels, now filled with wastes and soil.
- A discontinuous natural organic peat layer (an organic-rich marsh deposit) with a thickness of 1 to 3 feet. This layer was present in many boreholes installed within the formerly existed marsh.
- Discontinuous sand, silts, and clays, with a total thickness of 10 to 15 feet. This layer lies above bedrock. These apparently natural soils are similar in description to natural Trenton Gravel deposits, but are often difficult to distinguish from overlying fill soils.
- Wissahickon Formation rock, consisting of micaceous schist (with distinctive muscovite mica). The Wissahickon Formation typically showed a highly-weathered upper rock zone grading into harder, less-weathered deeper bedrock. Monitoring wells MW1S and MW08 in the City Park encountered Wissahickon Formation rock.

Eastwick Neighborhood

- Re-worked fill soil and demolition debris in one-to-two feet thickness (thicker in places) at ground surface. Demolition debris is common (bricks, wood, etc.) and appears to be a relic of demolition of structures that pre-dated the current Eastwick Neighborhood townhouse construction in the mid-1970s.
- A 15- to 25-foot thick (in total) layer of discontinuous sand, silts, and clays. This layer lies above bedrock. These appear to be natural soils that are similar in description to natural Trenton Gravel deposits.
- Wissahickon Formation rock, consisting of micaceous schist (with distinctive muscovite mica). The Wissahickon Formation typically showed a highly-weathered upper rock zone grading into harder, less-weathered deeper bedrock. This formation was encountered at boreholes GP007, GP008, GP010, GP011, GP013, GP014, and GP015 during drilling (**Figure 11**).

5.2.2 Landfill and Soil Gas

VOCs (primarily petroleum related VOCs) and Landfill-related gas components were the primary compounds detected throughout the Landfill study area. Methane was widely detected, but consistently at much lower concentrations (less than 5% of all landfill gases) except for several locations

within City Park. Active or recently closed municipal solid waste (MSW) landfills that undergo biodegradation (mostly anaerobic) typically have 40 to 60% methane content in landfill gas. The comparatively low methane content in on-site soil gas suggests that (a) most of the organic fraction of landfilled waste has already decomposed; (b) the majority of organics has dissolved and washed out (commonly occurring in a landfill with no engineering cover/liner systems); or (c) organic waste was a relatively small fraction of the original waste content. However, the third assumption is less likely based on historical information in that MSW was reportedly a large part of the waste managed at Clearview Landfill. Increased moisture in the waste within the former wetlands and stream channels likely contributed to the elevated methane readings observed in portions of City Park. Several Geoprobe® locations (**Figure 11**) including GPs: 024, 029, 031, 032, 033, 035, 036, 046, 055, 085 and SG024 had methane concentrations greater than 5%. The explosive range for methane is between 5 and 15%. Given the proximity of these sample locations to homes in the Eastwick Neighborhood, additional gas measurements were collected closer to the homes. Results indicated that migration of Landfill gases under residential properties was not occurring.

Table B. VOCs Detected Above Screening Criteria
(X = Detection)

Compound	Clearview Landfill	City Park	Eastwick Neighborhood
1,2,4-trichlorobenzene	X		
1,3,5-trimethylbenzene	X		X
1,3-dichlorobenzene	X		
1,4-dichlorobenzene	X		X
benzene	X		X
carbon disulfide	X		
chlorobenzene	X	X	
chloroethane	X	X	
dichlorodifluoromethane (Freon 12)	X	X	
methyl tert-butyl ether (MTBE)	X	X	X
tetrachloroethene (PCE)	X	X	X
trichloroethene (TCE)	X	X	X
vinyl chloride (VC)	X	X	
1,1,2-trichloroethane		X	X
1,2-dichloroethane		X	
benzyl chloride		X	
carbon tetrachloride		X	
chloroform		X	X
cis-1,2-dichloroethylene		X	
methyl ethyl ketone (2-butanone)		X	
methylene chloride		X	
1,2,4-trimethylbenzene		X	X

The Landfill consistently had the most frequent detections of total VOCs at elevated levels when compared to City Park and Eastwick Neighborhood. Benzene was the most frequently detected substance in soil gas throughout the Clearview Landfill and surrounding areas. Comparatively high

levels of VOCs were detected in the central and southern parts of the Landfill. The maximum concentration of benzene in the Landfill was 1,200 micrograms/cubic meter (μg/ m^3) at GP-230. The range of other VOC concentrations in the Landfill was 50 to 2,000 μg/m3 in the southern area and 4,671 μg/ m^3 in the central area at GP-220. More significant levels of VOCs were detected in the northern open field and central parts of City Park. Elevated concentrations of VOCs were detected in four locations within City Park - two in the northern open field (12,080 μg/m^3 at GP033 and 12,092 μg/m^3 at VM06) and two in the central part (13,119 μg/m^3 at VM01 and 13,029 μg/m^3at VM03). Methyl ethyl ketone (2-butanone), a common industrial solvent, was the major contributor in the VM wells. The primary VOC at GP033 was dichlorodifluoromethane (Freon-12). Levels of VOCs detected in the Eastwick Neighborhood area were not significant. The maximum benzene detection was 97 μg/m^3 at GP016, which also had the highest level of total VOCs (787 μg/m^3) attributable primarily to chloroform, which is not considered to be related to the Landfill. VOCs that were detected above EPA risk-based concentrations (RBCs) (now referred to as Regional Screening Levels [RSLs]) in each area of investigation are indicated in **Table B**.

Modeling of potential indoor air contaminant concentrations indicated that the benzene concentration detected at GP098 and chloroform at GP016, would exceed their respective indoor air RBCs. Chloroform is not considered to be a Landfill-related contaminant. To further evaluate the potential for VI of Landfill related compounds, a residential VI evaluation was conducted in 2010 and 2011. VOCs potentially related to the Clearview Landfill were detected in several air samples collected from various residential sampling locations. However, in many instances, it appeared as though the sources of these VOCs were related to activities inside of the buildings and/or the outdoor air. No significant accumulation of any vapors was noted under any structure and no unacceptable risks were identified. The full VI report is available in the 2012 RI Addendum. No additional action or investigation is necessary to address VI issues related to the Site.

5.2.3 Surface and Subsurface Soils

For the RI, typically three soil samples at different depths were collected from each sampling location, including one surficial (0-6 inches bgs) sample and two subsurface (0.5 feet - 32 feet bgs). Inorganics, semi-volatile organic compounds (SVOCs), pesticides and PCBs were the principle classes of contaminants detected in surface and subsurface soils. With the exception of several SVOCs (mostly PAHs), contaminant concentrations generally decreased with depth.

The key compounds with regard to contaminant distribution, frequency of occurrence and relative magnitude in concentrations consist of arsenic, lead, benzo(a)pyrene (a PAH), PCBs, total pesticides and dioxins. **Figures 12** and **13** display the detected concentrations for PCBs and benzo(a)pyrene (B[a]P), respectively. Generally, the other Site-related contaminants followed similar distribution patterns.

<u>Clearview Landfill Soils</u>

The southern portion of the Landfill, referred to as the southern industrial area (SIA) is the most impacted portion of the Landfill with regard to all contaminants. Eighteen (18) inorganic elements were detected above their respective RBCs in the Landfill surface soil. Five sampling locations (GP215, GP231, GP237, GP239, and GP251 – all in the SIA) contained elevated arsenic concentrations up to 42.2 milligrams/kilogram (mg/kg). Lead concentrations exceeded 400 mg/kg, the EPA residential soil lead

level (USEPA OSWER Directive 9355.4-12, July 14, 1994), at 12 locations. Four locations had lead concentrations greater than 1,000 mg/kg, the EPA level for industrial use (1,840 mg/kg at GP215; 1,410 mg/kg at GP231; 1,130 mg/kg at GP239; and 1,060 mg/kg at GP248), all in the SIA. Other metals detected at elevated concentrations include aluminum and iron. No subsurface soil samples collected within the landfill were analyzed for metals or pesticides.

SVOCs, particularly PAHs, were detected throughout the Landfill surface soil. The two highest concentrations of B(a)P were detected at GP219 (11,000 µg/kg) and GP277 (8,000 µg/kg). A cluster of medium to high PAH concentrations (90 – 4,000 µg/kg) was detected in the SIA. The locations with significant concentrations of PAHs in subsurface soil were typically located near Darby and Cobbs Creeks and in the SIA (GP218 – 110,000 µg/kg at 10 feet bgs).

As with other contaminants, very high concentrations of total PCBs (**Figure 12**) were detected within the SIA. The most commonly detected PCB was PCB-1260 (Aroclor 1260). The highest concentrations were observed at GP215 (51,000 µg/kg) and at GP239 (280,000 µg/kg). Surface soil in the low area of the southern part of City Park (near GP034 and 035) was also impacted by PCBs, most likely transported from the Landfill (see City Park section below.) PCBs in subsurface soils exceeded the Toxic Substances Control Act PCB Remediation Waste threshold of 50,000 µg/kg at three locations—GP215 (91,000 µg/kg), GP234 (120,000 µg/kg), and GP245 (2,100 µg/kg), all in the southern part of the Landfill.

Concentrations of total pesticides in Clearview Landfill ranged from 2.6 to 24,702 µg/kg. The highest concentration was detected at GP239, located in the SIA. Total dioxin concentrations in subsurface soils (10 feet bgs) were 8.87 picogram per gram (pg/g) (or parts per trillion (ppt)) at GP241 and 47.26 pg/g (or ppt) at GP245. These detections exceeded the EPA Region 3 RSL for residential soil of 4.5 pg/g (ppt). However, these detections were less than ecological screening value (ESV) of 10,000 pg/g (ppt), the EPA draft recommended interim PRGs for residential land use (51 pg/g (ppt) toxic equivalency [TEQ]) and commercial/industrial outdoor worker (664 pg/g (ppt) TEQ).

Special Note on Dioxin Nomenclature Used in this Document

Dioxins and furans are presented in this document using a "Toxic Equivalence" (TEQ) system, in which the total (sum) concentration of polychlorinated dibenzodioxins (dioxins or PCDDs) and polychlorinated dibenzofurans (furans or PCDFs) are reported as "Toxic Equivalence" to the specific dioxin compound 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). Comparisons of actual measured dioxin concentrations throughout this document are made using this "Toxic Equivalence" system.

Numerous samples were collected as part of a Time-Critical Removal Action (TCRA), as discussed in further detail under the **Scope and Role of Response Action** section, to characterize the extent that PCBs were above action criteria. As discussed above, the majority of PCBs above action criteria were removed during the TCRA, however due to accessibility issues because of existing buildings that are on the Site, four locations (GPR-11, -132, -147, and -166) with PCBs in excess of action criteria remain on Site (**Figure 2**). Two locations have PCBs at concentrations greater than 50

mg/kg: GPR-132 at 8 feet bgs and GPR-147 at 3 feet bgs. Two other locations have PCBs at concentrations greater than 100 mg/kg: GPR-11 at 8 – 10 feet bgs and GPR-166 at 25 feet bgs. EPA policy states that PCBs at concentrations greater than 100 mg/kg are considered principal threat waste (see **Principal Threat Waste** section below for more information).

City Park Soils

Key contaminants in Zone 2 (City Park) were the same as those detected in Zone 1 (Landfill), although at a lower frequency of screening criteria exceedances and generally at lower concentrations. Very high vapor concentrations, free-product oil, and visually-evident contamination were detected in subsurface soils in the northern part of City Park. However, the analytical results for subsurface soil indicated very low concentrations of contaminants.

Arsenic and lead were both frequently detected throughout City Park with the most significant concentrations being located in the northern portion of City Park and the far southern portion adjacent to the SIA in Zone 1 (Landfill). The majority of the arsenic concentrations were similar to one another and regional background levels. Concentrations between 7 and 15.2 mg/kg were detected at GP026, 029, 032, 035, and 081, with GP032 being the highest. Five locations exhibited lead concentrations over 400 mg/kg with the highest concentration at GP021 (8,540 mg/kg).

Significant concentrations of B(a)P were detected in surface soils throughout City Park and ranged from non-detect to 4,000 µg/kg (**Figure 13**). The current EPA Regional Screening Level for B(a)P in residential soil is 15 µg/kg. The highest concentration was detected at GP018 (4,000 µg/kg) located in the northern part of City Park. High concentrations of B(a)P were also detected in sampling locations GP031 (3,900 µg/kg) and GP034 (2,400 µg/kg), which were located near the Angelo Place residences. Boring GP034 also encountered probable free-product oil. Many SVOCs were detected in subsurface soils throughout City Park area as well. Maximum B(a)P levels were observed at GP094 (13,000 µg/kg), GP034 (2,000 µg/kg) and GP247 (1,200 µg/kg).

Surface soil PCB concentrations ranged from non-detect to 37,000 µg/kg. The surface soil in the low area of southern City Park might receive drainage from the southern industrial area of the Landfill with elevated total PCB concentrations, resulting in high PCB contamination (e.g., 37,000 µg/kg at GP034; 16,600 µg/kg at GP035; and 6,100 µg/kg at GP037). Elevated PCB concentrations were detected at GP021 (1,700 and 390 µg/kg for PCB-1242 and 1260, respectively) located within the northern City Park, along with high levels of other contaminants.

Pesticides, including aldrin, dieldrin, endrin, gamma chlordane, methyoxychlor, DDD, DDE, and DDT, were found mostly in the southern part of City Park (total pesticide concentration of 2,305 µg/kg at GP034, 216 µg/kg at GP035, and 328µg/kg at GP037). In addition, two other locations, GP021 and GP090, exhibited total pesticide concentrations of 199 and 297 µg/kg, respectively. The highest concentration of total pesticides in subsurface soils (primarily DDD and DDE) was detected in the deep soil sample collected from location GP018 (1,670 µg/kg) in the northern part of City Park near the open field.

To further evaluate potential risks, the northern portion of City Park surface soils were sampled for lead, PCBs and PAHs as part of the RSE in 2011. Analytical results were compared to appropriate screening levels and did not indicate a need to address soils in this area under the TCRA.

Supplemental subsurface samples (GPRs 107 and 112) collected during the TCRA exhibited unique characteristics, e.g., bright coloring, high VOC readings, etc., and were submitted for additional contaminant analysis. Results of the sample analyses indicated high concentrations of several VOCs, SVOCs (primarily PAHs), pesticides, diesel range organics (DRO) and gas range organics (GRO). These samples came from beneath the water table and represent a potential source for groundwater contamination.

Eastwick Neighborhood Soils

Most arsenic concentrations in Zone 3 were at or below the background value of 8.25 mg/kg. The highest concentration was detected at GP102 (20.2 mg/kg), located in the northern portion of the Eastwick Neighborhood. No location had lead concentrations above 400 mg/kg.

The primary SVOCs detected in exceedance of applicable RBCs and/or ESVs were PAHs. Concentrations of B(a)P ranged from non-detect to 3,600 μg/kg. Substantial concentrations of B(a)P were detected at four locations—2,500 μg/kg at GP007; 3,600 μg/kg at GP106; 2,800 μg/kg at GP108; and 2,200 μg/kg at GP109. GP007, 106 and 109 were collected from beneath an asphalt surface. Locations of detection and concentrations of B(a)P (and other SVOCs) were relatively low and very sporadic in subsurface soil.

Only four locations (GP008, 017, 105, and 109) had detections of PCBs in surface soil. Of these, surface soil at GP109 (collected from beneath asphalt surface) located near City Park area exhibited was the only sample that exceeded the RBC value (320 mg/kg) or ESV (100 mg/kg) for PCB-1260 with a concentration of 370 μg/kg.

Pesticides were detected at low concentrations in the Eastwick Neighborhood. However, no locations within the Eastwick Neighborhood exhibited concentrations that exceeded their RBCs or ESVs. One high concentration (5,600 μg/kg of DDD) was detected in the deep subsurface soil sample at GP002.

Extent of Non-Aqueous Phase Liquids (NAPLs)

Free-product oil or non-aqueous phase liquids (NAPLs) were noted during drilling of several borings and wells within the Clearview Landfill waste. NAPLs can partially dissolve into water at very slow rates and form a visible, separate oily phase in the subsurface. Evidence of NAPLs was observed in GP027, 031, 032, 033, 035, 050, 218, 224, and 227 as well as monitoring wells MW-04, MW-10 and MW-12, primarily in the form of sheens or strong odors. However, analytical results of groundwater samples from these boreholes and monitoring wells were not indicative of NAPLs being present in significant quantities or acting as major source of groundwater contamination. To date, measurable levels of oils or NAPLs accumulating on the top or bottom of the water column have not been observed in any borings or monitoring wells. Evaluation of potential groundwater contamination source areas within the waste as well as other questions are being addressed under the OU3 RI/FS.

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5.2.4 Stormwater Runoff

Stormwater or runoff on Clearview Landfill drains either toward Darby and Cobbs Creeks, or inland toward City Park. Significant ponding of water occurs in low lying portions of the Site after high precipitation events.

Metals were most commonly detected in stormwater. Three metals (arsenic, iron, and manganese) were detected above their respective RBC. One metal, lead, was detected above its EPA RSL (15 μg/L). Three VOCs (1,4-dichlorobenzene, MTBE, and PCE) were detected above their respective RBC in six stormwater samples. Five SVOCs, (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, and indeno[1,2,3-C,D]pyrene) were detected above their respective RBC in the stormwater sample from CS04. One pesticide, heptachlor epoxide, was detected above its RBC at one location (CS02) during a dry period.

5.2.5 Groundwater

Extensive groundwater sampling was conducted as part of the initial Clearview Landfill RI. Several data gaps still exist regarding the extent of impacted groundwater associated with the Landfill. These gaps are being addressed under the OU3 RI/FS. The conclusions from the initial groundwater investigation (RI and RI Addendum) are presented below. Currently, the groundwater in the vicinity of the Landfill is not being used for drinking water or other potable uses as the area utilizes public water utilities to supply drinking water.

Numerous groundwater samples were collected from Geoprobe® borings and permanent monitoring wells, including 21 overburden wells and 7 bedrock wells (**Figure 5**), throughout the Landfill, City Park and Eastwick Neighborhood. Low to moderate levels of Landfill-related pollutants were present throughout the Site at levels that exceeded their respective RBC (or RSL in more recent rounds of sampling). Groundwater in the main body of the Landfill (Zone 1), particularly in the central and SIA areas, is the most impacted. Similar contaminants were detected throughout the Landfill and City Park, including inorganics, many SVOCs, VOCs, and pesticides. A groundwater mound (or high water table) exists under the Landfill and produces radial groundwater flow away from Clearview Landfill in the shallow (coastal plain sediments) aquifer (**Figure 5**). This mound provides a large amount of recharge to the groundwater system in the area. A significant portion of groundwater flows east under the Eastwick Neighborhood and is suspected to alter its course northward and/or southward and eventually discharge into Darby Creek as a result of local groundwater flow towards the creek. Groundwater recharge of precipitation occurs throughout the Clearview Landfill area. Groundwater and/or leachate visibly discharged at seeps in the banks of the Darby and Cobbs Creeks north, west, and southwest of the Landfill. Gas bubbles were observed in the base of the Darby and Cobbs Creeks, suggesting that groundwater/leachate seeps into the creek beds with actively decaying organic matter. There is also potential for contaminated groundwater to migrate beneath Darby and Cobbs Creeks.

Figure 14 shows the approximate extent of leachate migration into the groundwater system in the Landfill area, based on specific conductivity[1] measured in the monitoring wells during August 2011.

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1 Specific conductivity is a measure of water's ability to conduct electricity and, therefore, found to be a good measure of total dissolved solids and salinity in groundwater - the higher the concentration of ionic (dissolved) constituents, the higher the conductivity. High specific conductivity in groundwater is usually an indicator of landfill leachate migration to groundwater. Specific

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As shown in the figure, the "plume" of higher specific conductivity is largely located east of the limit of the Landfill, and is consistent with an eastward component of groundwater flow. Therefore, it is likely that groundwater has carried dissolved constituents eastward below the Eastwick Neighborhood. The presence of elevated concentrations of 1,4-dioxane in MW-15S provides further confirmation of impacted groundwater migration. 1,4-dioxane is very mobile and often found to be present at the leading edge of groundwater contaminant plumes. The furthest extent of the eastward flow has been approximately defined as part of the field investigations of the OU3 RI/FS which utilized 1,4-dioxane, arsenic and trichloroethene (TCE) as the indicator parameters for delineation of impacted groundwater in the overburden and bedrock aquifers. Because of its characteristics (high mobility and miscibility in water), the 1,4-dioxane plume is presumed to represent the approximate maximum extent of groundwater impacts associated with the Landfill. In summary, the 1,4-dioxane plume was found to extend in the overburden aquifer several blocks east of Lindbergh Blvd. and south of S. 84th St. Arsenic impacts in groundwater appear to remain limited to the approximate landfill activity boundary and cover an aerial extent that is approximate to the plume shown in **Figure 14**. A small area of elevated TCE concentrations were detected in the most southeastern portion of the historic landfill boundary; a spatially limited TCE plume was also detected moving southward in the shallow bedrock aquifer. Numerous contaminants were detected in landfill leachate and stream sediment porewater. Additional monitoring wells will be installed as part of the RI/FS and sampled for a larger suite of contamination.

Clearview Landfill

Arsenic, iron, manganese and vanadium were more frequently detected at high concentrations than other inorganics. Concentrations of arsenic have been detected as high as 201 micrograms/liter (µg/L) at GP241 (located in the SIA); the EPA arsenic tap water RSL is 0.045 µg/L. Several locations along the central portion of the Darby Creek bank were impacted by elevated levels of PAHs in groundwater, including the highest observed concentration of B(a)P at GP218 with 7.6 µg/L. The SIA was the most heavily impacted area with regards to PAHs. 1,4-dioxane (historically used as a stabilizer) is frequently detected throughout the Landfill. Maximum detections have been observed at monitoring wells (MW) 1D and 11 with concentrations of 180 and 160 µg/L, respectively. VOCs, particularly fuel-related compounds such as benzene and chlorobenzene, followed distribution patterns similar to PAHs. MW-10 and MW-11 are the only wells to have PCB detections in the most recent rounds of monitoring (April and August 2011). The highest concentration of PCBs in groundwater to be observed at the Site was at GP243 (in the SIA) with a level of 54 µg/L. High concentrations of total pesticides were detected mostly in the groundwater samples from within and adjacent to the SIA with GP243 again having the highest concentration of 8.2 µg/L.

City Park

Inorganics were more frequently detected in groundwater samples collected in City Park than other classes of contaminants. The distribution and magnitude of detected arsenic is generally representative of the other inorganic contaminants detected at the Site, including City Park (**Figure 15**).

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conductivity generally reflects the impacts of highly mobile, dissolved mineral salts such as chloride ions that are normally present in landfill leachate. These mobile salts are "conservative" tracers of groundwater contaminant migration that migrate faster in groundwater than most other organic and inorganic/metals contamination. Because most other organic and inorganic/metals contaminants migrate more slowly than these salts (an effect called "retardation"), the limits of groundwater-borne contamination are normally less extensive than these conservative leachate-related indicators.

In other words, areas with elevated levels or more frequent detections of arsenic in groundwater typically also had elevated levels or increased frequency of other inorganic contaminants. Sample GP-067, adjacent to the SIA, had the highest concentration of arsenic at 241 µg/L. SVOCs were not commonly detected above RBCs in City Park. 1,4-dioxane was also detected in MWs 1S/D , 2S, and 14S at concentrations above the RSL in at least one of the 2011 samples with MW-1D registering the highest concentration of 150 µg/L. Limited detections of VOCs and PCBs were found sporadically above RBCs and RSLs in the northern and southern portions of City Park, primarily adjacent to the SIA and the county boundary (in the north). Pesticides were similarly patterned to, although detected more frequently than, VOCs and PCBs. The highest concentration of pesticides was detected within soil boring GP067 (adjacent to SIA); a similar concentration was also detected at GP026 near the tennis courts.

Eastwick Neighborhood

Inorganics were detected less frequently above RSLs in the Eastwick Neighborhood. Arsenic was detected at six locations at concentrations ranging from non-detect to 31.4 µg/L; the highest concentration being at GP-017. SVOCs and VOCs, with the exception of 1,4-dioxane at MW-16S and vinyl chloride at MW-15S, were not detected above RBCs or RSLs. No PCBs or pesticides were detected within the Eastwick Neighborhood.

Bedrock

Several bedrock wells were installed in 2011 around the perimeter of the Landfill to evaluate potential impacts from the Landfill on groundwater quality. Exceedances of EPA RSLs in the bedrock wells were detected in the MW-13I/D cluster and were limited to tetrachloroethene (PCE), trichloroethene (TCE) and its daughter breakdown products, 1,4-dioxane, arsenic and chromium. Levels of TCE and its daughter products were greater than any historical detections within the Landfill or adjacent shallow aquifer.

5.2.6 Sediment and Surface Water

Sediment

A total of forty four (44) sediment and surface water samples were collected upstream, adjacent to and downstream of the Clearview Landfill as part of the RI. PAHs were detected more frequently and at much higher concentrations than any other class of contaminants in the sediment samples. **Figure 16** shows the spatial distribution and concentrations of total PAHs from all sampling locations in 2002 and 2005. A pattern of increased PAH concentrations downstream of Clearview Landfill and other potential sources, e.g., urban runoff upstream, tank farm and Folcroft Landfill, is clearly evident. PAHs concentrations were highest at location SD24 immediately downstream of Clearview Landfill in 2002. PAH concentrations at SD24 and all other locations resampled in 2005 were markedly lower. This could be a function of heterogeneity within the sediment as well as erosion and depositional forces at work in the creek, as it is tidally influenced. Five sampling locations, SD23 through 27 in Darby Creek adjacent to/downstream of the Landfill exhibited elevated concentrations of benzo(a)anthracene, benzo(a)pyrene, and/or dibenz(a,h)anthracene which exceeded their respective RBC and/or ESV. Inorganics that were detected above their respective screening values in sediment samples collected from Darby Creek near Clearview Landfill were arsenic, antimony, cadmium, copper, iron, manganese, mercury, nickel, silver, and zinc.

As with stream sediment samples, PAHs were the most frequently detected type of organic compounds in all the Clearview Landfill leachate sediment samples, and their concentrations were greater than those of any other class of organic compounds. Leachate sediment samples represent the suspended particles contained within the liquid leachate as it discharges from the Landfill. Several inorganics exhibited elevated concentrations in leachate sediment including aluminum and iron concentration ranges of 7,930 to 23,300 mg/kg and 17,100 to 31,800 mg/kg, respectively (aluminum concentrations were below the RBC; no ESV). Arsenic was detected in exceedance of the screening values (4.3 mg/kg of RBC or 9.8 mg/kg of ESV) in five of the ten sediment samples. Other metals that were detected above their respective screening values in leachate sediment samples were cadmium, copper, iron, manganese, mercury, selenium, and zinc. Concentrations of PAHs in sediment at Tinicum Marsh (except SD31) were generally lower than upstream of the marsh; arsenic was generally higher.

The upstream background sediments in Darby and Cobbs Creeks had elevated concentrations of metals and PAHs, and relatively low concentrations of pesticides and VOCs. The source of sediment contamination downstream of the Landfill may be related to Clearview Landfill, but it is also likely that a significant portion can be attributed to other sources in the area including, but not limited to, the Folcroft Landfill, other properties initially proposed to be part of the LDCA Site, urban runoff and other non-point sources.

Surface Water

In general, the surface water samples contained far fewer contaminants at much lower concentrations than the sediment samples. Although **Figure 16** shows only results for total PAHs in sediment, as a reference, it does include all of the surface water and sediment sample locations that are discussed below. For pesticides, dieldrin was detected only at one location SW11, while heptachlor was detected at two locations in SW15 and SW18, all located in Cobbs Creek upstream of the Landfill. Low levels of PAHs were detected above or equal to their screening values at four locations (SW11, SW13, SW16, and SW19) in Cobbs Creek upstream of the Landfill; one location (SW7) in Darby Creek upstream of the Landfill; and one location (SW28) in Darby Creek downstream of the Landfill. Several VOCs were detected at low concentrations, but above their screening values, including carbon disulfide (upstream), TCE (SW29, SW34, SW 17, SW19), 1,1,2,2-tetrachloroethane (SW22, SW24, SW26), PCE (SW1) and toluene (SW11, SW13, SW14). Many inorganics in surface water samples were detected above their respective RBCs or ESVs.

Similar to the findings in the surface water samples, the aqueous leachate samples did not contain many organic compounds such as SVOCs, PAHs, VOCs, and pesticides. Leachate seep sampling locations are shown in **Figure 19**. Only metals were detected at elevated concentrations, and generally at higher levels than the surface water samples. Beta BHC (locations LS/LC-3, LS/LC-4), heptachlor (locations SEEP2, SEEP3, SEEP4, and SEEP5), and heptachlor epoxide (SEEP4) were detected at concentrations above their respective RBC or ESV. Water quality parameters analyzed for the aqueous leachate samples collected in 2002 indicated that the seeps consist of large amounts of groundwater mixed with the leachate.

Background surface water samples in Darby Creek upstream of the Landfill contained fewer analytes and at lower concentrations than surface water in Cobbs Creek or Darby Creek downstream of the Landfill. Background surface water samples upstream in Cobbs Creek were often higher than downstream. These levels could be attributable to numerous stormwater/sanitary sewer outfalls into Cobbs Creek that receive discharges from industrial and municipal processes, combined sewer

overflows, sanitary sewer overflow, stormwater non-point runoff, and urban drainage.

5.3 Conceptual Site Model

Sampling during the RI has identified numerous types of contaminants of concern (COCs) present in the soil, soil gas, groundwater and sediment within or in the vicinity of the Landfill. Potential contaminant migration pathways identified for the Site include:

- Airborne migration of fugitive dust and Landfill gas
- Soil/waste to groundwater migration
- Groundwater/leachate to surface water migration
- Surface runoff
- On-site sediment migration
- Creek sediment migration
- Subsurface vapor intrusion

Since an engineered cover system was never placed on the Landfill, surface soils may be eroded and underlying wastes may be exposed by stormwater during high precipitation events. Human and ecological receptors could then come into direct contact with contaminants in exposed soils and wastes. The possible pathways for contaminant migration and exposure media which provide a potential route of contact with human receptors are shown in **Figure 17.** Contaminants attached to soil and sediment may also be transported into Darby Creek and enclosed low areas on the east side of the Landfill adjacent to the residential properties. Water also pools in low areas throughout the Site and infiltrates into soil and waste. There is no bottom liner to prevent groundwater impacts and regional groundwater flows to the southwest toward the Delaware River. Wastes situated below the water table will continue to generate landfill leachate and impact the groundwater in the alluvial and potentially the bedrock aquifers.

Contaminated shallow groundwater (generally at depths less than 20 to 40 feet bgs) flows radially out from the center of the Landfill towards Darby and Cobbs Creeks, south towards the southern industrial area, and east under the Eastwick Neighborhood. Leachate is continuously generated from precipitation infiltration through the waste and mixes with groundwater. This groundwater mixed with leachate is the major source of seeps observed along the stream banks of the Landfill. Contaminated groundwater has also migrated eastward beyond the current Landfill footprint. The definitive fate of groundwater in the shallow aquifer as it relates to the creeks and deeper groundwater present in bedrock (e.g., at depths greater than 40-60 feet bgs) is not fully understood at this time; additional study as part of OU-3 RI/FS is underway to better characterize the nature and extent of the impacted groundwater. However, groundwater beneath or near the Landfill is not currently used as a potable water supply (potable water for residents in the vicinity is supplied by the City of Philadelphia Water Department, and no private or public water-supply wells were identified during the RI in the area); therefore, no complete exposure pathway currently exists for humans. The reasonably anticipated future use of the groundwater near the Site is expected to remain the same.

Surface water in Darby and Cobbs Creeks near Clearview Landfill flows to the John Heinz NWR at Tinicum. Sediment in those creeks is typically much more contaminated than surface water by the Site-related contaminants such as PAHs. Based on the evaluation conducted in the RI, the outgoing tides carry six times the volume of water when compared to what is brought in on the incoming tides. Within Tinicum Marsh, there is extensive mixing of water and sediment during each tidal cycle, making it difficult to distinguish Clearview Landfill contaminants from those derived from other sources. The Site-related contaminants are very similar in nature, concentration, and migration properties.

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With regard to the characteristics of the contaminants at the Site, most of the PAHs detected at the Clearview Landfill are very slow to degrade naturally and readily stick to soil and sediment; they can also accumulate in some organisms. The PCBs at the Site are even more persistent in the environment than PAHs and act in a similar manner. Pesticides found at the Site have varying rates of natural degradation, but are more readily destroyed by natural processes, e.g., sunlight, volatilization, than PAHs and PCBs. Inorganics found at the Site typically do not degrade or change toxicity naturally in the environment. The VOCs at the Site were found less frequently, are more mobile and degrade much quicker than most PAHs, PCBs, pesticides and inorganics.

The potential human and ecological risks from these contaminants and exposure pathways are discussed further under **Section 7.0 Summary of Site Risks** section below.

5.4 Principal Threat Waste

The proposed action is intended to address principal threat wastes at OU1. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure.

The EPA *Guidance on Remedial Action for Superfund Sites with PCB Contamination*, (August 1990, EPA/540/G-90/007) indicates that for residential areas, PCBs in concentrations greater than 100 mg/kg are generally considered to be principal threat wastes. Given the Landfill and the SIA's proximity to residential areas and pursuant to the EPA guidance, EPA has determined that the PCBs in the vicinity of GPR-11 (at a depth of 8-10 feet bgs) and GPR-166 (at a depth of 25 feet bgs) within the SIA portion of the Site that remained after the TCRA at concentrations greater than 100 mg/kg are principal threat waste (**Figure 2**). As discussed under the **Summary of Remedial Alternatives**, wastes with PCB concentrations greater than 100 mg/kg in the vicinity of GPR-11 will be excavated and sent off-site for treatment (if feasible) and disposal. As the PCBs are contained within the Landfill waste, treatment of the PCBs prior to disposal may not be feasible due to comingling of other potential contaminants not amenable to those treatment technologies which can address PCBs. If the PCBs cannot be treated, they will be disposed of at a permitted facility. The PCBs in the vicinity of GPR-166 are buried at a depth such that accessing and removing them from the waste would result in a greater overall risk to human health due to risks posed to workers as reaching such a depth could result in unstable excavation conditions or require substantial additional excavation of wastes that are not impacted by PCBs in order

What is a "Principal Threat?"

The National Contingency Plan (NCP) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 C.F.R. Section 300.430(a)(iii)A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that acts as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in groundwater may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur.

to maintain competent excavation walls. As such, the PCBs in the vicinity of GPR-166 will be contained in place and are addressed in this ROD.

6.0 CURRENT AND POTENTIAL FUTURE LAND USES

The estimated maximum extent of landfilling activities associated with the Clearview Landfill is 64 acres. The portion of the Landfill in Delaware County encompasses 44 acres and is where the majority of the waste is currently located. The majority of the Landfill in Delaware County is not in use, however several businesses operate in the Southern Industrial Area (SIA) portion of the Landfill. There are several structures of various size and construction within the SIA and which are being used by the various businesses. The SIA and other portions of the Landfill can only be accessed with automobile via the main access road. This access road can only be accessed through S. 84th St. in Philadelphia. The Delaware County portion of the Landfill is bordered by the Eastwick Recreational City Park to the east and Darby and Cobbs Creek to the west. The Eastwick Recreational City Park is bordered to the north and east by residential properties.

It is anticipated that Clearview Landfill (Zone 1) could continue to be used primarily for industrial purposes in the future, if allowed by the OU1 remedy, the City Park (Zone 2) for recreational purposes, and Eastwick Neighborhood (Zone 3) for residential purposes. However, the proximity of Zone 1 to recreational and residential areas increases the potential likelihood for non-industrial uses of Zone 1.

7.0 SUMMARY OF SITE RISKS

As part of the RI/FS, a Baseline Human Health Risk Assessment (HHRA), supplemental vapor intrusion HHRA, Screening Level Ecological Risk Assessment (SLERA), and Baseline Ecological Risk Assessment (BERA) were conducted to evaluate the potential risks to human health and the environment from chronic exposure to contaminants of concern associated with the Site. The HHRA was conducted in order to estimate the probability and magnitude of potential adverse human health effects from exposure to Site contaminants, assuming no further response actions were taken at the Site. The SLERA and BERA were conducted to identify the potential of the Site contaminants to adversely affect ecological resources in the absence of further response actions at the Site. The risk assessments provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the selected remedial action for OU1.

This section of the ROD summarizes the results of both the baseline human health risk assessment and ecological risk assessment for the Site.

Given the results of these risk assessments, it is EPA's current judgment that the response action selected in this Record of Decision is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, and contaminants into the environment.

7.1 Summary of Human Health Risk Assessment

This section of the ROD summarizes the results of the HHRA for this Site. The HHRA estimates

what risks the Landfill would pose if no additional action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action.

The HHRA considered the effects of exposure to different media at the Clearview Landfill. The HHRA consisted of a four step process: (1) the identification of chemicals of potential concern (COPCs), i.e., those that have the potential to cause adverse health effects; (2) an exposure assessment, which identified actual and potential exposure pathways, potentially exposed populations, and the magnitude of possible exposure; (3) a toxicity assessment, which identified the adverse health effects associated with exposure to each COPC and the relationship between the extent of exposure and the likelihood or severity of adverse effects; and (4) a risk characterization, which integrated the three previous steps to summarize the potential and actual risks posed by hazardous substances at the Clearview Landfill, including carcinogenic and non-carcinogenic risks. A summary of these components of the HHRA, which support the need for remedial action, is discussed below.

7.1.1 Contaminants of Concern

Numerous types of contaminants (including VOCs, SVOCs, PAHs, PCBs, pesticides, dioxins and furans, and inorganics) were identified in samples from various media collected from the Clearview Landfill including soil, groundwater, surface water and sediment. A screening of sample contaminant results from each media was conducted in which the maximum detected concentrations were compared against risk-based screening levels, e.g., EPA Region 3 Risk Based Concentrations (RBCs). Through this process, contaminants were selected as COPCs.

Not every COPC was detected or selected at every exposure area or in every environmental medium sampled at the Clearview Landfill. Consequently, potential health risks and hazards are characterized based on the selected COPCs for each relevant medium at each identified exposure area.

Tables 1.1 through **1.18** present a summary of the chemical constituents compared to EPA's screening concentrations (RSLs) to determine COPCs for each media. From the COPCs that were identified during the HHRA process, contaminants of concern (COCs) were selected. **Tables 2.1** through **2.9** identify the COPCs, their arithmetic mean, the 95% Upper Confidence Level (UCL) distribution, the maximum concentration and the exposure point concentration (EPC) for each COC in soil, groundwater, and fish tissue. **Table 3** provides a summary of COCs based on media (human health and ecological) and Site specific zones. Although COCs were identified for surface water, sediment, leachate seeps, outdoor vapors and indoor vapors, subsequent risk analysis were within EPA acceptable criteria and thus no COCs were identified for these media. Therefore these media are not included in **Tables 2.1** through **2.9**. Moving forward in this document, the focus will be on the COCs found in soil and groundwater. Those media presented unacceptable risks for which remedial alternatives were developed. COCs identified from consumption from fish tissue will also be discussed.

7.1.2 Exposure Assessment

The exposure assessment identifies categories of potential human exposure based upon a characterization of the Site setting, selects potential receptors consistent with current and possible future land use patterns, and identifies possible exposure routes for each medium and the estimated concentrations of COPCs to which a receptor may be exposed.

Potential human health effects associated with exposure to conceptual site model media were estimated qualitatively through the evaluation of potential current and future exposure pathways (see **Table 4**). These pathways were developed to reflect the potential for exposure to hazardous substances at the Site. A complete exposure pathway has four components: a source, a route of transport, an exposure point and a receptor, e.g., a resident. The determination of exposure routes is made by careful examination of the current extent of affected media, the conceptual site model (CSM), as described above, and predicting contaminant migration pathways and estimating exposure point concentrations. Major assumptions about exposure frequency, duration, and other factors included in the exposure assessment are included in the RI Appendix U – Risk Assessment Guidance for Superfund (RAGS) Table 4s for appropriate media and receptors.

The HHRA studied several exposure pathways for the Clearview Landfill. The possible pathways for contaminant migration and exposure media which provide a potential route of contact with human receptors are shown in **Figure 17.** The potential human exposure risks that were assessed included potable tap water usage, outdoor excavation trench worker exposure to groundwater, contact with soils, contact with surface water and sediment, ingestion of contaminated fish, vapor intrusion to indoor air, and soil gas volatilization to outdoor air.

Due to the current variety of uses on and around the Landfill within a small area, e.g., businesses on Landfill, close proximity to residential neighborhood and a recreational park, the potential risks from soil were split into three different zones. Zone 1 included the main body of the Landfill situated in Darby Township/Delaware County, Zone 2 included the City Park and residences immediately adjacent to the City Park, and Zone 3 covered much of the remaining Eastwick neighborhood (**Figure 3**). As a result, essentially three separate risk assessments for current and potential future exposure to soils were conducted. At the time of the risk assessment, it was anticipated that in the future, Clearview Landfill (Zone 1) would continue to be used primarily for industrial purposes, City Park (Zone 2) for recreational purposes, and Eastwick Neighborhood (Zone 3) for residential purposes. However, the proximity of Zone 1 to recreational and residential areas increases the potential likelihood for non-industrial uses of Zone 1, pending the final remedial alternative and future land use decisions. As such, these factors were taken into account as part of the potential receptor selection for the HHRA.

An evaluation of potential vapor intrusion risks in the HHRA was performed using modeling and a multiple lines of evidence approach. A subsequent vapor intrusion investigation was conducted that collected air quality data from inside, outside and beneath several residences. Potential exposure risks were calculated based on these additional data. That investigation and the risk assessment results are included in the Clearview Landfill Remedial Investigation Addendum. No vapor intrusion or unacceptable risks were identified based on the properties that were sampled. Since the completion of the Remedial Investigation Addendum, a new investigation has been initiated for contaminated groundwater associated with the Clearview Landfill, referred to now as Operable Unit 3. As part of this groundwater investigation, should the results indicate groundwater is impacted with VOCs related to the Landfill in areas previously not sampled as part of the vapor intrusion investigation, the potential for vapor intrusion will be re-evaluated, as appropriate.

Exposure scenarios for various media included:

- Groundwater Exposure Pathway – Potential future exposure to chemicals in groundwater was evaluated through ingestion, skin absorption during bathing or outdoor activities that used groundwater, inhalation during showering, as well as inhalation of ambient air near leachate

seeps for residential adults and children. Inhalation and skin absorption in a narrow trench exposed to groundwater was evaluated for industrial and construction workers.

- Surface and Total Soil Exposure Pathways – Potential Current/Future exposure to chemicals in soil was evaluated through ingestion and skin absorption routes. Recreational, residential, industrial and construction use scenarios were evaluated for surface and/or total soils depending on the location (landfill, park, and neighborhood). Inhalation of soil particulate dust was not modeled because this pathway is expected to yield orders of magnitude smaller risks compared to the ingestion and skin exposure pathways. Total soil includes the combination of surface and deeper soils.

- Surface Water Exposure Pathways – Potential Current/Future exposure to chemicals in surface water was evaluated through ingestion and skin absorption routes for construction and recreation users. Due to shallow water depths, it was assumed that skin exposure would be limited to adults' feet, lower legs, and hands, and a child's hands, forearms, lower legs and feet. Surface water areas included Darby and Cobbs Creeks, Tinicum Marsh and leachate seeps.

- Sediment Exposure Pathways – Potential Current/Future exposure to chemicals in sediment was evaluated through ingestion and skin absorption routes for construction and recreational users. Parameters for the portions of the body and sediment areas were the same as those used for the surface water exposure pathway.

- Fish Ingestion Exposure Pathways – Potential Current/Future exposure to chemicals in fish tissue was evaluated for both recreational and subsistence fisherman. Fish tissue concentrations were modeled based on sediment chemical concentrations.

- Soil-to-Air Exposure Pathways – Potential Current/Future exposure to chemicals migrating from soil gas into homes or buildings was evaluated for residential adults and children, industrial workers and construction workers.

- Blood-Lead Modeling – Potential Current/Future exposure to lead from groundwater and soil were modeled for the child resident. Potential Current/Future exposure to lead from soil was modeled for adult recreational and worker scenarios.

7.1.3 Toxicity Assessment

The purpose of the toxicity assessment is to identify the types of adverse health effects that each COC may potentially cause to exposed individuals and to define the relationship between the dose of a COC and the likelihood and magnitude of an adverse effect. The toxic effects of a chemical generally depend on its inherent toxicity, the pathway of exposure, e.g., ingestion, inhalation, skin contact, exposure frequency and duration and the level of exposure. There is generally a positive relationship between the dose (chemical intake through an exposure pathway) and an adverse effect.

Typically, as the dose increases, the type and severity of adverse response also increases. These dose-response relationships and the potential for exposure must be evaluated before the risks to receptors can be determined. Adverse effects are characterized by the EPA as carcinogenic and non-carcinogenic. Dose-response values [non-cancer reference doses (RfDs) and cancer slope factors (CSFs)] have been

developed by EPA and other sources for many organics and inorganics.

Toxicity criteria for carcinogens are provided as cancer slope factors (CSFs) in units of risk per milligram of chemical per kilogram of body weight per day $(mg/kg\text{-}day)^{-1}$. CSFs are based on the assumption that no threshold exists for carcinogenic effects and that any dose is associated with some finite carcinogenic risk. The chemical- specific CSF is multiplied by the estimated daily chemical intake to provide an upper-bound estimate of the increased likelihood of cancer resulting from exposure to the chemical. This risk would be in addition to any "background" risk of developing cancer over a lifetime due to other causes. Consequently, the risk estimates in this risk assessment are referred to as incremental or excess lifetime cancer risks. Cancer toxicity criteria for COCs for ingestion/ dermal exposures are presented in **Table 5.1 and 5.2.**

The criteria used to evaluate the potential for non-carcinogenic health effects are generally referred to as Reference Doses ("RfDs"). The term RfD was developed by EPA and represents the daily exposure to a chemical that would be without adverse effects, e.g., organ damage, biochemical alterations, birth defects, even if the exposure occurred continuously over a lifetime. The RfD is provided in units of milligrams per kilogram per day (mg/kg-day) for comparison with chemical intake into the body. Chemical intakes that are less than the RfD are not likely to be of concern even to sensitive individuals. Chemical intakes that are greater than the RfD indicate a possibility for adverse effects. Noncancer toxicity values for COCs for ingestion/ dermal exposures are presented in **Table 6.1 and 6.2.**

Detected chemicals that did not have published toxicity criteria were compared to surrogate RBC criteria that were adopted from available RBCs for substances having similar chemical structure. The RBC for acenaphthene was used as a surrogate for evaluating acenaphthylene and the RBC for pyrene was used as a surrogate for evaluating phenanthracene and benzo(g,h,i)perylene since these three substances do not have published RBCs.

EPA regulates lead based on blood-lead uptake using the Integrated Exposure Uptake Biokinetic (IEUBK) model and the Adult Lead Model (ALM). EPA requires a predicted blood lead level above 10 ug/dl in less than five percent of the receptor population. However, lead is screened at 400 mg/kg for residential exposures to soil and sediment and 15 ug/L for groundwater and surface water. Blood-lead levels in residential children (ages 0 to 6) were estimated using the Integrated Exposure and Uptake Biokinetic (IEUBK) Model (version 1.0) developed by EPA. The model was applied to groundwater and soil media in areas of interest where lead was selected as a COPC. Noncarcinogenic risks for workers from exposures to lead in soil were estimated using the Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (EPA, 2003b). The model is based on a biokinetic slope factor that estimates fetal blood lead concentration in pregnant workers exposed to lead in contaminated media. A simplified (linear) representation of lead biokinetics is used to predict quasi-steady state blood lead concentrations among adults who have relatively steady patterns of lead exposure.

7.1.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments to derive quantitative estimates and qualitative summaries of the potential cancer risk and non-cancer hazards that may occur due to exposure to COCs at the site.

For carcinogens, risks are generally expressed as the incremental probability of an individual's

developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SF

Where:

Risk = a unitless probability (e.g., $2x10^{-5}$) of an individual's developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as the inverse of daily dose $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that usually are expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This risk is referred to as an "excess lifetime cancer risk" because it would be in addition to the cancer risks associated with other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period with a reference dose (RfD) derived for a similar exposure period. An RfD represents a toxicity level that is not expected to cause any deleterious effect to an individual exposed. The ratio of exposure to toxicity is called a hazard quotient ("HQ"). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index ("HI") is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ=CDI/RfD

Where:

CDI = Chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

The output of the IEUBK Model is a histogram that presents the estimated percentage of residential children (ages 0 through 6 years) with a blood-lead level above 10 µg/dL (considered to be the threshold significance level above which adverse effects cannot be ruled out). When the percentage of the population estimated to have blood-levels above 10 µg/dL is greater than 5 percent, then EPA considers the potential for adverse effects to be significant.

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In accordance with EPA guidance, risk-based screening was performed to identify contaminants of potential concern (COPCs) in soil, waste, indoor air, sediment, surface water, groundwater, and fish tissue which required further evaluation during the human health and ecological risk assessments to determine which COPCs are contaminants of concern (COCs), or risk drivers. This section presents the unacceptable potential increased risks for the COPCs that were identified in each type of media sampled. Conclusions of the HHRA are summarized based on media and receptor. COCs were selected from the larger list of COPCs if they met any of these criteria:

- Individual contaminant HQ > 0.2 and the total HI > 1.0 for target organ, e.g., liver
- Individual contaminant predicted increased cancer risk greater than 1.0×10^{-6} and total receptor risk greater than 1.0×10^{-4}
- Lead when blood lead modeled to be higher than established EPA criteria described above

Two types of exposure scenarios were considered in the human health risk assessment, reasonable maximum exposure (RME) and central tendency exposure (CTE). RME incorporates input parameters into the exposure scenarios that are expected to represent a high end, but not worst-case, exposure in a given medium of concern. CTE is the exposure that is expected to represent an average exposure in a given medium of concern. CTE is only evaluated when the total cancer risk exceeds one in ten thousand or 1E-04 (considered the upper bound of EPA's acceptable risk range) or when the noncarcinogenic hazard index (HI) is greater than 1.0. In general, RME risk evaluation includes 95th percentile exposure input parameter estimates while CTE includes central tendency or average exposure input parameters estimates for each exposure pathway, e.g., amount of soil or water ingested, exposure frequency and exposure duration. For both RME and CTE risk analysis, it was assumed that a person who frequents the Landfill may come into contact with environmental chemical concentrations that are equal to the 95% upper confidence limit of the mean concentration (95% UCL).

Table 7 summarizes the total potential RME risks for soil, groundwater, and fish tissue, the primary risk drivers or COCs, and potential current or future receptors that exceeded EPA's acceptable risk criteria. Potential risks from surface water, sediment, leachate seeps, outdoor vapors and indoor vapors did not exceed EPA risk criteria, and thus are not included in **Table 7**.

As discussed above, for the HHRA, the Site was divided into the following three zones, each of which had a separate HHRA conducted for surface and total soils. (see **Figure 3**):

- Zone 1 - Clearview Landfill;
- Zone 2 - City Park; and
- Zone 3 - Eastwick Neighborhood;

Potential risks from theoretical exposure to surface soils (0-24") and total soils (combined surface and subsurface (deeper than 24" soils) for each of these zones were evaluated for specific human receptors.

<u>Clearview Landfill (Zone 1) Soils (Surface (0" – 24") and Total (surface + deeper)</u>

Contaminants found in the surface, subsurface soils and waste of Zone 1 were evaluated for potential risk to current and future residents, recreational users, construction and industrial workers.

Surface Soils

Exposure to Zone 1 surface soils presented potential RME cancer risks that exceeded the acceptable risk range for lifetime residents (6.7E-4 or 6.7×10^{-4}) and lifetime recreational persons (1.3E-4). Individual COCs that presented unacceptable cancer risk to the lifetime resident included Aroclor 1260 (3.7E-4) and benzo(a)pyrene (1.4E-4). Although no individual COCs presented unacceptable cancer risk to recreational users, cumulative risks (from all COCs together) did present an unacceptable risk. For the recreational receptor, exposures would be more likely to occur over a shorter duration, so it should be noted that the recreational child cancer risk was within EPA's acceptable risk ranged at 8.9E-5 and the recreational adult cancer risk was all acceptable at 3.8E-5. Other COCs that contributed to the lifetime resident and/or lifetime recreational user cancer risks included arsenic (which was greater than background), beta-BHC, dieldrin, gamma-chlordane, heptachlor epoxide, benz(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

For the child resident, adult resident, and recreational child exposed to Zone 1 surface soil, the maximum estimated target organ HIs were 18, 2, and 2.7, respectively, which exceeded EPA's benchmark, HI > 1.0. Antimony was the largest contributor to unacceptable noncancer HIs for the child resident, adult resident and recreational child with HIs of 16, 2, and 2.7, respectively. Other non-cancer risk drivers contributing to the unacceptable estimated target organ HIs include heptachlor epoxide, dieldrin, endrin, Aroclor-1254, cobalt, iron, thallium and copper. Cobalt and thallium were detected at levels similar to background levels, while iron and copper were detected at levels greater than their respective background level. **Tables 8.1 through 8.5** contain the Zone 1 surface soil COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Risks associated with exposure to a mean lead concentration of 372 mg/kg in Zone 1 surface soil were evaluated for an adult recreational receptor using the ALM model and for a residential child using the IEUBK model. (Lead risks were not appropriate to estimate using either model for an adult resident or a child recreational receptor.) Blood lead concentrations were predicted to exceed 10 μg/dL in 6.3 percent of an exposed population of child residents, which indicates that adverse effects cannot be ruled out. For adult recreational receptors, less than 5 percent of an exposed population was predicted to have blood lead concentrations above 10 μg/dL. Soil lead concentrations exceeded background.

Total Soils

Exposure to total soils (surface and subsurface soil) presented potential future RME cancer risks that exceeded the acceptable risk range for an industrial worker (3.9E-4). Aroclor 1260 was the only COC that presented unacceptable cancer risk to the industrial worker on its own with an RME risk of 3.5E-4. Other COCs that contributed to the industrial worker RME cancer risks included arsenic (which was greater than background), Aroclor 1268, dieldrin, heptachlor epoxide, 2,3,7,8-TCDD toxicity equivalents, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

For the industrial and construction workers exposed to Zone 1 total soils, the maximum of each receptor's estimated target organ HIs were 1.1 and 4.7, respectively, which exceeded the benchmark HI of 1.0. Antimony was the largest contributor to unacceptable non-cancer risks. No other contaminants individually contributed to an HI of greater than 1.0. However, heptachlor epoxide was also a non-cancer risk driver contributing to the unacceptable estimated target organ HI for the construction worker.

Tables 9.1 and 9.2 contain the Zone 1 total soil COCs and potential risks for those specific receptors that had one or more risk drivers. Individual COCs that presented an unacceptable risk are highlighted in these tables.

For the future construction worker exposed to a mean lead concentration of 372 mg/kg in Zone 1 total soils, the predicted percentage of a hypothetical population of pregnant workers that would exhibit a fetal blood lead level above 10 ug/dl was 19%, which exceeds the protective level cutoff set at 5 % of an exposed population. Soil lead concentrations exceeded background.

Clearview Landfill (Zone 2) Soils – (Surface (0" – 24") and Total (surface + deeper)

Contaminants found in the surface, subsurface soils and waste of Zone 2 were evaluated for potential risk to current and future residents, recreational users, construction and industrial workers.

Surface Soils

Exposure to Zone 2 surface soils (the City Park area) presented potential RME cancer risks that exceeded the acceptable risk range for lifetime residents (2.8E-4) but not for the recreational person, industrial worker or construction worker scenarios. Benzo(a)pyrene (B(a)P) was the only individual COC that presented unacceptable cancer risk to the lifetime resident included (1.4E-4). Other COCs that contributed to the lifetime resident cancer risks were arsenic (which was similar to background), aldrin, Aroclors-1260 and 1254, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

For the Current/Future child resident exposed to Zone 2 surface soil, the maximum of the estimated RME target organ HI was 2.5, which exceeded the benchmark HI level of 1.0. The PCB Aroclor-1254 was the largest contributor to unacceptable non-cancer risks. No other contaminants individually contributed an HI greater than 1.0 for the child resident. However other non-cancer risk drivers contributing to the unacceptable estimated target organ HIs include cobalt, antimony, and iron, which were similar to background. The maximum estimated RME target organ HI was less than 1 for the residential adult, recreational child, and recreational adult. **Tables 10.1 through 10.3** contain the Zone 2 surface soil COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Risks associated with exposure to a mean lead concentration of 282 mg/kg were evaluated for Zone 2 surface soil. Less than 5 percent of all potential exposed population receptors were predicted to have blood lead concentrations above10 μg/dL.

Total Soils

Exposure to total soils (surface and subsurface soil) in Zone 2 presented potential future RME cancer risks that exceeded the acceptable risk range for lifetime residents (2.3E-4), but not for the recreational person, industrial worker or construction worker. B(a)P was the only COC that presented unacceptable cancer risk to the lifetime resident on its own with an RME risk of 1.3E-4. Other COCs that contributed to the residential RME cancer risks included arsenic (which was similar to background), Aroclors-1260 and 1254, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

For the future child resident exposed to Zone 2 total soils, the maximum of the estimated target organ HI was 1.2. No individual contaminant contributed an HI greater than 1.0 for the child resident; although PCB Aroclor-1254 was the single largest contributor (0.4). Other non-cancer risk drivers include cobalt and iron, which were similar to background, and antimony. The maximum estimated target organ HI was less than 1 for the residential adult, recreational child and adult, industrial worker, and construction worker. **Tables 11.1 through 11.3** contain the Zone 2 total soil COCs and potential risks for those specific receptors that had one or more risk drivers. Individual COCs that presented an unacceptable risk are highlighted in these tables.

For the future construction worker exposed to a mean lead concentration of 227 mg/kg in Zone 2 total soils, the predicted percentage of a hypothetical population of pregnant workers that would exhibit a fetal blood lead level above 10 ug/dl was 9.3%, which exceeds the protective level cutoff set at 5 percent of an exposed population. Blood lead concentrations were not predicted to exceed 10 μg/dL for the child resident, adult recreational person, or industrial worker exposed to Zone 2 total soils. Soil lead concentrations were statistically demonstrated to be similar to background.

Clearview Landfill (Zone 3) Soils – (Surface (0" – 24") and Total (surface + deeper)

Contaminants found in the surface, subsurface soils and waste of Zone 3 were evaluated for potential risk to current and future residents, construction and industrial workers.

Surface Soils

Exposure to Zone 3 surface soil (the Eastwick Neighborhood) presented potential RME lifetime cancer risks that exceeded the acceptable risk range for Current/Future residents (1.9E-4). B(a)P (1.2E-4) was the only COC that presented an unacceptable cancer risk on its own. Other COCs that contributed to the lifetime resident RME cancer risks, but did not exceed the acceptable risk range individually, included arsenic (which was similar to background), benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, and Aroclor-1260.

The maximum of the target organ-specific HI exceeded 1.0 for the residential child (1.1). No individual contaminant contributed an HI greater than 1.0 for the child resident. The significant contributors to unacceptable noncancer HIs included antimony (0.48), cobalt (0.33), and iron (0.33), which were similar to background. **Tables 12.1 through 12.3** contain the Zone 3 surface soil COCs and potential risks for those specific receptors that had one or more risk drivers. Individual COCs that presented an unacceptable risk are highlighted in these tables.

Lead was not a COC for Zone 3 surface soil.

Total Soils

Exposure to Zone 3 total soils presented potential RME cancer risks that exceeded the acceptable risk range for current/future residents (1.2E-4). No individual contaminant posed an unacceptable risk. However, the cumulative risks results were unacceptable. COCs that contributed to the resident RME cancer risks, but did not exceed the acceptable risk range individually, included arsenic (1.5E-5) (which was similar to background), benz(a)anthracene (3.8E-5), benzo(a)pyrene (5.4E-5), benzo(b)fluoranthene (4.9E-6), dibenz(a,h)anthracene (3.8E-5), and indeno(1,2,3-cd)pyrene

(4.6E-6). **Tables 13.1 through 13.2** contain the Zone 3 total soil COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Non-cancer HIs did not exceed 1.0 for any receptor in Zone 3 total soils.

Lead was not a COC for Zone 3 total soils.

Groundwater

Collectively, groundwater exposure to the lifetime resident poses the highest risk among the exposure scenarios assessed for the Site. Exposure to groundwater presented potential cancer risks that exceeded the acceptable risk range for lifetime residents (6.6E-2) and industrial workers (2.5E-4), but not for construction workers (1.0E-5). B(a)P (3.9E-2) and dibenz(a,h)anthracene (1.4E-2) (both PAHs) were the largest contributors to potential future residential RME cancer risks. The major cancer risk drivers with individual cancer risks above 1.0E-4 for the lifetime resident exposed via tap water consumption were 2,3,7,8-TCDD TEQ (1.7E-3), arsenic (8.1E-4), Aroclor-1260 (2.9E-4), benz(a)anthracene (2.3E-3), benzo(b)fluoranthene (4.0E-3), benzo(k)fluoranthene (3.9E-4), indeno(1,2,3-cd)pyrene (2.8E-3), N-nitroso-di-n-propylamine (6.6E-4), and vinyl chloride (1.1E-4). Additional COCs that contributed significantly to the resident RME cancer risks for groundwater, but did not exceed the acceptable risk range individually, included 1,4-dichlorobenzene, 2,2'-oxybis(1-chloropropane), 2,4-dinitrotolulene, 2,6-dinitrotoluene, 3-nitroaniline, 3,3'-dichlorobenzidine, 4-nitroaniline, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, Aroclors-1016, 1242, and 1248, atrazine, aldrin, benzene, beta-BHC, bis(2-ethylhexyl)phthalate, delta-BHC, carbon tetrachloride, chloroform, dieldrin, gamma-BHC (Lindane), gamma-chlordane, heptachlor, heptachlor epoxide, N-nitroso-di-n-propylamine, naphthalene, PCE and trichloroethene.

For the industrial worker exposed to groundwater (i.e., in an excavation trench resulting in dermal and inhalation exposure), the only cancer risk driver above EPA's cancer risk criteria was B(a)P (1.2E-04). Additional COCs that contributed significantly to the resident RME cancer risks for groundwater, but did not exceed the acceptable risk range individually, included 2,3,7,8-TCDD TEQs, Aroclor-1260, benzo(a)pyrene, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, benzo(a)anthracene, naphthalene, chloroform, 2,2'-oxybis(1-chloropropane), benzene, and 1,4-dichlorobenzene.

Maximum RME target organ HIs exceeded one for the child resident (HI = 43) and adult resident (31), respectively. For the child resident, dioxins (as represented by Total 2,3,7,8-TCDD TEQs) were the largest contributor to non-cancer health risks with an HI of 37.8. The other COPCs which had individual HI greater than one for the child resident included antimony (5.92), arsenic (7.27), cadmium (1.65), cobalt (11), copper (1.77), iron (10.6), manganese (7.21), mercury (2.65), thallium (11.4), vanadium (1.69), Aroclor-1016 (5.1), and 3-nitroaniline (2.31). COPCs which had an individual HI greater than 1 for the adult resident included 2,3,7,8-TCDD (29), antimony (2.9), arsenic (3.5), cobalt (5.2), iron (5), manganese (3.6), mercury (1.3), thallium (5.4), Aroclor-1016 (3.9), and 3-nitroaniline (1.1). **Tables 14.1 through 14.4** contain the groundwater COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Blood lead concentrations for the child resident using the IEUBK model, were predicted to

exceed 10 ug/dl in 100 percent of the exposed population at an average groundwater concentration of 1,150 ug/L.

It should be noted that residential well water use is not expected, since residents are connected to a public water supply. Nonetheless, groundwater risk estimates are provided to evaluate potential future risks assuming use of the groundwater impacted by the Landfill.

Fish Tissue

Lower Darby and Lower Cobbs Creeks

Potential risks from the consumption of fish were modeled using maximum detected concentrations in sediment and the estimated rates at which fish accumulate those contaminants. As part of an aquatic risk assessment of the Folcroft Landfill (OU2) and the larger LDCA Site, actual fish tissue contaminant levels have been measured and will be used to further evaluate potential risks from fish consumption.

Cancer risks were estimated for the child and adult consumer who recreationally catches fish from lower Darby and lower Cobbs Creeks, and for the child and adult receptor who engages in subsistence fishing. Exposure to fish tissue through ingestion presented potential RME cancer risks that exceeded the acceptable risk range for adult subsistence fisher (1.7E-2) and child subsistence fisher (1.8E-2) as well as the child recreational fisher (2.7E-3) and adult recreational fisher (2.6E-3). The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the child subsistence fisher exposed via consumption of fish tissue from lower Darby and lower Cobbs creeks were Aroclor-1260 (1.4E-3), arsenic (4.9E-3), benz(a)anthracene (8.1E-4), benzo(a)pyrene (6.8E-3), benzo(b)fluoranthene (8.5E-4), cadmium (6.6E-4), dibenz(a,h)anthracene (1.7E-3), dieldrin (1.0E-3), and indeno(1,2,3-cd)pyrene (5.0E-4). The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the adult subsistence fisher exposed via consumption of fish tissue from lower Darby and lower Cobbs Creeks were Aroclor-1260 (1.4E-3), arsenic (4.7E-3), benz(a)anthracene (7.7E-4), benzo(a)pyrene (6.5E-3), benzo(b)fluoranthene (9.1E-4), dibenz(a,h)anthracene (1.6E-3), dieldrin (9.9E-4), and indeno(1,2,3-cd)pyrene (4.7E-4).

The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the child recreational fisher exposed via consumption of fish tissue from lower Darby and lower Cobbs Creeks were Aroclor-1260 (2.1E-4), arsenic (7.3E-4), benz(a)anthracene (1.2E-4), benzo(a)pyrene (1.0E-3), benzo(b)fluoranthene (1.4E-4), dibenz(a,h)anthracene (2.5E-4), and dieldrin (1.5E-4). The major cancer risk driver with individual RME cancer risks above 1.0E-4 for the adult recreational fisher exposed via consumption of fish tissue from lower Darby and lower Cobbs creeks were Aroclor-1260 (2.0E-4), arsenic (6.9E-4), benz(a)anthracene (1.1E-4), benzo(a)pyrene (9.5E-4), benzo(b)fluoranthene (1.2E-4), dibenz(a,h)anthracene (2.3E-4), and dieldrin (1.5E-4).

For the child and adult subsistence fisher the maximum of each receptor's estimated target organ HIs were 197 and 47, respectively. For the child subsistence fisher, the largest contributor to non-cancer health risks from consumption of fish from lower Darby and lower Cobbs Creeks were arsenic (130), cadmium (91), chromium (88), copper (110), mercury (95), nickel (36), selenium (47), silver (2.7), zinc (88), alpha-chlordane (4), dieldrin (15), and heptachlor epoxide (7). For the adult subsistence fisher, the largest contributor to non-cancer health risks from consumption of fish from lower Darby and lower Cobbs Creeks were arsenic (30), cadmium (22), chromium (21), copper (26),

mercury (22), nickel (8.5), selenium (1.1), zinc (21), dieldrin (3.6), and heptachlor epoxide (1.7).

For the child and adult recreational consumers of fish, the maximum of each receptor's estimated target organ HIs were 29 and 6.9, respectively. For the child recreational fisher, the largest contributor to non-cancer health risks from consumption of fish from lower Darby and lower Cobbs Creeks were arsenic (19), cadmium (13), chromium (13), copper (16), mercury (14), nickel (5.3), zinc (13), and dieldrin (2.2). For the adult recreational fisher, the largest contributor to non-cancer health risks from consumption of fish from lower Darby and lower Cobbs Creeks were arsenic (4.5), cadmium (3.2), chromium (3.1), copper (3.8), mercury (3.3), nickel (1.3) and zinc (3.1). **Tables 15.1 through 15.4** contain the Lower Darby and Lower Cobbs Creeks fish tissue COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Blood lead concentrations for child and adult subsistence fishers and child and adult recreational consumers of fish using the IEUBK Model, were predicted to exceed 10 ug/dl in 100 percent of the exposed populations at an average fish tissue lead concentration of 90,440 ug/kg.

Tinicum Marsh

Cancer risks were estimated for the child and adult consumer who recreationally catches fish from Tinicum Marsh, and for the child and adult receptor who engages in subsistence fishing. Exposure to fish tissue through ingestion presented potential RME cancer risks that exceeded the acceptable risk range for adult subsistence fisher (1.8E-2) and child subsistence fisher (1.9E-2) as well as the child recreational fisher (2.8E-3) and adult recreational fisher (2.6E-3). The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the child subsistence fisher exposed via consumption of fish tissue from Tinicum Marsh were arsenic (1.2E-2), benz(a)anthracene (3.3E-4), benzo(a)pyrene (3.7E-3), benzo(b)fluoranthene (4.8E-4), dibenz(a,h)anthracene (1.2E-3), dieldrin (6.6E-4), and indeno(1,2,3-cd)pyrene (2.9E-4). The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the adult subsistence fisher exposed via consumption of fish tissue from Tinicum Marsh were arsenic (1.1E-2), benz(a)anthracene (3.1E-4), benzo(a)pyrene (3.5E-3), benzo(b)fluoranthene (4.5E-4), dibenz(a,h)anthracene (1.2E-3), dieldrin (6.2E-4), and indeno(1,2,3-cd)pyrene (2.8E-4).

The major cancer risk drivers with individual RME cancer risks above 1.0E-4 for the child recreational fisher exposed via consumption of fish tissue from Tinicum Marsh were arsenic (1.8E-3), benzo(a)pyrene (5.4E-4) and dibenz(a,h)anthracene (1.8E-4). The major cancer risk driver with individual RME cancer risks above 1.0E-4 for the adult recreational fisher exposed via consumption of fish tissue from Tinicum Marsh were arsenic (1.7E-3), benzo(a)pyrene (5.1E-4), dibenz(a,h)anthracene (1.7E-4).

For the child and adult subsistence fisher the maximum of each receptor's estimated target organ HIs were 319 and 76, respectively. For the child subsistence fisher, the largest contributor to non-cancer health risks from consumption of fish from Tinicum Marsh were arsenic (310), cadmium (130), chromium (110), copper (110), mercury (96), nickel (47), selenium (6.8), silver (2.9), zinc (98), alpha-chlordane (4.7), dieldrin (9.6), and heptachlor epoxide (5.1). For the adult subsistence fisher, the largest contributor to non-cancer health risks from consumption of fish from Tinicum Marsh were arsenic (73), cadmium (31), chromium (26), copper (27), mercury (23), nickel (11), selenium (1.6), zinc (23), dieldrin (2.3), alpha-chlordane (1.1), and heptachlor epoxide (1.2).

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For the child and adult recreational consumers of fish, the maximum of each receptor's estimated target organ HIs were 47 and 11, respectively. For the child recreational fisher, the largest contributor to non-cancer health risks from consumption of fish from Tinicum Marsh were arsenic (45), cadmium (19), chromium (16), copper (17), mercury (14), nickel (6.9), zinc (14), and dieldrin (1.4). For the adult recreational fisher, the largest contributor to non-cancer health risks from consumption of fish from Tinicum Marsh were arsenic (11), cadmium (4.6), chromium (3.8), copper (3.9), mercury (3.3), nickel (1.6) and zinc (3.4). **Tables 16.1 through 16.4** contain the Tinicum Marsh fish tissue COCs and potential risks for those specific receptors that had one or more risk drivers; individual COCs that presented an unacceptable risk are highlighted in these tables.

Blood lead concentrations for child and adult subsistence fishers and child and adult recreational consumers of fish using the IEUBK Model, were predicted to exceed 10 ug/dl in 100 percent of the exposed populations at an average fish tissue lead concentration of 111,700 ug/kg.

Vapor Intrusion

No significant accumulation of any vapors was noted under any structure evaluated as part of the vapor intrusion investigation. The risk assessment findings also indicated that no current or future unacceptable cancer or non-cancer risks are present.

The Risk Assessment Summary Table is presented as **Table 17** for all the media, receptors and timeframes assessed in the HHRA for the Site. Maximum soil risks from each zone are shown separately and the cumulative risks from all media, including the highest soil risk, are shown for each receptor. In summary, the results of the human health risk assessment indicated that there are unacceptable risks related to soils (for applicable areas and receptors), shallow groundwater, and modeled fish tissue concentrations that exceed EPA target levels. Unacceptable soil risks were identified as follows:

- Clearview Landfill (Zone 1) Surface Soil: lifetime resident and recreational user.
- Clearview Landfill (Zone 1) Total Soil: construction and industrial worker.
- City Park (Zone 2) Surface Soil: lifetime resident.
- City Park (Zone 2) Total Soil: lifetime resident.
- Eastwick Neighborhood (Zone 3) Surface Soil: lifetime resident.
- Eastwick Neighborhood (Zone 3) Total Soil: lifetime resident.

Based on RI data, the Site does not pose unacceptable human health risks from exposure to surface waters, sediments, vapor intrusion and landfill leachate seeps.

EPA concluded that, based on the cancer and non-cancer results of the risk assessment for current and future use of Site soils and future use of groundwater, a remedial action should be taken to address contamination. Impacts to fish tissue (as well as surface water and sediments) can be addressed in part using source controls via the alternative selected to address landfill wastes and impacted soils.

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7.1.5 Uncertainties in Risk Characterization

Risk assessment provides a systematic means of organizing, analyzing and presenting information on the nature and magnitude of risks posed by chemical exposures. Uncertainties are present in all risk assessments because of the quality of available data and the need to make assumptions and develop inferences based on incomplete information about existing conditions and future circumstances. The goal of an uncertainty analysis in a risk assessment is to provide to the appropriate decision makers (i.e., risk managers) a wide range of information about risk assessment assumptions, their uncertainty and variability, and the effect of uncertainty and variability on the estimate of risk. Risk estimates presented herein are single-point estimates of risk rather than probabilistic estimates. Therefore, it is important to specify the uncertainties inherent in the risk assessment in order to place the risk estimates in proper perspective.

There are various uncertainties associated with any risk assessment. Most uncertainties identified for the Site HHRA will result in the potential for overestimation of risk for both the RME and CTE scenarios. Below is a brief discussion of the major uncertainties associated with the Baseline Risk Assessment. Further information regarding site-specific risk assessment uncertainties is discussed in Appendix U, Part 1, Section 7.8 of the Clearview Landfill RI.

- Impacts of Background Levels: Background tests were performed after Site risks were presented for soil COPCs. Tables 10.4 to 10.12 in Appendix U from the Clearview Landfill RI display all of the risk drivers that contribute to the significant cancer and noncancer risks, with footnotes added to inorganic substances found to be within the range of background based on statistical analysis. Organic compounds that were similar to background were not flagged on Table 10s; however, anthropogenic contributions from the urban environment are not expected to represent the bulk of detected soil concentrations for any substance. Groundwater data from the Clearview Landfill could not be compared to upgradient groundwater conditions because Clearview Landfill is situated at a topographic high point relative to surrounding areas, and creeks and streams surrounding the landfill are at lower elevations. Therefore, non-site related influences to groundwater, whether naturally occurring or anthropogenic, cannot be readily determined. The background urban environment surrounding the Landfill may have contributed to concentrations detected in Darby Creek, Cobbs Creek, and Tinicum Marsh. However, the HHRA did not attempt to characterize background levels of COPCs in surface water and sediment since urban background contaminant patterns are likely to be non-uniform, which would have led to a poorly representative data set, and could bias statistical comparisons of the Site versus background for surface water and sediment.

- Uncertainties Regarding the Estimation of the EPC: Several issues can introduce inaccuracies in the calculation of the EPCs for an area of interest. The EPA software program ProUCL, version 3 was utilized to estimate 95% UCLs. This version of the software does not impute non-detected values in a statistical manner, but instead relies on an across the board approximation which assumes one-half the detection limit concentration is present for any sample reported as non-detected, which tends to degrade accuracy as the proportion of non-detects in the data set increases. Another uncertainty related to EPCs is associated with UCL calculations based on data sets having very few (such as less than 8 to 10) detected sample results or data sets with too few sample results to allow any statistical calculation of a UCL. This occurred for a few organic COPCs in groundwater and soil, although nearly all of the major risk drivers were associated with an acceptable number of detected results used to

calculate the UCL.

- Uncertainties in Laboratory Data Quality: Validated laboratory data were used to calculate EPCs for groundwater, soil, surface water, and sediment. Therefore, rejected and blank-qualified data were eliminated from the risk assessment to avoid use of unreliable results. However, in a few cases, such as with methylene chloride and phthalates, this step reduced the total number of usable data points available to characterize an area of interest.

- Uncertainties in Risk-Based Screening Levels: RBCs from October 2007 were used to select COPCs, but these criteria have been revised by EPA as recently as June 2013. In certain cases, changes to RBCs could result in elimination of a candidate COPC or inclusion of a new COPC. However, in the HHRA, the estimated risks were based on the December 2009 noncancer RfDs and cancer SFs; therefore, the inclusion of too many COPCs would not cause inaccuracy in the final conclusions of the risk assessment. This uncertainty is evaluated further in Appendix U, Part 1, Section 7.5 of the Clearview Landfill RI.

- Uncertainties Associated with Exposure Assessment: The likelihood of the occurrence of the defined exposure scenarios is a source of uncertainty. The future anticipated land use near the landfill is expected to remain as residential in Zone 3 (existing Eastwick Neighborhood), recreational in Zone 2 (existing City Park), or industrial and possibly recreational in the case of Zone 1 (Clearview Landfill). All of these receptors, plus the construction worker, were evaluated to provide a comprehensive assessment of potential current and future risks from exposure. In addition, the exposure assessment includes various models and equations used to estimate exposure doses or contaminant concentrations, and include several physical parameters that cannot be measured precisely. For example, there is uncertainty in the use of modeled air concentrations (e.g., estimated indoor air and outdoor air breathing zone concentrations as a result of volatile emissions from soil gas or groundwater) in place of monitored values, which may not be indicative of actual Site conditions during exposure.

- Uncertainties Associated With Toxicity Assessment: For several COCs, revised toxicity values have been published since the HHRA was finalized. The extent to which revised toxicity values would contribute to or subtract from the risks stated in RAGS D tables was assessed, along with a discussion as to whether such revisions would impact risk drivers. This uncertainty is discussed in detail in Appendix U, Section 7.8 of the Clearview Landfill RI. Uncertainty is also associated with the RfDs and SFs because of the extrapolation of animal data to humans, the extrapolation of carcinogenic effects from the laboratory high-dose to the environmental low-dose scenarios, and interspecies and intraspecies variations in toxicological endpoints caused by chemical exposure. The use of EPA RfD values is generally considered to be conservative because the doses are based on no-effect or lowest-observed-effect levels and then further reduced with uncertainty factors to increase the margin of safety by a factor in the neighborhood of 10 to 1,000 fold. In most cases, toxicity assessment uncertainties tend to generate over-estimated risks rather than underestimates.

- Uncertainties Associated With Lifetime Recreational Exposure: While the long term exposure duration for all potential receptors is highly variable, a conservative approach was to assume that recreational receptors may visit the Site over a 30 year period, including 6 years as a child and 24 years as an adult. Unless the recreational user also happened to be a nearby resident, it

would be rather unlikely that the majority of recreational receptors would frequent the Site over such a long timeframe. Therefore, lifetime recreational receptor cancer risks tend to be overestimated.

- Uncertainties Associated With Blood Lead Modeling: The child and adult blood lead models applied to this risk assessment were developed and calibrated for soil and groundwater exposure modeling. Risks could not be estimated for lead exposures in surface water and sediment. In the groundwater data set for lead, the mean lead concentration was 1,150 µg/L and 14 out of 200 sample results exceeded 1,000 µg/L. These levels are well above the levels encountered in typical groundwater samples. As a result, the IEUBK model reported uncertainty in the accuracy of predicted blood lead levels because environmental exposures associated with blood lead levels above 30 µg/dl are above the range of values used in the IEUBK model's calibration and verification.

7.2 Summary of Ecological Risk Assessment

A Screening Level Ecological Risk Assessment (SLERA) was conducted to evaluate potential risks from contaminants associated with the Clearview Landfill to surrounding ecological receptors. The SLERA represents Steps 1, 2, and portions of Step 3 of the eight-step process provided in EPA's "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (USEPA 1997c). The study area consisted of various terrestrial and aquatic habitats, including the John Heinz NWR, which contains the largest remaining freshwater tidal marsh in Pennsylvania. Samples were collected in the following habitats, as shown in Figure 18:

- Maintained Lawn/Open Field (City Park)
- Disturbed Shrub-Scrub/Wooded Area (Clearview Landfill/southern part of City Park)
- Tidal Marsh/Open Water
- Non-Tidal Marsh/Open Water
- Tidal Riverine
- Landfill Seep Areas
- Groundwater

Steps 1 and 2 of the ERA process examined the potential risk to ecological receptors by comparing the maximum concentrations detected in Site media to literature-based ecological screening values. The risk to upper-trophic level receptors (birds, mammals, and reptiles) was also evaluated using food-web models which considered the bioaccumulation of COPCs in the food consumed by the receptors and their resultant exposure. Bioaccumulation of COPCs by upper-trophic level organisms and the food they ingest were examined by a food-web model. The use of maximum Site concentrations and other conservative exposure parameters were used in the food-web models to conservatively evaluate risk from COPCs in each medium. The preliminary COPCs were further examined as part of the SLERA (Step 3 of the ERA process), with respect to the complete exposure pathways identified in Step 2. During this evaluation, the list of preliminary direct and food chain COPCs established during Steps 1 and 2 were further evaluated in order to identify those chemicals that are risk drivers under more typical exposure scenarios.

Based on the findings of the SLERA, it was concluded that risk might exist to lower- and upper-level organisms in the terrestrial, tidal marsh/open water, and non-tidal marsh/open water habitat

areas. However, it appeared that there was no risk to fish-eating animals from contaminants in tidal riverine surface water through food chain exposure.

A Baseline Ecological Risk Assessment (BERA) was conducted to further evaluate COPCs identified during SLERA. Six ecological areas of interest (AOIs) within the Site were focused on as part of the BERA:

- Darby and Cobbs Creeks: Tidal Riverine Habitat
- Tinicum Marsh: Tidal Marsh/Open Water Habitat
- John Heinz NWR Impoundment Area: Non-Tidal Marsh/Open Water Habitat
- Landfill-Business Area (i.e., SIA): Wooded and Shrub Habitat
- Clearview Landfill: Wooded and Shrub Habitat
- City Park: Maintained Lawn/Open Field Habitat

Aquatic, riparian, or terrestrial receptors inhabiting or utilizing the Clearview Landfill may be exposed to Site-related COPCs. Potential complete exposure pathways include direct contact with contaminated media, ingestion of contaminated food items for surface water, incidental ingestion of soil or sediment, dermal contact, and inhalation. To evaluate potential risks to receptors through these exposure pathways assessment endpoints (AEs) and measurement endpoints (MEs) were selected. An AE is an explicit expression of the environmental value that is to be protected. MEs are numerical expressions of observations, e.g., toxicity test results, community diversity measures, etc., that can be compared to similar observations at a control and/or reference site. MEs can include measures of exposure, e.g., contaminant concentration in water or sediments, or measures of effects, e.g., survival of growth of amphipods in toxicity tests.

The list of AEs and MEs are described below.

- **Assessment Endpoint 1:** Survival and Growth of Aquatic Plants
  - Measurement Endpoint: Measured COPC concentrations in sediments along with associated physical/chemical measurements were compared to toxicological benchmarks for terrestrial plants.
- **Assessment Endpoint #2:** Survival, Growth and Reproduction of Terrestrial Plants
  - Measurement Endpoint: Measured COPC concentrations in soils along with associated physical/chemical measurements were compared with toxicological benchmarks for terrestrial plants.
- **Assessment Endpoint #3:** Survival, Growth, and Reproduction of Aquatic Invertebrates
  - Measurement Endpoint: Chronic sediment toxicity tests were conducted using the amphipod, *Hyallela azteca.* Effects of exposure to Site sediments and control sediments on the survival, growth, and reproduction of the amphipod were compared.

- Measurement Endpoint: A life-cycle test was conducted using the midge, *Chironomus tentans*. The effects of exposure to Site sediments and control sediments on the chironomid were compared.

- Measurement Endpoint: A 28-day *Lumbriculus variegatus* bioaccumulation test was conducted with sediments collected from Darby Creek sampling stations adjacent to the Clearview Landfill.

- **Assessment Endpoint #4:** Survival, Growth, and Reproduction of Terrestrial Invertebrates

  - Measurement Endpoint: Measured COPC concentrations in soils were compared with toxicological benchmarks for soil microorganisms, earthworms, and other soil-dwelling organisms.

  - Measurement Endpoint: A 28-day earthworm (*Eisenia fetida*) bioassay was conducted. Survival in Site soils and control soils were compared.

  - Measurement Endpoint: A 28-day earthworm (*Eisenia fetida*) bioaccumulation test was conducted.

- **Assessment Endpoint #5:** Survival, Growth, and Reproduction of Fish

  - Measurement Endpoint: Measured COPC concentrations in surface water along with associated physical/chemical measurements were compared with surface water toxicological benchmarks.

  - Measurement Endpoint: An acute (96-hour) fish bioassay using the fathead minnow, *Pimephales promelas,* was conducted.

- **Assessment Endpoint #6:** Survival, Growth, and Reproduction of Aquatic Feeding Birds and Mammals

  - Measurement Endpoints: Concentrations of COPCs in the tissues of prey species (i.e., whole body tissue residues based on *Lumbriculus* sp. bioaccumulation Site data), sediment and surface water were measured. The risk from dietary exposure to COPCs on-Site was determined using dietary exposure models. Exposure doses calculated using dietary models for sediment-probing birds (Lesser scaup) and aquatic feeding mammals (raccoon), incorporating COPC concentrations in prey, sediment and surface water, were compared with toxicity reference values (TRVs) derived from the literature.

- **Assessment Endpoint #7:** Survival, Growth, and Reproduction of Terrestrial Feeding Birds and Mammals

  - Measurement Endpoints: Concentrations of COPCs in the tissues of prey species, (*i.e.*, tissue residues based on earthworm bioaccumulation Site data), Site soil, and surface water were measured. The risk from dietary exposure to COPCs on-site was determined using dietary exposure models. Exposure doses calculated using the dietary models for soil-probing birds (American robin) and terrestrial feeding mammals (short-tailed shrew),

incorporating COPC concentrations in prey, sediment and surface water, were compared with TRVs derived from the literature.

The risk characterization portion of the BERA integrated exposure and effects data, to estimate risks to the AEs. Toxicity Reference Values that were used in the BERA are included in **Table 18**. Additional samples were collected from various media and in addition to bioaccumulation and toxicity studies as part of the BERA to support evaluation of the AEs and MEs listed above. **Table 19** identifies these sampling locations which are available in **Figures 11, 16, and 19**. Based on these sampling results, the list of retained COPCs was refined. The term "contaminants of potential concern (COPCs)" is used to be consistent with the terms used in the SLERA and BERA. However, the final COPCs from the BERA are referred to as contaminants of concern (COCs) and were evaluated further in the FS. The tables listed below are included in the ROD and document the data that was utilized for evaluation of each AE. **Tables 20 through 24** list these retained COPCs for sediment, surface water, soil, seep sediments and groundwater as well as the maximum concentrations detected and the number of samples analyzed for each respective media. **Tables 25 through 31** contain the results from the various bioaccumulation and toxicity tests.

- Table 20 – Sediment Data (AEs 1 and 6)
- Table 21 – Surface Water Data (AEs 5 and 6)
- Table 22 – Soil Data (AEs 2, 4 and 7)
- Table 23 – Seep Sediment Data (AEs 1,5 and 6)
- Table 24 – Groundwater Data (AE 5)
- Table 25 – *Lumbriculus* Tissue Data (AE 6)
- Table 26 and 27 – Earthworm and Tissue Data (AE 7)
- Tables 28 and 29 – *Hyallela* and *Chironomus* Toxicity Test Data (AE 3)
- Table 30 – Earthworm Bioassay Data (AE 4)
- Table 31 – *Pimephales* Toxicity Test Data (AE 5)

Risks for each assessment endpoint are summarized below. Calculation of Hazard Quotients (HQs) is one method of risk characterization that evaluates the potential health effects on specific ecological receptors from individual contaminants. The Hazard Quotient (HQ) is the ratio of an exposure level by a contaminant (e.g., maximum concentration) to a screening value selected for the risk assessment for that substance. If the exposure level is higher than the screening/toxicity value (HQ > 1) then there is the potential for risk to the receptor. In addition, risks to the aquatic and terrestrial feeding birds and mammals were evaluated using model-calculated dietary exposures.

Aquatic Ecosystem

Risk to the aquatic ecosystem was characterized based on risk to aquatic plants (AE 1), aquatic invertebrates (AE 3), fish (AE 5), and aquatic feeding birds and mammals (AE 6). An emphasis was placed on risk to these assessment endpoints within the Lower Darby Creek Area adjacent to the Clearview Landfill. Upstream reference areas were also included in the BERA to evaluate potential risks in areas not influenced by the Site.

Risk to aquatic plants within the Lower Darby Creek Area was defined by four COPCs: mercury, selenium, thallium and 4-methylphenol (**Table 32**), exceeding benchmarks based on maximum sediment concentrations. Risk to the aquatic plants at the Upstream Reference Area, as well

as Tinicum Marsh and the Impoundment Area, indicated that the same COPCs that posed risk within the Lower Darby Creek Area posed risk for these areas.

Risk to aquatic invertebrates within the Lower Darby Creek Area was evaluated by two chronic toxicity studies based on sediment collected from six sampling locations located on Darby Creek adjacent to and downstream of the Clearview Landfill. Three of the six sampling stations indicated risk to aquatic invertebrates based on reduced survival in the *Hyalella* toxicity study.

Risk to fish within the Lower Darby Creek Area was determined by comparing maximum surface water and groundwater concentrations of the COPCs to chronic benchmark values. For surface water there was only one COPC, cadmium (HQ = 88), that indicated risk based on maximum concentration. No acute toxicity to fathead minnow resulted from 96-hour exposure of seep water. However, for groundwater almost all of the retained COPCs posed risk based on maximum concentrations (See groundwater HQs in **Table 33**). At the time when the BERA was completed the movement of groundwater impacted by the Clearview Landfill to Darby Creek was not known and subsequently the potential for risk could not be appropriately characterized. These potential risks from groundwater to the environment will be further evaluated as part of the OU-3 investigation.

Risk to aquatic feeding birds and mammals was characterized based on dietary exposure models using two receptor species (lesser scaup and the raccoon). The contaminants which posed model calculated risk within the Lower Darby Creek Area and the Landfill seeps were the same contaminants that posed risk at the Upstream Reference Area: dibenzofuran, mercury and selenium (**Table 34**).

Terrestrial Ecosystem

Risk to the terrestrial ecosystem, specifically the Clearview Landfill - Business Area, the Wooded and Shrub Areas of the Clearview Landfill and City Park, was characterized based on risk to terrestrial plants (Assessment Endpoint 2), terrestrial soil invertebrates (Assessment Endpoint 4), and terrestrial feeding birds and mammals (Assessment Endpoint 7).

Risk to terrestrial plants was determined for a high number of the COPCs based on maximum soil concentrations exceeding benchmark values at all three AOIs (**Table 35**). A total of 27 COPCs for the Landfill-Business Area, 29 COPCs for the Landfill-Wooded and Shrub Area and 24 COPCs for City Park posed risk to the terrestrial plant community based on their calculated HQs. Likewise, risk to terrestrial soil invertebrates was determined by a high number of COPCs that exceeded the benchmark values resulting in HQs in exceedance of 1; that is, a total of 19 COPCs for the Landfill-Business Area, 22 COPCs for the Landfill-Wooded and Shrub Area and 12 COPCs for City Park posed risk (**Table 36**). The AOIs within the Landfill would pose greater risk to the invertebrates than City Park based on the higher number of COPCs exceeding the benchmarks and the higher HQ values.

Risk to terrestrial feeding birds and mammals was characterized based on dietary exposure models using two receptor species (American robin and the short-tailed shrew). Model-calculated risk indicated that there were a greater number of COPCs posing risk to the terrestrial mammals than to the terrestrial birds. Modeled calculated risk for the terrestrial mammals based on conservative life history parameters and maximum concentrations indicated that nine COPCs for the Landfill-Business Area, 10 COPCs for the Landfill-Wooded and Shrub Area and seven COPCs for City Park posed risk (**Table 37**).

Overall risk to the terrestrial AOIs would indicate that risk exists at all three AOIs based on Assessment Endpoints 2, 4 and 7. City Park would be considered to pose less risk than the Landfill AOIs.

8.0 REMEDIAL ACTION OBJECTIVES

The objectives for the selected remedy for waste, soil and shallow leachate/groundwater (OU1) associated with the Site is to reduce contaminant concentrations to levels that do not present an unacceptable risk to human health and the environment, prevent contact with the Landfill wastes and reduce the amount of contamination being released by the Landfill into groundwater and surface water. Several remedial action objectives (RAOs) have been identified to mitigate the potential present and/or future risks associated with OU1. These RAOS are:

- Prevent human and ecological receptor exposure to contaminated soils and landfill materials that pose an unacceptable risk.
- Prevent erosion and surface runoff of soils and wastes to reduce migration of contaminants
- Reduce the infiltration of precipitation into the Landfill waste materials to less than 1.0×10^{-5} cm/sec or an equivalent standard of performance.
- Control and capture seasonal leachate seeps above the mean high tide elevation of adjacent creeks that are migrating into the adjacent Darby and Cobbs Creeks.
- Reduce the concentrations of contaminants in collected leachate to meet the surface water discharge requirements established by NPDES permitting process during the remedial design.
- Reduce, to acceptable levels, risks to aquatic benthic receptors by reducing the discharge of Landfill-related contaminants to surface waters and sediments in Darby and Cobbs Creeks.
- Prevent the accumulation and off-site migration of Landfill gases and VOC vapors above the levels established in 40 C.F.R. § 258.23(a), Explosive Gases Control.
- Prevent unacceptable risks by site-related contaminants due to human consumption of fish from surface waters adjacent to the Landfill.

8.1 Cleanup Levels

In order to address the unacceptable risks posed by conditions at the Site and, thereby, protect human health and the environment, cleanup levels and objectives have been developed as follows:

For wastes and soil, the selected action should address contaminant migration to surrounding soil, surface water, and groundwater and prevent exposure to waste and soil. The preamble to the NCP identifies municipal landfills as a type of Site where treatment of the waste may be impracticable because of the size and heterogeneity of the contents (55 FR 8704). Waste in CERCLA landfills

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usually is present in large volumes and is a heterogeneous mixture of municipal waste frequently co-disposed with industrial and/or hazardous waste. Because treatment may be impracticable, EPA generally considers containment to be the appropriate response action for the source areas of municipal landfill sites.

Due to the large volume of municipal debris mixed with hazardous substances at the Site (2.9 million cubic yards over 67.4 acres), removal and treatment of the entire landfill are considered to be logistically impracticable, present a greater risk to the community and the environment, and be substantially more ineffective from a cost perspective. However, excavation of contaminated materials and soils are considered to be appropriate for areas within City Park, the Eastwick Neighborhood (if any), and for areas containing principal threat wastes (i.e., SIA). **Figure 20** identifies all of the areas proposed for excavation identified by dashed red or blue lines. The specific locations and rationale are discussed under **Section 9.0, Summary of Remedial Alternatives** section below.

As a result, proposed cleanup levels, referred to as preliminary remediation goals (PRGs) in the Proposed Plan, and were developed for all the COCs in the RI for surface and total soils in Zones 1 through 3. A multi-step process was followed to select the appropriate PRG for each COC. First, *candidate* PRGs were calculated based on concentrations that were protective against cancer and non-cancer risks for human receptors. Soil-to-groundwater PRGs based on PADEP medium specific concentrations (MSCs) were assembled and evaluated. PRGs were also calculated based on surface soil and sediment for terrestrial and aquatic receptors, respectively, based on toxicity testing results. Background surface and subsurface soil concentrations for COCs were taken into consideration to evaluate the reasonableness of establishing a PRG for COC concentrations within the range of background. These various sets of *proposed* PRGs were then compared to PADEP medium specific concentrations (MSCs) for direct contact, and the more conservative of the applicable PRGs or MSCs was selected for each COC. The lowest value from the assembled set of the above proposed PRG sources was generally identified as the recommended PRG for the human health COCs for surface and total soils. For several ecological COCs, the proposed PRG for surface soil was the calculated background value because the other proposed values based on the ecological risk assessment were lower than background. This evaluation resulted in three proposed soil cleanup levels for each COC in each of Zones 1-3: a proposed human health surface soil PRG and total soil PRG, as well as a proposed ecological surface soil PRGs. These *proposed* PRGs for each zone were further evaluated with respect to where the estimated limits of a cover system for the Landfill would extend as well as the current and reasonably anticipated further land uses for each zone. Specific land use assumptions for each Zone are described below. This resulted in a final set of *controlling* cleanup levels for OU1. These *controlling* cleanup levels are protective of potential human and ecological receptors.

Although Zone 1 *controlling* cleanup levels were developed for Zone 1 in the FS, they are not being proposed because all of the active response alternatives, including EPA's selected alternative for OU1, involve covering or capping the entirety of Zone 1. As a result, all exposure pathways to soils and waste for all potential receptors will be eliminated and, thus, cleanup levels for Zone 1 are not appropriate. Zone 2 *controlling* cleanup levels were based on residential land use for individual PAHs in surface soils, and protecting several ecological receptors exposed to select inorganics, total PAHs, high molecular weight (HMW) PAHs, and PCBs in surface soils. Zone 3 soil cleanup levels were *proposed* for PAHs, total and HMW PAHs, and cadmium in surface or total soils to protect residents or ecological receptors. However, the *controlling* surface soil cleanup levels established for Zone 2 were adopted for Zone 3, to ensure protectiveness, and given the similarities with respect to land use, proximity to the Landfill boundary, and the commonality of the COCs identified for each of these two

zones. Several of the inorganic COPCs identified in BERA were not selected as *controlling* cleanup levels as their detected concentrations were lower than their respective *proposed* cleanup level (mercury, vanadium) or they were detected in less than 10% of samples collected (manganese, chromium, nickel). **Table C** contains the cleanup levels for both waste and the soil surrounding the waste. *Controlling* soil cleanup levels for Zones 2 and 3 that are based solely on potential ecological risks are shown in a separate column in **Table C**. These cleanup levels are only applicable to the top two feet of soil as this is the area of primary biological activity. The *controlling* soil cleanup levels for Zones 2 and 3 which are based on potential risks to human receptors are applicable to soils at all depths. **Table 43** contains the *controlling* PRGs from the FS for human and ecological receptors that were selected as final candidates for each zone as well as their technical basis. It is from these PRGs the final *controlling* soil cleanup levels shown in **Table C** were selected. It is important to note that in the final FS, *controlling* PRG candidates for PCBs (Aroclors 1254 and 1260) were based on the lowest value from the assembled PRGs for all potential human and ecological receptors, which, in this case, were the ecologically based PRGs. However, it was later determined that the ecological *controlling*

Table C. Controlling Cleanup Levels

COCs	ZONES 2 AND 3[1]	
	Ecological[2] (Top 2 feet)	Human[2] (All Soils)
Inorganics (mg/kg)		
Cadmium	2.2	
Copper	166	
Lead	380	
Zinc	308	
PAHs (µg/kg)		
Benzo(a)anthracene		1,700
Benzo(a)pyrene		466
Benzo(b)fluoranthene		1,700
Benzo(k)fluoranthene		17,000
Dibenzo(a,h)anthracene		170
Indeno(1,2,3-cd)pyrene		1,700
Total PAHs	8,754	
HMW PAHs[3]	8,754	
PCBs (µg/kg)		
Aroclor-1254	840	1,240
Aroclor-1260	840	2,600

1 For Zone 3, controlling soil cleanup levels only apply to sample location GP108 for cadmium and PAHs. All other locations are under asphalt and (in the case of PAHs) may not be partially or wholly related to the Site (see **Summary of Remedial Alternatives** section for more detail).

2 Ecological cleanup levels only apply to the top 2 feet of soil as it is the area of primary biological activity. Human cleanup levels apply to all soils. If subsurface soils are contaminated above cleanup levels at substantial depths, it may be appropriate to extend the cap rather than excavate all of the impacted materials.

3 High molecular weight PAHs (compounds containing four or more fused benzene rings) such as benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene.

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PRG candidates (and the subsequent ecologically-based *controlling* cleanup levels) should only apply to the top two feet of soil (see footnote 2 from **Table C** below). As these Aroclors were also found to warrant human health cleanup levels, the lowest potential Aroclor risk-based cleanup values for the human receptors (in this case, from Zone 2) were selected as the human *controlling* cleanup levels.

While the proposed action for OU1 does not directly address impacted groundwater within the shallow or deep aquifers (OU3), one of the RAOs is to "reduce the quantity of leachate that is generated and contributes contaminants from the Site into groundwater." Thus, the overall quality of the groundwater outside the Landfill waste mass is anticipated to improve over time after the OU1 action is completed.

Also, based on the findings of the HHRA and BERA, the proposed action for OU1 does not directly address contaminants currently present in the sediment, surface water or fish tissue. Impacts to surface waters, sediments, and fish tissue will be addressed using source controls via the alternative selected to address Landfill wastes and impacted soils. Contaminant levels in sediment, surface water (and to a lesser degree) fish tissue, are expected to attenuate to some extent with implementation of the source control remedy. Following implementation of the OU1 remedy and subsequent long-term monitoring, as well as the OU3 groundwater investigation, EPA will determine if remediation of surface waters and sediments is warranted. As mentioned above, risk assessment of the aquatic environs associated with the two landfills that comprise the LDCA Site is underway, and potential risks to human and ecological receptors will be further evaluated.

9.0 SUMMARY OF REMEDIAL ALTERNATIVES

The Superfund law and regulations require that the alternative chosen to clean up a contaminated site meets several criteria. The alternative must protect human health and the environment, and meet the requirements of environmental regulations, known as Applicable and/or Relevant and Appropriate Requirements (ARARs). Permanent solutions to contamination problems, which reduce the volume, toxicity, or mobility of the contaminants, should be developed wherever possible. Emphasis is also placed on treating the wastes at the site, whenever this is possible, and on applying innovative technologies to clean up the contaminants.

The FS identified and evaluated a range of remedial alternatives to protect human health and the environment from potential risks associated with OU1 of the LDCA Site. The alternatives are:

Alternative 1 – No Action
Alternative 2 – Limited Actions (e.g., fencing, deed restrictions, monitoring)
Alternative 3 – Single Barrier Cap with Flexible Membrane Liner
Alternative 4 – Single Barrier Cap with Flexible Membrane Liner and Partial Evapotranspiration Cover
Alternative 5 – Composite Barrier Cap
Alternative 6 – Soil Cap
Alternative 7 – Evapotranspiration Cover

EPA's selected alternative for OU1 is Alternative 7, the Evapotranspiration (ET) Cover. Further information beyond what is contained in this ROD may be obtained from the Administrative Record.

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Section 121 (c) of CERCLA, 42 U.S.C. § 9621(c), requires five-year reviews for any remedy that will result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE). Since all of the alternatives developed for the Site will leave waste in place and not allow for UU/UE, five-year reviews will be a component of each alternative.

9.1 Remedial Alternatives Common Elements

Alternatives 3 through 7 share major common elements. The fundamental difference among Alternatives 3 through 7 is the type of cover that is placed over the Landfill wastes and the operation and maintenance (O&M) that would be required for each alternative. All other elements of the Alternatives 3 through 7 are the same. Those elements will be described directly below so that only the distinguishing features of the alternatives will be highlighted as part of the more detailed description which follows.

It is important to note that the Alternatives and their components as they are described below are conceptual in nature. The specific sizes, locations, materials, etc. for each component of the Selected Alternative will be ultimately determined during the remedial design.

Common Elements (Alternatives 3 – 7)

Element 1. *Pre-design investigations (PDI)* – PDI activities will be conducted to:

1. Estimate Landfill settlement rates after construction;
2. Fully delineate the thickness of wastes bordering City Park and creek banks;
3. Refine estimates of contaminated soils above cleanup levels to be excavated from the SIA (including PTW associated with GPR-11), portions of City Park and creek banks (**Figure 20** displays the entirety of the Site including cleanup level exceedances, **Figures 22 – 24** include the specific soil COC concentrations exceeding cleanup levels at each location);
4. Further evaluate representative background concentrations for PAHs;
5. Evaluate dioxin concentrations in soils outside planned Landfill cover boundary and,
6. Evaluate potential for cultural or historical artifacts in southeastern portion of the Landfill.

Additional information on the PDI activities #3 – #6 are discussed below.

PDI Activity #3 – The following areas will be further evaluated to determine the extent of impacted soils above cleanup levels.

- A cluster of points at the northern end of Clearview Landfill (in the vicinity of RI borings GPs-18, 21, 22, and33) (**Figure 20**);
- Four (4) additional isolated sample points within City Park where one or more cleanup levels were exceeded (in the vicinity of GPs-29, 31, 49, and 81); and,
- GP10 and GP108 in the Eastwick Neighborhood.

Nine locations in the Eastwick Neighborhood had one or more exceedances of soil cleanup levels. All of these cleanup level exceedances were limited to a small number of PAHs (human health and ecological protection) and cadmium (ecological protection), with the exception of GP10, which only exceeded the cleanup level for PCBs (human health and ecological protection). **Tables 38 and 39**

specify which contaminants exceeded cleanup levels at each sample location including the locations discussed here. Eight of the nine locations are covered by asphalt; GP108 was located in a grassy area. Pending findings from the PDI and background evaluation, ICs will be put in place in the asphalt covered areas to prevent future unacceptable exposure to soils that are beneath the asphalt and above cleanup levels. Non-PAH and PAH exceedances of soil cleanup levels in non-asphalt areas will be addressed by excavation.

PDI Activity #4 – PAHs are ubiquitous in urban environments due to asphalt surfaces, petroleum spills, coal, tar, and byproducts of fuel burning. Thus, it was assumed that at least some portion of the PAH concentrations detected in Eastwick Neighborhood soils are likely attributable to paved surfaces and other sources of PAHs. Some, if not all, of the PAH concentrations in the Eastwick Neighborhood samples are potentially related to the urban environment of the Site, and no current direct contact exposure pathway exists at these locations that are currently under asphalt. Additional soil sampling and analysis will be conducted during the PDI to further evaluate and establish representative background concentrations for PAHs as well as assuring appropriate PAH cleanup levels.

PDI Activity #5 – As part of the RI, soil sampling and analysis for dioxins was only conducted in Zone 1 in the estimated proximity of an incinerator that reportedly operated for a short period of time, which is inside the current extent of the planned ET Cover. Although EPA screening levels for dioxins were exceeded in one or more soil samples from Zone 1, the current PRG recommended by EPA for residential areas (50 pg/g) was not exceeded in any samples. To confirm that dioxins are not present at concentrations that would present a potential unacceptable risk in soils outside of the planned cover area, additional dioxin sampling will be conducted as part of the PDI as well. Should dioxins be detected in newly sampled areas above appropriate EPA screening criteria, the EPA risk assessment guidance for evaluating human and ecological risks will be followed, as appropriate. EPA would proceed with the appropriate decision making process should a risk assessment show unacceptable levels of dioxins in soils associated with OU1. This would include documentation of any new or changes to cleanup levels in some type of decision document.

PDI Activity #6 - As a result of a cultural resource survey conducted during the RI, the areas of potential effect (APE) for potential buried cultural deposits were established for the Site (**Figure 4**). As part of the PDI, additional archaeological planning and/or investigation to determine the presence of cultural resources within the APE will be required pursuant to the National Historic Preservation Act if the area is to be disturbed by the action.

Element 2. *Site Preparation* – During construction, all of the vegetation within the remedy boundary will be removed unless deemed to be suitable for construction and incorporation into the ET Cover. Erosion and sediment controls will be in place throughout the construction phase to prevent silt, soil and contaminant movement.

Element 3. *Removal and Disposal of PCBs in SIA Wastes and Soils* – As discussed under **Principal Threat Wastes (PTW)**, the PCBs greater than 100 mg/kg in the vicinity of GPR-11 and GPR-166 are considered to be PTW (**Figure 2**). PCBs associated with GPR-11 will be excavated and sent off-site for treatment (if practicable) and/or disposal. The estimated volume of material to be excavated around GPR-11 is 425 cubic yards. PCBs associated with GPR-166 are at a substantial depth (26 feet bgs) and removing them from the waste would result in a greater overall risk to human health due to risks posed to workers and, therefore, will be contained in place. Although not anticipated, should other locations

be identified with PCBs at levels above 100 mg/kg during PDI activities in the SIA, those PCBs would also be considered to be PTW and handled in the same manner.

The PCB wastes located within the SIA are defined as PCB Remediation Wastes at 40 C.F.R. Section 761.3 promulgated pursuant to the Toxic Substances Control Act (TSCA), 42 U.S.C. §§2601 et. seq. Pursuant to TSCA regulation 40 C.F.R. Section 761.61(c) (pertaining to PCB remediation waste), EPA will utilize a risk-based disposal approach that will leave all wastes containing PCBs with concentrations of less than 100 mg/kg on-site and beneath the final cover. As part of the design, the basis for the risk-based approach and other criteria required by 40 C.F.R. Section 761.61(c) will be provided to the appropriate EPA Region 3 program for review. The approach will provide justification for the approach's equivalency with 40 C.F.R. Section 761.61(a) and will demonstrate that there is no greater risk posed by this approach when compared to the requirements in 40 C.F.R. Section 761.61(a) or (b).

Pursuant to the EPA *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, PCBs located within large municipal landfills (such as the Clearview Landfill) and/or PCBs that are inaccessible (as is the case with some of the PCBs on the Site) should be contained where concentrations are greater than 10 mg/kg. As discussed further in this section, all solid wastes associated with the Site are to be consolidated and placed under the Landfill cap or cover. Doing so will ensure that all wastes containing PCBs in concentrations of less than 100 mg/kg, but greater than 10 mg/kg, meet this recommendation. PCBs contained in soils outside the Landfill cover that are greater than the soil cleanup levels in **Table C** will be excavated and consolidated under the cover. All appropriate signage and fencing will be included as part of the selected remedy for the Site.

Element 4. *Excavation and Consolidation of Other Wastes and Soils Above Cleanup Levels* – City Park soils containing contaminant concentrations exceeding cleanup levels (see **Table C**) will be excavated and consolidated under the cover system (which is primarily in Zone 1 but also extends into part of Zone 2 (primarily the City Park), or the cover system would be extended to the locations of these exceedances (**Figures 20, 22 – 24**). The ecological cleanup levels listed in **Table C** apply to the top two feet of soil only as this is the portion of soils to which receptors could come into contact with contaminants. Human health cleanup levels are applicable to soils at all depths. Thus, both human health and ecological cleanup levels apply to the top two feet of soil below ground surface, while only human health cleanup levels apply below two feet below ground surface. Excavations will be to a depth of at least 6 inches (approximately 2.3 acres based on areas enclosed by dashed red or blue lines on **Figure 20**). Exposed soils will be iteratively sampled to evaluate if all appropriate soil cleanup levels have been attained. If they have not, further excavation will be conducted and additional soil samples collected until it is confirmed that remaining soils do not exceed cleanup levels or excavation of soils is no longer deemed practicable, e.g., contaminated soils below the water table. If subsurface soils are contaminated above cleanup levels at substantial depths, it may be appropriate to extend the cap rather than excavate all of the impacted materials. These determinations will be made during the remedial design and will rely on the findings from the RI and PDI as well as input from the property owner (City of Philadelphia), users of the City Park and nearby residents. Current open areas of City Park may ultimately end up being within the boundary of the final cover or treatment wetlands upon completion of the selected remedy. After completion of excavation activities, a minimum of 12 inches of clean fill will be used to restore the surface to the appropriate grade and elevation. Factors that will be taken into consideration regarding proper grade and elevation of the excavated areas include, but are not limited to: final design conditions of the Landfill cover system, long-term stability, planned future use(s) of the areas being excavated and potential impacts to flooding within the 100-year flood plain at

the Site, upstream and downstream. An estimated 4,400 cubic yards of soils will need to be excavated from City Park. If the volume of wastes and soils to be consolidated is determined to exceed the capacity of the cap being designed, these wastes and soils would be excavated, characterized, transported, and disposed of off-site. An appropriate buffer zone between the limits of the cap and nearby properties will be established as part of the design, and coordinated with the property owners and local community members affected by remedial activities.

GP108 (located in the Eastwick Neighborhood) is considered to be outside of the contiguous "area of contamination" (AOC). An AOC is a Superfund concept in which broad areas of contamination, often including specific subunits, are considered to be a single land disposal unit for remedial purposes. Unless determined to be hazardous waste, the soils in the vicinity of GP108 will be excavated and consolidated under the new Landfill cover system. Although not expected, should the contaminated soils in the vicinity of GP108 demonstrate a characteristic(s) of hazardous waste upon testing, Resource Conservation and Recovery Act (RCRA) Land Disposal Restriction (LDR) requirements would be triggered. LDRs dictate treatment and disposal options for soils that are being disposed of or "placed" and soils associated with GP108 would need to be managed pursuant to LDR requirements and thus disposed of at a permitted off-site hazardous waste disposal facility.

Element 5. *Evaluation of Clean Soil Thickness Outside Cover Area* – An area of 11 acres outside the proposed cover system where solely construction debris was encountered in the subsurface during the RI will be evaluated to confirm 1) only construction and demolition debris are present in the subsurface soils and 2) no exceedances of cleanup levels in soils that are outside of excavation areas or ET cover perimeter, as well as to 3) evaluate thickness of clean surface soil in areas with construction and demolition debris present in subsurface. This area is outlined in a yellow dashed line on **Figure 20.** Exceedances of soil cleanup levels within this 11-acre area were limited to surface soils and be addressed in the manner described under Element 4 above. Any locations within this 11-acre evaluation area that have less than 2 feet of clean surface soils will have up to two feet of surface soils and other materials excavated and backfilled with clean fill material. Any soils exceeding cleanup levels will also be addressed in the same manner as described under Element 4.

Element 6. *Site Grading* – After all contaminated soils and Landfill wastes have been consolidated at the Landfill or shipped off-site, and the structures and debris at the SIA are removed, grading will be required prior to installing the cover system to ensure adequate and stable slopes, particularly the landfill slopes bordering Darby and Cobbs Creeks. Grading will allow for maximum slopes of 33%. Conceptually, at least two terraces would be constructed (15-feet wide minimum) at an approximate 20-foot rise in elevation. A 20-foot rise was selected so that the terraces could be more evenly spaced along the Landfill slopes bordering the creeks. The two conceptual terraces have 5% slopes towards the Landfill center. The proposed cover along Darby and Cobbs Creeks would have a slope of about 20%. Exact grading and slop requirements will be determined as part of the remedial design (RD).

Element 7. *East Bank of Darby Creek Erosion Controls* - Approximately 3,780 feet of the Darby Creek East bank will require permanent stabilization and monitoring to prevent erosion and contaminant migration. The estimated limits requiring stabilization are represented by the solid red line on **Figure 21**. Geocells or other bank stabilization products that allow for full slope vegetation will be utilized. Specific stabilization methods will be determined as part of the RD.

Element 8. *Stormwater Management* – To manage stormwater and runoff, drainage swales and/or bioswales would generally encircle the Landfill cover system and convey stormwater via gravity to

stormwater outfalls near the Site. **Figure 21** shows the four outfalls that are currently present on the Landfill. It is assumed that stormwater would not require treatment prior to discharge to surface water bodies as the uppermost components of the cover would consist of uncontaminated soil layers. Surface drainage features will be constructed to generally encircle the Landfill cover system. Consideration of other stormwater best management practices (BMPs), e.g., rain gardens, may also be considered during the design.

Element 9. *On-Site Leachate Seep Treatment via Engineered Wetlands* – To collect shallow leachate, an approximate two-foot wide trench along the Landfill banks would be excavated down to the mean high tide elevation of the adjacent creeks. The approximate location of the leachate seep collection trench is represented by a black dashed line on **Figure 21**. Collected leachate would be pumped to one of two proposed engineered wetlands/detention ponds for treatment of contaminants. The approximate location of the engineered wetlands/detention ponds is represented by the areas outlined in dashed green lines on **Figure 20**. As with other components of the various alternatives, the specific location, size and other factors will be determined during the RD. No trench would be constructed on the east side of the Landfill as leachate seeps have not been observed.

Subsurface flow (SSF) treatment wetlands are proposed to be constructed to act as a semi-passive network of biofilter cells to biodegrade or sorb contaminants, and would not require significant external sources of energy. In SSF treatment wetlands, water is maintained at a constant depth below the surface of the growing medium (typically gravel). Various types of vegetation, such as cattails, are planted in the growing medium. The Site is located inside the 10,000-foot separation distance from the Philadelphia International Airport (PHL) and wetlands typically serve as habitat for wildlife, including birds. Potential bird strikes, particularly with larger bird species, e.g., geese, eagles, etc., can present a hazard to aircraft. To address this issue, a SSF treatment wetland is proposed for the engineered treatment wetlands on the Site. Lack of open water and dense wetland vegetation above the surface will deter use by larger birds and additional steps can be taken to reduce the attractiveness and use of the wetlands by birds, e.g., goose wire near the wetland surface. Smaller birds may still utilize the wetlands; however, their relative hazard when compared to larger birds is markedly lower (FAA Circular 150/5200-33B) and much of the area outside the Site currently provides small bird habitat. The John Heinz NWR is located adjacent to the Site and contains over 1,000 acres of wildlife habitat. The estimated maximum extent of the treatment wetlands is five acres. EPA has determined that these factors and the thoughtful and coordinated design can mitigate any concerns with regard to PHL wildlife hazards attributable to the Site's SSF treatment wetlands. The SSF treatment wetlands will serve a critical ecological function by treating the collected Landfill leachate, eliminating the need for discharge to an off-site facility, creating habitat to sustain ecosystems, providing storage capacity for floodwaters, enhancing green space, serving as a carbon sink, and improving the Site's visual appearance (EPA, 2008a).

The engineered wetlands would be designed to treat and/or reduce bioavailability of any contaminants (e.g., metals, PAHs) that would accumulate and pose any risks to ecological receptors, and will be monitored to ensure accumulation of contaminants in wetlands will not occur. A conceptual planning phase is essential to construct engineered wetlands and would be conducted during the RD. The characteristics of a local natural wetland would be used as a model for the constructed wetland. The planning phase consists of characterizing the quantity and quality of leachate to be treated, determining the discharge standards to be met, selecting the locations, selecting system type and configuration, and specifying the design criteria to be met by the detailed engineering plans, including the land area required, the type of water containment, the control and transport of water

through the system, and vegetation.

The treated water from the SSF treatment wetlands would likely be passively discharged to Darby Creek, Cobbs Creek, or both. Once the cover system is placed, the volume of the leachate collected is estimated to steadily decrease from 6,600 gallons per day (gpd) to 100 gpd. For planning, the wetlands were assumed to cover an area of five acres which would allow for treatment of up to 1.1 million gpd. As with the other components of the remedies evaluated, the characteristics of the SSF treatment wetlands are conceptual and the specifics of the SSF treatment wetlands, including specific quantities and qualities of leachate, wetland location(s), elevation, configuration and size, the control and transport or water through the system and vegetation will be determined during the RD. For planning purposes, it was assumed that the wetlands can be constructed by excavating basins, building up earth embankments (dikes), or a combination of the two. A synthetic liner will be used to seal the bottom of the SSF treatment wetlands to avoid water leaching into the waste, possible contamination of groundwater and also to prevent groundwater from infiltrating into the wetland. Some portions of the SSF treatment wetlands may be constructed on top of contaminated soils and waste, and will serve as the ARAR-compliant cover system for those areas.

Site-specific discharge limits determined pursuant to the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) permit program will be identified during the RD. The capacity of the wetland to remove and store the pollutants such as phosphorous and metals may decrease over time and therefore, should be monitored. The engineered SSF treatment wetland will be monitored and maintained to ensure ecological receptors are not exposed to unacceptable risks. If necessary, wetland sediments and litter can be removed periodically and the wetland rebuilt with fresh substrate.

Element 10. *Relocation of Businesses and Demolition of Buildings* – Any businesses still operating in the SIA of the Landfill will have to be relocated. Relocation of businesses/tenants, if necessary, will be performed pursuant to the Uniform Relocation Act. Once the businesses are relocated and the structures used by them vacated, all existing structures in the SIA would be demolished and removed from the Landfill, along with any debris present, to allow for consolidation and grading of Landfill wastes and construction of the cover. Reoccupation of the Landfill by the current tenants or any new businesses onto the cover should not occur for several reasons including: 1) sloping on much of the Landfill would be too steep to accommodate any structures or vehicles, 2) terraces will be too narrow to allow for permanent structures and are intended to provide space for the access/service road, 3) settling will likely occur within the Landfill which could undermine the stability of any permanent structures, 4) flatter portions of the cover system are not intended or suitable for buildings as added substantial weight could damage the cover system and/or further compact wastes beneath and 5) potential recontamination of the cover system's surface after construction.

9.2 Remedial Alternatives

This section describes the remedial alternatives that EPA considered. Note that the Estimated Present Worth Cost for each alternative was calculated using a 7% discount rate and an Operations and Maintenance (O&M) period of 30 years (unless mentioned otherwise). This time period was used as a basis for comparison.

Alternative 1: No Action

Estimated Capital Cost:	*$0*
Estimated Annual O&M Cost:	*$0*
Estimated Present Worth Cost:	*$53,900 (cost for Five-Year Reviews)*
Estimated Construction Timeframe:	*None*

The NCP requires that a no action alternative be considered to provide a baseline for comparison with other alternatives. Under this alternative, no further action would be implemented and the current status of the waste, soil and leachate would remain unchanged.

Alternative 2: Limited Actions

Estimated Capital Cost:	*$1,797,781*
Estimated Annual O&M Cost:	*$100,369*
Estimated Present Worth Cost:	*$2,708,143*
Estimated Construction Timeframe:	*6 months*

Alternative 2 is considered a limited set of actions because it does directly address the contamination and waste identified on the Site. This alternative would utilize land use restrictions to be implemented through institutional controls (ICs) e.g., land development restrictions, covenants, orders, local ordinances, etc., and engineering controls, e.g., fencing, to prevent direct contact with Landfill contaminants and wastes and to protect the integrity of EPA's selected remedy. ICs would prohibit and/or regulate future on-site land and groundwater use and protect the integrity of the fencing around the Landfill. Fish consumption advisories would be put in place, if current Pennsylvania fishing advisories are insufficient to address potential risks associated with OU1 and RAOs. Currently, the Pennsylvania Fish and Boat Commission (PFBC) has an advisory for the Delaware Estuary (including Darby and Cobbs Creeks) which limits the ingestion of fish tissue to one meal per month due to PCB contamination; eel and carp are under a do-not-eat advisory. These advisories are not regulations and apply only to recreationally caught fish. Advisories currently in place will be evaluated during the RD to determine if they will address the types of fish and exposure assumptions in the HHRA. Additional community outreach may also be conducted to educate the surrounding community regarding potential risks from fish consumption. An Institutional Control Implementation and Assurance Plan (ICIAP) for the Site will be developed during the RD to outline appropriate land use restrictions, and to identify the mechanisms and parties that will be used to implement the land and groundwater use restrictions and monitor the use restrictions to ensure they remain effective. Examples of mechanisms that could be employed to ensure ICs are in place and effective include a Hazardous Site Control Act (HSCA) Section 512 order, which can provide the ICs necessary to protect human receptors and to restrict any use of the Site property that would interfere with the remedial action, as well as a covenant entered into pursuant to the Pennsylvania Uniform Environmental Covenants Act (UECA), that could be used to implement an approach to create, document, and assure

enforceability against present and future land owners of activity and use limitations at the Landfill.

An estimated 6,000 linear feet of fencing (an engineering control) would be installed around the Landfill perimeter to limit human access to contaminated soils and Landfill materials. Additional signs would be placed along the stream bank to warn fisherman of all fishing advisories and the potential risks from fish consumption. As this alternative is not actively treating contamination on the Landfill, the businesses currently operating on the Landfill will have to be shut down and relocated to address the unacceptable risks presented by potential direct contact with surface and subsurface soils to occupants. Demolition of the former business structures will assist in reducing the likelihood of trespassing and other nuisances. Groundwater, surface runoff, surface water, sediment, and leachate would be periodically sampled to monitor the quality of shallow groundwater and leachate leaving the Landfill and the potential impacts to downgradient receptors. Long-term monitoring would be necessary to evaluate changes in water quality in the future, over time and distance.

ICs and engineering controls could be reliably implemented and maintained in the long-term. However, as no active response actions are included under Alternative 2, the landfill surface would continue to erode and expose contaminated materials, allowing greater potential exposures, infiltration, and contaminant leaching and migration into groundwater, surface water and sediments.

Alternative 3: Single Barrier Cap with Flexible Membrane Liner (FML)

Estimated Capital Cost:	*$35,980,451*
Estimated Annual O&M Cost:	*$255,945*
Estimated Present Worth Cost:	*$36,895,641*
Estimated Construction Timeframe:	*18-20 months*
Estimated Time to Reach RAOs:	*2 – 5 years*

Alternative 3 addresses the remedial objectives for OU1 and contains the following remedial components:

- Common Elements – All the common elements described above in **Section 9.1** would be conducted including the PDI to fill data gaps and inform the RD, remove principal threat waste PCBs, excavate and consolidate soils above cleanup levels, manage stormwater, and treat collected shallow leachate using engineered treatment wetlands.

- Relocation of current on-site businesses – To address current exposure risks to those workers and allow for construction of Landfill cover system.

- Landfill Single Barrier Cap – To prevent direct contact with wastes and contaminants, reduce precipitation infiltration, leachate production and migration of contaminants.

- Institutional and Engineering Controls – To prevent access to the Landfill and use of groundwater beneath the Landfill, prevent consumption of fish above unacceptable risk levels, and protect the integrity of the selected remedy.

- Long-term monitoring – To provide preventative inspections and maintenance and to ensure protectiveness.

Alternative 3 utilizes a single barrier cap with flexible membrane liner (FML) to prevent contact with contaminants in soils and Landfill materials and limit precipitation infiltration. Solid waste currently on the surface of the Landfill will be collected, consolidated and placed under the new cap. This alternative includes all of the components of Alternative 2, although the environmental monitoring requirements would likely be more limited because the containment portion of Alternative 3 would minimize potential releases, as opposed to Alternative 2 which would continue to allow surface runoff and leachate seep discharge. As a result, less sampling at fewer monitoring points would be needed to evaluate the off-site impacts when compared to Alternative 2. Additional ICs will also be necessary to protect the components of this alternative that are not included in Alternative 2, e.g., landfill cap, SSF treatment wetlands, etc.

As discussed under Common Element 10, once any businesses are relocated and the structures used by them vacated, all existing structures in the SIA would be demolished and removed from the Landfill, along with any debris present, to allow for consolidation and grading of Landfill wastes and construction of the cap described below. Air monitoring would be conducted during demolition and removal. Asbestos and other non-salvageable materials would be disposed of in an approved and permitted municipal solid waste (MSW) or construction debris landfill. A topographic survey and a geotechnical engineering study would be conducted to obtain data necessary to design and construct the cover system.

Under Alternative 3, containment of the Landfill waste materials associated with historic landfill activities prior to the closure order in 1973 and solid waste currently on the surface of the Landfill would be addressed with a low-permeability single barrier cap system in accordance with the RCRA Subtitle D requirements for MSW landfills. The cover system would be installed over approximately 50 acres and utilize a FML with a maximum permeability of 1.0×10^{-7} cm/sec along with several other layers described below to prevent human and ecological receptor exposures to contaminated soils and Landfill materials, and to minimize precipitation percolation through the cover and into the waste (referred to as "drainage" or "leakage"), which can lead to leachate generation that can then impact groundwater. The conceptual cover system design was developed based primarily on the requirements of 25 PA Code Chapter 273, 40 C.F.R. Section 258, and EPA's guidance for closing MSW landfills (EPA, 1994). With regard to permeability, federal regulations (40 C.F.R. Section 258.60) only require a final cover with a permeability of no greater than 1.0×10^{-5} cm/sec. **Figures 20 and 21** display the approximate footprint, contours and components of the cover system. The components and purpose of a low-permeability cover system would, at a minimum, be as follows (from surface to top of wastes):

- **Erosion (Top Soil) Layer:** Minimum of six inches thick. Facilitates vegetation growth and reduces erosion.
- **Protection (Cover Soil) Layer**: Minimum of two feet of uniform, compacted soil. This layer would serve to support growth of vegetation, avoid frost penetration, protect underlying layers

from desiccation, and prevent accidental human intrusion, penetration by burrowing animals, or root penetration into underlying materials.

- **Drainage Layer:** Geosynthetics (geotextile/geonet or geocomposite) or coarse sand/gravel (minimum of 12 inches). This layer promotes the lateral drainage of water to the collection system.
- **Barrier Layer:** A 40-mil low-density polyethylene (LDPE) geomembrane barrier would serve as the representative barrier layer with a maximum permeability of $1x10^{-7}$ cm/sec, although a one-foot thick layer of compacted clay can also be used. This layer provides a hydraulic barrier to minimize precipitation leakage into the Landfill waste mass, thus reducing leachate production and potential contamination of the groundwater.
- **Gas Vent Layer:** A layer of geocomposite with perforated polyvinyl chloride (PVC) piping would serve as the representative gas vent layer, although a one-foot thick layer of sand or gravel can also be used. The objective of this layer is to passively vent Landfill gases and other VOCs to the ambient air; active venting can also be used.
- **Foundation (Subgrade) Layer:** Minimum of one foot well-compacted soil. This layer prevents damage to the barrier layer and minimizes differential settlement of the cover system.

Once the single barrier cover is constructed, the general overall grade on the Site is expected to lie three feet higher (i.e., 3-foot cap thickness) than the current overall grade. The proposed cap would have an approximate slope of 20% (20 vertical: 100 horizontal) with 33% being the maximum allowable slope. Any slope greater than 15% requires horizontal terracing for every 25 feet of rise in elevation. As a result, conceptually at least two terraces (15 feet minimum width) with a 5% slope towards the Landfill would be constructed to provide stability. The terraces could also serve as space for Site access roads.

Much of the Site, including the Landfill, sits within the 100-year flood plain and flooding within the adjacent neighborhoods is frequent. Potential impacts from the remedy to the floodplain adjacent to the Site as well as the remedy effects upstream and downstream must be appropriately assessed to ensure that no significant negative impacts on flooding occur and that the appropriate regulations pertaining to floodplain management are followed. Potential impacts from flooding on the selected remedy's integrity will also need to be considered and addressed. EPA is currently communicating regularly with the City of Philadelphia, Delaware County, PADEP, U.S. Army Corps of Engineers (USACE) and Federal Emergency Management Agency (FEMA) to collaboratively address flooding issues in this area. This communication with these stakeholders and other appropriate stakeholders should continue throughout the design, construction and operation phases.

New trees and shrubs will be planted along the perimeter of the Landfill bordering City Park (Zone 2) to provide a screen for the Eastwick Neighborhood. Surface run-on and runoff controls would consist of drainage ditches and be channeled, via drainage swales, bioswales or trenches, to surface drains located on the perimeter of the cover system, and ultimately discharged to the adjacent creeks. Gas vents would passively transmit gas (and vapors). Landfill gas levels would be monitored along the Landfill boundary.

The numerical model VADOSE/W© was used to predict the performance of the FML cap over a five year period using actual historic climate data. The model indicated that Alternative 3 would reduce precipitation percolation into the waste by a minimum of 98% (to between 526 to 823 gallons/day) compared to the current estimated condition of 35,600 to 43,500 gallons/day. These rates vary based on climatic conditions such as temperature, precipitation, season, etc.

O&M activities for Alternative 3 would include regular inspections, mowing (at least semi-annually), maintenance on an as-needed basis (e.g., revegetation, erosion repair, sediment removal, etc.), periodic groundwater, surface water and sediment monitoring to assess the effectiveness of the remedy's source control measures and any contaminant loading to the creeks, and periodic landfill gas monitoring (gas vents and wells). For engineered wetlands, long-term O&M may be needed to sustain the wetland plants. Engineered wetland O&M activities may include planting additional wetland species, adding limestone as a buffer material, removing sediments to maintain grades, monitoring treatment concentrations, and accounting for seasonal variations in system performance and maintenance. Discharge samples from the engineered wetlands would be analyzed quarterly for water quality criteria or permitted discharge limits. Upon completion, the portions of City Park outside of the cover system would be available for all types of future uses including residential and recreational. There is potential that soils with COCs at concentrations greater than cleanup levels could remain in the subsurface and not under the cap if excavation of those soils is impracticable, e.g., below the water table. In this case, additional ICs beyond those described in Alternative 2 would be implemented to prevent future exposure of these saturated soils to human and ecological receptors. All human and ecological exposure risks on the Landfill would be eliminated by the cap. Future uses of the Landfill would be limited to the surface and need to be compatible with the remedy. Fencing around the perimeter would still be necessary to prevent unauthorized access from recreational vehicles, e.g., ATVs, and to deter unauthorized activities. However, limited access for recreational purposes, e.g., walking trails, open space, ball fields, etc. could be allowed in certain areas that are not too steep or narrow. The nature of the cap, steep slopes and other factors would prevent the construction of most permanent structures. ICs will be put in place to prevent direct contact with Landfill contaminants, prevent fish consumption from adjacent creeks above unacceptable risk levels and wastes and protect the remedy.

Alternative 4: Single Barrier Cap with FML and Partial Evapotranspiration Cover

Estimated Capital Cost:	*$31,086,497*
Estimated Annual O&M Cost:	*$245,951*
Estimated Present Worth Cost:	*$32,072,090*
Estimated Construction Timeframe:	*18-20 months*
Estimated Time to Reach RAOs:	*2 – 5 years*

Alternative 4 is similar to Alternative 3, but is a hybrid cover that includes a partial Evapotranspiration (ET) Cover encircling the single barrier FML cap in the middle. The term ET Cover refers to the use of a cover system that relies on a combination of temporary storage of precipitation in soil near the surface followed by removal of the stored water by evaporation and transpiration to minimize precipitation percolation through the cover and subsequently into the underlying waste (leakage). The term "ET Cover" is synonymous with alternative covers, store-and-

release covers, and water balance covers[2]. The ET Cover would be used on the steeper Landfill slopes adjacent to the two creeks because it does not contain geomembrane layers, thus minimizing slope instability and slippage. Approximately 35% (17.5 acres) of the cap would be an ET Cover.

The components for the single barrier FML cap are the same as that described for Alternative 3, including the need to relocate any businesses still operating in the SIA of the Landfill and demolish all current structures on the Site, except the cover system. The components and purposes of the ET Cover would, at a minimum, be as follows (from surface to top of wastes):

- **Erosion (Top Soil) Layer:** Minimum of 6 inches thick. This layer facilitates vegetation growth and reduces the potential for erosion. Lower quality soils can be amended with various natural fertilizers and other high nutrient components, e.g., biosolids. Unlike the FML cap, the ET Cover is designed for trees and other large vegetation with deep root systems.
- **Fine-Grained Layer:** Layer of fine-grained soils will be three to four feet thick.
- **Foundation (Subgrade) Layer**: This sand and gravel layer will be 12 inches thick. It prevents the puncture of upper cover barrier layers (extended to the single barrier FML cap portion) by Landfill materials.

Once the hybrid cover system is constructed, the general overall grade on the Landfill is expected to lie 3 to 4 feet higher than the current overall grade. Sloping and terrace assumptions are the same as those used for Alternative 3. Solid wastes on the surface will be managed as described in Alternative 3. Flooding impacts and the need to assess the remedy's impact within the 100-year floodplain are the same as those described under Alternative 3. Potential impacts from flooding on the selected remedy's integrity will also need to be considered and addressed. Communication with Philadelphia, Delaware County, PADEP, USACE and FEMA, as well as other identified stakeholders, should continue throughout the Site's design, construction, and operation phases. The passive gas collection/venting system installed within the area covered by the single barrier FML cap would adequately vent the Landfill gas (methane) generated, if any from the ET Cover. In addition, any trace amount of methane would likely be consumed by aerobic bacteria within the root system (rhizosphere) of the ET Cover.

The numerical model VADOSE/W© was used to predict percolation rates through this hybrid cap over a five year period using actual historic climate data. Once vegetation for the cover is fully established (fair stand of grass for FML; dense deciduous broadleaf forest for the ET Cover), the hybrid cap system employed in Alternative 4 would reduce precipitation percolation into the waste by a minimum of 97.6% (to between 719 to 1,207gallons/day) compared to the current estimated condition of 35,600 to 43,500 gallons/day, assuming a good growth of trees on the ET Cover. When the hybrid drainage rate is converted to the appropriate unit rate (gallons/day to cm/sec) for comparison to the Pennsylvania permeability requirement for MSW landfill covers, the drainage rate from the bottom of the ET portion of the cover once vegetation is fully established corresponds to an average daily rate ranging from 2.3×10^{-8} cm/sec to 4.2×10^{-8} cm/sec, which is less than 1.0×10^{-5} cm/sec. It is important to note that these calculated percolation/drainage rates represent drainage, and not the permeability properties of the ET Cover materials themselves. These comparisons demonstrate that

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2 Albright, W.H., Benson, C.H., Waugh, J.W. (2010). *Water Balance Covers for Waste Containment, Principles and Practice*. American Society of Civil Engineers. 2010. Reston, Virginia.

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performance of an ET Cover would meet or exceed the intended goal for precipitation percolation reduction that is established by the Federal requirement that a MSW cover be designed such that its impermeability is less than 1.0×10^{-5} cm/sec. During the design process for the remedy, the required and maximum storage capacity for the ET Cover will be further evaluated, and variables such as climatic conditions, soil, vegetation, snow and cover thickness will be revised as necessary. Current vegetation and soil thickness will be evaluated during the RD to determine if any portions of the Site where the ET Cover is to be constructed can be enhanced with additional soil to save large trees. Note that maximum effectiveness of reduction of percolation through and drainage from the bottom of the ET Cover will not be realized immediately after installation is completed. Percolation through the ET Cover and subsequent drainage into the waste will decrease over time as vegetation and tree growth become more established. The ET cover is expected to require at least two to five years to fully establish vegetation and achieve the required precipitation drainage rate from the bottom of the cover. In addition, the VADOSE/W© model assumed that trees on the ET Cover would have a root depth of 12 to 24 inches. However, it was found that a root system of trees planted on the ET Cover penetrated far beyond 24 inches (e.g., poplar trees at the Welsh Road Superfund Site - also referred to herein as Welsh Road Landfill or the Welsh Road Site), which provides greater transpiration and further reduces drainage. As part of the cover design, additional modeling for longer periods of time (typically 50 years) would be conducted once certain design parameters (e.g.,. final cover configuration, actual vegetation, settlement effects, etc.) are defined.

Environmental monitoring, O&M, and ICs would be required as described under Alternative 3. Monitoring of the ET Cover's performance would focus primarily on drainage from the base of the cover. Monitoring tools may include, but are not limited to, flux meters, pan lysimeters and soil moisture probes beneath and within the ET Cover to collect performance data. Performance data for the ET cover would be collected on a daily basis. This data would be used to evaluate the ET cover's performance on an annual basis. Property reuse options for City Park and the Landfill would be the same as those discussed under Alternative 3 with the exception being that the ET Cover portion would require a dense stands of trees. As such, use in those areas would be limited to green space and natural ecological habitat, although access roads could also potentially be used as walking or bike paths.

Alternative 5: Composite Barrier Cap

All components of Alternative 5 are identical to Alternative 3, including the need to relocate any businesses still operating in the SIA of the Landfill and demolish all current structures on the Landfill, aside from certain aspects of the cover design. In addition to the geomembrane, the composite barrier cap considered under Alternative 5 includes a 24-inch thick layer of compacted clay or geosynthetic clay liner (GCL) under the geomembrane. This type of cap is typically used to contain hazardous waste.

During the FS development process, it was determined that based on the waste characterization data collected during the RI, this type of cover was not necessary or appropriate for the Landfill and was eliminated from further consideration. Thus, no cost or construction time estimates were developed for Alternative 5. This alternative also was not included in the detailed analysis of alternatives. Additional information on Alternative 5 is available in the FS for the Site, which is part of the administrative record.

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Alternative 6: Soil Cap

Estimated Capital Cost:	*$27,262,480*
Estimated Annual O&M Cost:	*$238,301*
Estimated Present Worth Cost:	*$28,828,236*
Estimated Construction Timeframe:	*14-16 months*
Estimated Time to Reach RAOs:	*2 – 5 years*

Alternative 6 utilizes a soil cap as the cover option, and incorporates all components of Alternative 3, including the need to relocate any businesses still operating in the SIA of the Landfill and demolish all current structures on the Site, except the cover system. The soil cap would be designed to meet the minimum Federal RCRA Subtitle D requirements for a MSW landfill, including an erosion control layer (a minimum of 6 inches in thickness), and the native soil (non-clay) layer (minimum of 18 inches in thickness and a permeability no greater than 1.0×10^{-5} cm/sec). The various components of the conceptual soil cap would be as follows (from surface to top of waste):

- **Erosion (Top Soil) Layer:** 6 inches thick. Same as Alternative 3.
- **Infiltration Layer**: 18 inches thick. Compacted soil barrier consisting of sandy clay loam that would be compacted to permeability less than 1×10^{-5} cm/sec.
- **Gas Vent Layer:** Geocomposite with PVC riser piping. Same as Alternative 3.
- **Foundation (Subgrade) Layer:** 12 inches thick. Same as Alternative 3.

Once the soil cap is constructed, overall grades would generally lie three feet higher than current Site grades. Sloping and terrace assumptions are the same as those used for Alternative 3. Solid wastes on the surface will be managed as described in Alternative 3. Flooding impacts and the need to assess the remedy's impact within the 100-year floodplain are the same as those described under Alternative 3. Potential impacts from flooding on the selected remedy's integrity will also need to be considered and addressed. Communication with Philadelphia, Delaware County, PADEP, USACE and FEMA as well as other identified stakeholders should continue throughout the Landfill's design, construction, and operation phases. Trees and shrubs would be planted to replace any vegetation that was cleared to construct the soil cap and perimeter drains.

The major differences between Alternative 6 and Alternatives 3, 4, and 5 are compliance with applicable or relevant and appropriate requirements (ARARs) and the amount of precipitation infiltration. The EPA HELP model (version 3) indicates that Alternative 6 would reduce precipitation percolation into the waste by about 27% (to 38,765 gallons/day) compared to the current estimated condition of 52,921 gallons/day estimated by the HELP model (40,440 gallons/day estimated by VADOSE/W©). Surface runoff/on controls, gas monitoring/venting, and O&M features, and compatibility with open space reuse scenarios are the same as those for Alternative 3.

Alternative 7: Evapotranspiration Cover

Estimated Capital Cost:	*$22,371,782*
Estimated Annual O&M Cost:	*$228,152*
Estimated Present Worth Cost:	*$23,955,276*
Estimated Construction Timeframe:	*14-16 months*
Estimated Time to Reach RAOs:	*2 – 5 years*

Alternative 7 is similar to Alternative 4, but provides for an ET Cover to be installed over the entire 50 acres. Alternative 7 includes the need to relocate any businesses still operating in the SIA of the Landfill and demolish all current structures on the Landfill. As discussed under Alternative 4, to minimize precipitation percolation into the waste and subsequent leachate generation, the ET Cover relies on the soil layer to store water until it is either utilized by vegetation or evaporated from the soil surface. The ET Cover offers several advantages over conventional impermeable covers, including:

- Reduced construction time and cost due to elimination of geosynthetic cover materials;
- Reduced long-term maintenance requirements;
- Larger potential for sequestration of carbon from forest when compared to grass; and,
- Higher quality habitat.

Once the ET Cover is constructed, the general overall grade on the Landfill is expected to lie three to four feet higher than the current overall grade. Sloping and terrace assumptions are the same as those used for Alternative 3. Solid wastes on the surface will be managed as described in Alternative 3. Flooding impacts and the need to assess the remedy's impact within the 100-year floodplain are the same as those described under Alternative 3. Potential impacts from flooding on the ET cover's integrity will also need to be considered and addressed. Communication with Philadelphia, Delaware County, PADEP, USACE and FEMA as well as other identified stakeholders should continue throughout the Site's design, construction, and operation phases. Long-term monitoring costs for the ET Cover may be lower because damage to the ET Cover is limited to erosion and differential settlement (unlikely for an old landfill such as Clearview Landfill), both of which can be repaired by on-site personnel with addition of soil and replanting. In contrast to conventional covers with thin vegetation, the ET Cover is designed to support a vigorous plant and tree community with roots throughout the depth of the cover. As a result, maintaining healthy vegetation and controlling erosion are typically less problematic for an ET Cover. The components and purposes of the ET Cover are identical to those listed for the ET Cover portion of Alternative 4.

The cover will require between 500 to 1,000 trees per acre and each tree may transpire 5 to 20 gallons of water per day during the growing season (EPA, 2006). The numerical model VADOSE/W© was used to predict the performance of the ET Cover over a five year period using actual historic climate data. The model indicated that once vegetation for the cover is fully established (dense deciduous broadleaf forest), the ET Cover employed in Alternative 7 would reduce percolation into the waste on average by a minimum of 96% (to between 1,080 to 1,920 gallons/day, or, an average of

1,458 gallons/day over five years) compared to the current estimated condition of 35,600 to 43,500 gallons/day. When the ET Cover drainage rate is converted to the appropriate unit rate (gallons/day to cm/sec) for comparison to the various potential federal and state permeability requirements for MSW landfill covers, the drainage rate from the bottom of the ET Cover once vegetation is fully established corresponds to an average daily rate ranging from 2.3×10^{-8} cm/sec to 4.2×10^{-8} cm/sec, which is less than all the required standards. It is important to note that these calculated percolation/drainage rates represent drainage, and not the permeability properties of the cover materials themselves. These comparisons demonstrate that performance of an ET Cover would meet or exceed the intended goals for precipitation percolation reduction that are established by permeability requirements in the regulations.

During the design process for the remedy, the required and maximum storage capacity for the ET Cover will be further evaluated, and variables such as climatic conditions, soil, vegetation, snow and cover thickness, will be revised as necessary. Current vegetation and soil thickness will be evaluated during the RD to determine if any portions of the Landfill where the ET Cover is to be installed can be enhanced with additional soil to save large trees. Note that maximum effectiveness of reduction of percolation through and drainage from the bottom of the ET Cover will not be realized immediately after installation is completed. Percolation through the ET Cover and subsequent leakage into the waste will decrease over time as vegetation and tree growth become more established. The ET Cover is expected to require at least two to five years to fully establish vegetation to achieve the required precipitation drainage rate from the bottom of the cover. As with Alternative 4, the VADOSE/W© model assumed that trees on the ET Cover would have a root depth of 12 to 24 inches. However, it was found that a root system of trees planted on the ET Cover penetrated far beyond 24 inches (e.g., poplar trees at the landfill at the Welsh Road Superfund Site), which provides greater transpiration and further reduces drainage. As part of the cover design, additional modeling for longer periods of time (typically 50 years) would be conducted once certain design parameters (e.g.,. final cover configuration, actual vegetation, settlement effects, etc.) are defined.

Environmental monitoring, O&M, and ICs would be implemented as described under Alternative 3. Any trace amount of methane would likely be consumed by aerobic bacteria within the root system (rhizosphere) of the ET Cover. Monitoring of the ET Cover's performance would focus primarily on drainage from the base of the cover. Monitoring tools may include, but would not be limited to, flux meters, pan lysimeters and soil moisture probes beneath and within the ET Cover to collect performance data. Performance data for the ET cover would be collected on a daily basis. This data would be used to evaluate the ET cover's performance on an annual basis. Property reuse options for City Park and the Landfill would be the same as those discussed under Alternative 3 with the exception being the ET Cover portion which requires dense stands of trees. As such, land and activity use in those areas would be limited to green space and natural ecological habitat, although access roads could also potentially be used as walking or bike paths.

10.0 EVALUATION OF ALTERNATIVES

The remedial alternatives described above were evaluated in detail to determine which alternative would best meet the requirements of CERCLA, as amended, and the NCP, and achieve RAOs identified in section 8.0 of this ROD. EPA uses the nine criteria set forth in the NCP, 40 C.F.R. § 300.430(e)(9)(iii), to evaluate remedial alternatives. The first two criteria are threshold criteria: (1) overall protection of human health and the environment, and (2) compliance with applicable or

relevant and appropriate requirements ("ARARs"). The selected remedy must meet both of these threshold criteria, except when an ARAR waiver is invoked. The next five criteria are the primary balancing criteria: (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility or volume through treatment; (5) short-term effectiveness; (6) implementability; and (7) cost. The remaining two criteria are referred to as modifying criteria and are taken into account after public comment is received on the Proposed Remedial Action Plan: (8) state and (9) community acceptance.

The following discussion summarizes the evaluation of the remedial alternatives developed for the Site against the nine evaluation criteria. **Table 40** provides a summary of the comparative analysis. Alternative 5 will not be included in this evaluation because of reasons already described in **Section 9.2**.

Overall Protection of Human Health and the Environment (Threshold Criteria)

This criterion addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or ICs.

A no action alternative (Alternative 1) must be evaluated in accordance with CERCLA and the NCP to serve as a basis for comparison with the other alternatives. Alternative 1 would not be protective of human health and the environment since no actions would be taken to prevent exposure to and migration of Landfill contaminants and wastes nor would action be taken to reduce infiltration into Landfill wastes. No risk reduction to human or ecological receptors will occur. This alternative fails to achieve this threshold criterion and will not be considered further.

Alternative 2 (Limited Action) would not be protective of human health and the environment as the proposed actions would allow infiltration into wastes and migration of Landfill contaminants via surface runoff, shallow groundwater and Landfill seeps to continue. This alternative would only result in a minor reduction in human exposure and risks due to the fence around the Landfill perimeter. No ecological risk reduction would occur. This alternative fails to achieve this threshold criterion and will not be considered further.

Alternatives 3, 4, 6, and 7 all utilize containment measures to protect human and ecological receptors from direct contact with contaminants, and reduce infiltration and off-site migration of contaminants. All four alternatives will satisfy all RAOs and each equally meets the threshold criterion for Overall Protection of Human Health and the Environment. Alternative 6 (Soil Cap) would not achieve RAOs with regard to reducing infiltration of precipitation through the cover system and drainage into landfill wastes. Aside from the RAO regarding the reduction of precipitation infiltration into the Landfill waste materials, Alternatives 3, 4 and 7 will achieve the remaining RAOs within the same timeframe as their other components are identical. For Alternative 3, the RAO for reducing the infiltration of precipitation into the Landfill waste materials will be met when construction of the cover system is complete. For Alternatives 4 and 7, the estimate timeframe to achieve the RAO for reducing the infiltration of precipitation in to the Landfill waste materials is two to five years. Under Alternatives 3, 4, 6 and 7, ecological risks are significantly reduced by excavating contaminated soils and wastes and placing them under the Landfill cap.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) (Threshold Criteria)

This criterion addresses whether a remedy will meet all of the requirements of other federal and state environmental statutes, regulations, and other requirements that are pertinent to the Site, and/or justifies a waiver.

Any cleanup alternative selected by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements or, under certain conditions, waive one or more ARAR as set forth in section 121(d) of CERCLA, 42 U.S.C §9621(d) and 40 C.F.R §300.40(f)(1)(ii)(B). Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the remedial action to be implemented at a site. Relevant and appropriate requirements, while not being directly applicable, address problems or situations sufficiently similar to those encountered at a site such that their use is well-suited to the particular site. EPA is waiving one ARAR for the Clearview Landfill as described below.

A closure order was issued for the Landfill in 1973. However, the Landfill was never closed or maintained appropriately as required by the established regulations at the time. As a result, PADEP's position is that the Landfill closure regulations in place at the time of the closure order (25 PA Code § 75) are the applicable regulations to be used for completing the closure of the Site. These regulations are not as stringent as the Federal closure requirements established for MSW landfills that stopped receiving wastes prior to October 9, 1993 and consequently, the Pennsylvania regulations cannot be considered an ARAR. Therefore, the final cover permeability, thickness and component requirements established in 40 C.F.R. § 258.60(a) are the proper landfill cover ARAR for the Site. Cover permeability dictates the amount of precipitation that reaches the landfill wastes and the subsequent amount of leachate that is generated. Approximately 33.5% of the Landfill waste is located beneath the natural water table and will always be saturated. As such, precipitation infiltration control measures, such as capping, would have little or no influence on this submerged waste and presumably on the leachate generated from this waste.

Alternatives 3 and 6 would comply with Federal landfill ARARs by installing a presumably impermeable cover. However, flaws and damage to impermeable landfill caps during installation are well documented in the EPA Alternative Cap Assessment Program (ACAP) Report and can result in increased infiltration rates[3]. The ET Cover employed in Alternative 7 and partially in Alternative 4 would comply with the Federal and State landfill cover ARARs, with the exception of the requirement pertaining to the permeability of the final cover materials. While the ET Cover will substantially reduce percolation into the Landfill materials, the measurement of a permeability of 1.0×10^{-5} cm/sec is not applicable as an ET Cover is not designed to function as an impermeable barrier. Rather, an ET Cover is intended to allow precipitation into the cover, where it is stored in the soil layer like a sponge, until it is transpired by vegetation or evaporates into the atmosphere. Drainage of precipitation from the bottom of the ET Cover will occur during time periods when precipitation is greater than moisture

3 Albright, W.H., Benson, C.H. (2005). "Alternative Cap Assessment Program (ACAP) Report to Office of Research and Development, National Risk Management Research Lab, Land Remediation and Pollution and Control Division." EPA. 2005

storage capacity of the ET Cover.

Selection of Alternatives 4 or 7 would require a waiver of the cover permeability requirement under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D), "Equivalent Standard of Performance" criterion waiver. As discussed under the description of those alternatives, the full or partial ET Covers would provide an equivalent or better standard of performance when compared to a conventional landfill cover with a permeability of 1.0×10^{-5} cm/sec. ET Covers utilize different design functions than what is required by federal and Pennsylvania MSW regulations. Currently, no federal guidance exists for evaluating percolation rates for conventional landfill covers that are built to meet required regulatory standards. Nor are specific numerical values for percolation rates provided that can be used to define equivalency[4]. However, a conventional landfill cover built to attain a 1×10^{-5} cm/sec permeability should result in a percolation/drainage rate through the cover system that is no greater than 1×10^{-5} cm/sec (461,837 gallons/day over 50 acres or 9,237 gallons/day/acre), assuming there are no construction flaws. Using this assumption, the calculated percolation/drainage rates of the various cover systems considered for OU1 can then be compared to the required permeability design standard and the performance equivalency evaluated. **Table D** below displays the modeled maximum and minimum percolation rates into waste over a five year period for Alternatives 4 and 7.

Table D. Average Five Year Percolation Rates into Waste Over 50 Acres

Alternative	Maximum Average Daily Drainage (cm/s)	Maximum Average Daily Drainage (gallons/day)	Minimum Average Daily Drainage (cm/s)	Minimum Average Daily Drainage (gallons/day)
#4	2.64×10^{-8}	1207	1.5×10^{-8}	719
#7	4.2×10^{-8}	1920	2.3×10^{-8}	1080

The drainage rate from the bottom of the ET Cover once vegetation is fully established (LAI = 8; dense deciduous leaf forest) corresponds to an average daily rate ranging from 2.3×10^{-8} cm/sec to 4.2×10^{-8} cm/sec, which is several orders of magnitude less than 1.0×10^{-5} cm/sec. These comparisons demonstrate that performance of an ET Cover would meet or exceed the intended precipitation percolation reduction that is established by the federal landfill cover regulations which require the design standard of a permeability of 1.0×10^{-5} cm/sec.

To implement Alternatives 4 or 7 using the waiver, established performance criteria and demonstration of their equivalent performance with regard to percolation will be required. Alternatives 3 and 6 would achieve Federal regulation pertaining to cover permeability and leachate generation as they would be built to achieve a cover permeability of 1.0×10^{-7} and 1.0×10^{-5} cm/sec, respectively.

The leachate collection and treatment components of Alternatives 3, 4, 6 and 7 are identical and, aside from Alternative 6, the volume of leachate would be approximately the same. Alternative 6 would result in a much greater volume of leachate generation as it is more permeable and would allow more leakage.

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4 Albright, W.H., Benson, C.H., Waugh, J.W. (2010). *Water Balance Covers for Waste Containment, Principles and Practice*. American Society of Civil Engineers. 2010. Reston, Virginia.

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Another key ARAR would be the state surface water quality criteria which would need to be met by water discharged from the engineered treatment wetlands. The specifics of the wetlands treatment components needed to achieve all discharge requirements will be determined during the RD. Alternatives, 3, 4, 6, and 7 would all comply with all other treatment, location- and action-specific ARARs.

Alternatives 3, 4, 6 and 7 would achieve compliance with ARARs within a reasonable period of time. Alternatives 3 and 6 would likely achieve ARARs in a shorter amount of time, while the ET portions of Alternatives 4 and 7 would require at least two to five years to fully establish vegetation.

Of those alternatives that are considered protective, Alternatives 3 and 6 would comply with all ARARs, but an ARAR waiver would be required for the ET Cover portion of Alternative 4 and the entirety of Alternative 7.

Long-Term Effectiveness and Permanence (Primary Balancing Criteria)

This criterion addresses expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Alternatives 3, 4 and 7 will all achieve a high level of long-term effectiveness and permanence. Alternative 6 would also be effective in the long-term by reducing direct contact with contaminants, but reduction of precipitation leakage into the waste and subsequent leachate generation with that alternative would not be as effective as Alternatives 3, 4, and 7. Use of the ET Cover in Alternatives 4 and 7 and the soil cap in Alternative 6 on the steep Landfill slopes along the creek bank will reduce the potential for slope failure and slippage that is a common problem for conventional cover systems employing FML. The ET Covers in Alternative 4 and 7 will offer greater long-term permanence as they do not require a high degree of maintenance once vegetation is fully established.

With regard to performance in reducing precipitation percolation into the waste, modeling of Alternatives 3 and 7 indicated that over a five year period, performance of the ET Cover would steadily increase in small intervals while the FML cap and soil cap would steadily decline in similarly small increments. This variation is a function of vegetation on the ET Cover becoming more robust and increasing evapotranspiration rates, whereas the FML and soil cap used for Alternatives 3 and 6, respectively, would slowly degrade over time due to wear and tear on the materials that were used. As Alternative 4 is a combination of Alternatives 3 and 7, the respective components would see similar changes in performance. Surficial damages, e.g., erosion, cracking, etc., to either of the cover types would be relatively easy to identify and repair. Degradation of deeper portions of the cover would be increasingly more difficult to identify and, in the case of the FML, more costly to repair and/or replace.

For Alternatives 3, 4, 6 and 7, waste and contaminated materials beneath the natural water table would continue to be saturated and generate leachate. Much of the leachate (and/or shallow groundwater) generated in the future is anticipated to be captured by collection trench systems, and treated on-site prior to surface discharge or further treated at off-site facilities. Engineered treatment wetlands are a component of Alternatives 3, 4, 6 and 7 and are expected to be effective in the long-term. Periodic monitoring and maintenance of the engineered wetlands will be performed to ensure continued effectiveness in treating leachate to NPDES permit equivalent discharge standards.

Of the four remaining alternatives, Alternative 7 is considered to be the most advantageous alternative with regard to long-term protectiveness and permanence, with Alternative 4, Alternative 3, and Alternative 6 following in descending order.

Reduction of Toxicity, Mobility, or Volume through Treatment (Primary Balancing Criteria)

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances as their principal element. This preference is satisfied when treatment is used to reduce the principal threats at a site.

Use of a cover or cap in Alternatives 3, 4, 6, and 7 does not offer treatment of contaminants; therefore, reduction of toxicity, mobility and volume of the Landfill contents through treatment would not be accomplished.

Treatment of leachate seeps collected along the creek bank via on-site wetlands would reduce toxicity and mobility of contaminants equally for Alternatives 3, 4, 6 and 7. The volume of contaminants in leachate that are actively treated is directly proportional to the amount of infiltration that occurs. Thus, the alternatives with the higher projected precipitation infiltration and leakage rates would result in a larger volume of contaminants being reduced via treatment in the wetlands. The amount of PCBs in soils potentially treated off-site is also equal for all of these alternatives. Landfill gas treatment by the microbial community within tree root zone (rhizosphere) of the ET Cover in Alternative 7 (partly in Alternative 4) would reduce toxicity and volume of contaminants in the Landfill gas naturally.

Of the four remaining alternatives, Alternative 7 is considered to be the most advantageous alternative with regard to reduction in toxicity, mobility, and volume of contaminants through treatment due to the destruction of methane in the root zone portion of the ET Cover, with Alternative 4 providing a lesser amount of methane destruction and Alternatives 3 and 6 being considered equivalent with regard to reduction in toxicity, mobility, and volume of contaminants through treatment.

Short-Term Effectiveness (Primary Balancing Criteria)

This criterion addresses the period of time needed to achieve protection of and prevent any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Alternatives 3, 4, 6, and 7 are equally effective in the short-term as they all entail substantial earthwork, include some type of cover system, have the same components outside of the cover and thus face similar implementation challenges. There would be minimal risks, if any, to the community, workers, or the environment in implementing these alternatives. Earthwork and construction within the 100-year floodplain and in close proximity to the Eastwick Neighborhood would require planning and coordination with community and various government agencies. It is likely that some excavation, backfilling and grading would occur near the homes that border the City Park or are near the soil cleanup level exceedance areas within the Eastwick Neighborhood. Additional impacts to residents in nearby homes could be encountered if results from the PDI indicate exceedance of soil cleanup goals is more expansive or extends onto one or more private properties. Workers from the businesses currently

located in the SIA portion of the Landfill will have been moved off the Landfill by the time construction begins and therefore exposure to contaminants will not occur during remedy implementation. Noise control, dust suppression, air quality monitoring, and other precautions would be necessary when working near any homes. Similar controls, including air monitoring and erosion controls, would be implemented throughout the entirety of the OU1 action. There would be additional traffic due to preparation and the import and placement of capping materials. The estimated construction duration for each of the alternatives is as follows:

- Alternative 3: 18 to 20 Months
- Alternative 4: 18 to 20 Months
- Alternative 6: 14 to 16 Months
- Alternative 7: 14 to 16 months

Aside from the RAO regarding the reduction of precipitation infiltration into the Landfill waste materials, Alternatives 3, 4 and 7 will achieve the remaining RAOs within the same timeframe as their other components are identical. For Alternative 3, the RAO for reducing the infiltration of precipitation into the Landfill waste materials will be met when construction of the cover system is complete. For Alternatives 4 and 7, the estimate timeframe to achieve the RAO for reducing the infiltration of precipitation in to the Landfill waste materials is two to five years. Of the four remaining alternatives, Alternatives 6 and 7 are considered the most advantageous alternatives with regard to short-term effectiveness due to the shorter estimated construction timeframes, with Alternatives 3 and 4 following and being considered equivalent with one another.

Implementability (Primary Balancing Criteria)

This criterion addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

Technically, Alternatives 6 and 7 would be more easily implementable than Alternatives 3 and 4 due to lack of FML and/or geocomposite for the cover systems. Alternative 7 would be most implementable among the remaining alternatives in consideration since it involves no geosynthetic materials and fewer cover component materials, which require significant surface preparation and placement, including along the Darby and Cobbs Creek banks. However, Alternatives 4 and 7 involve an alternative cover design and therefore, they may require more time and effort to demonstrate their performance equivalency. Potential excavation near homes in City Park to remove contaminated soils and waste would also be challenging, which is a common implementation issue for Alternatives 3, 4, 6 and 7. Excavating near the creek bank during the cap construction may pose some additional challenges for Alternative 3 due to the use of the FML which will require substantial surface preparation, slope stability and anchoring. It is likely that no single borrow source will be able to provide all of the soil materials necessary for the cover/cap portion of these alternatives. The estimated volumes of various quality soils needed for Alternatives 3, 4, 6 and 7 are 282,333 cubic yards (cy), 298,463 cy, 242,000 cy and 326,667 cy, respectively. An additional estimated 4,400 cy of topsoil will be needed for each of these alternatives for backfilling of excavated areas in the City Park. These volumes are similar and will likely present common challenges with identification of the multiple borrow sources necessary to provide these materials. The types of ICs required for these four alternatives should be the same and relatively easy to implement. It may be more challenging to ensure

that all fishing advisories are being followed as there will not be full time patrols of the shoreline adjacent to the Landfill.

Of the four remaining alternatives, Alternative 7 is considered to be the most advantageous alternative with regard to implementability, with Alternative 6, Alternative 4 and Alternative 3 following in descending order.

Costs (Primary Balancing Criteria)

This criterion includes estimated capital and operation and maintenance costs, compared as present worth costs.

The majority of the costs associated with Alternatives 3, 4, 6 and 7 (**Table E**) are associated with the cover and leachate collection trench materials. Alternatives 3 and 4 require more Site preparation, which will increase time and funding needs, in order to ready the surface for placement of the FML cap.

Table E. Estimated Costs (in dollars)

Number	Alternative	Capital	Annual O&M	Present Worth
3	Single Barrier Cap with FML	$35,980,451	$255,945	$36,895,641
4	Single Barrier Cap with FML and Partial ET Cover	$31,086,497	$245,951	$32,072,090
6	Soil Cap	$27,262,480	$238,301	$28,828,236
7	ET Cover	$22,371,782	$228,152	$23,955,276

State/Support Agency Acceptance (Modifying Criteria)

PADEP has reviewed the draft Record of Decision and comments from the public, and concurred with the selected remedy in a letter dated September 17, 2014.

Community Acceptance (Modifying Criteria)

From August 1, 2013 through August 31, 2013, EPA held a 30-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study and the Proposed Plan and the other documents contained within the Administrative Record for the Site. As a result of several requests, EPA extended the public comment period for an additional 30 days to September 30, 2013. On August 15, 2013, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record. The summary of significant comments received during the public comment period and EPA's responses are included in the Responsiveness Summary, which is a part of this Record of Decision. In general, the community accepts the selected remedy. There were several comments submitted on various topics including, but not limited to, the projected performance of the ET cover and engineered treatment wetlands, stormwater management and flooding, types of institutional controls that can be used and potential reuse of the Site.

11.0 SELECTED REMEDY

Following review and consideration of the information in the Administrative Record, the requirements of CERCLA and the NCP, and public comments, EPA has selected the following as the remedy for the Lower Darby Creek Area Superfund Site – OU1 Clearview Landfill Soils and Waste: Alternative 7, Evapotranspiration (ET) Cover to address Landfill waste, contaminated soils and shallow leachate.

11.1 Summary of the Rationale for the Selected Remedy

EPA's selected remedy meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs. Based on the information currently available, EPA (the lead agency) has determined that Alternative 7 provides the best balance of advantages and disadvantages among the alternatives, when evaluating them using the balancing criteria.

EPA's selected remedy for the Landfill:

1. Will be protective of human health and the environment;

2. Will meet federal and state ARARs with the exception of 40 C.F.R. § 258.60(a) which is being waived under the "Equivalent Standard of Performance" waiver established under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D);

3. Will be readily implementable in a shorter amount of time and provides long-term effectiveness, yet will require less maintenance;

4. Will be more cost effective while providing the same level of protectiveness as the other alternatives

5. Will address known principal threat wastes at the Site; and,

6. Prevents human and ecological exposure to Site contaminants above cleanup levels, reduces the generation and migration of contaminants, and achieves all RAOs.

Overall, EPA's selected remedy satisfies the statutory requirements of CERCLA §121 and the NCP by being protective of human health and the environment; complying with ARARs except as has been noted; being cost-effective; utilizing permanent solutions and alternative treatment technologies to the maximum extent practicable; and addressing principal threat waste. The selected remedy represents the best balance of the nine evaluation criteria.

11.2 Description of the Selected Remedy and Performance Standards

Based on the comparison of the nine criteria, EPA's selected remedy for the Landfill is Alternative 7. The total present worth cost for the EPA's selected remedy is $23,955,276. In addition to the common elements described in **Section 9.1**, the major components of the selected remedy (as discussed in detail in **Section 9.2**) are:

1. Pre-design investigation (PDI) activities to delineate waste and contaminated soil boundaries.

2. Installation, maintenance and monitoring of an evapotranspiration (ET) Cover System over approximately 50 acres, including relocation of on-site business and demolition of all structures within the ET Cover boundary, Site grading, storm water controls and erosion controls along the east bank of Darby and Cobbs Creeks.

3. Removal and off-site disposal of PCB principal threat wastes.

4. Excavation and consolidation of wastes and contaminated soils above cleanup levels within and beneath the ET Cover.

5. Construction and maintenance of a leachate collection trench along the Landfill creek banks down to the mean high tide elevation of the creeks and construction, maintenance, and monitoring of engineered wetlands to treat contaminants to surface water discharge requirements.

6. Long-term monitoring of groundwater, leachate, landfill gas, surface water and sediment, to evaluate remedy performance and effectiveness.

7. Land and groundwater use restrictions to be implemented and maintained through institutional controls (ICs) and engineering controls to protect the integrity of the selected remedy including the ET Cover, leachate collection trench, engineered wetlands, and prevent exposure to soils outside of the ET Cover above cleanup levels. Additional fishing advisories may also be required. Signs will be placed along the stream bank to warn fisherman of all fishing advisories and the potential risks from fish consumption. An Institutional Control Implementation and Assurance Plan (ICIAP) will be developed for OU1 during the remedial design (RD) to ensure appropriate land and groundwater use restrictions are implemented, and monitored and maintained against future land owners.

The selected remedy shall meet all applicable or relevant and appropriate requirements as set forth in **Table 41**.

11.2.1 Conduct Pre-Design Investigation

Perform pre-design investigation (PDI) to refine landfill waste boundaries, determine extent of soil contamination above cleanup levels and evaluate background levels of PAHs.

Performance Standards for PDI

1. As discussed under Element #1 of Section 9.1, an investigation shall be conducted prior to or during the initial stages of the RD to address the following six factors:

a. Geotechnical studies will be performed to evaluate long-term evapotranspiration (ET) Cover stability, minimize long-term grade deterioration, and estimate Landfill settlement rates after construction.

b. Install additional borings and collect additional sample data as necessary in the approximate 11 acre area outside the ET Cover perimeter in the eastern portion of the Eastwick City Park and western edge of Eastwick Neighborhood (as identified by the area outlined in a yellow dashed-line in **Figure 20**) to confirm 1) only construction and demolition debris are present in the subsurface soils and 2) no exceedances of cleanup levels in soils that are outside of excavation areas or ET Cover perimeter, as well as to 3) evaluate thickness of clean surface soil in areas with construction and demolition debris present in subsurface. Relevant and appropriate portions of 25 PA Code 277.233(a)(3) regarding final cover requirements of construction/demolition waste landfills will be met.

c. Collect surface and subsurface soil samples to determine horizontal and vertical extent of soil cleanup level exceedances in areas outside of the ET Cover perimeter and engineered treatment wetlands. **Figures 20, 22 – 24** and **Tables 38 and 39** identify those locations with one or more exceedances of cleanup levels. The soil sampling plan should take into account potential future uses of sampled areas. Multi-increment sampling (MIS) should be utilized where appropriate.

d. Collect surface and subsurface soil samples to evaluate regional anthropogenic background levels of PAHs in soils not impacted by the Landfill. It is likely that some, if not all, of the PAHs concentrations in the Eastwick Neighborhood samples are potentially related to the surrounding urban environment. Based on results of background study, reevaluate and refine PAH cleanup levels in soils as appropriate. MIS should be utilized where appropriate.

e. Collect surface and subsurface soil samples in Eastwick City Park to evaluate concentrations of dioxins in soils outside of the planned ET Cover perimeter. Background sampling for dioxins should also be conducted. Soil sampling plan should take into account potential future uses of sampled areas. MIS should be utilized where appropriate. Potential human and ecological risks from dioxins should be evaluated pursuant to EPA risk assessment guidance. If sample results indicate potential unacceptable risks, the dioxin evaluation should be expanded until areas with acceptable dioxin risks around the landfill or a non-site-related source is identified. EPA will evaluate potential risks to determine what appropriate response actions for dioxins in OU1 soils, if any, are necessary pursuant to CERCLA and the NCP. This would include documentation of any new or changes to cleanup levels in a of decision document issued by EPA.

f. Conduct an additional archaeological evaluation to determine the potential presence of cultural resources within the Areas of Potential Effect (APE) in any portions to be disturbed by the selected remedy. The evaluation shall be conducted in accordance with the applicable portions of the National Historic Preservation Act, 18 C.F.R. §380.14

11.2.2 Installation, Maintenance and Monitoring of an Evapotranspiration Cover System for Landfill Wastes and Contaminated Soils

Prevent human and ecological exposure to contaminated soils and landfill materials that pose an unacceptable risk, reduce infiltration of precipitation into Landfill waste materials and reduce the subsequent quantity of leachate that is generated by constructing an evaporation (ET) cover. This work shall include relocation of on-site business and demolition of all structures with the cover system boundary, Site grading, storm water controls, erosion controls along the east bank of Darby Creek and revegetation of the new ET cover.

Performance Standards for Evapotranspiration Cover System for Landfill Wastes and Contaminated Soils

1. Remedial design (RD) of the ET Cover shall include determination of how much water must be stored by the ET Cover based on meteorological conditions at the Landfill, how much water can be stored in the proposed cover profile, water balance simulations of the designed cover system using appropriate computer models, and goals, objectives, success criteria and monitoring parameters for ET Cover revegetation and performance.

2. As part of the RD, the environmental footprint of the remedy shall be evaluated following the EPA *Methodology for Understanding and Reducing a Project's Environmental Footprint, EPA 542-R-12-002.* The environmental footprint includes metrics such as, but not limited to, energy use and water use as well as air emissions to fully represent the effects a cleanup project may have on the environment. This footprint evaluation shall be applied to the design, construction, long-term monitoring, and operation and maintenance phases of the remedy. Based on the findings of the footprint analysis, effective steps should be taken to reduce the remedy footprint, while still meeting the regulatory requirements established in this Record of Decision (ROD).

3. The ET Cover will prevent human and animal exposure to contaminated soils and landfill materials, and reduce infiltration of precipitation into waste materials. The ET Cover shall include soil and vegetation of quantity and quality to be determined during the RD. The ET Cover may extend over areas with no waste but with contaminated soil above cleanup levels at depths which make excavation impracticable, e.g., below the water table. The ET Cover meets, and in one instance waives, the applicable or relevant and appropriate requirements for landfill closure. Applicable requirements include 40 C.F.R. § 258.60(a). 40 C.F.R. § 258.60(a)(1) requires that a final cover for a MSW landfill have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1.0×10^{-5} cm/sec, whichever is less. This requirement is being waived using the "Equivalent Standard of Performance" under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). As discussed under the **Evaluation of Alternatives** section, a conventional landfill cover built to attain a 1×10^{-5} cm/sec permeability should result in a percolation rate through the cover system that is no greater than 1×10^{-5} cm/sec, which equates to 9,237 gallons/day/acre (461,837 gallons/day over 50 acres). The ET Cover shall provide an Equivalent Standard of Performance to achieve the relevant and appropriate requirement in 40 C.F.R. § 258.60(a)(1) by ensuring the drainage

rate from the bottom of the ET Cover is no greater than the above value. The ET Cover is expected to achieve this performance standard incrementally over time and that progress shall be evaluated during the first five-year review for which five years of monitoring data is available after the remedy is determined to be Operational and Functional. Performance data for the ET cover with respect to drainage and other factors shall be collected on a daily basis. These data will be used to evaluate the ET cover's performance on, at minimum, an annual basis. An annual average drainage rate from the bottom of the ET cover shall be calculated each year and used to evaluate the ET Cover's ability to attain the 9,237 gallons/acre/day percolation rate. Collection and evaluation of the ET cover performance monitoring data shall continue until sufficient data are available such that EPA can determine that the ET cover is providing an equivalent standard of performance as required by the ROD. The effectiveness of the ET Cover will continue to increase over time as the vegetation grows and becomes more established.

4. Any businesses still operating on the landfill within the boundaries of the ET Cover at the commencement of the remedial action shall be permanently relocated and the structures used by them vacated and demolished as they physically block and will interfere with the selected remedy. Relocation of businesses/tenants will be performed pursuant to the Uniform Relocation Act, 42 U.S. Code §§ 4601 et seq., and regulations promulgated pursuant thereto at 49 C.F.R Part 24.

5. To the extent practicable, all vegetation used for the ET Cover shall be native species to promote transpiration and minimize erosion by stabilizing the surface of the cover.

6. Proposed design for the ET Cover final elevation and elevations of other remedial components shall be evaluated for potential flooding impacts to the 100-year floodplain. Potential impacts from potential sea level rise over the lifetime of the remedy shall be taken into consideration as part of the RD. The final ET Cover shall not significantly increase the 100-year flood height or stream velocity as is required by 25 PA Code § 106.31(a)(1). Additional relevant and appropriate requirements in 25 PA Code § 106.31-.32 shall be met by the final ET Cover. Applicable portions of Executive Order 11988, Federal Floodplains Requirements, shall be met. As needed, the applicable process for a Conditional Letter of Map Revision per 44 C.F.R. § 65.8 shall be followed.

7. Vegetation will be removed as needed within the ET Cover boundary. Some existing trees may be suitable for incorporation into the ET Cover. Erosion and sediment controls will be in place throughout the construction phase to prevent silt, soil and contaminant movement into adjacent water bodies or the Eastwick Neighborhood.

8. After all contaminated soils and Landfill wastes have been consolidated at the Landfill or shipped off-site, and the structures and debris at the SIA are removed, grading will be required prior to placing the cover system to ensure adequate and stable slopes. Grading will allow for maximum slopes of 33%. The slopes will be terraced as needed for erosion control and successful vegetation. The applicable portions of the Pennsylvania Air Quality Standards, 25 PA Code § 123.31 and the Pennsylvania Erosion Control Regulations, 25 PA Code § 102.4, .11 and .22 shall be met during grading of the Site and construction of all remedy components.

9. Stormwater management controls and surface drainage features, such as swales and/or bioswales generally encircling the Landfill cover system to convey stormwater via gravity to stormwater outfalls near the Site, will be incorporated into the design. Consideration of other stormwater best management practices (BMPs), e.g., rain gardens, may also be considered during the design. The stormwater controls shall meet the applicable requirements of the Pennsylvania Water Quality Standards 25 PA Code, Chapter 93 and the applicable requirements of 40 C.F.R. § 122.26 and 40 C.F.R. § 122.44(h)(i)(4).

10. Portions of the creek banks along Darby and Cobbs Creeks impacted by the ET cover and/or other components of the remedy will be permanently stabilized to help ensure the remedy's integrity. Stabilization products and materials that allow for full slope vegetation of native species shall be used to the extent practicable. Periodic monitoring for damage or degradation of these banks shall be included in the long-term monitoring program.

11. Landfill gas monitoring shall be conducted during construction and as part of long-term monitoring to ensure the concentration of methane gas generated does not exceed 25% of the lower explosive limit (LEL) for methane in any structures on the landfill and that the concentration of methane gas does not exceed the LEL for methane at the landfill cover boundary. Perimeter gas monitoring wells to monitor landfill gas will be installed. If necessary, gas vents or wells will be installed to mitigate methane gas that may exceed the requirements above. The landfill gas levels shall meet the relevant and appropriate requirements of 40 C.F.R. § 258.23(a), Explosive Gases Control.

12. Engineering controls, including fencing, shall be incorporated into the design and construction of the remedy to prevent unauthorized access and protect the integrity of the remedy. Contiguous fencing around the landfill cover and engineered treatment wetlands will be necessary for several years after construction is complete until the vegetation is well established. Once vegetation is well established, modifications to fencing or other access controls to allow for uses compatible with the remedy may be considered and implemented, as appropriate. During and after construction, signs will be placed along the stream bank to warn fisherman of all fishing advisories and the potential risks from fish consumption.

13. Long-term monitoring to evaluate the ET Cover's drainage rate and attainment of Performance Standard #3 shall be conducted. Direct performance monitoring of the cover is required. Pan lysimeters or an equivalent shall be installed on the top deck, side slopes and in other variations within the cover design. At least one nest of sensors to collect interpretive data shall be installed within each lysimeter. These sensors will include, but not be limited to water content and temperature. Number and placement depths for the sensors will depend on the final cover design. Sensors may also be placed at other locations in the cover to assess the variation in hydrologic conditions due to microclimates. An evaluation of spatial variability in flux using flux meters should also be conducted. Long-term monitoring of vegetation will also be conducted. Vegetation surveys will evaluate the relative distribution of plant species on the cover as well as the percent coverage to ensure that a diverse and desirable plant community has been established and that succession toward a complex plant community is occurring. Such surveys will be conducted annually for the initial 5 years after cover installation is complete. The frequency of the surveys thereafter may be adjusted, depending on observations and trends.

14. The following additional applicable requirements shall be met during construction: Fugitive Particulate Matter, 25 PA Code Chapters 123.1 and 123.2; Ambient Air Quality Standards for Particulate Matter, 25 PA Code Chapters 131.2 and 131.3;

11.2.3 Excavation and Off-Site Disposal of PCB Principal Threat Wastes

Excavate known PCB principal threat wastes in the SIA and ship off-site for treatment (if practicable) and disposal.

Performance Standards for Excavation and Off-Site Disposal of PCB Principal Threat Wastes

1. Develop and submit a plan to EPA Region III, Land and Chemicals Division, Office of Toxics and Pesticides, which documents the basis for using a risk-based approach as described in this ROD to address PCB principal threat wastes and other criteria required by 40 C.F.R. § 761.61(c). The plan shall provide justification for the approach's equivalency with 40 C.F.R. § 761.61(a) and will demonstrate that there is no greater risk posed by this approach when compared to the requirements in 40 C.F.R. § 761.61(a) or (b).

2. Characterize the wastes with PCBs above 100 mg/kg around GPR -11 (**Figure 2**) as required by the selected off-site treatment/disposal facility to determine if treatment of PCBs is practicable.

3. PCBs above 100 mg/kg associated with GPR-11 will be excavated and sent off-site for treatment (if practicable) and/or disposal. Should other areas be identified with levels above 100 mg/kg in the SIA, those PCBs will also be handled in the same manner as GPR-11 soils.

11.2.4 Excavation and Consolidation of Wastes and Contaminated Soils above Cleanup Levels beneath the ET Cover System

Prevent human and ecological receptor exposure to contaminated soils and Landfill materials that pose an unacceptable risk. Based on the results of the PDI, excavate soils outside of the ET Cover perimeter that are above soil cleanup levels in the City Park or Eastwick neighborhood and place under the ET Cover. Soils below asphalt or other hardened surfaces with solely exceedances of PAHs will be left in place and addressed with ICs.

Performance Standards for Excavation and Consolidation of Wastes and Contaminated Soils above Cleanup Levels beneath the ET Cover System

1. Perform excavation of approximately 2.3 acres of soils above cleanup levels established in **Table C.** Ecological cleanup levels apply only to the top two feet of soil. Human cleanup levels apply to all soils. **Figures 20, 22 – 24** and **Tables 38 and 39** list the known sample locations with one or more exceedances of soil cleanup levels.

2. Initial excavations will be to a depth of at least six inches. Exposed soils will be iteratively sampled to evaluate attainment of cleanup levels. Confirmatory samples shall be collected from excavation floor and sidewalls. After completion of excavation activities, a minimum

of 12 inches of clean fill will be used to restore the surface to the appropriate grade and elevation. Factors that will be taken into consideration regarding proper grade and elevation of the excavated areas include, but are not limited to: final design conditions of the ET cover, long-term stability, planned future use(s) of the areas being excavated and potential impacts to flooding within the 100-year flood plain at the Site, upstream and downstream.

3. Excavations shall be conducted until cleanup levels are achieved or excavation is no longer practicable. If excavation of soils is not practicable, the ET Cover will be extended over the area and/or ICs will be put in place to prevent future unacceptable risks. These determinations will be made during the RD and will rely on the findings from the RI and PDI.

4. Eight of the nine soil cleanup level exceedances in Zone 3 (Eastwick Neighborhood) are covered by asphalt. GP108 was the lone location in a grassy area. Pending findings from the PDI and background evaluation, ICs will be put in place in the asphalt covered areas if PAH levels are determined to be above background. Non-PAH and PAH exceedances of soil cleanup levels in non-asphalt areas will be addressed by excavation.

5. GP108 (**Figures 20 and 23**) is considered to be outside of the contiguous "area of contamination" (AOC) for the Landfill. Excavated soil will be tested to determine if it is a RCRA characteristic hazardous waste pursuant to the applicable requirements in 25 PA Code Chapter 261a.1 which incorporates 40 C.F.R.§ 261.20-24 by reference. Unless determined to be hazardous waste, the soils in the vicinity of GP108 will be excavated and consolidated under the ET Cover. Should the contaminated soils in the vicinity of GP108 demonstrate a characteristic(s) of hazardous waste upon testing, the applicable portions of the Resource Conservation and Recovery Act (RCRA) Land Disposal Restriction (LDR), 40 C.F.R. Part 268 requirements will be followed.

11.2.5 Construction of Leachate Collection Trench and Engineered Treatment Wetlands

Minimize and control seasonal leachate seeps that migrate into adjacent surface water bodies. Reduce risks to aquatic ecological receptors via preventing the discharge of Landfill-related contaminants to surface waters and sediments in Darby and Cobbs Creeks. Construct a leachate collection trench along the creek banks down to the mean high tide elevation of the creeks from which collected leachate will be conveyed to an engineered wetland for treatment of contaminants. Construct and monitor engineered wetlands to treat contaminants to meet surface water discharge requirements.

Performance Standards for Leachate Collection Trench and Engineered Treatment Wetlands

1. Construct a trench along the Landfill's western perimeter adjacent to Darby and Cobbs Creek banks. The trench will be excavated down to the mean high tide elevation of the creeks. The trench is intended to collect a portion of landfill leachate. Leachate collected in the trench will be conveyed to engineered treatment wetlands prior to discharging to creek surface water.

2. Design and construct engineered subsurface flow (SSF) treatment wetlands with the ability to treat and/or remove solid and dissolved contaminants in leachate conveyed from the trench to achieve National Pollutant Discharge Elimination System (NPDES) permit equivalent discharge standards. Quantity and quality of leachate to be treated, location, discharge standards, monitoring criteria and frequency, and other parameters shall be determined during RD. Characteristics of local natural wetlands should be used as model for the constructed wetland.

3. NPDES discharge requirements for the engineered treatment wetlands shall be determined during the RD in accordance with the applicable portions of the Pennsylvania Water Quality Standards regulation, 25 PA Code Chapter 93.1-.4, 93.6-.7, 93.8a-.8dc, and 93.9 and 93.9g and the Clean Water Act NPDES Requirements, 40 C.F.R. § 122.1-.2, 122.4-.5, 122.21, 122.26, 122.29, 122.41, 122.43-.45, 122.47-.49, and 122.61-.64.

4. A synthetic liner will be used to seal the bottom of the SSF treatment wetlands to avoid possible contamination of groundwater and also to prevent groundwater from infiltrating into the wetland. Some portions of the SSF treatment wetlands may be constructed on top of contaminated soils and waste, and can serve as the cover system for those areas.

5. SSF wetlands will be constructed to minimize the attraction of large birds, using e.g., minimal open water area, dense vegetation, goose wire, etc.

6. Sediment and surface water from the engineered SSF treatment wetland will be monitored to ensure that unacceptable risk is not posed to ecological receptors. If unacceptable risks are identified, the SSF wetland shall be maintained as appropriate to address those risks.

11.2.6 Long-term Monitoring and Maintenance to Evaluate Remedy Performance and Effectiveness

Collect sampling data from groundwater, collected leachate, landfill gas, surface water, engineered treatment wetlands, and sediment from within or in the vicinity of the Landfill to determine the effectiveness of the remedy with regard to containment of contamination from the Landfill waste, soils and leachate. Conduct regular inspections of all remedy components and perform all necessary maintenance. Develop a long-term monitoring plan and operation and maintenance plan for the selected remedy.

If EPA conducts the remedy, criteria for determining that the remedy is Operational and Functional, including the ET Cover, will be established during the Remedial Design and included Superfund State Contract.

Performance Standards for Long-term Monitoring to Evaluate Remedy Performance and Effectiveness

1. Collect and analyze samples from groundwater, collected leachate, landfill gas, surface water, engineered treatment wetlands, and creek sediment at multiple locations. The specific locations and frequency of sampling shall be as determined in the Long-Term

Monitoring Plan (LTMP), which will be updated as necessary. Effluent samples will also be used to evaluate the effectiveness of the engineered treatment wetlands. The LTMP shall include monitoring requirements for any portions of the Site impacted by large flood events to evaluate the potential for recontamination of surface soils by contaminants in flood waters. Although approximately 33% of the Landfill is permanently saturated below the water table, positive effects from minimizing the amount of precipitation reaching the waste should be realized. Groundwater contamination and risks are being addressed under OU3 and data collected from OU1 will be used to supplement the OU3 investigation.

2. Develop and implement an O&M Plan (OMP) detailing activities for operating, inspecting and maintaining all components of the remedy. These activities should include regular inspections and maintenance on an as-needed basis (e.g., revegetation, erosion repair, sediment removal, etc.). For engineered wetlands, long-term O&M may be needed to sustain the wetland plants. Engineered wetland O&M activities may include planting additional wetland species, adding limestone as a buffer material, removing sediments to maintain grades, monitoring treatment concentrations, and accounting for seasonal variations in system performance and maintenance.

3. Update the LTMP and OMP every five years, coinciding with EPA's five year review, unless EPA develops an alternate schedule.

11.2.7 Land Use Restrictions, Groundwater Use Restrictions and Fishing Advisories for the Site and Surrounding Area

An Institutional Control Implementation and Assurance Plan (ICIAP) shall be developed during the RD to address land and groundwater use restrictions, for OU1. The requirements for such use restrictions contained in this ROD are based on current, reasonably anticipated uses of the Site and areas in the vicinity of the Site. The purpose of the restrictions shall be to prevent exposure to unacceptable risks associated with remaining Landfill-related contaminants and to protect the components of the selected remedy. The restrictions will be implemented through ICs which may include property use controls (such as easements and restrictive covenants) and governmental controls (such as zoning ordinances and local permits). The ICIAP shall identify parties responsible (i.e., federal, State or local authorities or private entities) for implementation, enforcement, and monitoring and long-term assurance of each IC including costs, both short-term and long-term, and methods to fund the costs and responsibilities for each step. The ICIAP shall include maps, which shall describe coordinates of the restricted areas depicting all areas that do not allow unlimited use/unrestricted exposure and areas where ICs have been implemented along with a schedule for implementation of the remaining ICs. The maps and information about the ICs shall be made available to the public in several ways, including being posted on the internet and in the Information Repository for the Site. In addition, the ICIAP shall identify reporting requirements associated with each institutional control which shall include at a minimum an annual review of the status and effectiveness of the ICs.

Performance Standards for Land Use Restrictions, Groundwater Use Restrictions and Fishing Advisories for the Site and Surrounding Area

1. Maintain and protect the integrity of the selected remedy including, but not limited to, the landfill cover and stormwater management features, leachate collection trench and infrastructure, engineered treatment wetlands and monitoring wells.

2. Prohibit exposure to contaminated soils not under the ET cover that are left in place. This potentially includes subsurface soils in the SIA, City Park, or Eastwick Neighborhood. Specific activities that could result in unacceptable exposure to contaminated soils at the Landfill, via ingestion or dermal contact shall be prohibited and/or specific protocols shall be put in place to ensure appropriate precautions are taken in the event that exposure to these soils is necessary.

3. Use and/or contact with contaminated groundwater beneath OU1 shall be prohibited to ensure no human exposure to contaminants in groundwater.

4. Evaluate current Pennsylvania fishing advisories do determine if additional advisories are warranted. If necessary to reduce human consumption of fish in Darby and Cobbs Creeks that may be impacted by the Landfill, fish consumption advisories shall be put in place in coordination with appropriate local, state and federal agencies.

11.3 Summary of the Estimated Remedy Costs

The estimated present worth costs of the selected remedy is $23,955,276. See **Table 42** for a detailed cost summary.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the response action. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Minor changes may be documented in the form of a memorandum in the Administrative Record. Changes that are significant, but not fundamental, may be documented in an Explanation of Significant Differences. Any fundamental changes would be documented in a ROD amendment.

11.4 Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy in terms of resulting land use and risk reduction achieved as a result of the response actions. Following excavation of contaminated soils above cleanup levels and the completion of the ET Cover, there should no longer be an unacceptable health risk to current or future residents, recreational users or workers due to exposure to contaminated soil or wastes. The ET Cover will prevent any future erosion or exposure of Landfill contents. The ET cover will also minimize the amount of precipitation that reaches the Landfill waste and the subsequent amount of generated leachate that could reach groundwater or surface water bodies.

The ET cover remedy selected for OU1 is expected to eliminate any potential unacceptable risks to humans or the environment from exposure to Landfill-related contaminants. The ET Cover

remedy and stabilization of the eastern creek bank will also eliminate the potential for erosion of contaminated wastes and soil into adjacent water bodies. The ET Cover will not significantly increase the 100-year flood height or stream velocity as is required by 25 PA Code § 106.31(a)(1). Construction of the ET Cover is expected to take 14 to 16 months. The ET cover is expected to require at least two to five years to fully establish vegetation and achieve the required precipitation drainage rate from the bottom of the cover. The selected remedy should restrict the use of the Landfill area that could interfere with any of the engineered components of the cover system. The ET Cover is expected to operate for at least 30 years.

The excavation and/or implementation of use restrictions on Landfill soils that are above the cleanup levels summarized in **Table C** will eliminate any potential unacceptable risks to humans or the environment outside of the final boundaries of the ET Cover. Excavation and the implementation of use restrictions are expected to be completed within the construction timeframe of the cover. Treatment of leachate in the engineered wetlands will meet the surface water discharge requirements that will be established during the RD. The construction of engineered wetlands should be completed within the cover construction timeframe and, once established, the leachate collected from the trench will be sent to the wetlands for treatment prior to discharge.

The ET Cover, collection and treatment of leachate, and excavation of contaminated soils above cleanup levels are expected to reduce the contaminant loading to the adjacent water bodies, and should help improve the ecological integrity of the adjacent aquatic environments in the creeks including sediments, surface water and biota.

The area addressed by the ET Cover will be available for certain light recreational purposes such as walking trails in areas that are not too steep or narrow. Allowable surface load weight limits for the ET Cover will be established in the RD. The ET cover will also by its nature provide improved ecological habitat both along the stream bank and at higher elevations which should help extend the natural riparian corridor northward from the John Heinz National Wildlife Refuge. Areas outside the ET Cover boundary should be available for all of the current uses, e.g., recreational and residential use; the exception being areas where any contaminated soils above cleanup levels are left in place. It is anticipated that any contaminated soils addressed by ICs will be at substantial depths, e.g., below the water table, or beneath hardened surfaces, e.g., asphalt. For these areas, uses would be unlimited until the depths at which the contaminated soils are present; ICs will describe the steps to be taken if these contaminated soils are to be encountered.

12.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element. The following sections discuss how the selected remedy for the Lower Darby Creek Area Superfund Site – Clearview Landfill OU1 meets these statutory requirements.

12.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by eliminating exposure or the potential for exposure to landfill waste and Site-related contaminants through the installation of a landfill ET cover system. . The collection and treatment of shallow leachate along the landfill creek will provide treatment for the contaminated leachate which will reduce the volume and toxicity of the contamination. The soil excavation will remove and contain or dispose of contaminants in soil that are above cleanup levels and/or considered to be principal threat wastes.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will attain, and in one instance waive, all applicable or relevant and appropriate requirements, which are identified as a performance standard in **Section 11.2** and specified in **Table 41** of this ROD. The applicable requirement in 40 C.F.R. § 258.60(a). 40 C.F.R. §258.60(a)(1) requires that a final cover for a MSW landfill, "have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1.0×10^{-5} cm/sec, whichever is less." This requirement is being waived using the "Equivalent Standard of Performance" criterion under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). As discussed under the **Evaluation of Alternatives** section, a conventional landfill cover built to attain a permeability of 1×10^{-5} cm/sec should result in a percolation/drainage rate through the cover system that is no greater than 1×10^{-5} cm/sec, which equates to 9,237 gallons/day/acre (461,837 gallons/day over 50 acres), assuming there are no construction flaws. The ET Cover shall provide an Equivalent Standard of Performance to achieve the relevant and appropriate requirement in 40 C.F.R. § 258.60(a)(1) by ensuring the drainage rate from the bottom of the ET Cover is no greater than the value, which results from multiplying the total final acreage of the ET Cover by 9,237 gallons/day.

12.3 Cost Effectiveness

The selected remedy is cost effective in that it eliminates or mitigates the risks posed by the contaminants for OU1, meets all requirements of CERCLA and the NCP, and provides overall effectiveness in meeting the RAOs. The ET Cover alternative is the least costly of the alternatives that satisfy the threshold criteria discussed above.

12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes long-term solutions and treatment technologies to the maximum extent practicable through the use of engineered treatment wetlands to address collected leachate. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of advantages and disadvantages, in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element, and State and community acceptance.

12.5 Preference for Treatment as a Principal Element

The selected remedy will meet the statutory preference for treatment as a principal element

since it treats the collected leachate along the eastern creek bank. If practicable, PCB principal threat wastes excavated will be shipped off-site and treated prior to disposal.

12.6 Five-Year Review Requirements

Because the OU1 remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years to ensure that the selected remedy is, or will be, protective of human health and the environment pursuant to CERCLA Section 121(c) and the NCP, 40 C.F.R. § 300.430(f)(5)(iii)(C). The first review will be conducted five years after the initiation of remedial action at the Site and will continue every five years thereafter.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant or fundamental changes to the proposed remedy as a result of public comments.

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III. RESPONSIVENESS SUMMARY

LOWER DARBY CREEK AREA SUPERFUND SITE
OPERABLE UNIT 1 – CLEARVIEW LANDFILL SOILS & WASTE

PHILADELPHIA AND DARBY TOWNSHIP, PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA

AR306988

LOWER DARBY CREEK SUPERFUND SITE
OPERABLE UNIT 1
PHILADELPHIA AND DARBY TOWNSHIP
PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA
RESPONSIVENESS SUMMARY

1. INTRODUCTION

This Responsiveness Summary provides a summary of significant public comments and concerns regarding the Proposed Remedial Action Plan (Proposed Plan) for the Lower Darby Creek Area Superfund Site (the Site) to address waste, soil and shallow leachate contamination associated with the Clearview Landfill Site, known as Operable Unit 1 (OU1) and provides the U.S. Environmental Protection Agency's (EPA) responses to those comments. After reviewing and considering all public comments received during the public comment period, EPA has selected a remedy to address the contamination at OU1 of the Site.

The Proposed Plan and supporting documentation were made available to the public in the Administrative Record at http://www.epa.gov/reg3hwmd/npl/PASFN0305521.htm. EPA provided notice to the public that the Administrative Record could also be viewed at the following locations:

Free Library of Philadelphia
2851 Island Avenue
Philadelphia, PA 19153
(215) 685-4170

Administrative Records Room
US EPA Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3157 (please call for an appointment)

The notice of availability of these documents was published in the *Southwest Globe Times,* a local Philadelphia newspaper, and the *Delaware County Times*, a Delaware County newspaper, on August 1, 2013. In addition, EPA delivered a fact sheet summarizing its preferred remedial alternative for OU1 to residences and businesses near the Site in August 2013.

From August 1, 2013 to August 31, 2013 EPA held a 30-day public comment period to accept public comments on the remedial alternatives presented in the Feasibility Study, the Proposed Plan and the other documents contained within the Administrative Record for OU1. As a result of several requests, the comment period was extended an additional 30 days to September 30, 2013. On August, 18, 2013, EPA held a public meeting to discuss the Proposed Plan and accept comments. A transcript of this meeting is included in the Administrative Record.

This Responsiveness Summary provides a comprehensive summary of significant questions, comments, concerns, and responses by summarizing oral and written comments received during the public comment period and EPA's responses. Section 2 below includes a summary of major issues raised during the comment period and EPA's responses thereto. In Section 2, the comments have been grouped into the following categories:

- Whether a Fence Will Be Erected Prior to the Start of the Remedial Action
- Incomplete Sampling and Characterization of Contaminated Soils
- Types, Effectiveness and Appropriateness of Proposed Institutional Controls
- Effectiveness and Long-Term Sustainability of Engineered Treatment Wetlands
- Sufficient Evaluation of and Details for Engineered Treatment Wetlands
- Capture of Deeper Leachate by the Collection Trench
- Use of Pilot Scale Studies to Evaluate Engineered Treatment Wetlands
- Evaluation of Other Leachate Treatment Options
- Monitoring of Engineered Treatment Wetlands and Groundwater
- Performance of Evapotranspiration (ET) Cover in Meeting Infiltration Performance Standards
- Initial Performance of ET Cover
- Modeled Performance of ET Cover
- Reuse of OU-1 after the Cover is in Place and How Those Uses Could Impact the Cover
- Impacts of the OU-1 Remedy on Contaminated Groundwater
- Additional Groundwater Investigations
- Stormwater Management and Treatment
- Vapor Intrusion Concerns
- Flooding Impacts on the OU1 Remedy
- Landfill Creek Bank Stabilization Technologies
- Current On-Site Businesses

- Feasibility Study Remedy Cost Estimates

Section 3 below includes responses to all other significant questions, comments, or new information received during the comment period.

2. MAJOR ISSUES

2.1 Whether a Fence Will Be Erected Prior to the Start of the Remedial Action.

Issue: Several commenters raised concerns about the lack of current fencing around OU1 to prevent trespassing and exposure to physical hazards and contamination on OU1. A comment was also made regarding the use of sufficiently tall fencing after the remedy is constructed to exclude deer.

EPA Response: A legal mechanism and necessary funds are not available, at this time, to erect the fencing prior to the remedial action. As part of the remedial action, EPA intends to erect fencing, where appropriate, to prevent trespassing and injury during construction and to protect the remedy after its construction is completed. As part of the remedial design (RD), EPA will evaluate and select the appropriate type of fencing to achieve all of the objectives established in the ROD. EPA will consider, among other factors, potential damage to the evapotransipiration cover, including that which could be caused by deer and other wildlife. Considering that the effectiveness of key components of the remedy will be dependent upon the successful establishment of the vegetation, it is likely measures will be taken to exclude deer.

The primary way that someone could be exposed to contamination associated with OU1 on the landfill proper (Zone 1) and City Park (Zone 2) is through surface soil exposure. Low-level risks that slightly exceeded EPA's unacceptable cancer risk thresholds were identified for someone living or working on the landfill. Currently there is no one living on the landfill and EPA cannot currently restrict access for those individuals who operate, or work for a business in the southern industrial area. Slightly increased non-cancer risks were also identified for a child that used the landfill (Zone 1) for recreational purposes. However, based on the EPA risk assessment and removal site evaluation for the Clearview Landfill, at the time of this writing there is no imminent or short-term threat from potential exposure to contaminants in surface soils that would allow for a removal action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as Superfund.

The potential risks present on the portion of OU1 located in Delaware County, City Park and several locations in the Eastwick neighborhood warrant a remedial action as stated in the ROD, but not an expedited removal action. The presence of physical hazards currently on the landfill does not provide a legal mechanism for the installation of fencing at this time. Currently, there are numerous EPA's signs around the perimeter of the landfill at all access points, and in full view from the City Park, that notify any trespassers on the landfill that it is a Superfund Site.

2.2 Incomplete Sampling and Characterization of Contaminated Soils

Issue: Two commenters expressed concerns over the need for further evaluation of soil gas risks and additional characterization of contaminants in soils due to the detections of certain contaminants above EPA Regional Screening Levels or Pennsylvania Department of Environmental Protection risk-based screening levels, as well the various types of sampling methods that were used, e.g., multi-increment samples (referred to by the commenters as "composite" samples). There was concern that the composite samples "dilute" contaminants or mask "hotspots." The commenters believe additional sampling is needed to determine the extent of soil contamination in the City Park and Eastwick; a regional polycyclic aromatic hydrocarbon (PAH) background concentration of 1 part per million (ppm) was cited, but no reference provided. They also asked if contamination would be removed from the City Park.

EPA Response: All soil controlling preliminary remediation goals (PRGs) from the Proposed Plan (which became cleanup levels in the ROD), including those for polycyclic aromatic hydrocarbons (PAHs), were based on the lower of risk-based values and any applicable or relevant and appropriate (ARARs) chemical standards. Cleanup levels are protective of human health and the environment, and the process for selecting them is based on EPA Risk Assessment Guidance. It is important to note as part of EPA's Risk Assessment approach, an exceedance of a Regional Screening Level does not automatically indicate an unacceptable risk. Rather, it indicates that additional investigation of the contaminant(s) and a full quantitative risk assessment is warranted. As is discussed in Section 5.2.2 of the ROD, based on the soil gas VOC screening results, EPA modeled potential indoor air VOC concentrations and evaluated the risks. Subsequent to this effort, EPA completed a residential vapor intrusion investigation which did not identify any vapor intrusion issues or unacceptable risks.

It is not clear where the regional background of 1 ppm for PAHs originates. However, EPA does not cleanup based on regional background values but rather cleanup is based on site specific risk values or site specific background values.

With regard to the supplemental sampling that was conducted in the Eastwick Recreational City park (referred to as "composites"), multi-increment sampling (MIS) was used for the Removal Site Evaluation (RSE) as well as discrete samples in locations with former high exceedances of one or more contaminants. Both sample types were collected with the objective of evaluating the potential need for removal action. MIS was conducted in sampling units (SUs) that were representative of potential exposure area based on potential use and to potentially identify areas missed by previous discrete sampling. MIS is not a composite soil sample in the traditional sense. MIS does not "dilute" the sample contaminant results. Rather, MIS provides an accurate representation of the mean contaminant concentrations of an area based on selected criteria, e.g. use type and receptors. MIS is intended to overcome the inherent variability in contaminant concentrations due to heterogeneity in distribution and particle size/type.

The term "hotspot" is a relative term that is rarely defined and has various meanings. Often, one or more discrete sample locations with elevated levels of contamination will be deemed as "hotspots," however there commonly are significant distances between discrete sample locations. This presents a challenge in determining the boundaries of a "hotspot." Discrete

sampling presents unique limitations in that the density of samples collected is rarely sufficient to provide an accurate representation of the contaminant conditions, which is why subsequent statistical analysis is conducted, e.g., ProUCL. There is no guarantee that one or more discrete samples will be better or worse at identifying areas of elevated contaminant concentrations. Discrete samples can only provide contaminant information for that exact location(s) that has been sampled. Both MIS and discrete sampling with the use of statistical analyses are intended to provide the same result: that is a mean contaminant concentration for the area over which exposure may occur. The RSE utilized both MIS and discrete sampling procedures to replicate previous RI sampling results (discrete) and evaluate mean concentrations over multiple exposure units (MIS). Neither set of results indicated that contaminants were present at a level that would warrant a removal action. In fact, with the exception of several benzo(a)pyrene and high molecular weight PAH results, none of the PAH, lead or PCB levels in City Park surface soil samples (MIS or discrete) collected as part of the RSE exceeded the cleanup levels for soils that are selected in the ROD.

Discrete soil sample locations from the RI which exhibited exceedances of one or more soil cleanup levels will either be encompassed by the ET cover or will be fully delineated and excavated, However, as is required in the ROD, further additional characterization as part of the pre-RD investigation will be conducted to determine the limits of soil exceedances identified in the RI with contaminants above cleanup levels that are outside the ET cover boundary. These locations are shown on Figures 20, and 22-24 of the ROD. Identified areas with exceedance of one or more surface soil cleanup levels will be excavated from the City Park and placed under the ET cover.

2.3 Types, Effectiveness and Appropriateness of Proposed Institutional Controls

Issue: A number of comments raised questions regarding what types of institutional controls (ICs) would be used, how they would be protective, and how they would be enforced. One commenter did not believe that ICs were appropriate for the asphalt areas covering soils with contaminants above PRGs.

EPA Response: As part of the RD, land and groundwater use restrictions will be evaluated and identified for areas where contaminants remain in place. As discussed under Section 11.2.7 of the ROD, an Institutional Control Implementation and Assurance Plan (ICIAP) will be developed during the RD as well. The ICIAP shall identify the institutional controls which will be used to implement the land and groundwater use restrictions. The ICIAP shall also identify parties responsible (i.e., federal, State or local authorities or private entities) for implementing, enforcing, and monitoring each institutional control. The ICIAP shall include maps, which describe coordinates of the restricted areas depicting all areas that do not allow unlimited use/unrestricted exposure and areas where ICs have been implemented, along with a schedule for implementation of the remaining ICs.

The specific mechanisms by which ICs will be implemented have not yet been identified for the various components of the remedy or different locations, (e.g., beneath asphalt areas in the Eastwick neighborhood). Examples of mechanisms that could be put in place include a Hazardous Site Control Act Section 512 Order or an environmental covenant utilizing the Pennsylvania

Uniform Environmental Covenants Act. In addition, local municipal codes may potentially be modified or supplemented to achieve the necessary land controls. As will be detailed in the ICIAP, these mechanisms will prohibit certain land and groundwater uses and provide instructions to property owners, tenants, etc. for situations that could result in exposure to subsurface materials.

The potential risks from the contaminated soil locations in the Eastwick neighborhood which are to remain beneath the asphalt are low-level risks that present small exceedances of EPA's risk criteria assuming long-term chronic exposure. Potential risks from emergency or short-term construction workers exposed to these soils beneath the asphalt in the Eastwick neighborhood were determined to be acceptable based on the EPA's risk criteria. As such, ICs are not warranted to prevent this type of exposure. However, these activities could result in facilitating a release of the contamination as a result of any excavation or other road work that might occur. Further, development of residential areas on these soils that are currently beneath asphalt could also potentially present unacceptable risk. ICs that are utilized will be designed to prevent these scenarios from occurring. Often, EPA has worked with local municipalities to update their maps and GIS databases and put procedures in place to ensure any work, redevelopment, etc., planned in areas where ICs are present is identified prior to initiation so that the ICs can be followed. EPA is currently working with the City of Philadelphia to identify appropriate ICs for property owned by the City.

2.4 Effectiveness and Long-Term Sustainability of Engineered Treatment Wetlands

Issues: A number of commenters raised concerns regarding the performance of the engineered treatment wetlands. Specifically, the concerns were how they will be designed, their susceptibility to damage due to being located in or near the 100-year flood plain and potential interaction with any future flood mitigation efforts by the City of Philadelphia.

EPA Response: As with the other components of the remedy, the characteristics of the treatment wetlands are conceptual and their specifics, including quantity and quality of leachate, wetland location(s), elevation, size, the control and transport of water through the system, and vegetation, will be determined during the RD. The wetlands will be constructed above the 100-year floodplain (e.g., via dikes) to ensure that they are not inundated by the tidally-influenced creeks. Further, Section 11.2.2.6 of the ROD states, "Potential impacts from potential sea level rise over the lifetime of the remedy shall be taken into consideration as part of the RD." The treatment wetlands are also designed to treat and/or reduce bioavailability of contaminants, and monitored to ensure accumulation of contaminants in wetlands will not occur. The capacity of the wetland to remove and store the pollutants will be monitored regularly and evaluated as part of each five-year review.

Leachate seep samples collected during the RI indicate that leachate contains elevated concentrations of PAHs and metals. Engineered wetlands are known to effectively settle/biodegrade suspended solids, heavy metals, total phosphorus, total nitrogen, toxic organics, and petroleum products. Since Clearview Landfill is an old unlined landfill, most of organics have been washed out and leachate organic strength is very low. Therefore, biofouling potential would be minimal, especially for subsurface flow wetlands. The wetland design will be consistent with

the PA Best Management Practices Manual and other guidances as appropriate. Upon completion of the RD, the specific details of the engineered wetlands will be available to the public.

EPA is aware that the City of Philadelphia is working with the U.S. Army Corps of Engineers to evaluate flood mitigation options for Eastwick and will consider the impacts on the OU1 remedy if and when the mitigation plans become final. The engineered wetlands will be designed to be out of the 100-year flood plain and numerous factors will be taken into account during the remedial design process. EPA has been and will continue to monitor and coordinate on flood mitigation efforts in this area.

2.5 Treatment of Specific Contaminants by Engineered Treatment Wetlands

Issue: A number of comments were submitted with regard to how the leachate collection trench (LCT) and engineered treatment wetlands will address toxic chemicals such as PAHs and polychlorinated biphenyls (PCBs)

EPA Response: The leachate collected by the OU1 remedy will primarily contain low levels of PAHs and metals. PAHs are considered biodegradable, but the biodegradation process is slow. PAHs have a strong affinity for soil and sediment. When leachate containing PAHs is introduced in the engineered wetlands, the PAHs will most likely be sorbed onto sediment in wetlands. Similarly, metals in leachate will be precipitated and sorbed onto sediment in the wetlands. Therefore, PAHs and metals do not leave the wetlands. The capacity of the wetland to remove and store the pollutants will be monitored regularly and evaluated as part of the five-year review. If necessary, wetland sediments and litter can be removed periodically and the wetland rebuilt with fresh substrate. The leachate collection trench will be constructed along the Landfill's western perimeter adjacent to creek banks. The trench will be excavated down to the mean high tide elevation of Darby and Cobbs Creeks. The trench is intended to collect a portion of the landfill leachate.

2.6 Sufficient Evaluation of, and Details for Engineered Treatment Wetlands

Issue: Several comments were made regarding the evaluation of treatment wetlands in the feasibility study, as well as the potential impacts that should be considered which could impact the engineered treatment wetlands' performance, (e.g., weather, seasonal variability and climate change).

EPA Response: The FS developed remedial alternatives that include a conceptual design of associated technologies and treatment options. These were evaluated based on EPA's screening criteria. When applicable, green sustainability and emerging or innovative technologies (e.g., engineered wetlands) were evaluated during the FS. Although major treatment components such as engineered wetlands can be tested during the FS, a treatability test of their effectiveness is typically conducted during the RD. The volume of leachate required for testing cannot be collected due to the lack of a collection system at this point. The RI indicated that leachate contains only PAHs and metals at concentrations higher than those in surface water, and did not contain PCBs. PAHs are considered biodegradable, but that process is slow. PAHs have a strong affinity for soil and sediment. When leachate containing PAHs is introduced to the engineered

wetlands, they will most likely be sorbed onto sediment in the wetlands. Similarly, metals in leachate will be precipitated and sorbed onto sediment in the wetlands. Therefore, PAHs and metals do not leave the wetlands.

A flow analysis conducted during the RI indicates that the volume of leachate collected would be 6,600 gallons per day (gpd) under current conditions and reduce to 100 gpd with the ET cover. A 5-acre wetland with a hydraulic retention time of 3 days and a depth of 2 feet can treat up to 1.1 million gpd of leachate. During the RD, the details of the engineered wetlands will be provided, including characterizing the quantity and quality of leachate to be treated, determining discharge limits, and selecting specific design criteria, based on actual climate conditions and the characteristics of a local natural wetland. As with other biological processes, there may be seasonal slowdown in treatment in colder climates, which can decrease the overall treatment efficiency of an engineered wetland. To minimize fluctuation of treatment efficiency, operating conditions such as a hydraulic retention time may need to be monitored and adjusted if necessary. Since the removal of PAHs and metals in the wetlands is primarily accomplished by sorption and precipitation, temperature effect on the performance of the proposed wetlands for OU1 may not be significant.

2.7 Capture of Deeper Leachate by the Collection Trench

Issue: There were multiple comments inquiring as to whether the leachate collection trench would capture subsurface leachate discharging or passing under the adjacent creeks.

EPA Response: As specified in Section 11.2.5 of the ROD, the leachate collection trench will extend into the subsurface to the mean high tide elevation of the portions of Darby and Cobbs Creek adjacent to the landfill. The leachate collection trench is intended to collect only what is being referred to as "shallow leachate" and prevent its uncontrolled discharge to the adjacent creeks. Darby and Cobbs Creek are tidally influenced. During periods when the tide is coming in, it is likely that there is some intrusion of surface water into the landfill waste. At this time, the fate of the groundwater discharging from the landfill is not clear and is one of the focuses of the Clearview Landfill OU-3 remedial investigation. The lack of information regarding the fate of contaminated groundwater from the landfill below the mean high tide line and the potential subsequent risks could not be sufficiently evaluated during the OU-1 feasibility study and was one of the main drivers for the creation of OU-3. The remedial investigation/feasibility study for OU3 will evaluate the fate of deeper leachate and groundwater and evaluate various response actions as appropriate.

2.8 Use of Pilot Scale Studies to Evaluate Engineered Treatment Wetlands

Issue: There were several comments which suggested field tests and pilot studies be conducted to evaluate the projected performance of the engineered treatment wetlands.

EPA Response: A pilot-scale testing and/or treatability study of the selected remedy are typically conducted during the RD. In addition, a pilot testing of the wetlands is not practical at this point because the volume of leachate required for testing is not collectable. Specific information required for design will be gathered during the PDI and RD. As part of the evaluation of the

potential efficacy of treatment wetlands, EPA considered all of the shallow groundwater and seep data from the landfill. There were no elevated concentrations of PCBs found in the leachate samples collected during the RI. Thus, high concentrations of PCBs are not anticipated to be entering the treatment wetlands.

2.9 Evaluation of Other Leachate Treatment Options

Issue: Several commenters asked whether pretreatment and/or other options were considered for remediating captured leachate.

EPA Response: The feasibility study (FS) for OU-1 documents the treatment options considered for collected leachate. These options included the containment via capping and groundwater extraction, on-site treatment via wetlands, and off-site treatment at a privately owned treatment works (POTW). The FS also discussed the potential for sending collected leachate to a POTW after treatment by the treatment wetlands if the discharge standards for surface water could not be met. The ROD has selected leachate treatment via on-site, engineered treatment wetlands. If during the RD or implementation of the remedy, it is determined that the treatment wetlands cannot meet the discharge requirements, an alternative approach will be selected and documented as required by CERCLA and the NCP.

2.10 Monitoring of Engineered Treatment Wetlands and Groundwater

Issue: Two commenters asked how the monitoring of the engineered treatment wetlands and the water that is discharged will be conducted.

EPA Response: In general, treated water discharged from the wetlands will meet appropriate surface water quality discharge criteria such as those established in an NPDES permit. Section 11.2.5.3 of the ROD discusses the discharge limits for the treatment wetlands. Environmental monitoring would include inspection and periodic sampling and analysis. The specifics for treatment wetland monitoring will be established in the long-term monitoring plan as part of the RD. Conceptually, the OU1 FS assumed that groundwater and leachate would be sampled semi-annually to monitor its quality over time. Wetland effluent would be sampled regularly to ensure its compliance with permit requirements. O&M activities for the engineered wetlands may include planting additional wetland species, adding limestone as a buffer material, removing sediments to maintain grades, monitoring treatment concentrations, and accounting for seasonal variations in system performance and maintenance.

2.11 Performance of Evapotranspiration (ET) Cover in Meeting Infiltration Performance Standards

Issue: Some commenters asked about what range of infiltration would be acceptable for the evapotranspiration (ET) cover and how this would be monitored. There were also concerns raised that if the ET cover did not meet performance standards, nothing would be done to address that issue.

EPA Response: Section 11.2.2, bullet #3 of the ROD describes the performance standard for the ET cover: " This requirement is being waived using the "Equivalent Standard of Performance" criterion under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). As discussed under the **Evaluation of Alternatives** section, a conventional landfill cover built to attain a 1×10^{-5} cm/sec permeability should result in a percolation rate through the cover system that is no greater than 1×10^{-5} cm/sec, which equates to 9,237 gallons/day/acre (461,837 gallons/day over 50 acres). The ET Cover shall provide an Equivalent Standard of Performance to achieve the relevant and appropriate requirement in 40 C.F.R. § 258.60(a)(1) by ensuring the drainage rate from the bottom of the ET Cover is no greater than the above value. The ET Cover is expected to achieve this performance standard incrementally over time and that progress shall be evaluated during the first five-year review for which five years of monitoring data is available after the remedy was determined to be Operational and Functional. Post-construction monitoring of the ET cover's performance with regard to precipitation and drainage is essential and is necessary to demonstrate its Equivalent Standard of Performance for the waiver of the final cover requirements in 40 C.F.R. § 258.60(a). As discussed in the ROD, direct performance monitoring of the ET cover is required. Pan lysimeters or an equivalent shall be installed on the top deck, side slopes and in other variations within the cover design. Section 11.2.2 of the ROD contains additional detail on the cover system monitoring performance standards.

Should performance monitoring data indicate that the ET cover is not achieving the cover drainage performance standard, appropriate steps to address the identified performance issues and achieve the performance standards will be evaluated and implemented as appropriate. It is difficult to anticipate the issues that could arise until the design has been completed and construction of the remedy implemented. One goal of the remedial design will be to identify potential issues with long-term cover performance and address them as part of the cover construction, e.g., soil particle size and thickness of cover.

2.12 Initial Performance of Evapotranspiration Cover

Issue: Several commenters raised concerns over the performance of the ET cover over the first few years after construction was completed, while the vegetation was being established.

EPA Response: EPA agrees that the ET cover may not initially achieve the targeted drainage rate established in Section 11.2.2.3 of the ROD. Maximum effectiveness of reduction in percolation through and leakage from the bottom of the ET Cover will not be realized immediately after installation is completed. Infiltration percolation through the ET Cover and leakage into the waste will decrease over time as vegetation and tree growth become more established. However, currently there is a relatively thin cover of unconsolidated soil (0 to approximately 12") on the landfill which is providing little to no reduction of precipitation infiltration into the waste. The installation of the ET cover that is approximately four feet thick based on the conceptual design will provide an immediate reduction in the amount of precipitation reaching the waste due to the inherent capacity of the cover soils themselves. Exactly what the level of reduction will be is not immediately known but will be evaluated during the remedial design. This reduction will contribute to the reduction of leachate and subsequent groundwater contamination. It is also important to note that approximately 33% of the landfill's waste mass is beneath the natural water table and permanently saturated. If no additional precipitation was to ever reach the waste,

leachate and contaminated groundwater would continue to be generated. Nonetheless, the ET cover is intended to meet the legal requirements for landfill covers using an equivalent standard of performance.

2.13 Modeled Performance of Evapotranspiration Cover

Issue: Several comments were provided which raised questions regarding the types of models that were used to evaluate the different cover scenarios, data inputs to the models, the sensitivity and accuracy of the models and the projected infiltration rates that resulted from the models. Concerns regarding seasonal performance, e.g., during the dormant season, of the ET cover were also raised.

EPA Response: A finite element model VADOSE/W© was used to conduct the quantitative water balance analysis of the ET cover because it can simulate potential evapotranspiration more accurately, and utilize model input parameters with a more detailed resolution than the HELP model. Climatic data used for the model were obtained from the Philadelphia International Airport weather station (PHL - Station 724080). A data set spanning from 2000 to 2004 was assembled and included the general climate data such as average daily wind speed, average daily relative humidity, minimum and maximum daily temperatures, maximum leaf area index, evaporative zone depth, and latitude (39.9 degrees).

The result of the model projected a 96% reduction in infiltration through the ET cover which was the annual average of growing and dormant seasons. The modeled annual average infiltrations rates through the single barrier cap with flexible membrane liner (FML) and ET cover over 50 acres were approximately 705 gpd and 1,458 gpd, respectively. Since the primary focus of the FS was to identify and evaluate landfill cover design alternatives, further analysis was conducted to refine the potential infiltration of the landfill caps (covers) presented in the FS, including Alternatives 1 through 4 and 7. In addition, the single barrier cap with compacted clay that complies with the 25 Pennsylvania Code, Chapter 273, Subchapter C §273.234 (requiring a permeability of the cap no greater than 10E-7 cm/sec) was analyzed for comparative purposes. The modeling results are available in the FS addendum.

The modeling of infiltration for Alternative 7 (ET cover) was performed with a varying Leaf Area Index (LAI) values (LAI begins and ends at zero during the dormant winter months, and is at its maximum value during the active growing season when plants are utilizing water from the underlying cover soils.) During the RD, additional cover modeling will be performed when the final cover configuration is chosen. The modeling will include any changes to materials that need be incorporated into the model, a sensitivity analyses will be performed to explore the relationship between the infiltration and the plant water uptake over time and use of the final cover design with actual vegetation parameters to verify the effect of evapotranspiration; verify the effects of consolidation under self-weight; to model for a longer period of time (typically 50 years), to verify the performance of the cover over time.

In addition, the current condition of OU1 encourages infiltration. Significant infiltration decreases will come from removing this recharge feature. Once OU1 is sculpted with appropriate slopes to encourage runoff of clean rainwater, OU1 will most closely resemble forested hillsides. Natural analogs of forested slopes in the area indicate minimal recharge. The ET cover works like

a natural forest, absorbing water in the soil sponge daily, weekly, and seasonally for later use. Percolation rates are expected to vary seasonally. Other ET covers, as well as conventional covers, show that most percolation occurs during occasional events. More percolation is likely to occur in the dormant season as the soil sponge reaches capacity and releases percolation. Model predictions of ET cover performance vary in accuracy with no one model capturing all the intricacies of an in-situ cover. The ET design process includes iterative use of a model to test various parameters to achieve an acceptable result. Typically, the cover designer will use the VADOSE/W, Hydrus, or UnSAT-H model instead of HELP to compare the relative importance of soil thickness, slope, vegetation, and other ET cover components. Models have proven to be useful for comparison of cover parameters; however, there are not generally accurate enough to predict a cover's performance alone. They are, however, the only way to explore cover choices in a site-specific case without building multiple full-scale test pads, which are very expensive and take years to return results.

2.14 Reuse of OU-1 after the Cover is in Place and How Those Uses Could Impact the Cover

Issue: Several comments inquired about potential reuse options for the ET cover. There were concerns about how reuse could impact the cover as well as the need for coordination between EPA and property owners, municipalities, etc. when the design and construction were being conducted.

EPA Response: The area encompassed by the ET cover requires a contiguous dense stand of trees to ensure optimal performance. Use in those areas will be limited to green space and ecological habitat. However, there is potential that limited walking or bike paths could be included on or around the cover. Any current features on or around OU1 that are to be impacted by the remedy construction, e.g., bike trails, will have a suitable replacement provided as part of the remedy, to the extent that final remedy design can accommodate those features. The portion of the cover located in Delaware County is on private property and as such, public access to this area will be determined by the land owner. Any portion of the cover that extends into the City Park will be controlled by the City of Philadelphia. EPA previously conducted a "Phase 1 Reuse Assessment for the Lower Darby Creek Area Superfund Site". Currently, EPA is evaluating whether it will conduct a Phase 2 Reuse Assessment for the Landfill. In addition to any reuse evaluation, it is EPA's intent to continue coordinating with the landfill owners, local community and other stakeholders during the remedial design to discuss potential reuse options for OU1. This information can be utilized to inform the design specifications and locations of various components of the remedy. The remedy will have physical controls, e.g., fencing, and include regular inspections to prevent use of OU1 by unauthorized vehicles.

2.15 Impacts of the OU-1 Remedy on Contaminated Groundwater

Issue: Several commenters inquired as to how the remedy for OU-1, in particular the ET cover, would impact the contaminated groundwater associated with the Clearview Landfill. Comments also pertained to potential future treatment options for groundwater.

EPA Response: The OU1 remedy will address shallow leachate and groundwater seeping into Darby and Cobbs Creeks only. The remaining shallow groundwater that is not captured in the

leachate collection trench and deep groundwater will be addressed by the OU3 RI/FS. Vertical barriers/slurry walls may be evaluated during the OU3 FS as a groundwater containment option if the OU3 RI data indicate such containment would be necessary. The remedy selected for OU1 (capping) will have positive impact on groundwater contamination since it will dramatically reduce infiltration through the landfill wastes and contaminated soils, which eventually migrates into groundwater. Stormwater will be managed as part of OU1 remedy using surface runoff and erosion controls such as bioswales and stormwater detention ponds. As with precipitation, stormwater infiltration into the waste will be greatly reduced by the ET cover and should result in a positive effect on the groundwater quality over time. Approximately one third of the OU1 waste is below the natural water table and permanently saturated. Any contamination present in this waste will not be impacted by a reduction in precipitation infiltration and will continue to impact groundwater.

2.16 Additional Groundwater Investigations

Issue: There were numerous comments submitted which inquired as to the nature of the additional groundwater sampling that would be conducted as part of the OU3 investigation.

EPA Response: EPA is currently conducting the Remedial Investigation for Operable Unit 3 (OU3). Extensive sampling was conducted from April - October 2013. The goal of this phase of the investigation was to use a set of "indicator contaminants" and a dynamic sampling approach to determine the maximum extent of impacted groundwater associated with the landfill in both the coastal plain sediment (shallow) and fractured bedrock (deep) aquifers. The results of this phase of the investigation showed that contaminated groundwater from the landfill is discharging into and passing beneath the adjacent creeks in the shallow aquifer to a limited extent. The groundwater contamination is also moving east and south of the landfill in the shallow aquifer. A small plume of contamination was detected in the bedrock beneath the southern portion of the landfill and also extended onto a small portion of the John Heinz National Wildlife Refuge. The next phase of the investigation entails installation of additional permanent monitoring wells throughout the contaminated areas and conducting several rounds of sampling for a larger suite of contaminants. These data will be used to evaluate the full nature and extent of contamination, potential current and future risks and consider potential cleanup alternatives.

2.17 Stormwater Management and Treatment

Issue: Several commenters asked how stormwater would be managed, the nature of the design for the stormwater management features, and if stormwater would be treated.

EPA Response: The specific construction and location of stormwater conveyances (swales, etc.) will be determined during the RD. All stormwater from the landfill cover should be able to be discharged directly to the creek since it will not be in contact with waste and/or contaminated soils. However, it may include landforms such as bioswales to intercept silt, nutrient, and pollutants (if any) reaching surface water.

2.18 Vapor Intrusion Concerns

Issue: Numerous comments were submitted that expressed concerns with the potential for vapor intrusion in other residences that could be impacted by the larger area of groundwater contamination which has been discovered as part of OU3. There were concerns about the number of residences which participated in the initial vapor intrusion investigation as well as what future steps will be taken to evaluate potential vapor intrusion.

EPA Response: As part of the residential vapor intrusion evaluation conducted for OU1, EPA conducted numerous public outreach activities and made several attempts to obtain access to the residential candidate properties that were initially identified for the investigation. Twenty one residences and the Eastwick Park Recreation Center were assessed during Phase 1 of the investigation; 10 locations were assessed as part of Phase 2. EPA has limited ability to compel residents or tenants to participate in an investigation of this nature. Only those residents that consented to EPA's requests for participation in the investigation could be tested. If conclusive evidence of vapor intrusion or unacceptable risks associated with the landfill were identified as part of the investigation, the investigation was to be expanded further east. However, no vapor intrusion or potential unacceptable risks were identified. As stated in the Remedial Investigation Addendum Report *"VOCs potentially related to the Clearview Landfill were detected in several air samples collected from various sampling locations. In many instances, it appears as though the sources of these VOCs may not be related to the Site, but rather activities inside of the buildings and/or the outdoor. However, it cannot be concluded with complete certainty that those VOCs which historically have been associated with the Site and were also detected beneath or inside of a property cannot be attributable to the landfill. There is often overlap between the VOCs that were found in the landfill and those that are commonly used in household items. No significant accumulation of any vapors was noted under any structure. Some minimal intrusion of VOCs from beneath the foundations may be occurring in several of the buildings discussed above. However, the risk assessment findings indicated that no unacceptable risks are present. Given these findings, no additional investigation or action is necessary to address vapor intrusion issues related to the Clearview Landfill."* If additional information is obtained during the OU3 investigation which suggests vapor intrusion requires further evaluation, EPA will take the appropriate steps.

2.19 Flooding Impacts on the OU1 Remedy

Issue: There were several comments submitted which asked if surface soils could have historically been contaminated by floodwaters or that were concerned about potential impacts from flood events on the OU1 remedy.

EPA Response: EPA is fully aware of this flooding issue. There is some potential that contaminants contained in floodwater from previous events could have been deposited on surface soils around the OU1. In large flood events, runoff from large urban areas such as where the Landfill is located can carry common urban pollutants. However, soils sampled before and after the Hurricane Floyd flood event in 1999 did not identify any pattern of contamination which indicated that this had occurred. Potential impacts from the selected remedy to the floodplain adjacent to OU1, as well as remedy effects upstream and downstream will be appropriately assessed during the RD to ensure that no significant negative impacts on flooding occur. Appropriate regulations pertaining to floodplain management will also be followed. Potential

impacts from flooding on the final remedy's integrity will also need to be considered and addressed. EPA is currently communicating regularly with the City of Philadelphia, Delaware County, Pennsylvania Department of Environmental Protection (PADEP), U.S. Army Corps of Engineers (USACE) and Federal Emergency Management Agency (FEMA) to collaboratively address flooding issues in this area. Communication with these and other appropriate stakeholders will continue throughout the OU1 design, construction and operation phases.

2.20 Landfill Creek Bank Stabilization Technologies

Issue: A number of comments inquired about where "geocells", "gabion baskets" or other types of materials had been used to stabilize stream banks previously at other sites and how the stream bank would be protected from normal stream flow and flood events.

EPA Response: Bank stabilization will be performed to prevent erosion and potential migration of contaminants to the creeks. At this time, the exact design of the stream bank and its erosion controls have not been determined. Numerous options were considered in the FS and certain promising technologies were proposed in the PRAP. The main purpose of an FS is to compare alternatives against one another and the nine NCP criteria. Thus, knowing the exact design details of each alternative is not necessary, nor is it possible, for a feasibility study. Thus, while the feasibility study and PRAP discussed these different stabilization materials and methods, a final determination on stabilization methods and appropriate monitoring and maintenance requirements must be determined as part of the remedial design. Geocells or other bank stabilization products (e.g., riprap, gabions, and concrete mats) that allow for full slope vegetation and provide for a high likelihood of stability during large storm events, floods, etc., will be utilized. There are numerous sites along water bodies that have required bank stabilization. One example of a site which has employed several designs for stabilization is the Bo-Rit Asbestos Site in Ambler, PA.

2.21 Current On-Site Businesses

Issue: Several comments inquired as to when the businesses will be relocated off the landfill and what will ensure that new businesses do not move in after the remedy is completed and recontaminate OU1.

EPA Response: EPA has evaluated the data collected from the multiple investigations conducted on the landfill and in the vicinity of the southern industrial area (SIA) where the businesses are located. While the SIA is consistently the most impacted portion of OU1, no specific evidence of a release(s) of any hazardous substances, pollutants or contaminants from any of the businesses present has ever been identified. In addition, the PADEP has conducted several inspections of the businesses in the SIA. As is stated in Section 11.2.2 of the ROD, "all businesses operating on the landfill within the boundaries of the ET cover shall be relocated and all structures demolished." A specific date for the relocation of the businesses has not yet been determined. EPA is working to ensure that the relocation of the businesses will not delay implementation of the remedy. As part of the remedy, institutional controls will be put in place to ensure that future uses of OU1 do not interfere with the selected remedy.

2.22 Feasibility Study Remedy Cost Estimates

Issue: Several comments expressed concern over the accuracy of the cost estimates for operation and maintenance (O&M) of the ET cover in the feasibility study (FS). Additional detail and refinement of the costs were requested.

EPA Response: The main purpose of an FS is to compare alternatives against one another and the nine NCP criteria. The cost estimates in the FS are prepared to meet or approach the goal of a +50/-30 percent accuracy level when compared to final actual costs of the remedy per EPA guidance. As the specific details of various remedial components, such as the treatment wetlands, are determined during the remedial design (RD), more specific refinement of O&M costs are not practical at this time, or considered to be any more reliable, than what is presented in the current FS. The O&M costs provided were based on a percentage of the capital costs. O&M of treatment wetlands will be the same for all remedial alternatives. With regard to the O&M of the ET cover, the costs were also calculated based on the capital costs of the remedy as estimated in the FS. The ROD provides additional detail with regards to the specific performance criteria that must be met by all components of the remedy. This includes the ET cover, as well as the types of monitoring data, frequency, etc. that should be used. The specific details of how data are collected to evaluate these criteria will be established in the RD.

3. RESPONSES TO SPECIFIC COMMENTS

This section provides responses to specific comments received during the comment period. Comments received during the public meeting that have been responded to in the discussion of major issues above are not repeated here.

Comment: "EPA should also post multilingual signage along the creek now and once the cap is installed to inform and educate about not eating the fish."

EPA Response: One of the Remedial Action Objectives for the OU-1 remedy is, "Reduce human consumption of fish in Darby and Cobbs Creeks that may be impacted by Landfill-related contaminants and pose unacceptable risks." The selected remedy as described Section 11.2 of the ROD includes provisions for installation of signage during and after remedy construction regarding risks from fish consumption. EPA will coordinate with local community representatives to determine which languages are most appropriate for the new signs.

Comment: "What happens to the site if the proposed remedial activities don't get funded?"

EPA Response: The remedy selected by EPA in this ROD will either be implemented by EPA or by parties EPA has determined are responsible for the Landfill contamination, under EPA oversight. The issue is not if the remedy will be funded, but when that funding will be available. Funding availability is influenced by several factors including whether EPA or a responsible party(s) will be funding the remedy or if there will be a sharing of costs. The Superfund program evaluates all Superfund sites requesting funds for remedial actions on an annual basis. These requests are prioritized based on several factors which determine which remedial actions are funded each year. Ongoing remedial actions get priority over new remedial actions. If a responsible party(s) is funding the remedial action, they must demonstrate an ability to fund their portion of the remedies cost. When the work will be performed by the responsible parties (RPs), specific timelines for various components of the remedial design and remedial action are specified in legal agreements negotiated between EPA and the RPs.

Comment: "The Walsh Road landfill in Chester County had a 16 year time gap between the ROD and the installation of the landfill cap. What is the expected timeframe for installation of protective measures? What is the schedule for Pre Design Investigation? Is that work funded?"

EPA Response: The specific schedule for the pre-design investigation, remedial design and remedial action are not known at this time. The timetable is a difficult question to answer because there are many factors that play into what happens after the ROD is issued. EPA must work with the Department of Justice to determine which parties EPA will pursue. A period of negotiations and/or enforcement actions must take place with any identified responsible parties. This will determine who is funding the work, EPA, the responsible parties, or a combination of the two. Generally, once the ROD is finalized, if EPA is conducting the pre-design

investigation and remedial design, funding will need to be obtained in order to begin this phase of work. Remedial designs can typically require 12-24 months to complete, depending on the complexity of the remedy, data collection needs, etc. Once the design is complete, the remedial action must be reviewed and prioritized by EPA's National Prioritization Panel. The timeframe for receiving EPA funding can vary greatly from several months to several years based on the number of other sites requiring funding nationally and the funds available. However, it is always EPA Region 3's intent to negotiate with PRPs, where appropriate, to perform the remedial action.

Comment: "Metals were most commonly detected in stormwater. Three metals, arsenic, iron, and manganese, were detected above their respective RBC and one metal, lead, was detected above its EPA action level. Three VOCs (1, 4-dichlorobenzene, MTBE, and PCE) were detected above their RBCs in six stormwater samples. Five SVOCs, (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-C,D)pyrene) were detected above their respective RBC in the stormwater sample from CS04. One pesticide, heptachlor epoxide, was detected above its RBC at one location (CS02) during a dry period. Will there be additional assessment of these sources when EPA looks at Folcroft landfill (OU3)? Eastwick Friends and Neighbors Coalition (EFNC) requests that EPA determine and disclose the origin of these contaminants so appropriate measures can be taken to prevent further deposits."

EPA Response: Exceedance of an RBC (or as they are now called, Regional Screening Levels), is not necessarily an indicator of unacceptable risk. The RI did not identify any unacceptable human health risks from sediment or surface water; potential risks to aquatic plants, invertebrates, fish, and feeding birds and mammals were identified for various media, including surface water and sediment. As part of the aquatic risk assessment being conducted by EPA as part of the Folcroft Landfill (OU2) Remedial Investigation, EPA has performed extensive sampling of sediment, surface water, fish tissue and turtle tissue ranging from OU1 to the confluence of Darby Creek with the Delaware River. Data collected from these sampling efforts will be used to evaluate potential risks to human and ecological receptors, and determine, to the extent practicable, the potential contributors to this contamination. However, given the complicated flow patterns with the Darby Creek watershed, the extensive timeframe for contaminant contribution to the system, the location within an urban watershed and the presence of numerous point and non-point sources, it is not clear at this time the extent to which this attribution evaluation will be successful. Regardless of how the contamination came to be located in this area, potential unacceptable risks attributable to the LDCA site which require response action will be addressed accordingly. As a clarification, the Folcroft Landfill is designated as OU2.

Comment: "The PRAP states "(t)o confirm that dioxins are not present at concentrations in soils outside of the planned cover area that would present a potential unacceptable risk, additional dioxin sampling will be conducted as part of the PDI as well." (Page 33). EFNC supports and thanks EPA for addressing the dioxin issue and conducting dioxin sampling as

part of the PDI. We request EPA collect sample for dioxin analysis within Eastwick and City Park."

EPA Response: As discussed in Section 9.1 and Section 11.2.1 of the ROD, additional sampling for dioxins is planned as part of the pre-design investigation, "To confirm that dioxins are not present at concentrations in soils outside of the planned cover area that would present a potential unacceptable risk, additional dioxin sampling will be conducted as part of the PDI as well. Should dioxins be detected in newly sampled areas above appropriate EPA screening criteria, the EPA risk assessment guidance for evaluating human and ecological risks will be followed, as appropriate."

Comment: "The location of the upstream sediment "background" sample location in close proximity to combined sewer overflow discharge locations does not represent a reasonable background sediment sample location. The presence of construction debris materials in the soil background samples collected as part of the RI brings into question what other contaminant sources maybe affecting the 'background' samples. These sediment and soil background samples are not acceptable as background concentrations because they have potentially been impacted by outside containment sources (combined sewer or contaminants in the fill). Risk-based removal of contaminants based on comparison with these background sample locations is not acceptable. Site wide soils should not be compared to contaminated "background" samples as part of the evaluation. Page 24 [of the Proposed Plan] contains several examples where risks were compared to background risks and therefore minimized. 'Soil lead concentrations were statistically demonstrated to be similar to background.'"

EPA Response: In Appendix U of the RI Report, page 79, it is acknowledged that "the background urban environment may have contributed to concentrations detected in Lower Darby Creek, Cobbs Creek, and Tinicum Marsh." Given that OU1 is surrounded by a large urban area, there are not any pristine upstream locations within the same creeks that pass alongside the OU1. However, the background surface water/sediment results did not affect the estimation of potential risks from OU1 because no chemicals were eliminated from the risk assessment based on the consideration of surface water/sediment background conditions. Background samples for surface water/sediment were presented only to illustrate representative upstream conditions.

As stated in the Background Soil Evaluation Report, the soil collected from sampling locations within the Korman Suites property consisted primarily of common urban fill material, as anticipated. Soil was most likely brought into this area to level the ground when the property development commenced. This mixture of fill and native soil is typical of all properties located in the immediate surrounding urban environment, where land development has been continuously occurring for many years. The data are considered representative because there are not likely any areas close to OU1 where surface soil and shallow subsurface soil have not been disturbed by previous urban development or typical urban activities, e.g., automobile exhaust.

Note that one background surface soil sample (PSS08S) and one subsurface soil sample (PSS08D) were reported in field notes to contain fragments of glass and bricks. These two samples also exhibited substantially elevated levels of arsenic, iron, and antimony compared to the remaining background samples, and were eliminated from the background soil database before conducting statistical tests. This eliminates any gross impacts from including non-soil materials in the background comparisons. However, all background soils are acknowledged to be representative of disturbed material that is typical of the surrounding area.

In soils collected from City Park (Zone 2) and the residential neighborhood (Zone 3), arsenic concentrations were found to be similar to background. Iron, antimony, and cobalt were also similar to background in one or both areas. In the remedial investigation report, risk summary tables (Appendix U, RAGSD Table 10s) display all of the risk drivers that contribute to significant cancer and noncancer risks, with footnotes added to the above metals where they were found to display concentrations within the range of background based on statistical analysis. For lead, only the soil from City Park (Zone 2) revealed lead concentrations that exceeded risk benchmarks but were similar to background levels. In general, statistical background comparison tests were not performed for any organic compounds and organic compounds were not flagged on Table 10s because of background conditions. Generally, anthropogenic contributions from the urban environment are not expected to represent the bulk of detected soil concentrations for any organic substance.

Comment: "When this Lower Darby Creek site was initially proposed for Superfund Listing, five other additional and potentially contributing properties were proposed for listing. EPA narrowed the CERCLA listing to just these two sites, accepting the findings that these two landfills were the primary contaminant and risk sources in the area. After acknowledging these two landfills as the primary risk factors in the area, how does EPA limit the Scope of Response by citing the urban environment and 'likely non site related sources of contamination?'"

EPA Response: The scope and role of the response actions for the Lower Darby Creek Area Site are limited to dealing with impacts from those areas that are included in the final Site listing. The purpose of the quoted text from the Proposed Plan was to convey the challenges in evaluating potential risks to the aquatic environment from the landfill and other potential point and non-point sources throughout the watershed. The Clearview and Folcroft Landfills were included in the final National Priorities List because direct releases of hazardous substances from those two sources to surface waters had been observed. The other five properties initially proposed for listing were not included in the final Site listing because no direct releases of hazardous substances from th0se properties had been observed during the time of evaluation for listing. This is not to say that the properties not included in the final LDCA listing did not contribute contaminants to surface water bodies at some point, but at the time of listing, no direct observation of a release had occurred and as such, these properties were not aggregated with Clearview Landfill and Folcroft Landfill in the final listing. Further, at the time of listing, remedial work had been completed or was ongoing at several of the proposed properties and Notices of Intent to Remediate under the Pennsylvania Land Recycling and Environmental Remediation Standards Act ("Act 2") for several proposed properties were also provided during the listing process. In addition, given that the size of the watershed that drains into Darby and

Cobbs Creeks is extensive, there are likely numerous other point and non-point sources that were not included in the final LDCA listing which may have contributed to contamination. Thus, as stated in the PRAP, the existence of these factors contributes to the challenge of evaluating risks and assessing attribution of contamination.

Comment: "The first goal of remedial action objectives is to prevent human and ecological exposure receptors. If contaminated soils are covered with 6" of clean fill, is it possible for earthworms and borrowing animals to interact with the contaminated soils at depth of up to 5' and bring them to the surface?"

EPA Response: Biointrusions in the landfill cap may not only pose a threat to the cap integrity and waste isolation, but also have the potential to access buried waste below ground surface which may lead to contaminant exposures to human and ecological receptors. This issue is especially important to barrier type caps using a geosynthetic barrier layer which is crucial to their performance. The vegetation (and densely planted trees) on the ET cover will provide greater resistance to burrowing owing to the dense root masses. Further, the thickness of the ET cover (estimated to be four feet in the feasibility study), will greatly reduce the likelihood of burrowing mammals to come in contact with the landfill waste. During the RD, the ET cover will be designed for types of trees and other large vegetation with deep dense root systems as well as the depth and types of cover soils to account for potential biointrusion. As is stated in Section 11.2.4 of the ROD regarding contaminated soils outside the ET cover, "Excavations shall be conducted until cleanup levels are achieved or excavation is no longer practicable. If excavation of soils is not practicable, the ET cover will be extended over the area and/or ICs will be put in place to prevent future unacceptable risks." Footnote 2 of Table C from the ROD states that "Ecological cleanup levels only apply to the top 2 feet of soil as it is the area of primary biological activity." Application of these cleanup levels will ensure protectiveness for any ecological receptors using the top 2 feet of soil.

Comment: "Please provide a figure showing the elevated soil locations and concentrations exceeding the cleanup values....Please provide the rationale for leaving the contaminated soils in place.... Please provide a map/figure of the locations of soils with exceedances and identify which soils will be removed. The proposal is to remove the soils in City Park that have chemical concentrations that exceed the risk-based cleanup values. How deep will the removal go?"

EPA Response: Figures 20 and 22-24 of the ROD show all locations outside the planned ET cover area that exceed the soil cleanup levels and need to be excavated and consolidated under the ET cover. These excavated areas will be backfilled with clean soils. Also, an area of 11 acres outside the proposed cover system where solely construction debris was encountered during the remedial investigation will be evaluated to confirm 1) only construction and demolition debris are present in the subsurface soils and 2) no exceedances of cleanup levels in soils that are outside of excavation areas or ET cover perimeter, as well as to 3) evaluate thickness of clean surface soil in areas with construction and demolition debris present in subsurface. This area is represented by the area outlined in a yellow dashed line on Figure 20 of the ROD. Any

locations within this 11- acre evaluation area that have less than 2 feet of clean surface soils will have up to two feet of surface soils and other materials excavated and backfilled with clean fill material. If subsurface soils are contaminated above cleanup levels at substantial depths, excavation may be impracticable and it may be appropriate to extend the cap rather than excavate all of the impacted materials. The details will be determined during the pre-design investigation.

Comment: "According to the PRAP, the landfill cap may be expanded further into City Park. The PRAP states that, "(e)xposed soils will be iteratively sampled to evaluate if all appropriate soil Preliminary Remediation Goals (PRG) have been attained. If they have not, further excavation will be conducted and additional soil samples collected until it is confirmed that remaining soils do not exceed clean-up goals or excavation of soils is no longer deemed practicable, e.g., contaminated soils below the water table. If subsurface soils are contaminated above PRGs at substantial depths, it may be appropriate to extend the cap rather than excavate all of the impacted materials." (Page 34) "Upon completion, the portions of City Park outside of the cap would be available for all types of future uses including residential and recreational. There is potential that soils with Contaminants of Concern (COC) at concentrations greater than PRGs could remain in the subsurface and not under the cap if excavation of those soils is impracticable, e.g., below the water table. In this case, Institutional Controls would be implemented to prevent future exposure to human and ecological receptors. All human and ecological exposure risks on the Landfill would be eliminated by the cap." (Page 40) Where else has this technology/methodology been utilized? Please provide summaries of those sites' assessments."

EPA Response: Each Superfund Site is unique and the response actions that are selected must be tailored to account for the Site's characteristics while still addressing potential risks. Institutional controls are an integral part of the Superfund program and are often used to compliment and protect the integrity of remedies. For both any contaminated soils below the water table and soils beneath street asphalt, there are no current exposures for any receptors. This would not change as a result of the remedy. The potential risks from the soil locations in the Eastwick neighborhood which are to remain beneath the asphalt are low-level risks that present small exceedances of EPA's risk criteria assuming long-term chronic exposure. The potential risks from saturated soils beneath the City Park are not definitively known, but will be evaluated as part of the pre-design investigation. However, it is important to reiterate that there is no current exposure to these soils or the contaminants that may be present as the groundwater is not being used and no vapor intrusion risks have been identified. When evaluating the potential use of institutional controls, factors such as potential risks, implementability of alternative response actions, future land use, etc. must be considered when weighing the benefits and drawbacks of the various approaches. In this situation, the lack of current exposure to these contaminants, low level risks, challenges for excavation to potentially substantial depths below the water table, risks to the workers conducting that excavation and the substantial increased costs that would be incurred led to the selected approach of removal of all contaminated soils above cleanup levels that can practicably be removed and implementation of institutional controls (ICs) over those contaminated soils which cannot be practicably removed

or that are currently present under the asphalt and inaccessible. Use of ICs will prevent any future contact and unacceptable risks by imposing land and groundwater use restrictions.

Comment: "What options are available to EPA should these systems (leachate collection trench, engineered treatment wetlands) not work as designed?"

EPA Response: As part of the remedy, EPA or the responsible parties will monitor the leachate collection trench, treatment wetlands and their performance to ensure that established discharge limits are being met and ensure they are functioning properly. Sections 11.2.5 and 11.2.6 of the ROD contain additional detail on the monitoring requirements. Also, as is noted in Section 9 of the ROD, a five-year review of the remedy must be conducted every five years by EPA. During this time, monitoring and performance data will be used to evaluate the remedy and determine if it is functioning as intended, including the treatment wetlands. Should any issues be identified during long-term monitoring of the treatment wetlands or five-year review, these would need to be addressed. Options for addressing performance issues regarding the treatment wetland are contingent upon whatever issues are identified. At this time, it is not possible to know exactly what issues could arise. However, as part of the remedial design, potential issues that could affect the treatment wetlands and other components of the remedy will be considered and planned for as necessary.

Comment: "Volatile organic chemicals (VOCs) also pose a concern for the subsurface (SSF) wetlands. VOCs are actively biodegraded by the microbial life in the wetlands. However, VOCs as their name implies, tend to volatize quickly and exit the system in gas form. This will render the air in the vicinity of the wetlands potentially toxic. Therefore, an advisory should be set in place to prevent any human intrusion into the area and its surroundings."

EPA Response: As part of the remedy, leachate will be collected and treated with engineered subsurface flow wetlands. The contaminants in the leachate are predominantly metals and PAHs. PAHs are not considered to be volatile. The leachate has relatively low concentrations of SVOCs, pesticides, and VOCs. While it is correct that VOCs will volatilize from the leachate as it is exposed to the atmosphere, the leachate will be diluted by water in the wetlands. The VOCs emissions from the diluted leachate will then disperse readily into the atmosphere due to winds and atmospheric mixing, not accumulating in the vicinity of the wetlands. Once the landfill is capped, infiltration would decrease dramatically, and groundwater elevation and leachate generation would also decrease over time. Many VOCs will also be biodegraded aerobically and anaerobically in the wetlands.

Comment: "The Feasibility Study states that on-site treatment of the leachate and the discharge effluent from the wetlands to the City of Philadelphia sewer may be required under certain conditions. However, the information presently available is insufficient for PWD to determine if the on-site treatment will be effective in reducing the pollutants in the effluent to levels that comply with PWD's regulations applicable to contributors to the City's wastewater system. (See PWD Regulations Chapter 5, Sections 501.0 through 501.8....)."

EPA Response: The Feasibility Study for OU1 included consideration of treatment of collected leachate at a Publicly Owned Treatment Works (POTW) such as one that is run by the Philadelphia Water Department. However, the ROD selected on-site treatment of leachate via subsurface treatment wetlands with discharge to the nearby creeks.

Comment: "The same principle can be applied to the leaching problem. Your trench solution is negated when Ridley Creek overflows, as it does. It would concentrate the contaminants further in Ridley Creek instead of reducing them. Grading away from the creek, and then using stone drainage to again redirect the water would be more effective for containing contaminants."

EPA Response: To clarify, the Clearview Landfill is not adjacent to Ridley Creek. However, EPA believes the concerns voiced by the commenter would be the same for Darby and Cobbs Creeks. The trench will be a subsurface trench that will extend to the mean high tide line of the portions of Darby and Cobbs Creeks adjacent to the landfill. Short of a catastrophic failure of the east bank stabilization measures and ET cover, it is unlikely that flood events would cause the trench to overflow and discharge to the creeks as there will be an approximate four foot thick cover over the trench surface. However, as part of the remedial design, potential impacts from storm events and potential sea level rise on the remedy will be evaluated. Storm water management components on the ET cover will also be designed.

Comment: "What are EPA's targeted goals for contaminants and volume in the leachate collection systems?"

EPA Response: The maximum volume of leachate that will be collected under current conditions is estimated to be 6,600 gpd. This volume is anticipated to decrease dramatically once the ET cover is placed on OU1. With the OU1 remedy, the two remedial action objectives which directly address leachate treatment are: "Control and capture seasonal leachate seeps above the mean high tide elevation of adjacent creeks that are migrating into the adjacent Darby and Cobbs Creeks" and "Reduce the concentrations of contaminants in collected leachate to meet the surface water discharge requirements established by NPDES permitting process during the remedial design." Section 11.2.5.3 of the ROD discusses the discharge limits for the treatment wetlands.

Comment: "What was the cause of significant tree failures at Walsh Road and at other ET cover installations?"

EPA Response: Every tree planting has a certain amount of loss in the early years like any growing plant subject to unfavorable weather and predation by wildlife. Replanting expenses are built into planting budgets. Landfill soils are often difficult to work in because they are not agriculturally balanced. The Welsh Road Site team did not conduct an extensive analysis of why some trees did not survive during the initial planting and simply filled in the empty spots

with new trees, as is standard practice. The new trees survived, and after a few years, it is now not possible to tell which trees are original and which are the replacements.

Comment: "The Walsh Road May 2011 report indicates that there were gaps in collecting soil moisture data due to monitoring equipment failures and data quality failures. What was the cause of these failures and how will soil moisture data be collected at the proposed cover?"

EPA Response: The instruments used for soil moisture monitoring are buried in the ground and exposed to environmental and climate impacts. Occasional data gaps are common and do not decrease the value of the collected data. The Welsh Road Site is located in a rural area, and replacement and repair is difficult, especially for equipment that is buried in a plot testing area - digging for repair and replacement disturbs the test. The instrumentation for OU1 has not yet been chosen; the information obtained during the course of the implementation of the remedy at the Welsh Road Site will be used in that selection during the RD.

Comment: "A well-established ET cover appears to evaporate and transpire water from the soil layer during the growing season. An ET cover located in southeast PA is exposed to a six month dormant season and humid conditions in the growing season. During the dormant season, the cover will experience frequent winter rains and snowmelt episodes. In 2005, a report entitled "Alternative Cover Assessment Program (ACAP)" was prepared by William H. Albright of Desert Research Institute and Craig H. Benson of University of Wisconsin, Madison. The report states on page 3-31, 'In humid locations with the abundant precipitation and typically lower potential evapotranspiration, the store-and-release mechanism used by ET covers does not provide sufficient hydraulic control to match the performance of conventional composite covers.'"

EPA Response: The water balance for an ET cover includes transpiration from plants, evaporation, and run-off components. During the vegetation's dormant season, both evaporation and runoff functions continue to occur. When the ground is frozen or saturated, runoff increases. EPA expects that there will be some natural degree of seasonal storage of moisture. Each of these components will be assessed during the design phase.

Comment: "We are aware of the Walsh Landfill (8 acres) site in Honeybrook, PA which had an ET cover constructed in 2006 but is undergoing the second five year review post construction to determine whether the system meets the functional equivalence of final covers required under Pennsylvania's Solid Waste Regulations. The FS and PRAP we have reviewed for the Clearview Landfill do not identify any example sites, with similar climate and setting as the Clearview site, where an ET cover has been shown to perform as equivalent to conventional covers required by regulations. Beyond infiltration and percolation reduction, the FS does not adequately address the potential effects of groundwater and surface water interactions, floodway conditions and the general hydrodynamic characteristics of the Clearview Landfill site on the design, function and performance of an ET Cover system."

EPA Response: The selected ET cover does not attempt to match the performance of a conventional composite cover. However, the ET cover will provide an equivalent standard of performance to a landfill cover/cap that is built to achieve the design specifications, specifically the permeability requirement, established in the applicable and relevant appropriate requirements (ARARs). This is discussed in further detail in sections 9.2, 10.0 and 11.2.2.3 of the ROD. Because the landfill is unlined and a significant percentage of waste is below water table, there is no chance to create a dry entombment landfill at OU1. One goal of this ET cover is to minimize and manage infiltration. Other goals for an ET cover include preventing human and animal contact with the waste, creating a usable and aesthetic space, creating wildlife habitat and natural vegetation, and sequestering carbon. The Remedial Design will further evaluate the potential groundwater and surface water interactions, floodway conditions and other hydrodynamic conditions associated with the ET cover.

Comment: "Darby Creek Valley Association (DCVA) is not opposed to the use of an ET cover in concept but feels that the performance of the ET cover option at this site has not been properly demonstrated in the Proposed Plan. An evaluation of the performance and the "Functional Equivalence" of the Walsh Landfill has not been done. It is planned for 2016. Are there other ET covers installed within a 100 mile radius of Clearview for which the results from functional equivalence reviews are available? If so, please provide those reviews/results. Have other nearby ET cover been determined to be functionally equivalent?"

EPA Response: At the Welsh Road Superfund Site EPA is requiring that the ET cover achieve a functional equivalent to the standard minimum landfill cover required by the Commonwealth of Pennsylvania, or 18" of compacted clay overlain with 6" of planted topsoil. Prior to installation, modeling showed that the ET cover would easily match that standard. Data from the monitoring instruments installed at the time that the ET cover was planted and corroborated by groundwater wells indicate that the modeling was accurate. At the time of the last Five-year review in 2011, the Welsh Road Landfill ET cover was functioning as intended. Monitoring data indicated that percolation reduction was greater than 81% which was near the high end of the range of average percolation reductions predicted by the models used during the RD. This amount of infiltration was still a larger quantity than desired for the Site, but it was concluded by EPA that this amount of infiltration was not negatively impacting the protective nature of the cover, as measured by groundwater monitoring. The decision document which selected the ET cover for Welsh Road Landfill recognized that the ET cover system would take several years to become efficient at reducing infiltration. As a result, an evaluation of the functional equivalence of the Welsh Road Landfill ET cover system to the requirements for final covers under the Commonwealth of Pennsylvania's Solid Waste Regulations will be made during the next Five-year review in 2016. EPA is not aware of any other sites, other than the Welsh Road Site, that are within a 100 mile radius from Clearview Landfill which have selected an ET cover as part of a Superfund site remedy. Several other sites are in the process of evaluating ET covers, but final remedies for these sites have not been selected.

Comment: "The effectiveness of an ET cover under regional growing and weather conditions has not been demonstrated."

EPA Response: Most Superfund sites within a shared same climate zone do not have an established and well monitored ET cover. The Clearview Landfill is unusual and greatly benefits from the nearby Welsh Road Site that has demonstrated its effectiveness, including robust growth of the cover vegetation and a significant reduction in precipitation percolation from the ET cover. The planted trees have grown remarkably well and are closing the canopy. The most recent monitoring data from the Welsh Road Site demonstrates that the ET cover is effective in significantly reducing the amount of precipitation percolation into the waste.

Comment: "What would be the baseline conditions for groundwater conditions? How long would groundwater monitoring continue after cover installation?"

EPA Response: It is important to bear in mind that the remedy for OU1 is to address landfill waste, contaminated soils and "shallow" leachate on the western edge of the OU1 adjacent to the creeks. OU3 is the groundwater that is impacted by OU1 and is currently under investigation, and any response actions for OU3 will also include long-term monitoring of groundwater conditions. While the ET cover will greatly reduce the amount of precipitation that reaches the waste and subsequent leachate generation, approximately 33% of the OU1 waste mass sits below the natural water table and is permanently saturated. As such, groundwater that passes through this saturated waste will continue to be impacted. No specific groundwater cleanup levels are being selected as part of the OU1 remedy. However, to evaluate the impact of the OU1 remedy, specific details of groundwater monitoring for the OU1 remedy will be determined during the remedial design. It is possible that the groundwater monitoring program for OU1 could be merged with the OU3 remedy monitoring, if appropriate.

Comment: "EFNC supports EPA's efforts to save selected large trees on the current site. "Current vegetation and soil thickness will be evaluated during the design to determine if any portions of the Site where the ET Cover is to be constructed can be enhanced with additional soil to save large trees" (Page 41). This effort will reduce percolation during installation of the ET or Hybrid until the new plantings become established. The overall size and massive weight of the land fill has placed a tremendous amount of pressure on the underlying aquifers and water table. How will the ET solution help to slow or prevent the continuation of the downward, gravity aided movement of the toxic pollutants so that these pollutants will not continue to have a negative effect on the underground water table, the Eastwick community and the Darby Creek?"

EPA Response: Groundwater is always moving. The ET cover will significantly reduce infiltration of precipitation; therefore, minimize the downward movement of the toxic pollutants reaching groundwater. Approximately 33% of the OU1 waste mass sits below the natural water table and is permanently saturated. As such, groundwater that passes through this saturated waste horizontally will continue to be impacted. No specific groundwater cleanup levels are selected for OU1. Groundwater at the site is being investigated as part of OU3.

Comment: "What quantity of infiltration, in inches per year is estimated for the current landfill cover?"

EPA Response: Under current conditions, the water infiltration into the waste within 50 acres ranged from 35,600 to 43,500 gallons per day (gpd), depending on the annual precipitation. Approximately 40,440 gpd (or approximately 10.86 inches per year) of water on average would infiltrate into the waste, which is 25.5% of the average annual precipitation (42.62 inches per year or 158,525 gpd).

Comment: "Your proposal doesn't grade to redirect water away from Ridley Creek, nor drainage with a stone base to get rid of the water. More stones as a base to drain the water would probably mean you wouldn't have to use 4' of soil, and would be more effective as a barrier, especially in hurricane season when the possibility of 4-8" of rain can occur. In a 4-8" rain, the water seeped through the clay and rocks down 5-6', to get into my basement. Clay retains water!... A deeper stone drainage pond for all the drained water to collect, would ensure contamination would be contained. Covering it with soil is only necessary for whatever is planted on it. The trees do most of the work, as they require 7 gallons of water a week. Willow trees could be used over the stone drainage pond when large amounts of water accumulate. This stone drainage pond would probably only be needed whenever the rainfall exceeds 4". This does occur regularly."

EPA Response: To clarify, the Clearview Landfill is not adjacent to Ridley Creek. A drainage layer above the flexible membrane liner (FML) is an integral part of a conventional landfill cap. It serves to reduce the head of water on the barrier layer (i.e., FML) and promote the lateral drainage of water to the collection system outside the cover, as the commenter indicates. However, the ET cover does not have an impermeable layer such as FML; therefore, a drainage with stone cannot function as previously described. The ET cover rather relies on a vigorous plant community with roots throughout the depth of the cover to retain water until it is either transpired or evaporated and to minimize infiltration. The remedial design will provide for stormwater collection and conveyance system to deal with heavy precipitation events.

Comment: "Historically, ET covers have been used and proven to be effective in arid and semi-arid regions (as defined by a less than or equal level of precipitation vs. evapotranspiration). However, very few studies have demonstrated this to be consistently true in more humid climates (Barnswell & Dwyer 2011, 2012). This is evidenced by studies that measured average percolation rates for alternative covers at generally less than 2.2 millimeters/year (0.4% of total precipitation) in arid/semi-arid/sub-humid climates and between 33 and 160 mm/yr (6 and 18% of total precipitation respectively) in humid climates [Albright 2004]. The climate of southeastern Pennsylvania is very humid, with an average annual precipitation rate of 42.1 inches (107 cm). [weather.com] As a result, the ability of an ET cover to provide the necessary level of protection against water percolation is highly questionable."

EPA Response: Any type of landfill cover would be more effective in reducing infiltration where there is less precipitation, therefore precipitation alone is not a very good quick indicator

of an ET cover's potential. Most basic evaluations compare precipitation (P) to potential evapotranspiration (PET) on an annual basis. More accurate is to compare P/PET on a monthly basis. Another way to gauge PET effectiveness is to look at USGS analysis of groundwater recharge estimates, which at OU1 is about 10 inches per year. Groundwater recharge predominately occurs in low lying areas, and this ET cover will have engineered slopes to manage runoff and to further decrease infiltration. This is a quick evaluation technique and the ET cover design process will provide much more rigorous evaluation of the cover's potential.

Comment: "The PRAP notes that "maximum effectiveness of reduction of percolation through and drainage from the bottom of the ET Cover will not be realized immediately after installation is completed. Percolation through the ET Cover and subsequent leakage into the waste will decrease over time as vegetation and tree growth become more established" (Page 44). What are the anticipated impacts on the increased infiltration rates and corresponding contamination plume during the 18-20 month construction timeframe (Hybrid) and the 14-16 month construction timeframe (ET Cover)?"

EPA Response: Construction of any landfill cover will include disturbing existing vegetation and loosening soil structure with a potential temporary increase in percolation. Although this increase is not quantifiable at this time, it is anticipated that it will not significantly add moisture to the waste that is already saturated at the bottom of the landfill.

Comment: "How many years will it take for the ET cover to become "established" to attain full effectiveness?"

EPA Response: Full effectiveness depends on the final tree selection, size, and spacing, which will be determined in the final design phase. Evapotranspiration effectiveness reaches full potential when the tree branches touch and utilize all available sunshine. This is called canopy closure and typically occurs 3-5 years after planting. EPA will leave as many existing trees in place as practical and institute operations and maintenance procedures to maximize growth and minimize the impacts of construction. Once constructed, the placement of the ET cover, in and of itself, should substantially reduce the amount of precipitation that reaches the landfill waste as it will serve as a sponge to retain much of the precipitation until it evaporates

Comment: "Gas emissions from the landfill's waste may not be adequately controlled since typical ET cover designs do not have impermeable layers to restrict gas movement. In a report on phytoremediation (the use of vegetation to degrade, extract, contain, or immobilize contaminants from soil and water), EPA acknowledged that "if there is potential for gas generation a vegetative cover may not be an option. For example, a municipal solid waste landfill can produce landfill gas that may be of concern to human health and the environment. Sites with requirements to collect and control landfill gas may not meet Federal requirements under the Clean Air Act if a vegetative cover is used" (2000). Therefore, an active gas collection layer should be engineered into the ET cap in order to control gas emissions."

EPA Response: There is little anticipated landfill gas production for the Clearview Landfill because the waste was placed many years (six decades) ago and because water infiltration has not been restricted. Therefore, it is anticipated that most of the methane generation from the waste has already occurred. An ET cover will create a microbially active soil zone. These aerobic soil zones have been shown to be effective at consuming methane, even during the dormant season. In fact, sampling during the remedial investigation indicated that a comparatively minimal amount of methane was being generated over the majority of the landfill. Several locations did present elevated levels of methane in areas near buried former stream channels or wetlands. Additional investigations near and within residences adjacent to the City Park did not identify the presence of any methane. Substantial methane generation is not expected to occur after implementation of the remedy; methane generation is expected to continually decline with time. The nature of the ET cover is such that it will allow for the passive venting of methane throughout the cover and into the atmosphere. Levels of methane are not expected to accumulate to levels that will present a health risk or explosion hazard. However, disturbance of the waste during implementation could result in temporary increases in methane generation. As such, both during the implementation of the remedy and as part of long-term monitoring, landfill gas levels will be monitored to ensure methane does not exceed 25% of the lower explosive limit for methane in any structures on the landfill and that the concentration of methane gas does not exceed the lower explosive limit (LEL) for methane at the landfill cover boundary. This is discussed in further detail in Section 11.2.2.11 of the ROD.

Comment: "The proposed remedial alternative provides, under "Site Preparation" that, "all of the vegetation within the remedy boundary will be removed unless deemed to be suitable for construction and incorporation in the ET cover." (PRAP, p. 33) Philadelphia Parks and Recreation (PPR) asks for clarification whether this statement means that EPA intends to salvage and store plant material for re-planting into the ET cover. If that is EPA's intention, PPR requests that PPR be consulted to identify appropriate plant material and that the remediation contractor assign a staff ecologist for Operable Unit 1 work. PPR notes that much of the vegetation community in the vicinity of Clearview Landfill is comprised of invasive/non-native species."

EPA Response: The final design for the cover will incorporate leaving as many old and established plants as practical. EPA is coordinating with staff from U.S. Fish and Wildlife Service, the John Heinz National Wildlife Refuge and the U.S. Forest Service to determine appropriate species for the cover. EPA will also coordinate and seek input from the PPR.

Comment: "The total amount of precipitation over a year, as well as its form and distribution, determines the total amount of water storage capacity needed for the cover system. The engineered soil layers need to accommodate extreme water conditions, such as snow/ice pack, snowmelts, summer thunderstorms, hurricanes and associated storm surges or periods of time during which ET rates are low and plants are dormant. The function and performance of an ET cover during periods of extreme weather events or a considerably wet year, as this area has more recently experienced, has not been adequately addressed in the FS and PRAP."

EPA Response: While ET covers can be considered innovative, emerging, or unconventional, ET covers have been installed in many places, including Superfund sites, across the United States. They have been studied for many years in dry, wet, cold, and warm climates. The design process will determine the exact characteristics of the ET cover system and will be based on modeling for a variety of climatic conditions. Based on the ACAP that examined 14 sites over 5-7 years and, and the nearby example of the Welsh Road Site, there is a reasonable amount of certainty that this cover will perform as expected. The ACAP report noted that for many of the study locations, increased drainage rates into waste coincided with periods of heavy precipitation for "traditional" composite covers as well as ET covers. All types of landfill covers or caps are influenced by large weather events and periods of above average precipitation.

Comment: "Storage capacity of the cover system is particularly important when significant weather events occur and local vegetation is dormant, resulting in less evapotranspiration. During the dormant winter months, the plants will release water back into the soils and increased infiltration will occur as evapotranspiration is reduced in the non-growing season. The PRAP indicates a 36-inch thickness of the fine-grained soil layer that will provide storage capacity but the actual required design thickness may need to be substantially thicker to meet the storage capacity requirements at a greater cost. The FS and PRAP do not discuss the range of uncertainty, at this time, related to the thickness of the fine grained layer and ultimate cover system elements and associated costs that will be required."

EPA Response: The Proposed Plan and ROD indicate that the fine-grained soil layer of the ET cover would be three to four feet thick. The actual thickness of the final cover, including the fine-grained layer, will be determined during the RD. As noted previously, the cost estimates provided in the Feasibility Study provide a +50/-30% estimate of the cost for each alternative.

Comment: "The record of construction cost for ET covers indicates the cost is expected to be less than that for a conventional cover. However, the costs for O&M after construction are not as easily estimated and can vary based on site specific characteristics. Several factors affecting the O&M cost include frequency and level of maintenance (for example, irrigation and nutrient addition), and activities needed to address erosion and bio intrusion (pests and animals). Plant growth and survival rates are important factors that affect performance and costs. The PRAP is not clear on whether trees and vegetation planned for the ET cover will be prevented from extending into the waste. The PRAP also fails to consider whether landfill waste and leachate may be toxic or otherwise detrimental to the plant growth and survival. These potential concerns relate to issues of implementability, effectiveness and performance of the ET cover. Further, it is not clear how the FS and PRAP have accounted for O&M costs related to frequency and need to replace trees on a routine basis because of bio intrusion, disease, erosion and other factors known to affect vegetation growth and survival."

EPA Response: Biointrusion will be a potential challenge that would need to be addressed by all alternatives involving cap/cover placement. Therefore, the same O&M cost associated with anti-biointrusion was anticipated for all cover systems evaluated during the FS. Biointrusions

of the ET cover may not only pose a threat to the cap integrity and waste isolation, but also have the potential to access buried waste below the ground surface. The vegetation (and densely planted trees) on the ET cover would provide greater resistance to burrowing due to the dense root masses. During the RD, the ET cover will be designed for types of trees and other large vegetation with deep dense root systems as well as the depth and types of cover soils to minimize the potential for biointrusion. Considering existing vegetation on the landfill, it appears that levels of soil contamination would not be detrimental to the plant growth and survival on the ET cover. The cost comparison to membrane covers was based on historical data which include design, construction, and operations and maintenance. ET covers tend to cost less in O&M than conventional covers because of less mowing and the generally self-repairing nature of soil covers as compared to membrane-type covers. Plant survival is critical and at the same time plant stress is a useful diagnostic tool. On Clearview, as with most ET covers, many plant species and varieties will be planted, and it is anticipated that replanting of about 10% of the vegetation will be needed. The more robust and adapted of the species will thrive, and any dying trees will be replaced with more of the successful kinds. Trees will be chosen that are capable of producing seeds and over time a self-replicating natural forest ecosystem will evolve. While it is not clear exactly how deep the waste is in all parts of the site, it is not anticipated to be a concern if tree roots interact with waste. Most trees are self-protective enough not to grow roots into areas that contain toxic materials or areas that are anaerobic. Root zones have been shown to gradually aerate and detoxify soils.

Comment: "As two primary components of the proposed remedial action, ET cover systems and engineered treatment wetlands are non-conventional measures based on fundamental scientific and engineering concepts that have shown the potential to be effective to treat and manage water. We understand that ET cover systems are founded on basic principles of water balance and have been studied since the mid-late 1990s to address a growing interest in the use of innovative alternatives to prescribed landfill cover designs. However, ET covers have generally been considered more applicable in areas that have arid or semi-arid climates; their application has more typically been limited to the western United States. Engineered treatment wetlands are designed and constructed to make use of the natural processes involving wetland vegetation, soils, and the microbiological processes to assist in treating wastewaters. Typically, treatment wetlands are built on uplands and outside floodplains. As innovative alternatives to more conventional landfill cover and wastewater treatment systems, the ET cover and engineered treatment wetlands that are proposed for the remedial action present several questions with regard to the climatic, humid, wet, flood plain and flood prone characteristics of the Clearview Landfill site. At a minimum, the specific characteristics of the Clearview landfill site pose significant engineering, design, construction, operation and maintenance challenges that impose a considerable degree of uncertainty related to implementability, effectiveness, and cost of the proposed remedial action, at this time. Further, the United States Army Corps of Engineers (USACE) in a collaborative effort with the Philadelphia Water Department (PWD) are completing a hydrologic and hydraulic analysis of the feasibility of constructing a levee at the project site (USACE May 6, 2013 Letter to Philadelphia Water Department; Page 2 of the Appended Scope of Work for Planning Assistance to States Agreement: Hydrologic and Hydraulic Modeling of East Germantown (Philadelphia), Pennsylvania). The outcome of the ongoing study could have significant implications and adds even greater uncertainty for the

proposed remedial action plan that is currently conceived. While the ET cover and engineered treatment wetlands may eventually be proven to be the best alternatives for this site, there is an atypical degree of uncertainty, even at this conceptual stage of the proposed plan, about implementability, performance, effectiveness and costs, at this time. Because of the uncertainty, Langan has reservations and concerns and seeks to have EPA provide further clarification, understanding and reassurance of EPA's proposed remedial action plan."

EPA Response: As has been discussed in other responses, while both the engineered subsurface treatment wetlands and the ET cover are innovative approaches, EPA believes there is sufficient information to design these systems in a manner that will achieve the performance standards established in the ROD. Should performance monitoring data indicate that the ET cover or treatment wetlands are not achieving performance standards, appropriate steps to address the identified performance issues and achieve the performance standards will be evaluated and implemented as appropriate. A primary goal of the remedial design will be to identify potential issues which can impact long-term performance and address them as part of the remedy implementation.

Comment: "Langan notes that the Feasibility Study (FS) and PRAP do not adequately address the function and performance of the ET Cover during periods of extreme weather events, for a considerably wet year, or during the dormant winter months."

EPA Response: EPA evaluated performance of the ET cover with water balance analysis using actual climate data from the nearby weather station. During the RD, further analysis will be performed when the final cover configuration is chosen, which may include a consideration of any changes to materials that need be incorporated into the model, a sensitivity analysis to explore the relationship between the infiltration and the plant water uptake over time and the final cover design with actual vegetation parameters to verify the effect of evapotranspiration, verification of the effects of consolidation under self-weight, and modeling for a longer period of time (typically 50 years) to verify the performance of the cover over time.

While ET covers are considered innovative, emerging, or unconventional, they have been installed in many places, including Superfund sites, across the United States. They have been studied for many years in dry, wet, cold, and warm climates. The design process will determine the exact characteristics of the ET cover system and will be based on modeling for a variety of climatic conditions. Based on the ACAP that examined 14 sites over 5-7 years and, and the nearby example of Welsh Road Site, there is a reasonable amount of certainty that this cover will perform as expected. The ACAP report noted that for many of the study locations, increased drainage rates into waste coincided with periods of heavy precipitation for "traditional" composite covers as well as ET covers. All types of landfill covers or caps are influenced by large weather events and periods of above average precipitation.

Comment: "Does deed regulation prohibit disturbing the tree cover, as this would eliminate most future uses of the land. I would like to suggest the possibility of creating another nature

preserve as a means of protecting the remediation of toxic waste, as was done with Heinz Refuge. Only the animals suffer then, though not in the long run."

EPA Response: Section 11.2.7 of the ROD discusses institutional controls to protect the integrity of the remedy, including the ET cover. Specific land use restrictions will be identified during the remedial design and documented in the Institutional Control Implementation and Assurance Plan. EPA agrees that the nature of the ET cover, in addition to the topography, will limit the potential uses of the Landfill. Creation of a nature preserve is not within the authority of the Superfund program.

Comment: "[Philadelphia Parks and Recreation] (PPR) is concerned that the City of Philadelphia's City Park, immediately adjacent to the Clearview Landfill, will be impacted and disturbed by remediation activities as part of Operable Unit 1. The PRAP states: "Current open areas of City Park may ultimately end up being within the boundary of the final cover or treatment wetland upon completion of the remedy." (PRAP, p. 34) City Park is an actively-used park that serves the immediately adjacent Eastwick neighborhood. PPR requests that EPA provide for the continued use of City Park throughout the remediation process (design, construction and O&M) to the maximum extent possible. PPR further requests that EPA include PPR and its staff in decision making for all proposed work – both temporary and permanent – on or that affects City Park and any other City of Philadelphia property under PPR's jurisdiction."

EPA Response: As the PPR is the land owner for a portion of the OU1 Site, EPA will continue to coordinate with the PPR. It is a goal of EPA to coordinate with all stakeholders who are potentially affected by a Superfund cleanup. To the extent that all or a portion of the City Park is safe for use by the public during the remedial design and remedial action, it can continue to be used. However, the majority of the City Park is expected to be impacted in some way by implementation of the selected remedy. Public safety and the implementation of a protective remedy are of paramount importance when constructing and implementing a remedy. EPA will continue to coordinate with PPR, the community and other stakeholders to make sure we are aware of issues and concerns and to be aware of future reuse plans for the property after construction of the remedy is complete.

Comment: "EFNC recognizes that EPA has conducted some fish tissue studies as part of the Clearview Superfund cleanup. When will that data and analysis be made public? We look forward to that information."

EPA Response: The results of the fish tissue sampling are available on the EPA Lower Darby Creek Area Superfund Site website at http://www.epa.gov/reg3hwmd/npl/PASFN0305521/reports/Fish/Folcroft_Fish_Results_Trip_Report(8-21-12).pdf. The document was posted to the website in September 2012. This data will be included in the aquatic risk assessment for OU2 which EPA is planning to complete in 2014.

Comment: "What is the timeline for the Operational Unit-3 (OU3) groundwater assessment? How will the results of OU3 study impact the capping decision in the Clearview Landfill (OU2)?"

EPA Response: Operable Unit 3 (OU3) is currently in the remedial investigation phase. EPA conducted extensive sampling from April - October 2013 in the shallow and deep aquifers. At this time, it appears that the extent of the contamination has been determined, but additional sampling and risk assessment is needed. Pending the findings of the remedial investigation, EPA will conduct a feasibility study to evaluate potential treatment options. This process will take several years to complete. The results of the OU3 remedial investigation and feasibility study will not impact the remedy selected by EPA in this ROD for OU1 of the Clearview Landfill. The anticipated substantial reduction in infiltration reaching the majority of the waste should assist in reducing the amount of landfill contamination that is reaching the groundwater. However, approximately 33% of the waste sits below the natural water table elevation and is permanently saturated. Regardless of how much precipitation reaches the waste, the portion of the OU1 that is saturated will always continue to generate groundwater contamination until all the contaminants are flushed out. Further, the extent of the groundwater contamination has been determined to be far beyond the extent of the landfill waste horizontally. This groundwater contamination that is beyond the waste boundary will not be affected by any remedial activities within OU1. However, the response action for OU3 will address this contamination and any other issues that are identified for that OU.

Comment: "What measures will be taken to protect residents from windborne particulates during construction?"

EPA Response: Contaminant releases during construction would be prevented through engineering controls, e.g., dust suppression and air monitoring. Access to OU1 by unauthorized personnel during construction will be restricted via security personnel. The potential impact to the community would be noise and dust. Construction will be restricted to reasonable hours and dust will be controlled using dust suppression techniques, e.g., wetting. Appropriate dust and air quality monitoring will also be conducted during construction to ensure that nearby residents are not impacted by the work. EPA will work with the nearby residents and other stakeholders during the design and construction process to discuss and address potential concerns such as air quality, noise, etc.

Comment: "Does the clean air and water act apply?"

EPA Response: Yes. Both the Clean Air Act and the Clean Water Act have applicable or relevant and appropriate requirements (ARARs) that must be complied with during the implementation of the OU-1 remedy. Please see Table 41 for a list of all the ARARs for the OU1 action.

Comment: "The slopes of the capped landfill design are steep. Given the proposed angle of the side slope of the final landfill, which Alternative provides the best long-term stability to prevent sagging or slippage?"

EPA Response: All of the various cap or cover options would require the same general slopes. Steep slopes along the creek bank can pose the potential for slope failure and slippage that is a common problem for conventional cover systems employing FML. EPA believes that the ET cover or soil cap provides longer-term stability than the conventional or hybrid caps from Alternatives 3, 4 and 5. The presence of a FML used in Alternatives 3, 4 and 5 provide for less friction and can result in slippage of materials from the upper cap layers that are placed on top of them

Comment: "The PRAP states that, "An appropriate buffer zone between the limits of the cap and nearby properties will be established as part of the design and coordinated with the local community members affected by remedial activities." (Page 34). "New trees and shrubs will be planted along the perimeter of the Landfill bordering City Park (Zone 2) to provide a screen for the Eastwick Neighborhood. (Page 39). Please describe the specific materials and appearance of the proposed buffer zone. Will it be fencing, vegetation, etc.? EFNC requests that EPA plant native plant species for these buffer areas to increase survivability, reduce maintenance requirements and prevent increased infiltration of invasive species."

EPA Response: Specific materials and appearance of the proposed buffer zone will be determined during the RD. The goal is to use all native species for all facets of the remedy, to the extent practicable. EPA is coordinating with staff from U.S. Fish and Wildlife Service, the John Heinz National Wildlife Refuge and the U.S. Forest Service to determine appropriate native species for the cover. EPA will also coordinate and seek input from the PPR and community. EPA will work with stakeholder groups to determine appropriate transitional landscaping between the landfill, City Park, and Eastwick neighborhood. At this time, it is anticipated that a fence around the ET cover and treatment wetlands will be required at least until they are well established in order to prevent damage. The recommendations of specific plants and features will be considered as part of the final cover design.

Comment: "The PRAP states that "PCBs associated with GPR-111 will be excavated and sent off-site for treatment (if practicable) and/or disposal." (Page 33) Please describe what would make this material impractical for treatment and/or disposal. If deemed "impractical for treatment and/or disposal, what would happen to them?"

EPA Response: The ROD indicates that any soils with PCB concentrations greater than 50 mg/kg within and adjacent to the SIA would be excavated and transported off-site for treatment or disposal. There is potential that the PCBs could be co-located with other contaminants that cannot be treated in the same manner as the PCBs, or that a permitted-facility cannot or will not treat those wastes. If the wastes cannot be treated prior to disposal off-site, then they will have to be disposed of at an appropriate permitted facility that can accept waste containing PCBs greater than 50 mg/kg and any other contaminants that are present in the waste.

Comment: "EFNC urges EPA to strictly monitor and enforce all erosion and sediment controls throughout the construction process. This area is subject to chronic and catastrophic flooding. During flooding events and severe storms, erosion and sediment controls can be compromised. EPA must assure there is compliance systems in place to assure these controls are maintained constantly, but particularly during weather events."

EPA Response: EPA agrees that the estimated time frame and the current setting (within a 100-yr flood plain, in a flood prone area, adjacent to a residential area, upgradient of a wildlife refuge, etc.) are factors that will make the implementation of the selected remedy more challenging. EPA is aware of these challenges and as part of the remedial design, will ensure that all appropriate plans and contingencies are included to address potential issues such as these. Further, EPA will ensure that erosion and sediment control strategies are complied with during construction.

4. RESPONSES TO SPECIFIC COMMENTS SUBMITTED DURING THE PRAP PUBLIC MEETING

On August 15, 2013, EPA hosted a public meeting to present the proposed remedial alternative for OU1 and solicit public comments. The comments submitted and the responses provided by EPA during that meeting are summarized below. There are several instances where the EPA responses provided during this meeting referenced providing additional information in the Responsiveness Summary. This additional information is contained in Sections 1 through 3 of the Responsiveness Summary. Comments and responses have been edited to remove extraneous dialogue that was included in the transcript. The entire transcript for this public meeting is included in the Administrative Record for OU1 (see Section 1, above, for the location of the administrative record).

Comment: How in depth will the Philadelphia Water Department (PWD) be evaluating the storm water impacts and will there be any place to see information about how it relates or addresses that issue at some point, either in the EPA website or somewhere else?

EPA Response: We do not know all of PWD's plans for management of the storm water. That question would need to be posed to the PWD. We know that PWD is looking at storm water management issues and flooding issues.

Comment: I really didn't understand what that Evapotranspiration Cover was other than planting trees. Second, is that recreation center next to a couple of schools; like, an elementary school and I think a high school. Are you monitoring the water in Darby Creek? And how far away is that leachate trench from the creek? If it's close enough it could get in regardless of whatever you're doing. I don't understand why you don't have restrictions regardless, period, because that stuff is poisonous and all the problems involved in it. So why is that not part of the plan?

EPA Response: Deed restrictions are a component of Alternative 7. When EPA takes a cleanup action, legal controls must be in place to protect that cleanup action. The exact location of the leachate collection trench relative to the creek will be determined during the RD, as we don't know the exact location at this time. The conceptual design would be for the leachate collection trench to run along the very edge of the landfill stream bank. It's a subsurface trench that is covered up and is intended to extend down to the main mean high tide line of Darby and Cobbs Creeks. It will be designed to catch the leachate that is leaving above that elevation.

The main goal of the ET cover is twofold: 1) prevent direct contact with the Landfill waste and contamination and 2) prevent precipitation from getting into the waste because that's how it generates contaminated ground water and leachate.

The Recreation Center is located in the Eastwick Park. There are no schools immediately adjacent to the Recreation Center, but there are three schools within several blocks of the Landfill. There is one that's a few blocks north of 78th Street. There's also the Pepper Middle School and Communications Technology High School.

Commenter Follow-Up Question: "So it won't go down through?"

EPA Follow-up Response: We're not going to say there won't be a single drop of moisture that will ever make it through the ET Cover, but it has been shown to work very well in local areas and we actually did a lot of modeling as part of the Feasibility Study to see how the cover would function.

Commenter Follow-Up Question: "Is it actually a cover or is it soil or what?"

It's a cover consisting of a thick soil layer. Yes, it's soil.

Comment: What are the cumulative effects of this landfill on the Eastwick Community? Has the EPA done a comprehensive study with regards to the immediate area and the residential area adjacent to the Landfill? Is there a process for community engagement throughout the process of doing the cover and will there be continuing comprehensive health initiatives by EPA as this cover is developed?

EPA Response: For the last question, EPA needs to provide a thoughtful, detailed response with regards to additional ongoing health assessments during the construction and during the cleanup action, but what can be said now is that we evaluated the potential risks from the site. Unacceptable potential risks from contaminated soils to workers, recreational users and residents were identified. That's what the action was intended to address and there will be safeguards put in place during the cleanup to make sure that there's no exposure to contamination while EPA is working. Superfund requires that at the end of the design, we have another public meeting like this where the fine details of how the ET cover and all the other

parts of the remedy will be conducted. However, as we have been doing for several years prior to tonight, the plan is to have regular community involvement and community meetings to keep everybody updated as to how things are moving in the process. So that is a yes with regards to involving the community.

Commenter Follow-Up Question: Is there any chance that an independent evaluator can be involved in this process as to kind of have a third party to look at these health questions?

EPA Follow-up Response: The Darby Creek Valley Association actually has a grant from EPA to hire their own private consultant who is evaluating the proposed plan and helping them to develop comments. Early on in the Superfund and the Clearview Landfill history there was actually an independent third party review done by a doctor from the University of Pennsylvania which is on the Lower Darby Creek Area website that looked at how we were evaluating risk as well.

Comment: If you have a child that was growing up and playing in the park or nearby what are their potential health risks, if any? Because they went through all these years playing there. We need that answered and I think the public needs to hear it.

EPA Response: EPA does not know what types of exposure may have occurred many years ago when the Landfill was in operation, so EPA has to look at what the potential risks are moving forward. As summarized during the Proposed Plan presentation, there are no short term risks from going out on the Landfill now. Potential long-term health risks were evaluated by EPA assuming a 30 to 70 year exposure period. It's a challenging thing to try and answer what could be the effects on anybody who was exposed to the site or going on the site before EPA was involved and our current risk assessment process does not provide for that. EPA looks at the contamination that we know of right now and that is the information which is used to evaluate the potential risks.

Comment: "I have two questions. The first one is what is the projected time table for the installation of the ET cover? And the second is, once the cover is completely installed and all of its components, what is the plan for monitoring its effectiveness and how long will that occur?"

EPA Response: The time table is a difficult question to answer because there are many factors that play into what happens after the Record of Decision is issued, which is usually several months after the Proposed Plan is issued. EPA is going to attempt to have the responsible parties who sent waste to the Landfill, ran the Landfill or generated waste, pay for some or all, of the cleanup. It takes time to work with the Department of Justice and see which parties EPA can pursue. Once that decision is made, EPA develops an enforceable agreement or order with the responsible parties. That can take several months after the ROD is signed and that process cannot start officially until after ROD is final. Once either the responsible party(s) has decided they're willing to pay or EPA is going to pay or there's going to be a combination of both of

those things, the funding has to be provided, the design has to be developed. The design takes about 12 months to complete, on average. If EPA is paying for the cleanup in its entirety, after the design is done, EPA Region 3 submits a request for funding to EPA Headquarters. If it's a responsible party funded cleanup, EPA does not have to request funding for the cleanup. Assuming that the responsible parties have the funding, the construction can begin immediately or shortly after the remedial design is complete. It's challenging to estimate how long enforcement negotiations will take, how long the design will take and who will be paying for it. All of these factors are not known at this time.

The specific details of how the Landfill will be monitored after construction is completed, are not known at this time. We know generally what has to be monitored, but that information will be incorporated into a long term monitoring plan and an operation and maintenance plan that are developed as part of the remedial design. These documents are intended to measure the remedy's performance and insure that it's protective. In addition, because this remedy will be leaving waste in place due to the volume of the landfill materials that are there, every five years EPA will evaluate OU1 to ensure that the remedy remains protective.

Commenter Follow-Up Question: "I know you probably can['t] disclose this, but is EPA aware of who the responsible parties are?"

EPA Follow-up Response: A description of many of the parties who have been identified as potential responsible parties associated with the Landfill can be found in the summary of enforcement activities on page 5 of the ROD.

Comment: I'm concerned about the monitoring of Darby Creek as to water quality. Has it been done and will it be done? Because that goes into the Delaware River, which is Philadelphia's water supply source and I guess probably part of the Clean Air and Water Act.

EPA Response: Yes, as part of the Clearview Landfill investigation, as well as part of the Folcroft Landfill investigation, surface water testing has been conducted on Cobbs and Darby Creeks from the Clearview Landfill down to where the Darby Creek discharges into the Delaware River. The focus for the Site is on contaminants. The Superfund does not address general water quality parameters that are not related to a site.

Commenter Follow-Up Question: "...[C]an you clarify the responsible parties? Would they be named in the record of decision or would it be later?"

EPA Follow-Up Response: Please see the summary of enforcement activities on page 5 of the ROD for a discussion of the potential responsible parties associate with the Landfill.

Comment: My other question is, can you tell us, historically, in all of the Superfund Sitesin the Continental United States, what percentage of them are the responsible parties paying for the cleanup? Is it a high percentage, low percentage?

EPA Response: In EPA Region 3 we have a very successful Potentially Responsible Party (PRP) search program. They go out, look through records. They're looking for companies that, in some cases, went bankrupt 50 years ago. They're looking for companies with operations that have changed and have been incorporated into other companies with names potentially changing, amongst other issues. Approximately seventy-five (75) percent of sites in Region 3 are being cleaned up with money from responsible parties and in many cases, these responsible parties are paying tens, if not hundreds of millions of dollars to do these cleanups. Getting a responsible party to conduct a cleanup can require substantial discussions and time for EPA to negotiate with these parties.

Commenter Follow-Up Question: "Does that make it go faster or slower than getting the money from the Federal government?"

EPA Follow-Up Response: That's another difficult question to answer. Initially there's definitely what people would perceive as a downtime. It may appear as though nothing is happening while EPA is negotiating with the responsible parties to step onboard and agree to do this $30 million cleanup, but that's a necessary step. Once the agreement is in place, they can begin the design and start the construction. If the responsible parties decide to perform the design and construction, they know they have the money to do it, so it moves forward quickly. On the other hand, if the Superfund pays for it, EPA Region 3 still must go before the National Prioritization Panel. It meets every year to decide, for those sites that are being paid for by the Superfund, what sites are going to get funding.

Comment: Were you able to get the residents' opinions about the effectiveness of the ET cover that was built for the Welsh Rd. Landfill?

EPA Response: I'm Steve Rock from the Office of Research and Development and I'm here backing up Josh on technical questions. I worked on the Welsh Road Landfill a long time ago during the installation and during the five year review which was just done at the end of last year. As with this Landfill, we had public meetings such as this to discuss the proposed remedy, so there were people who came out to the site who had known it for a long time and, in general, as far as we could tell they were fairly delighted to have that slightly scary eyesore turn into a forest. Five years later it's full of trees that have sprouted up on their own. It's full of wildlife. There are not a lot of paths to it because it's located in a more rural area.

Commenter Follow-Up Question: Okay. I was reading through the newsletter that you sent us and it indicated that EPA was actually going to go into this Clearview Landfill, extract the most toxic elements and dispose of them offsite. Now, my concern is this. You indicated that there was certain parts of these toxic elements that are in the community or adjacent to the

community and you're going to extract those. The extraction of the stuff that's in the community, you're going to put underneath your ET Cover instead of disposing of those toxins. Why is it that it is important to extract the toxic stuff off the Landfill and then take it someplace else than go into the community and extract that stuff and then put it right back into the Landfill again?

EPA Follow-Up Response: That's a very good question. The biggest difference is that the concentrations of the PCBs in the Landfill is what we deemed principal threat waste. EPA policy states that PCBs that are in a landfill in a residential area are considered principal threat waste when they're at concentrations higher than 100 parts per million. We know that waste with PCBs above 100 parts per million was left in a few locations beneath a few of the businesses in the industrial area after the removal action.

The levels of PCBs that were detected in the few soil sample locations in the park and one instance in the neighborhood underneath the asphalt, are all less than 10 parts per million. In the proposed plan there's a table that shows the proposed clean up numbers for PCBs, as well as for a few other contaminants that are risk drivers. These areas are where we don't have PCBs or something else at a very high concentration, but it's above our cleanup goal. So it can be excavated and placed under the cover where it will not move anywhere else.

Commenter Follow-Up Question: "So you're saying then that the stuff that's coming out of the community is of less danger?"

EPA Follow-Up Response: Yes. It's of less danger because the contamination is present at a lower concentration. It's just there in the surface or deeper soil or it's under the streets. So we are going to remove what's there through excavation and it will be placed under the cover and the excavated area will be backfilled with clean materials.

Comment Follow-Up Question: "Are you absolutely sure though that 48 inches of the ET Cover, knowing that it's soil, is good enough to handle, let's say, for instance, four to five inches of rain so that that rain water will not go through your ET Cover and into the soil itself, and cause that same problem to reoccur?"

EPA Follow-Up Response: That is a complicated question to answer because you're talking about contaminant movement. As part of the feasibility study, we modeled the performance of the Evapotranspiration Cover using five years of real climatic data from 2000 to 2004 from the Philadelphia Airport. That showed not only was there hardly any precipitation getting to the waste, it actually showed that it was meeting all of the standards of a typical landfill cover and then some. It is also important to consider how different types of contaminants move. Contaminants like PCBs, PAHs, metals, etc., don't necessarily dissolve or don't dissolve very quickly into water. What those contaminants more typically do is they adhere to soil particles. So even if water is infiltrating into the waste, the particles to which the contaminants are adhered must start to move or the contaminants must dissolve in order to have contaminant migration. PCBs typically do not dissolve or move with groundwater unless they are commingled with oils or

solvents. When there is a large volume of waste, the comparative volume of precipitation that is migrating through an ET cover is very small. In addition, that precipitation must then be of a volume sufficient enough over time to travel all the way down through the waste, rather than be absorbed by the waste at some point, and reach the water table.

Commenter Follow-Up Question: And with the plants, trees, etc., that should be enough to reduce the movement of stuff that's under that ET Cover?

EPA Follow-Up Response: It's an excellent question. And it's not a question that we have an answer to yet because the nature of the soil and its ability to act as sponge, changes depending on what kind of soil we use. Certain soils are very, very water absorbent and some are not. If we put 12 feet of sand on top of it, it would not be effective because sand does not retain water well. However, if a soil such as Midwestern loam is used, that would be much more effective. It is not clear what soils will be used for OU1 at this time. That will be determined during the RD. One of the things we don't want to do is tear up a farm and put it on top of the landfill to use the best soil possible. So that's still under investigation. We don't exactly know what that thickness is going to be. We do know that we have some really competent modelers working on this who can take the data that we have already developed in the last 20 years of building these landfills and, once we figure out what kind of soil we have available for this landfill, we'll determine the correct thickness for the ET cover. EPA has worked with other government agencies to assemble a list of potential tree species that can be used with the ET cover. The exact details haven't been figured out yet, but the experience with the Welsh Road Site and several years of data shows how it can be done in Eastern Pennsylvania. It's not the farthest north, it's not the coldest site with an ET cover, so EPA is confident the ET cover will work for this Landfill as well.

Commenter Follow-Up Question: My biggest concern is the cumulative effect of the toxic stuff that we have been living through for the last three and a half decades. We just want to make sure that we get this thing right this time and we just don't want anything to happen to our residents from this point on. We hope that our residents will be able to say yes, finally, we've got this thing done and we certainly appreciate that. One other question. This is in reference to what I saw in your newsletter. My question is, is the EPA changing its method of communicating with the residents by not holding additional open meetings like this one, but instead establishing what you call community interviews? And I notice that you have in your newsletter a statement that says that we have to call in and then those people who call in are going to be asked specific questions in reference to data that's going to be coming back to the community?

EPA Follow-Up Response: Unfortunately, it is not possible for EPA to determine all of the contaminants or their concentrations that were present throughout the Landfill's history of operations. Thus, we cannot determine what the potential cumulative effects would be simply because we do not know what residents living nearby could have been exposed to in the past. The Superfund program bases its risk assessments and cleanup decisions on sample results

collected to determine the current concentrations of contaminants to which people potentially could be exposed.

At the July 18th meeting one of the things that we wanted to communicate was our intent to revise the official community involvement plan for this Site. There is a community involvement plan for this site, but it's very old. EPA guidance says we should update the community involvement plan when we sign the Record of Decision. We want to get that process started earlier so we asked people when they signed the sign-in sheet if they'd like to be part of that process. As part of updating the community involvement plan means that we would like to come out and talk with you, interview you, find out how you would like to be involved going forward. Are these meetings helpful? What kind of meetings would you like? What kind of information is helpful for you? How do you get your information? Would you like to be more involved in the Darby Creek Valley Associations Technical Assistance Grant process? Would you like to think about the concept of forming a community advisory group around these issues? So there are a lot of community involvement opportunities that we can talk to you about and that's what we want to do.

Commenter Follow-Up Question: "But we will still have meetings like this?"

EPA Follow-Up Response: Our intent is to have ongoing meetings with the community, but a bit less formal. We needed a court reporter for this meeting, but going forward we can have more informal meetings, more frequent meetings. What you're reading in the fact sheet was our offer to the community to participate in the community involvement plan revision. So if you wanted to call Larry Brown or Josh and say when you start the community involvement process, yeah, I'd like to be part of that --- or you can indicate it on sign in sheet. When you signed in there's a box that says yes, I'd like to be contacted, so that's our plan going forward.

Comment: So a quick question about the park, actually. I was wondering if you could comment on what the extent of the cover will be in the park? Will it touch any of the amenities that are in the park, like the trail or the courts that are there? If the cover does extend to those things, will EPA replace those things as part of the cleanup? And the cover, itself, is the idea that nothing would go on that area besides trees or are there other potential uses that could happen through that area?

EPA Response: Based upon where the cover and the treatment wetlands and other components of the remedy are currently shown and planned, those do involve removal and we're going to have to destroy some parts of the trails that are there as part of the construction of the remedy. So when EPA conducts a response action, any damages or things that we destroyed or have to move will be restored. It doesn't have to be exactly the same. EPA likes to be involved with the community, the property owners and the municipalities as we're developing a design so we can get a sense of this as we move forward. What are your thoughts on it and how would you like to see it pan out so we can take those things into consideration.

EPA has built a lot of Evapotranspiration Covers on Superfund Sites and solid waste sites across the Country and there have been a lot of ancillary uses put to those. It's very common to put trails across the top of these. It's not uncommon to put solar collectors, for example, as a structure on top of these. If the community wants to use an ET cover for a certain use and suggests it and those functions or uses would work with a forest without hurting it, then it probably is going to be an acceptable potential use. You don't want big open areas because we're looking for tree coverage. We're looking for 100 percent coverage. If you fly over the site, you shouldn't see any ground after about five years roughly. Anything you can do in and under trees in a public park would probably be acceptable.

Comment: I've been reading through some of the comments that we're already getting from scientists that are on the TAG committee and I wanted to bring just one of them up to make a clarification. Regarding the trail that goes to the SSF treatment wetlands, which from what I'm seeing here is not really a wetlands because the idea is to put the water that's coming off of the hillside and the other sides away from anyone or any biological receptors. So would that be able to handle a trail? Also, what would that look like?

EPA Response: Generally it is a wetland by definition. The soils will be saturated. It will not have standing water at the surface, so it won't attract that kind of wildlife, but it will not be suitable for a trail to be right on the wetlands. You could potentially construct a boardwalk trail, similar to what's in a wildlife refuge.

So if a trail was desired and it fit into the overall function of the design, it could happen. It's not intended to be used as such. It is a functioning treatment system as opposed to an actual restored wetland.

And I just wanted to clarify one thing. With regards to what's going into the treatment wetlands, it is the leachate that's collected from the leachate collection trench. The storm water runoff from the landfill cover surface would not be diverted into that wetland because it is a subsurface flow wetland. That is going to be diverted along natural channels so that it can discharge to the surface water bodies.

Commenter Follow-Up Question: Is there any cleanup of that wetland? How does it clean itself? I'm not sure how the PCBs are treated because my understanding is that they hang around for a long time.

EPA Follow-Up Response: "It is not likely that PCBs will be entering the wetland because we have not seen PCBs in water discharging from the area where the leachate collection trench will be constructed. The idea is that anything that does go into solution and is collected by the trench will be absorbed onto the soil particles and the organic matter within the wetlands, and it won't be available to move outside of that. There will be calculations done to insure that the wetlands are built big enough to absorb everything that is going to be coming in and we'll know ahead of time what the carrying capacity of that wetland is. It may need maintenance on a regular basis. The monitoring plan and monitoring results will help us to determine when

maintenance is needed. They may need some maintenance after a few years and then as concentrations decrease within the leachate the maintenance requirements will decrease. So there will be contaminants bound up within the wetlands, but they will be maintained as part of the treatment system.

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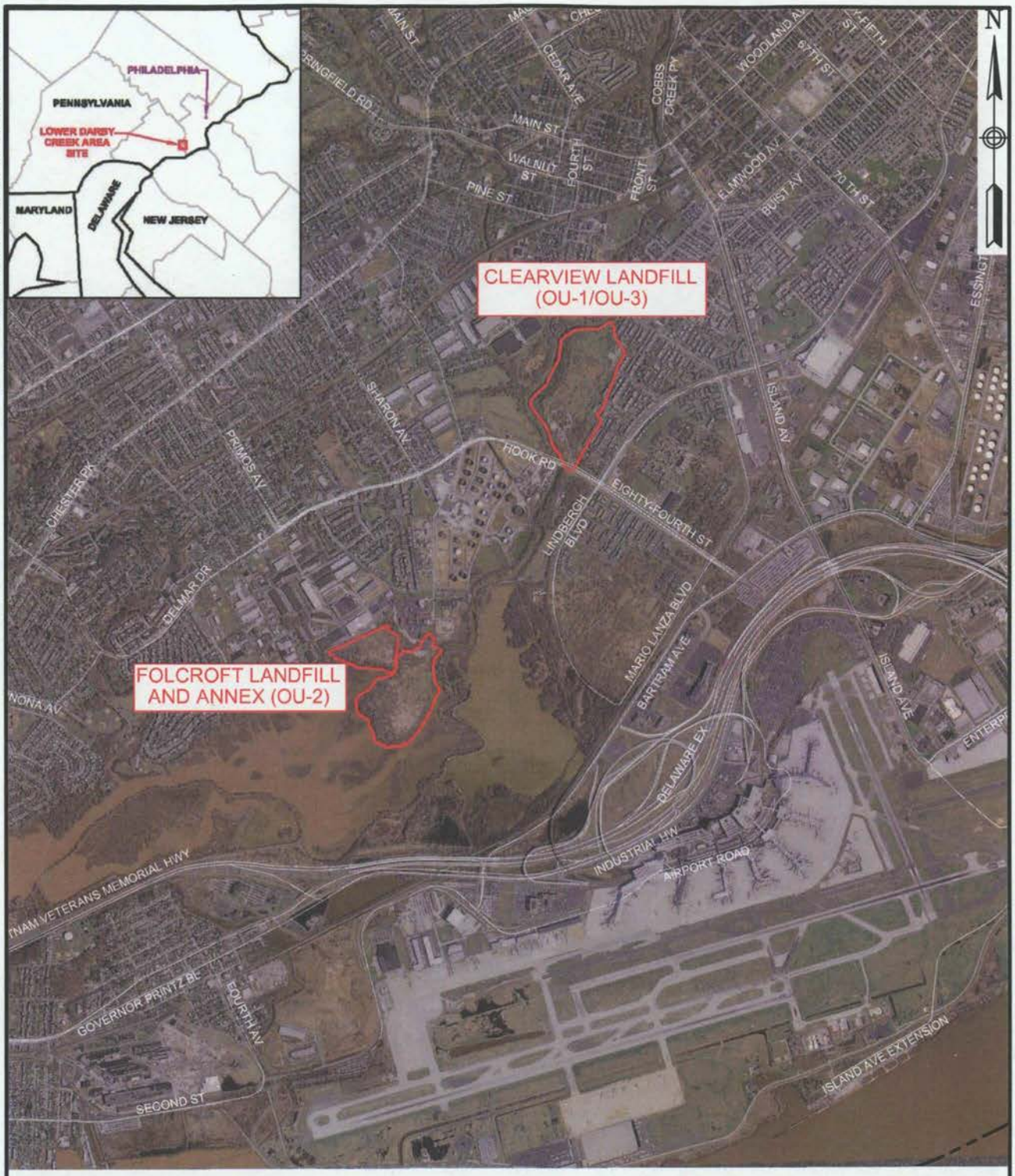
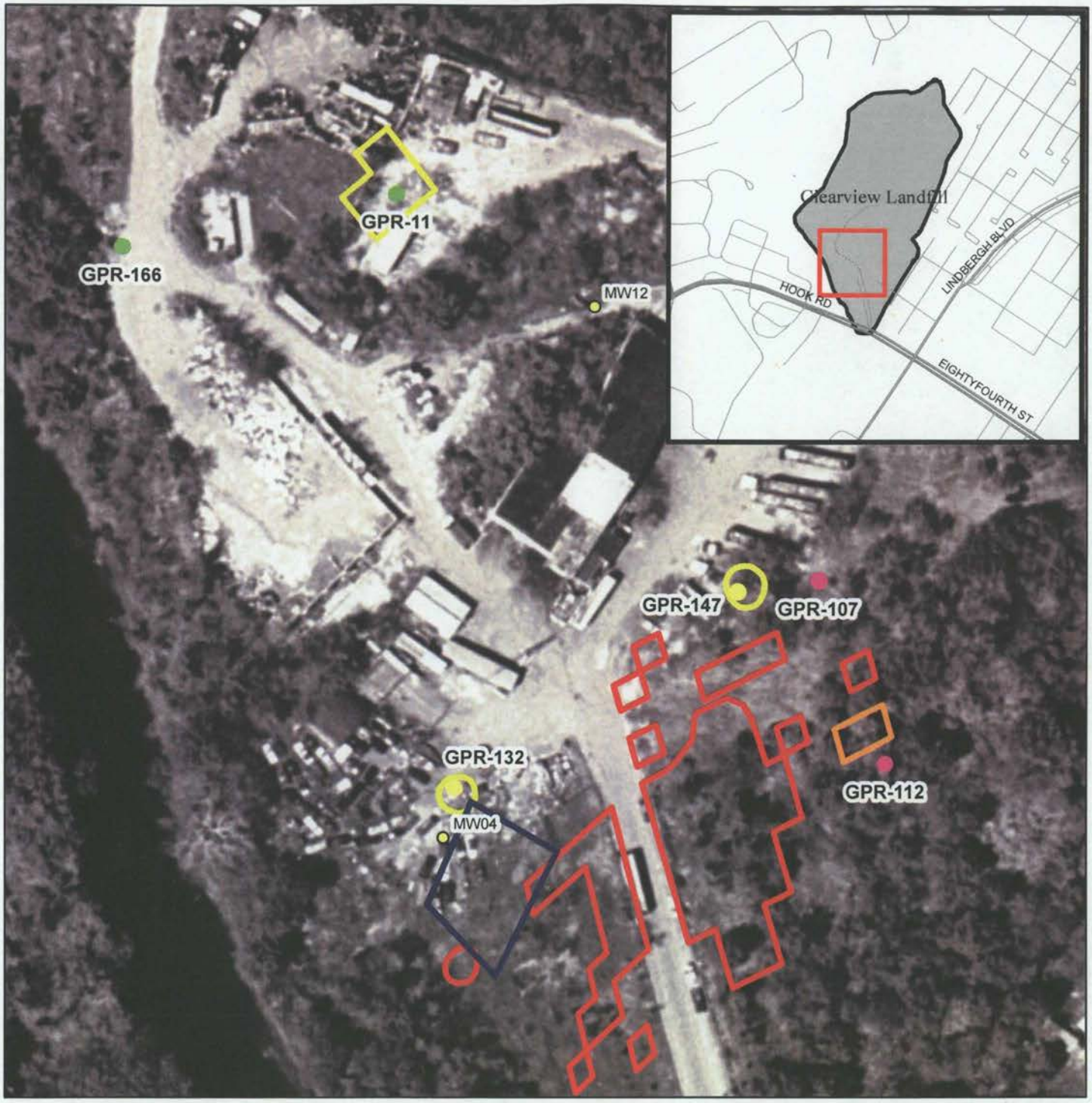


TETRA TECH NUS, INC.

SITE LOCATION
LOWER DARBY CREEK AREA SITE
PENNSYLVANIA

SCALE	
AS NOTED	
FILE	
112G01067GM25	
REV	DATE
0	02/08/12

Figure 1



Legend

- Area with PCBs > 25 mg/kg Addressed under Removal Action (Top 12" Surface Soil was Excavated)
- Areas with PCBs > 50 mg/kg To be Addressed under Remedial Action (estimated extent)
- Areas with PCBs > 50 mg/kg Addressed under Removal Action (approximate extent)
- Area To be Investigated under Remedial Action (Currently Inaccessible)
- **Removal Action "Hot" Samples (VOC/SVOC/Pest.)**
- **Principal Threat Waste Samples**

Figure 2
Areas with PCB-Contaminated Soils Addressed Under the Time Critical Removal Action (TCRA)
Lower Darby Creek Area Site (OU-1)
Pennsylvania

0 50 100 200 Feet

1 inch = 100 feet

1:1,200

N W E S

Tetra Tech, Inc
Phone: (302) 738-7551
Toll Free: (800) 462-0910
www.tetratech.com

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Clearview Landfill **(Zone 1)**
City Park **(Zone 2)**
Eastwick Neighborhood **(Zone 3)**
Historical Extent of Landfill Footprint
Elevation (ft)
County Boundary

0 125 250 500 750 Feet
1:3,000 1 inch = 250 feet

N W E S

Tetra Tech Delaware
Phone: (302) 738-7551
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www.tetratech-de.com
www.tetratech.com

Figure 3
Surface Features of Clearview Landfill
Lower Darby Creek Area
Pennsylvania

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TETRA TECH

AREA OF POTENTIAL EFFECT FOR
BURIED CULTURAL RESOURCES

PHILADELPHIA & DARBY TWP, PENNSYLVANIA

SCALE	
AS NOTED	
FILE	
APE.MXD	
REV	DATE
0	12/14/10

Figure 4

Historical Extent of Clearview Landfill
New Monitoring Well (2011)
Existing Monitoring Well
Clearview Landfill
City Park
Eastwick Neighborhood
County Boundary
22.39 Groundwater Elevation (ft. MSL) of Shallow Wells
Groundwater Elevation Contour (ft msl)
Groundwater Flow Direction

300 150 0 300 Feet
1:3,900 1 inch = 325 feet

Figure 5
Groundwater Countour Map
Shallow Aquifer - August 2011
Clearview Landfill
Lower Darby, Pennsylvania

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LEGEND

- SOIL BORING SAMPLE (WASTE OBSERVED)
- SOIL BORING SAMPLE (WASTE OBSERVED); FURTHER INVESTIGATION REQUIRED
- SOIL BORING SAMPLE (NO WASTE OBSERVED)
- 0.5-4 DEPTH OF WASTE IN FEET
- NW NO WASTE

(SAMPLED IN 2002 THROUGH 2006)

- ESTIMATED EXTENT OF WASTE
- COUNTY BOUNDARY
- HISTORICAL EXTENT OF CLEARVIEW LANDFILL
- CLEARVIEW LANDFILL ZONE (ZONE 1)
- CITY PARK ZONE (ZONE 2)
- EASTWICK NEIGHBORHOOD ZONE (ZONE 3)

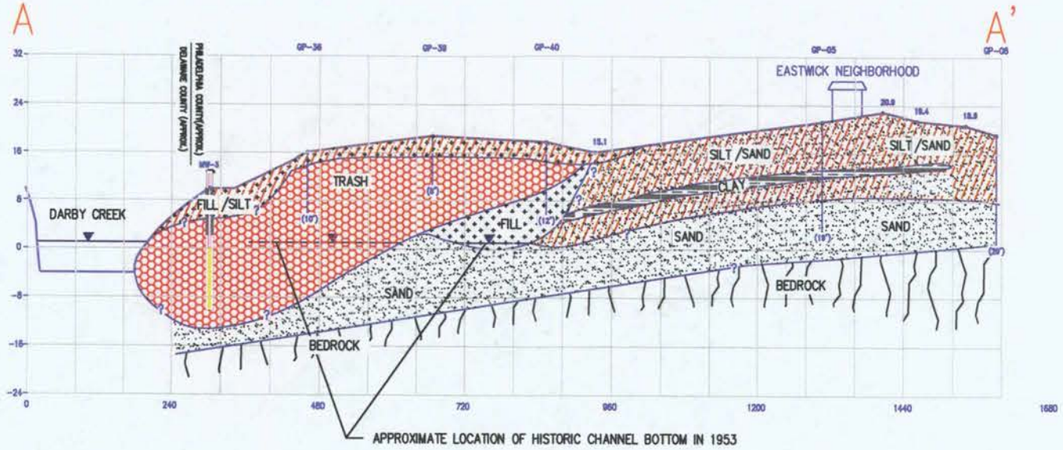
0 300 600
SCALE IN FEET

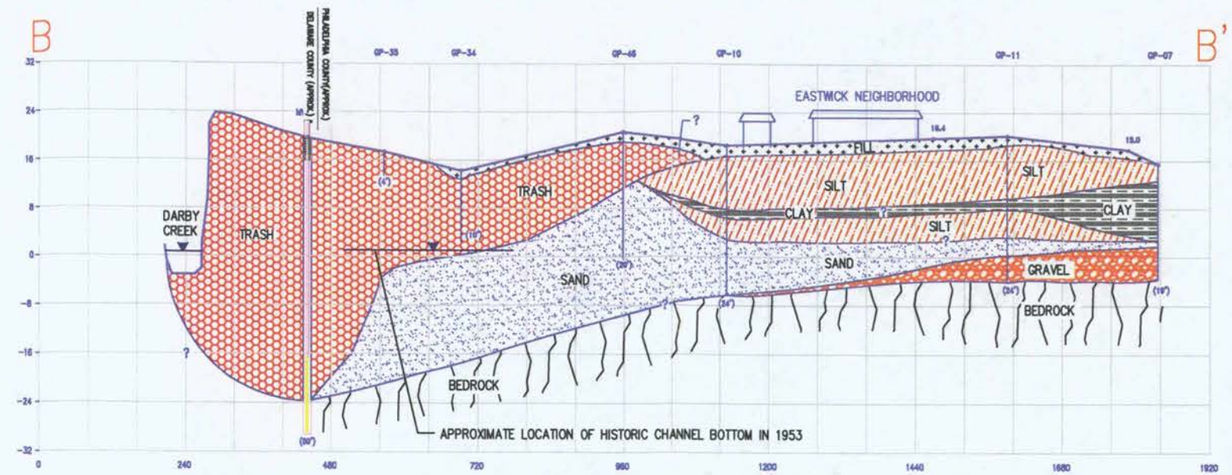
TETRA TECH NUS, INC.

NATURE & EXTENT OF CONTAMINATED SOILS/ LANDFILL WASTE MATERIALS
LOWER DARBY CREEK AREA SITE (OU-1)
PENNSYLVANIA

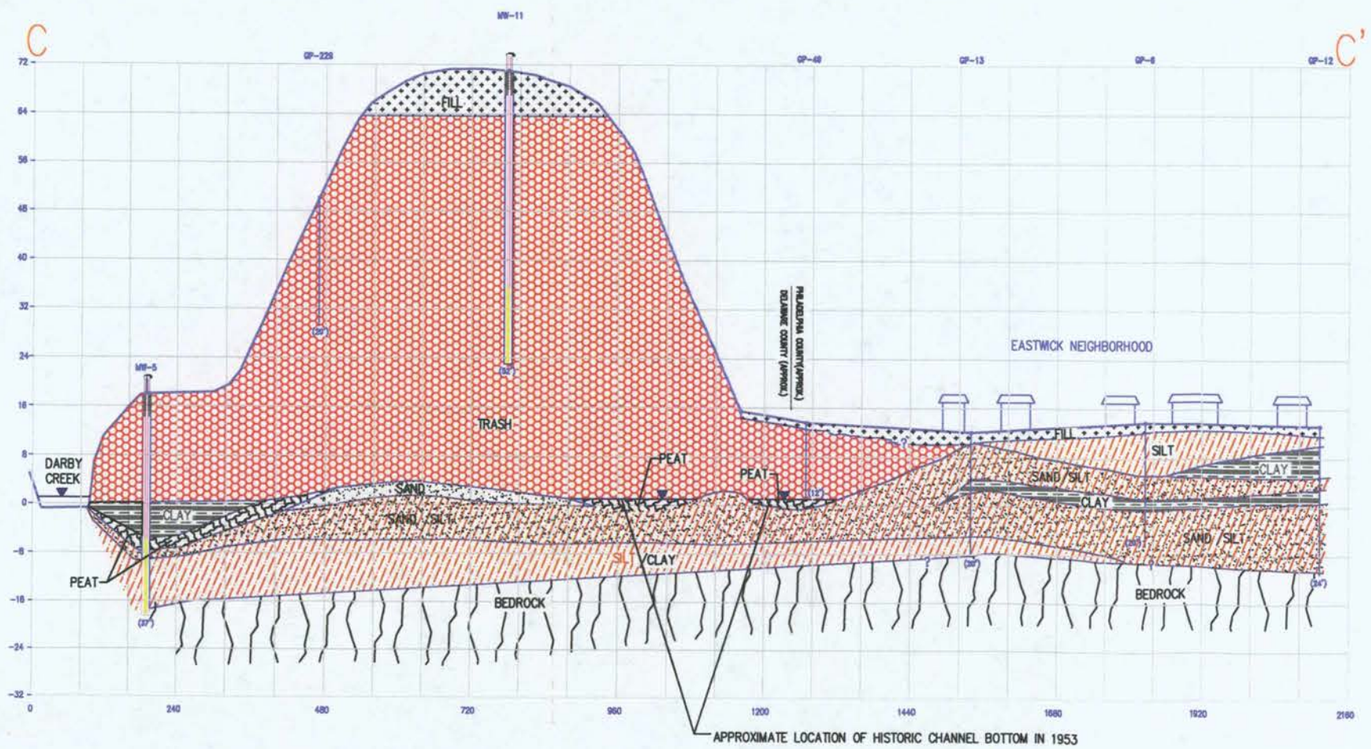
FILE	SCALE
12G01067GM07-1	AS NOTED
Figure 6	REV 1 / DATE 07/09/12

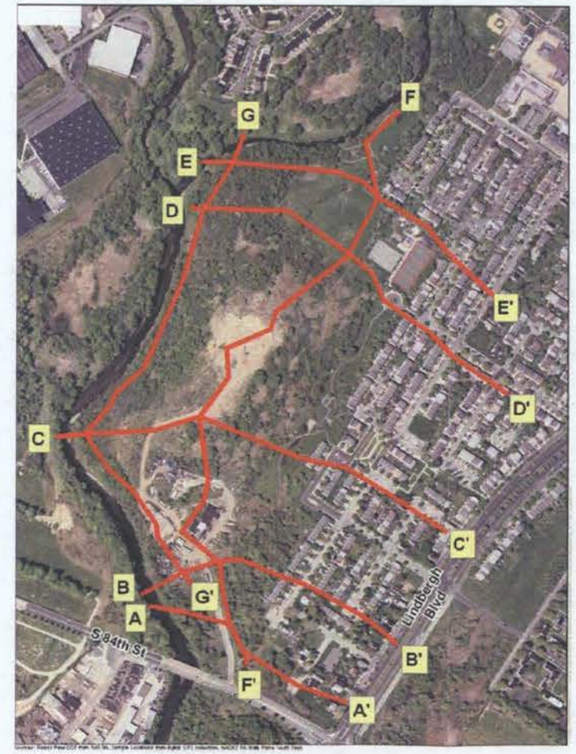
ARCHITECTURE • CONSTRUCTION SERVICES • SURVEYING • LANDSCAPE ARCHITECTURE • PLANNING • CIVIL ENGINEERING • INTERIOR DESIGN • STRUCTURAL ENGINEERING • GEOLOGICAL SCIENCES • ENVIRONMENTAL ENGINEERING • WATER RESOURCES MANAGEMENT • HEALTH AND SAFETY • GIS MAPPING • ENVIRONMENTAL INVESTIGATION AND REMEDIATION • GEOTECHNICAL AND SOILS ENGINEERING





VERTICAL SCALE: 1"=24'
HORIZONTAL SCALE: 1"=240'
VERTICAL EXAGGERATION: 10





LOCATION MAP
NOT TO SCALE

GP-12 GEOPROBE BORINGS

(12') WELL'S DEPTH

FILL

TRASH

SAND

SILT

PEAT

CLAY

GRAVEL

BEDROCK

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RCN:	T47111
DRAWN BY:	EGA
CHECKED BY:	KH
SCALE:	AS NOTED
APPROVED BY:	
DATE:	1 MARCH 2007
CAD FILE:	ALL REV1

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III

LOWER DARBY CREEK AREA

DRAWING TITLE: GEOLOGIC CROSS-SECTIONS PROFILES A-A'; B-B' AND C-C'

Figure 7

DRAWING NUMBER:

N:\Projects\T40000\T47111 LowerDarby\Drawings\Cross Sections\All Rev1.dwg 04/25/2011 09:26

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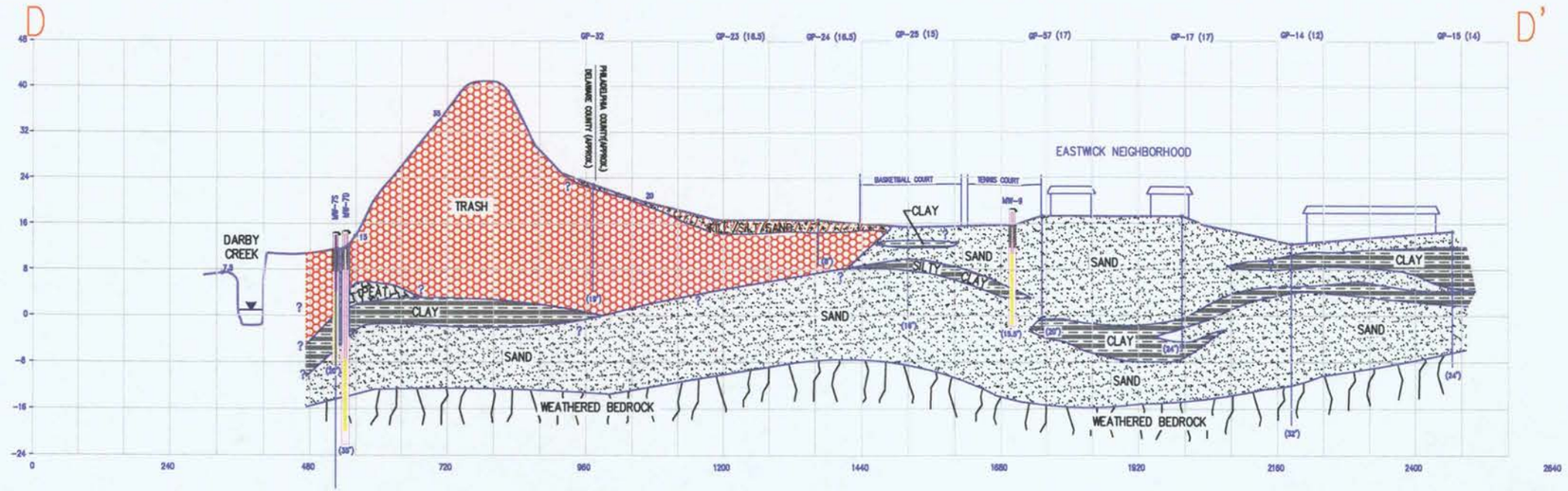
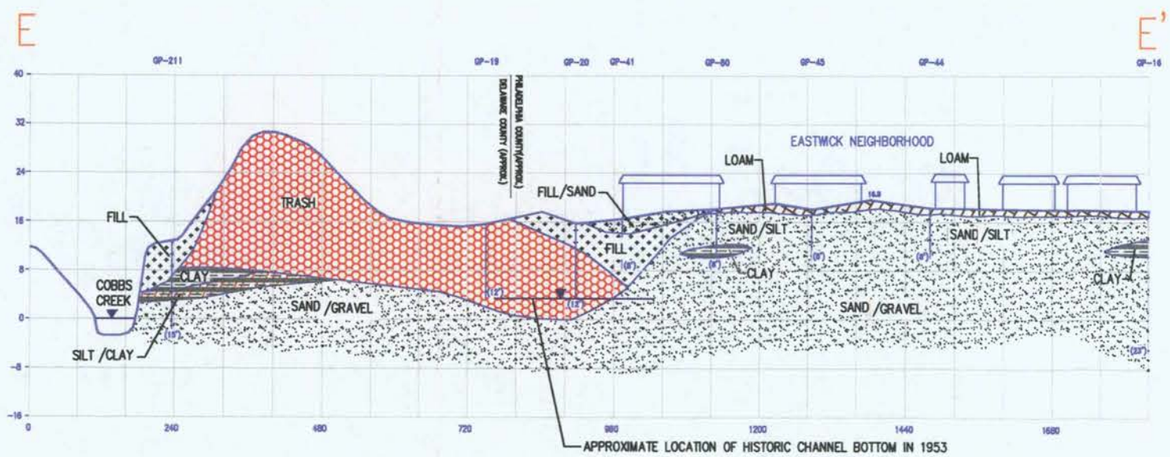
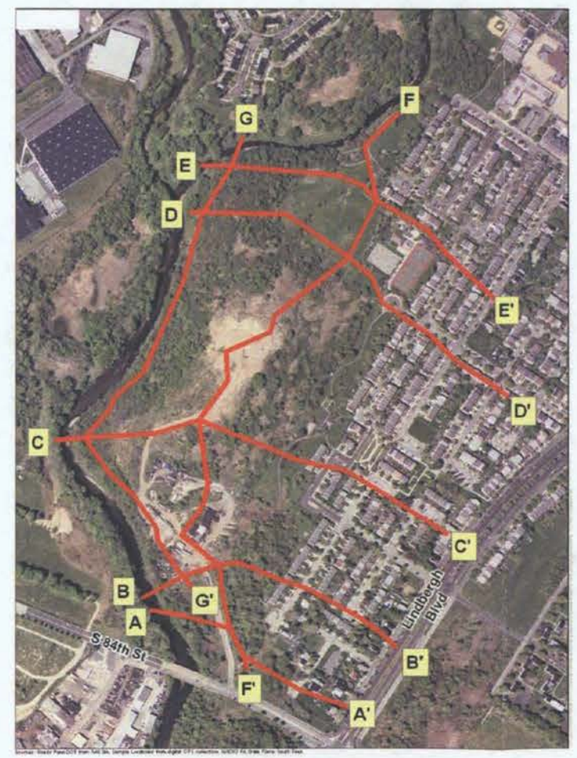


VERTICAL SCALE: 1"=24'
HORIZONTAL SCALE: 1"=240'
VERTICAL EXAGGERATION: 10





LOCATION MAP
NOT TO SCALE

GP-12 GEOPROBE BORINGS

(12') WELL'S DEPTH

FILL
TRASH
SAND
SILT
LOAM
PEAT
CLAY
GRAVEL
BEDROCK

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RCN:	T47111
DRAWN BY:	EGA
CHECKED BY:	KH
SCALE:	AS NOTED
APPROVED BY:	
DATE:	1 MARCH 2007
CAD FILE:	ALL REV1

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III

LOWER DARBY CREEK AREA

DRAWING TITLE: GEOLOGIC CROSS-SECTIONS PROFILES D-D' AND E-E'

Figure 8

DRAWING NUMBER:

N:\Projects\T40000\T47111 LowerDarby\Drawings\Cross Sections\All Rev1.dwg 04/25/2011 09:25

SEE FIGURE 4-46A FOR LOCATIONS OF CROSS-SECTIONS.

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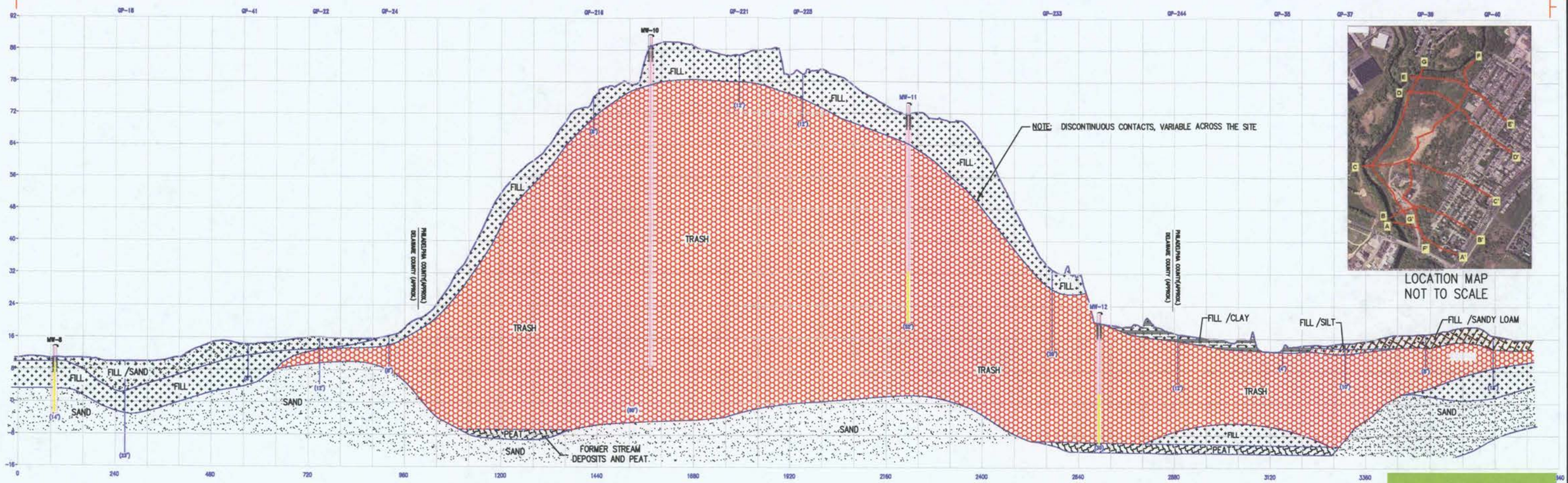
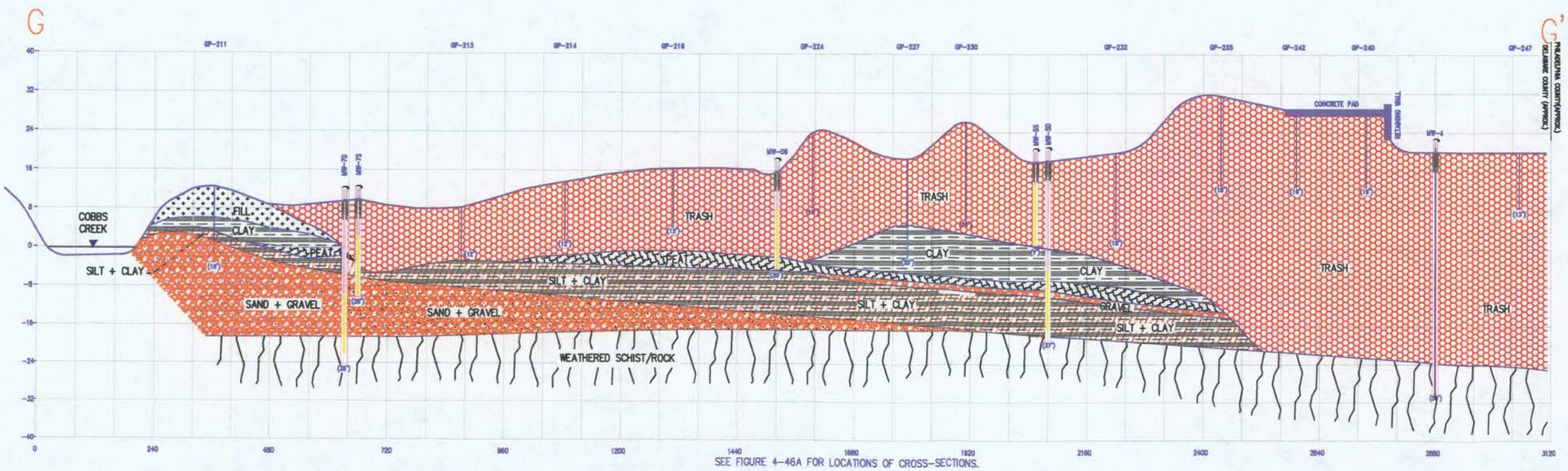


LOCATION MAP
NOT TO SCALE

VERTICAL SCALE: 1"=24'
HORIZONTAL SCALE: 1"=240'
VERTICAL EXAGGERATION: 10



SEE FIGURE 4-46A FOR LOCATIONS OF CROSS-SECTIONS.

GP-12 GEOPROBE BORINGS

(12') WELL'S DEPTH

FILL

SOLID WASTE

SAND

SILT

LOAM

PEAT

CLAY

GRAVEL

BEDROCK

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APPROVED BY:	
DATE:	29 DECEMBER 2006
CAD FILE:	ALL REV1

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III

LOWER DARBY CREEK AREA

DRAWING TITLE: GEOLOGIC CROSS-SECTIONS PROFILES F-F' & G-G'

Figure 9

DRAWING NUMBER:

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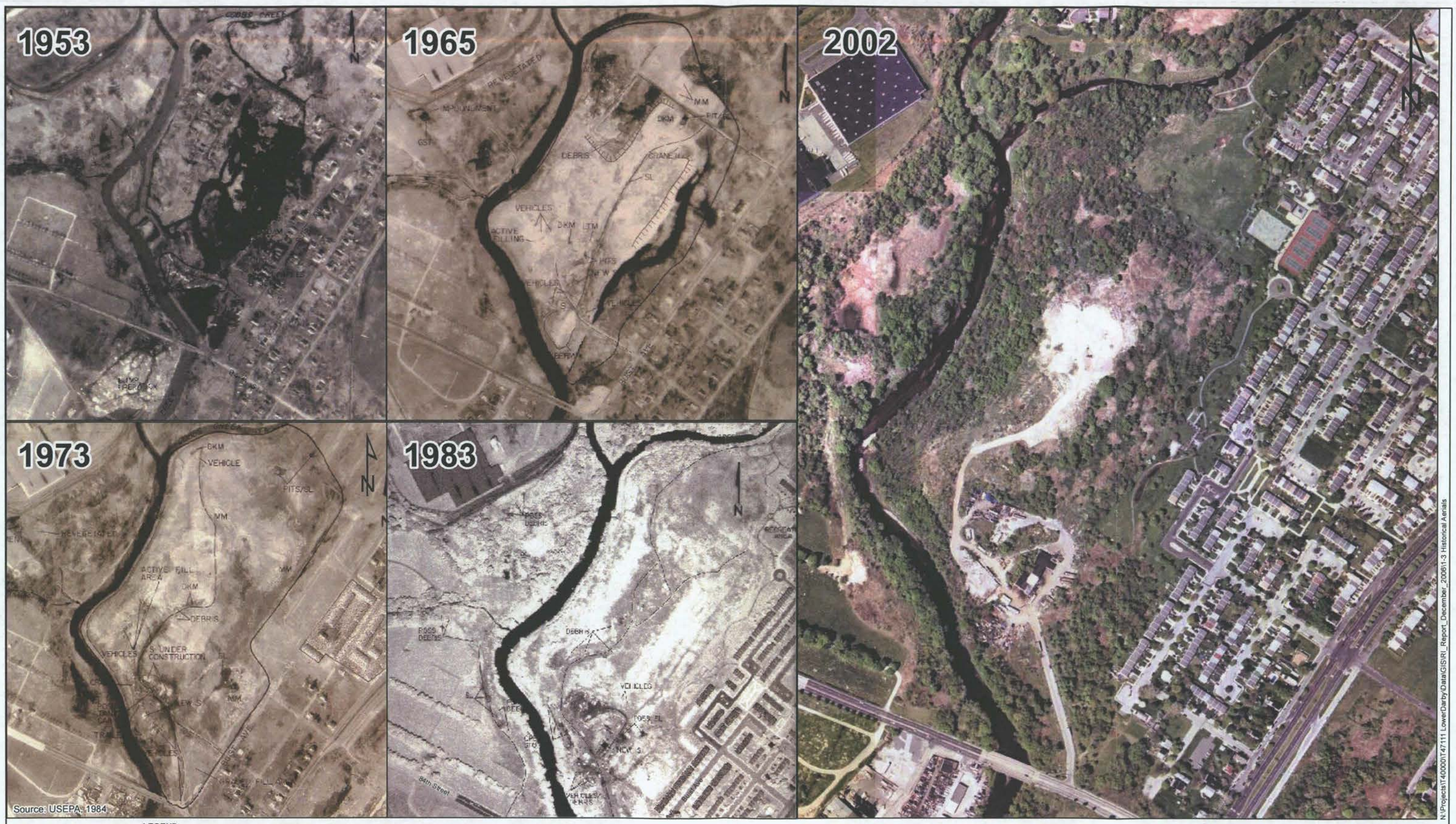

Source: USEPA, 1984

Source: 2002 aerial by Land and Mapping Services, Inc.

LEGEND

- Access Road
- Drainage
- Historical Boundary
- New Residences
- Site Boundary
- Sloped Edge of Fill
- Wetlands

DKM - Dark-Toned Material
GS - Ground Scar
GST - Ground Stain
LTM - Light-Toned Material
MM - Mounted Material
S - Structure
SL - Standing Liquid

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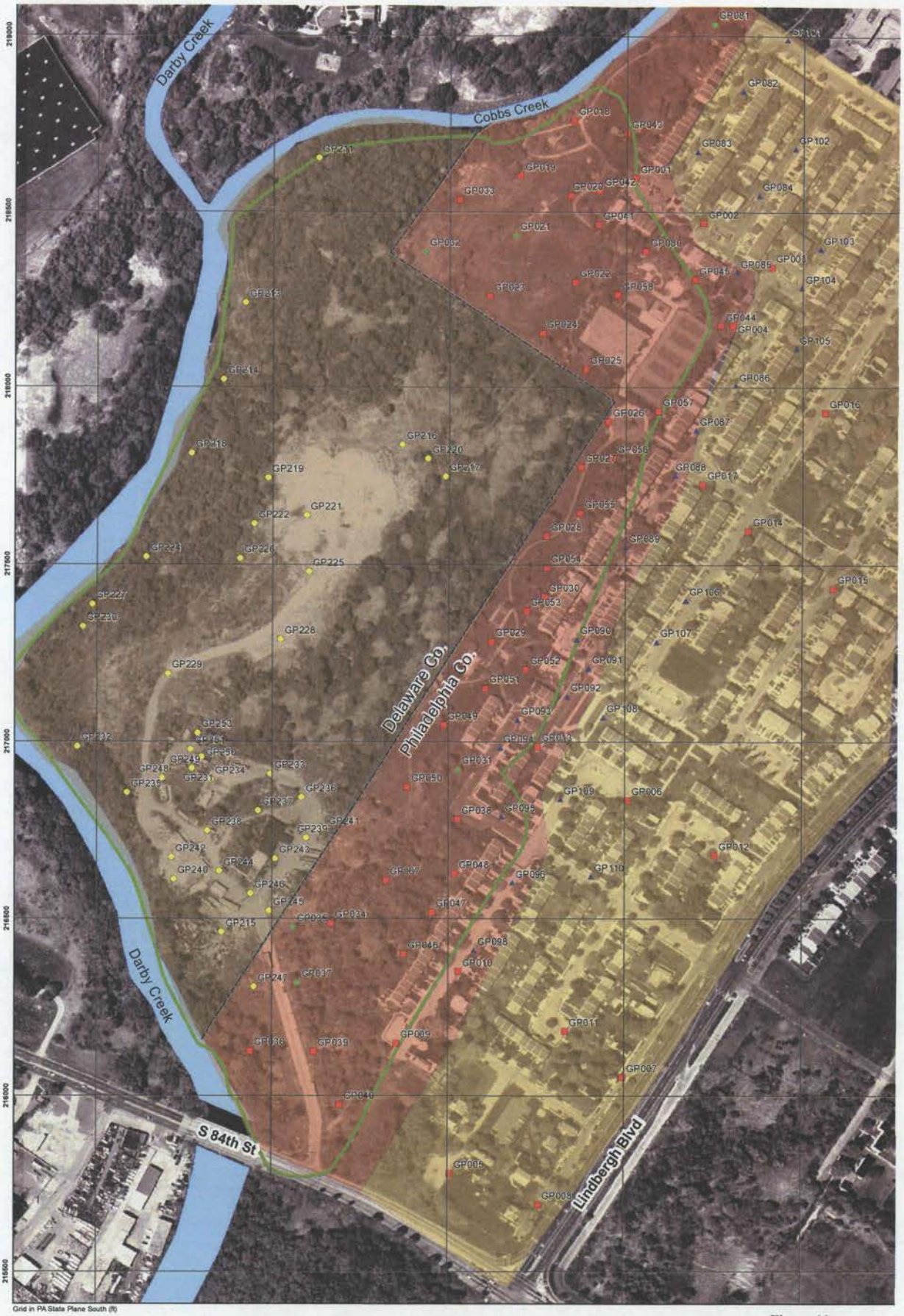
Figure 10

Historical Aerial Photos of Clearview Landfill

N:\Projects\T40000\T47111 LowerDarby\Data\GIS\RI_Report_December_2006\1-3 Historical Aerials



Sampled 2003
Sampled 2003 or 2005
Sampled 2004
Sampled 2006
County Boundary

Clearview Landfill
City Park
Eastwick Neighborhood
Historical Extent of Clearview Landfill

0 170 340 680 Feet
1:3,000 1 inch equals 250 feet

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Figure 11

Soil Boring Locations
2003 - 2006
Clearview Landfill
Pennsylvania

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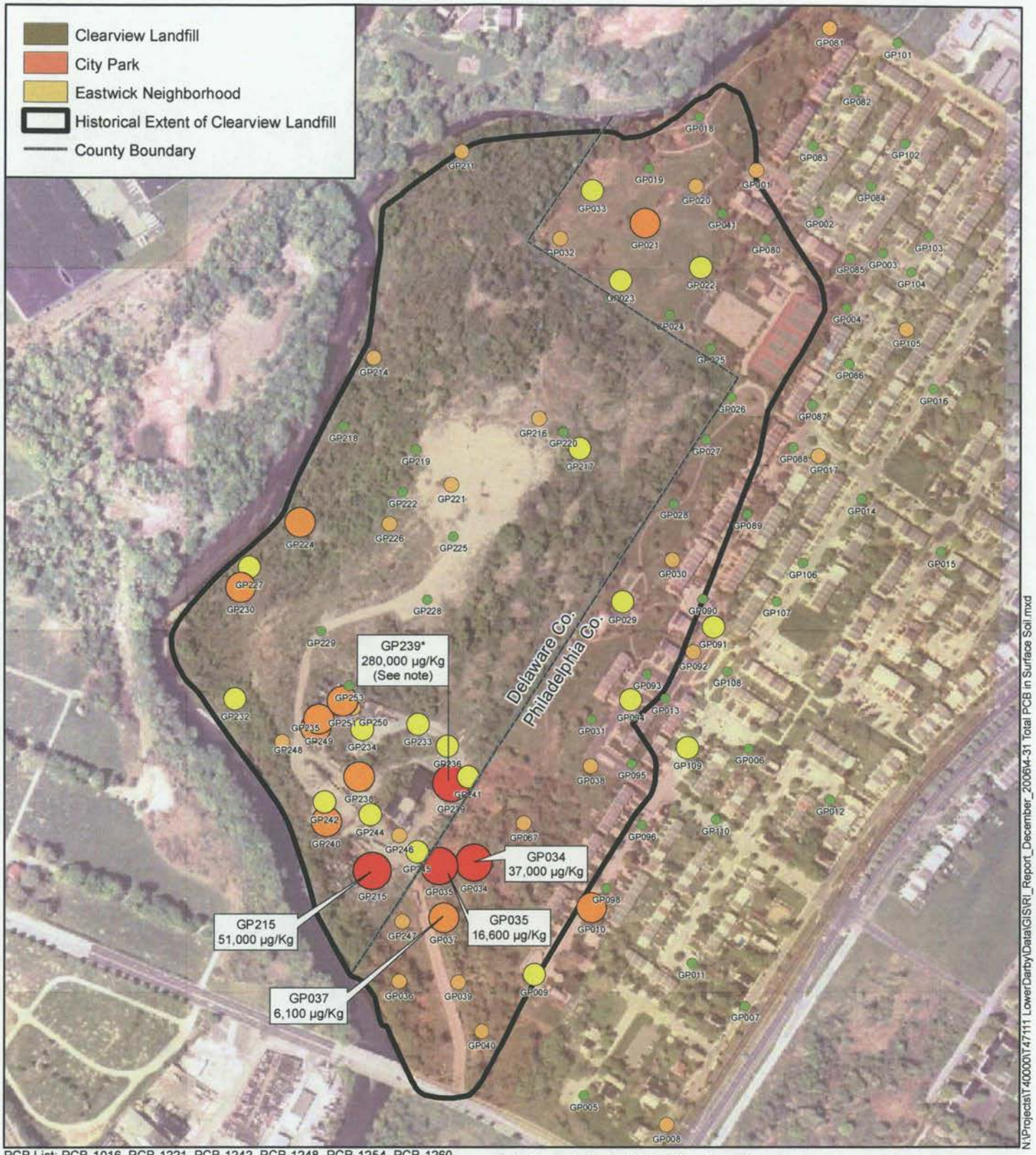

PCB List: PCB-1016, PCB-1221, PCB-1242, PCB-1248, PCB-1254, PCB-1260

*Note: Location of a leaking transformer

Total PCB

- No Detect
- 24 - 94 µg/Kg
- 110 - 860 µg/Kg
- 1000 - 6100 µg/Kg
- 16600 - 280000 µg/Kg

0 200 400 800 ft.

1 inch = 400 feet

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Figure 12
Total PCB
in surface soil (µg/Kg)
2002 - 2006
Clearview Landfill
Philadelphia, PA

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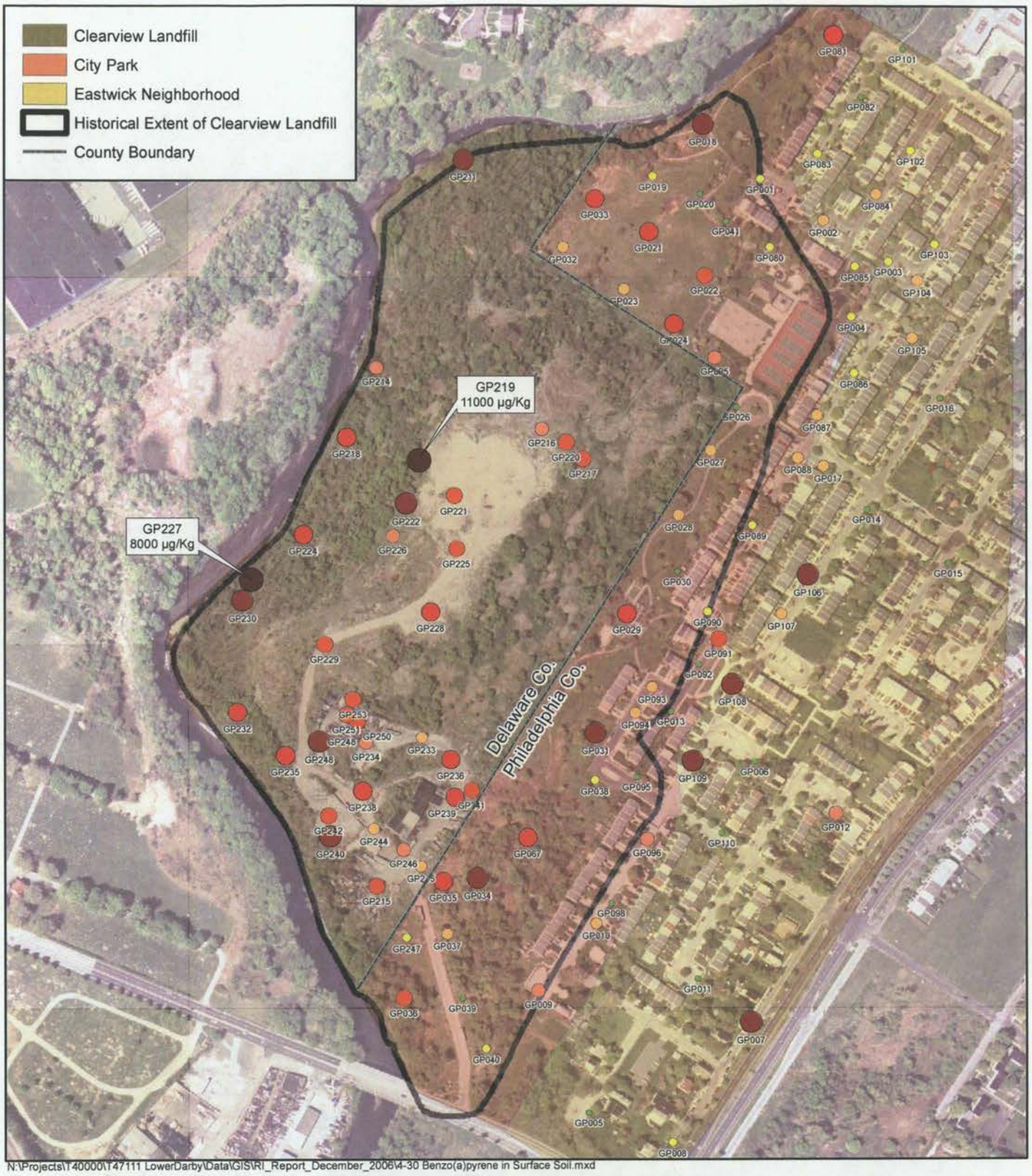

N:\Projects\T40000\T47111 LowerDarby\Data\GIS\RI_Report_December_2006\4-30 Benzo(a)pyrene in Surface Soil.mxd

- 0 - 22 µg/Kg
- 23 - 100 µg/Kg
- 101 - 250 µg/Kg
- 251 - 500 µg/Kg
- 501 - 1000 µg/Kg
- 1001 - 2000 µg/Kg
- 2001 - 4000 µg/Kg
- 4001 - 11000 µg/Kg

EPA Region 3 RBCs (October 2007) = 22 ug/Kg (residential soil); 390 ug/Kg (industrial soil)
EPA Region 3 SLs (November 2010) = 15 ug/Kg (resident soil); 210 ug/Kg (industrial soil)

0 200 400 800 ft.

1 inch = 400 feet

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Figure 13
Benzo(a)pyrene
in surface soil (µg/Kg)
2002 - 2006
Clearview Landfill
Philadelphia, PA

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Note that wells in blue color are used to generate contours.

0 200 400 800 1,200 Feet

1 inch = 500 feet

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Figure 14
Extent of Leachate Migration as Specific Conductivity in Shallow Groundwater
August 2011
LOWER DARBY CREEK AREA
PHILADELPHIA CO./DELAWARE CO., PA

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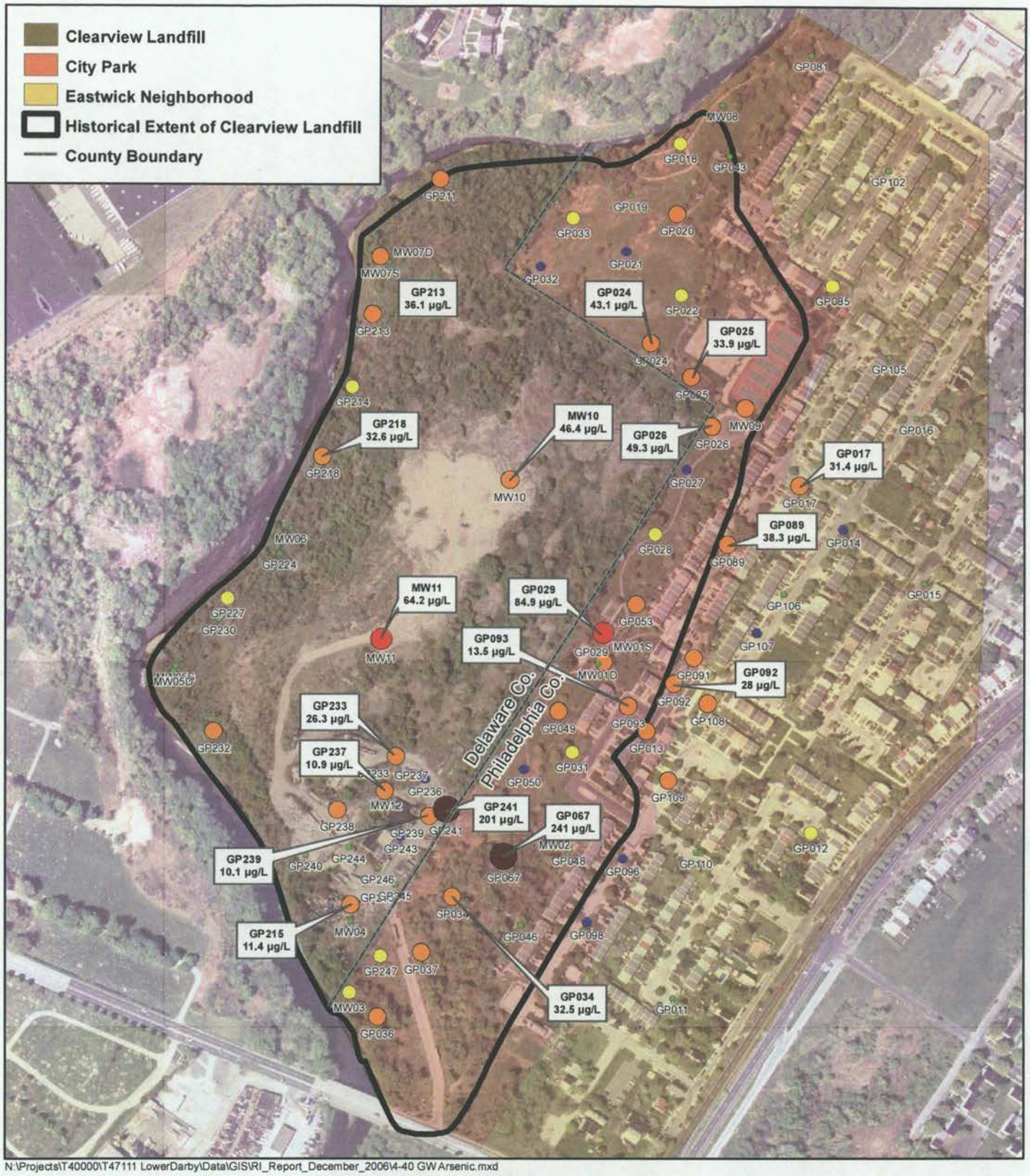

N:\Projects\T40000\T47111 LowerDarby\Data\GIS\RI_Report_December_2006\4-40 GW Arsenic.mxd

EPA Region 3 RBC for tap water (October 2007) = 0.045 ug/L
EPA Region 3 SL for tap water (November 2010) = 0.045 ug/L

- Not Detected
- 0 - 5 µg/L
- 5 - 10 µg/L
- 10 - 50 µg/L
- 50 - 100 µg/L
- 100 - 250 µg/L

0 200 400 800 Feet

1:4,800 1 inch = 400 feet

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Figure 15
Groundwater Sampling Results
Arsenic µg/L
2002 - 2006
Clearview Landfill
Philadelphia, PA

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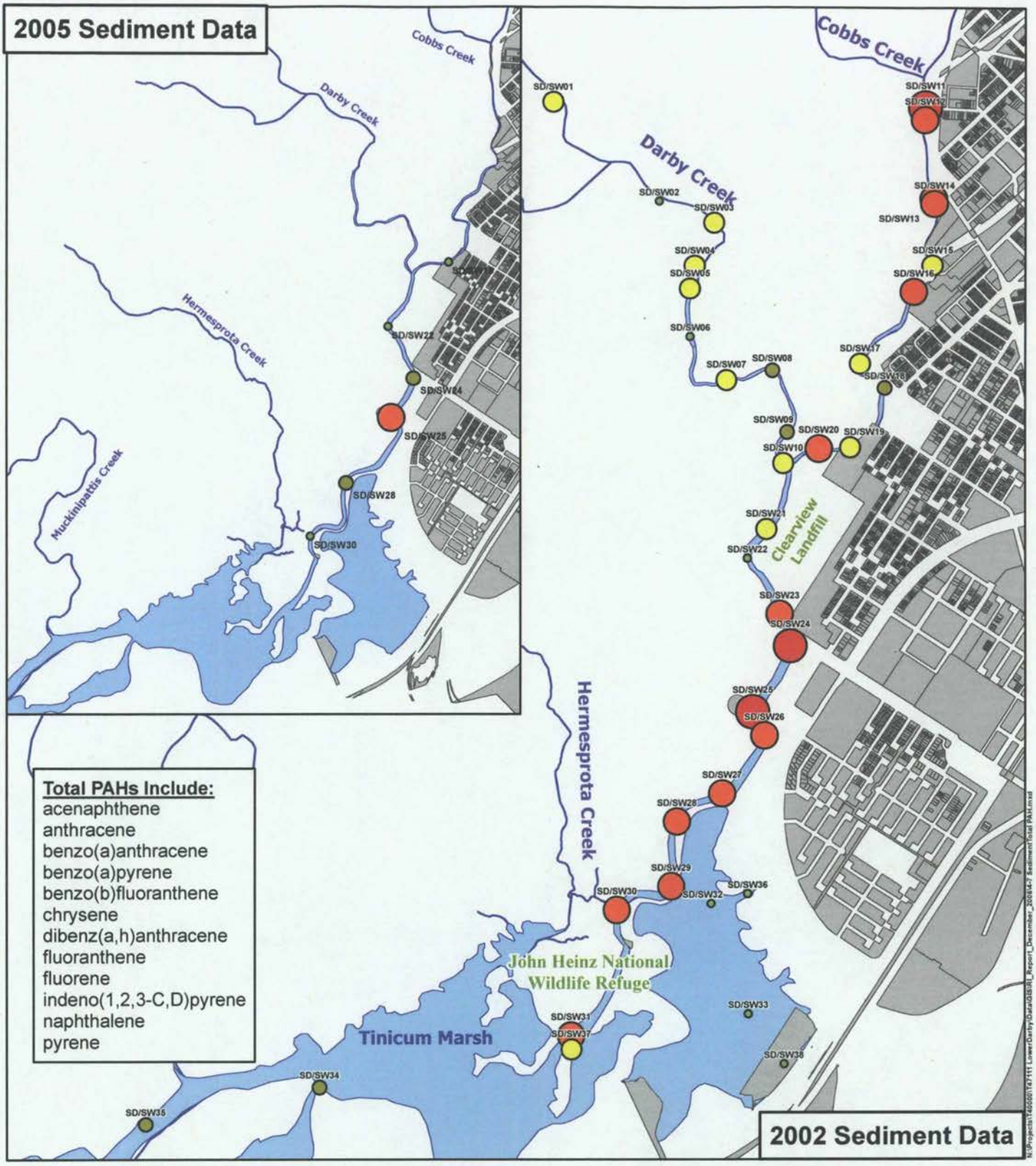

- 1500 - 8000 µg/Kg
- 8000 - 16000 µg/Kg
- 16000 - 32000 µg/Kg
- 32000 - 64000 µg/Kg
- 64000 - 128000 µg/Kg

0 1,000 2,000 4,000 ft.

1 inch equals 2,000 feet

Figure 16

Total Polycyclic Aromatic Hydrocarbons (PAHs) µg/Kg
2002 - 2005 Data
Clearview Landfill
Philadelphia, PA

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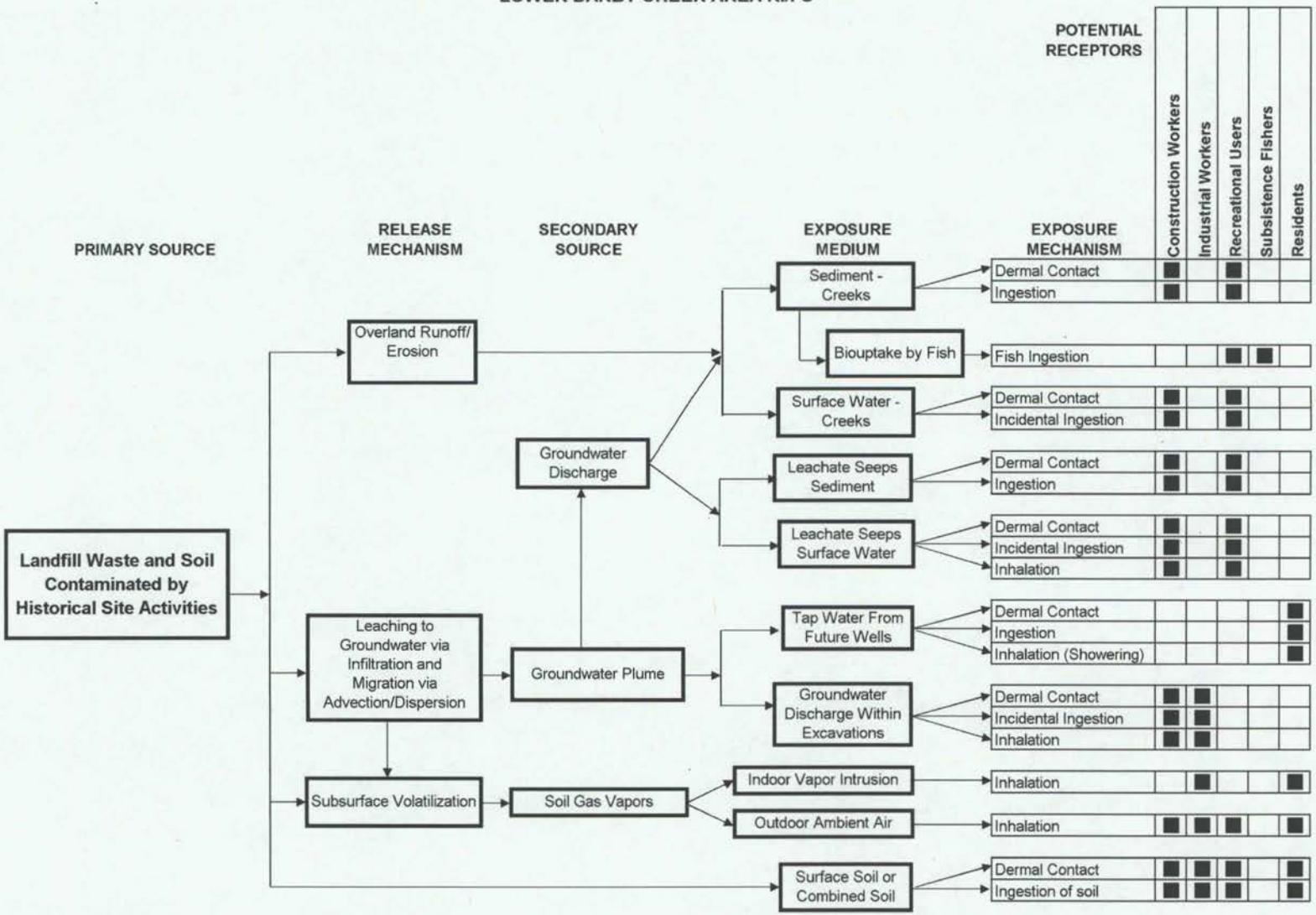
Figure 17

CONCEPTUAL SITE MODEL FOR HUMAN HEALTH RISK EXPOSURE PATHWAYS
LOWER DARBY CREEK AREA RI/FS



Grid in PA State Plane South (ft)

0 500 1,000 2,000 Feet

1:12,000 1 inch = 1,000 feet

N W E S

Figure 18
Major Habitats and Ecological Sample Locations
October/November 2005
Lower Darby Creek Area
Pennsylvania

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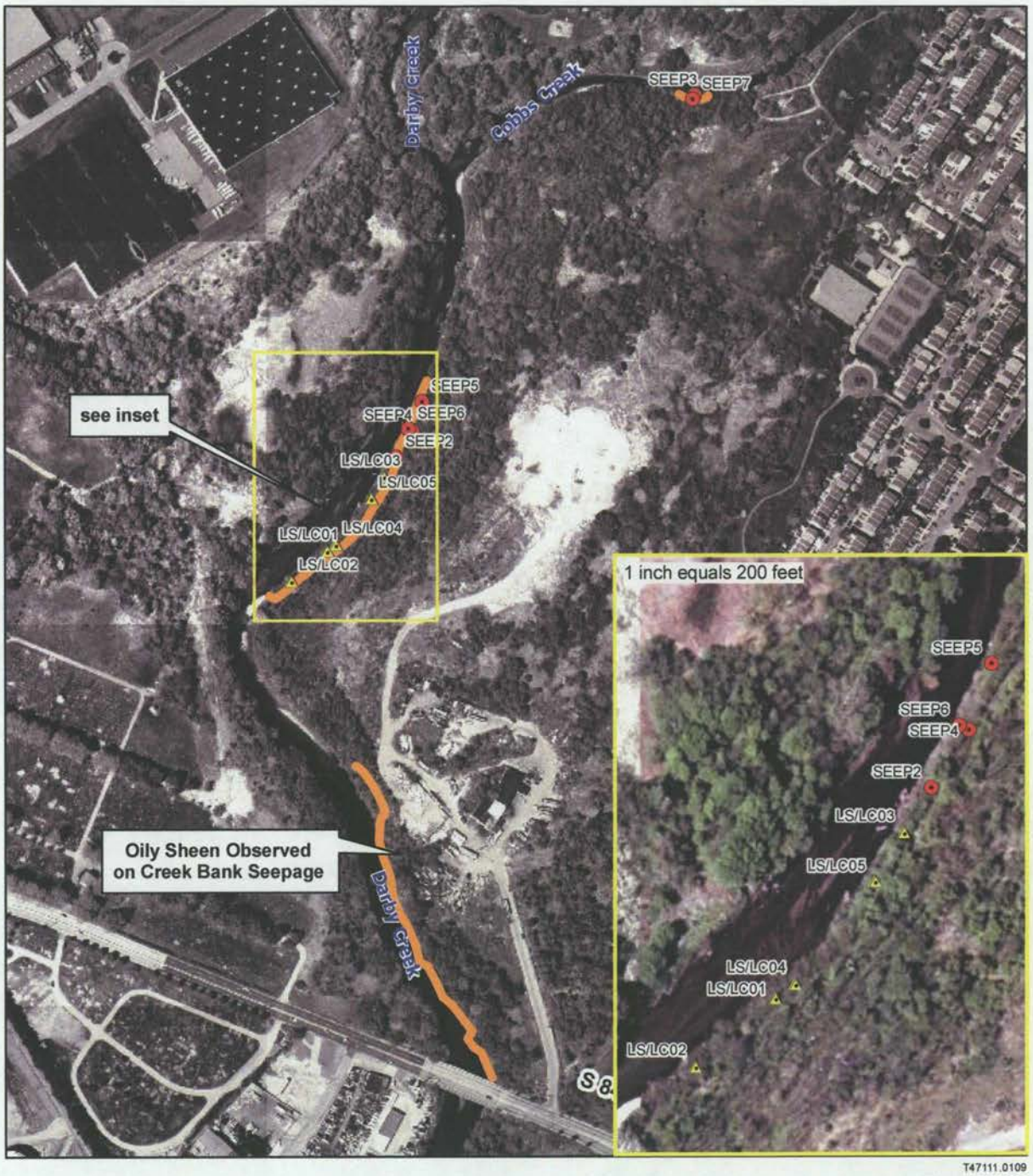

N:\Projects\T40000\T47111 LowerDarby\Data\GIS\RI_Report_December_2006\3-8 Leachate Seep Sample Locations.mxd

T47111.0109

Figure 19

Leachate Seep Sample Locations
July 2002/April 2006
Clearview Landfill
Pennsylvania

0 240 480 960 Feet

1:5,400 1 inch equals 450 feet

N W E S

Legend

- Sampled in July 2002
- Sampled in April 2006
- Seeping Banks

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112G01067\1210\12G01067GM21.DWG 03/02/12 MKB/CSG

LEGEND

- SOIL BORING SAMPLES WITH NO WASTE AND NO COC CONCENTRATIONS > HH OR ECO PRGs
- SOIL BORING SAMPLES WITH CONSTRUCTION DEBRIS
- SOIL BORING SAMPLES WITH COC CONCENTRATIONS > HH PRGs (PER TABLE 2-5)
- SURFACE SOIL BORING SAMPLES WITH COC CONCENTRATIONS > ECO PRGs (PER TABLE 2-5)
- SOIL BORING SAMPLES WITH WASTE, BUT NO COC CONCENTRATIONS > PRGs
- COUNTY BOUNDARY
- LIMITS OF COVER SYSTEM
- AREAS TARGETED FOR ADDITIONAL STUDY:
  - TO CONFIRM THE PRESENCE OF CONSTRUCTION AND DEMOLITION (C&D) DEBRIS ONLY
  - TO DELINEATE EXTENT OF WASTE
- PROPOSED ENGINEERED WETLAND/ DETENTION POND
- SOILS WITH COC CONCENTRATIONS > PRGs TO BE DELINEATED, EXCAVATED, AND CONSOLIDATED UNDER CAP
- AREAS TARGETED FOR DEMOLITION AND REMOVAL

NOTE THAT SAMPLE LOCATIONS WITH COC CONCENTRATIONS THAT EXCEED ONE OR MORE PRGs, BUT ARE NOT PLANNED FOR FURTHER ACTIONS ARE BEING RISK MANAGED (SEE SECTION 2.4.3 FOR MORE DETAILS)

* SOIL BORING LOCATION WITH POTENTIAL PCB-CONTAMINATED SOILS

0 300 600
SCALE IN FEET

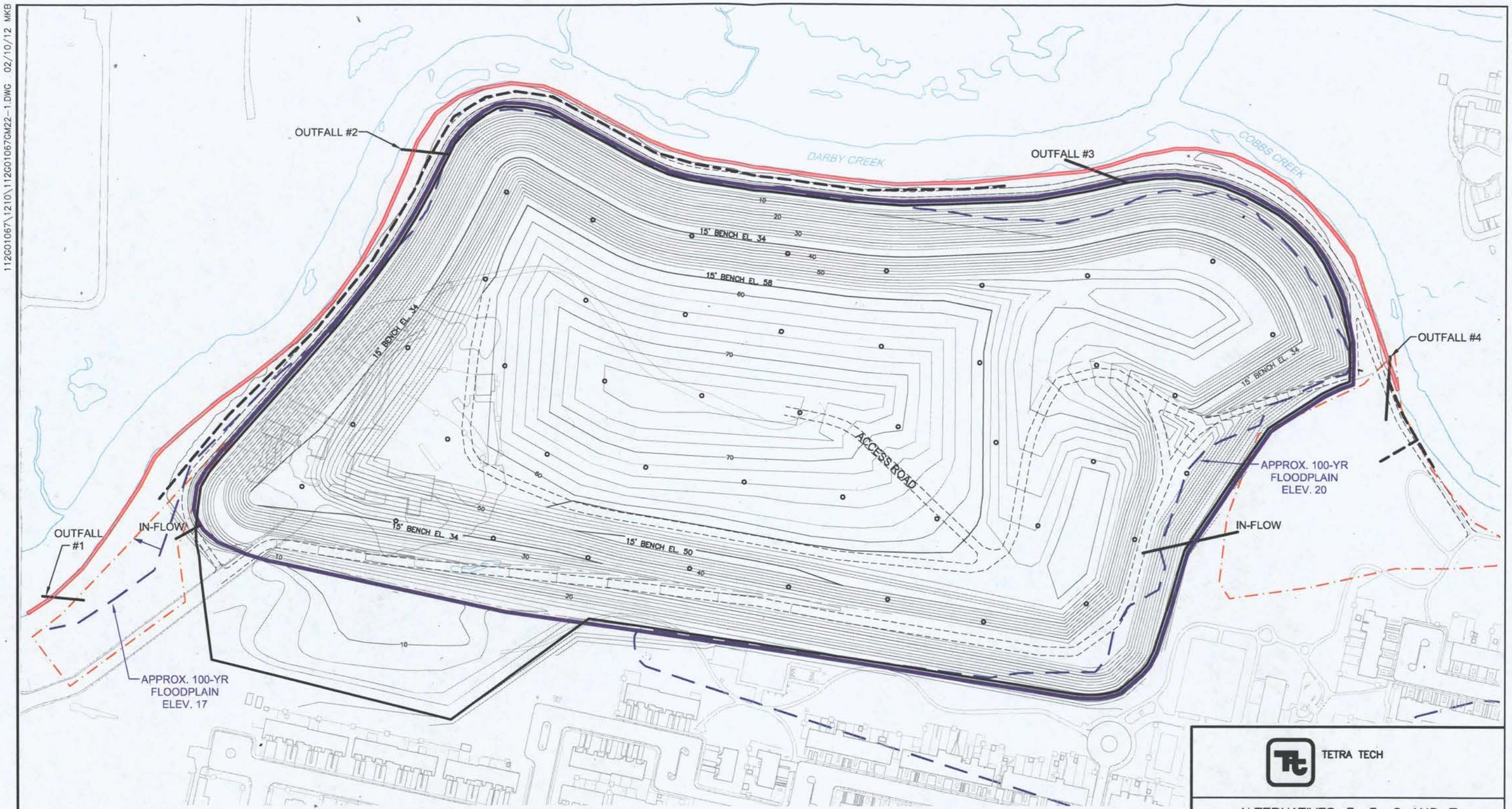
TETRA TECH, INC.

COMMON ELEMENTS OF
ALTERNATIVES 3, 4, 6, AND 7
LOWER DARBY CREEK AREA SITE (OU-1)
CLEARVIEW LANDFILL
DELAWARE AND PHILADELPHIA COUNTIES,
PENNSYLVANIA

FILE	SCALE
12G01067GM21	AS NOTED
Figure 20	REV 3 / DATE 08/9/12

AR307054

112G01067\1210\112G01067GM22-1.DWG 02/10/12 MKB



LEGEND

- LIMITS OF COVER SYSTEM
- GAS VENT
- PROPOSED ENGINEERED WETLAND/ DETENTION POND
- STORMWATER DRAINAGE DITCH
- LEACHATE SEEP COLLECTION SYSTEM
- BANK STABILIZATION
- 100 YEAR FLOODPLAIN

0 200 400
SCALE IN FEET

TETRA TECH

ALTERNATIVES 3, 5, 6 AND 7
CONCEPTUAL COVER SYSTEM
LOWER DARBY CREEK AREA SITE (OU-1)
CLEARVIEW LANDFILL
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

FILE	SCALE
112G01067GM22-1	AS NOTED
Figure 21	REV 0 / DATE 02/10/12

AR307055

Contaminant	Concentration*
Zinc	429
Total PAHs	58,490
HMW PAHs	44,700
Benzo(a)anthracene	5,700
Benzo(b)fluoranthene	3,300
Benzo(a)pyrene	4,000
Dibenz(a,h)anthracene	1,100
Indeno(1,2,3-cd)pyrene	2,300

Contaminant	Concentration*
Cadmium	3.9
Lead	461
Zinc	535
Total PAHs	14,956
HMW PAHs	11,460
Benzo(a)pyrene	1,200
Dibenz(a,h)anthracene	260

Contaminant	Concentration*
Cadmium	6.7

Contaminant	Concentration*
Zinc	715
Total PAHs	12,920
HMW PAHs	10,400
Benzo(a)pyrene	1,200

Contaminant	Concentration*
Cadmium	4

Contaminant	Concentration*
Benzo(a)anthracene	2,100
Benzo(b)fluoranthene	2,100
Benzo(a)pyrene	2,000

Contaminant	Concentration*
Cadmium	7.7
Copper	282
Lead	8,540
Zinc	1,110
Total PAHs	19,620
HMW PAHs	14,960
Benzo(a)pyrene	1,600
Dibenz(a,h)anthracene	360

Contaminant	Concentration*
Lead	876

Contaminant	Concentration*
Total PAHs	9,041
Benzo(a)pyrene	610

Contaminant	Concentration*
Lead	404
Zinc	328
Total PAHs	20,970
HMW PAHs	15,630
Benzo(a)anthracene	1,800
Benzo(a)pyrene	1,700
Dibenz(a,h)anthracene	430

LEGEND

- SOIL BORING SAMPLES WITH NO WASTE AND NO COC CONCENTRATIONS > HH OR ECO PRGs
- SOIL BORING SAMPLES WITH CONSTRUCTION DEBRIS
- SOIL BORING SAMPLES WITH COC CONCENTRATIONS > HH PRGs (PER TABLE 2-5)
- SURFACE SOIL BORING SAMPLES WITH COC CONCENTRATIONS > ECO PRGs (PER TABLE 2-5)
- SOIL BORING SAMPLES WITH WASTE, BUT NO COC CONCENTRATIONS > PRGs
- COUNTY BOUNDARY
- LIMITS OF COVER SYSTEM

AREAS TARGETED FOR ADDITIONAL STUDY:

- TO CONFIRM THE PRESENCE OF CONSTRUCTION AND DEMOLITION (C&D) DEBRIS ONLY
- TO DELINEATE EXTENT OF WASTE
- PROPOSED ENGINEERED WETLAND/ DETENTION POND
- SOILS WITH COC CONCENTRATIONS > PRGs TO BE DELINEATED, EXCAVATED, AND CONSOLIDATED UNDER CAP
- AREAS TARGETED FOR DEMOLITION AND REMOVAL

NOTE THAT SAMPLE LOCATIONS WITH COC CONCENTRATIONS THAT EXCEED ONE OR MORE PRGs, BUT ARE NOT PLANNED FOR FURTHER ACTIONS ARE BEING RISK MANAGED (SEE SECTION 2.4.3 FOR MORE DETAILS)

* SOIL BORING LOCATION WITH POTENTIAL PCB-CONTAMINATED SOILS

Table C. Controlling Cleanup Levels

COCs	ZONES 2 AND 3	
	Ecological (Top 2 feet)	Human (All Soils)
Inorganics (mg/kg)		
Cadmium	2.2	
Copper	166	
Lead	380	
Zinc	308	
PAHs (µg/kg)		
Benzo(a)anthracene		1,700
Benzo(a)pyrene		466
Benzo(b)fluoranthene		1,700
Benzo(k)fluoranthene		17,000
Dibenzo(a,h)anthracene		170
Indeno(1,2,3-cd)pyrene		1,700
Total PAHs	8,754	
HMW PAHs[3]	8,754	
PCBs (µg/kg)		
Aroclor-1254	840	1,240
Aroclor-1260	840	2,600

* Concentrations for individual sample points are the same as those used in Table C.

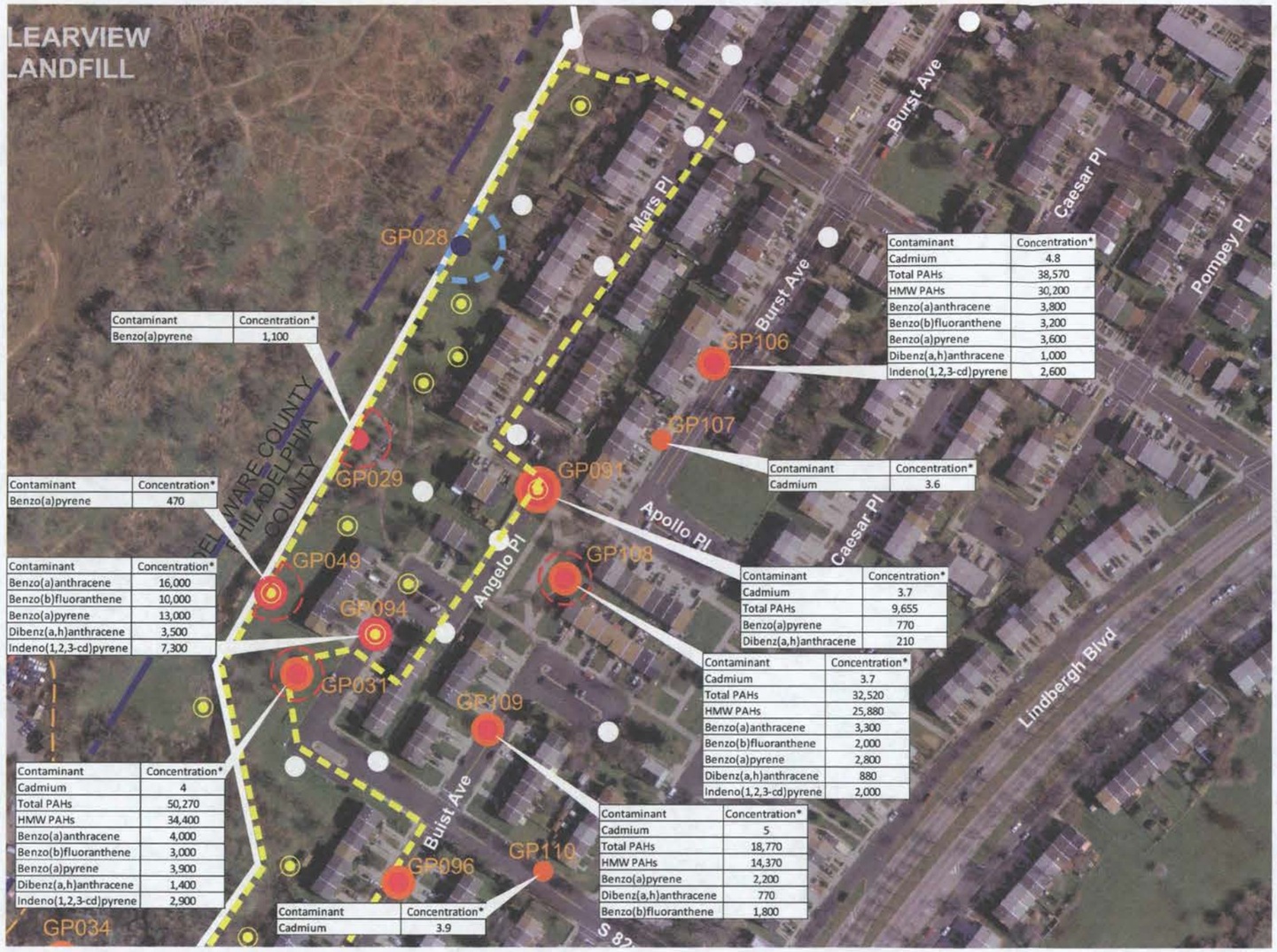
N

0 200 400
SCALE IN FEET

TETRA TECH, INC.

COMMON ELEMENTS OF ALTERNATIVES 3, 4, 6, AND 7
LOWER DARBY CREEK AREA SITE (OU-1)
CLEARVIEW LANDFILL
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

FILE	SCALE
12G01067GM21	AS NOTED
FIGURE 22	REV 0 / DATE 01/13/14



Contaminant	Concentration*
Benzo(a)pyrene	1,100

Contaminant	Concentration*
Benzo(a)pyrene	470

Contaminant	Concentration*
Benzo(a)anthracene	16,000
Benzo(b)fluoranthene	10,000
Benzo(a)pyrene	13,000
Dibenz(a,h)anthracene	3,500
Indeno(1,2,3-cd)pyrene	7,300

Contaminant	Concentration*
Cadmium	4
Total PAHs	50,270
HMW PAHs	34,400
Benzo(a)anthracene	4,000
Benzo(b)fluoranthene	3,000
Benzo(a)pyrene	3,900
Dibenz(a,h)anthracene	1,400
Indeno(1,2,3-cd)pyrene	2,900

Contaminant	Concentration*
Cadmium	3.9

Contaminant	Concentration*
Cadmium	4.8
Total PAHs	38,570
HMW PAHs	30,200
Benzo(a)anthracene	3,800
Benzo(b)fluoranthene	3,200
Benzo(a)pyrene	3,600
Dibenz(a,h)anthracene	1,000
Indeno(1,2,3-cd)pyrene	2,600

Contaminant	Concentration*
Cadmium	3.6

Contaminant	Concentration*
Cadmium	3.7
Total PAHs	9,655
Benzo(a)pyrene	770
Dibenz(a,h)anthracene	210

Contaminant	Concentration*
Cadmium	3.7
Total PAHs	32,520
HMW PAHs	25,880
Benzo(a)anthracene	3,300
Benzo(b)fluoranthene	2,000
Benzo(a)pyrene	2,800
Dibenz(a,h)anthracene	880
Indeno(1,2,3-cd)pyrene	2,000

Contaminant	Concentration*
Cadmium	5
Total PAHs	18,770
HMW PAHs	14,370
Benzo(a)pyrene	2,200
Dibenz(a,h)anthracene	770
Benzo(b)fluoranthene	1,800

N

0 200 400
SCALE IN FEET

TETRA TECH, INC.

COMMON ELEMENTS OF
ALTERNATIVES 3, 4, 6, AND 7
LOWER DARBY CREEK AREA SITE (OU-1)
CLEARVIEW LANDFILL
DELAWARE AND PHILADELPHIA COUNTIES,
PENNSYLVANIA

FILE	SCALE
12G01067GM21	AS NOTED
FIGURE 23	REV 0 / DATE 01/13/14

LEGEND

- SOIL BORING SAMPLES WITH NO WASTE AND NO COC CONCENTRATIONS > HH OR ECO PRGs
- SOIL BORING SAMPLES WITH CONSTRUCTION DEBRIS
- SOIL BORING SAMPLES WITH COC CONCENTRATIONS > HH PRGs (PER TABLE 2-5)
- SURFACE SOIL BORING SAMPLES WITH COC CONCENTRATIONS > ECO PRGs (PER TABLE 2-5)
- SOIL BORING SAMPLES WITH WASTE, BUT NO COC CONCENTRATIONS > PRGs
- COUNTY BOUNDARY
- LIMITS OF COVER SYSTEM

AREAS TARGETED FOR ADDITIONAL STUDY:

- TO CONFIRM THE PRESENCE OF CONSTRUCTION AND DEMOLITION (C&D) DEBRIS ONLY
- TO DELINEATE EXTENT OF WASTE
- PROPOSED ENGINEERED WETLAND/ DETENTION POND
- SOILS WITH COC CONCENTRATIONS > PRGs TO BE DELINEATED, EXCAVATED, AND CONSOLIDATED UNDER CAP
- AREAS TARGETED FOR DEMOLITION AND REMOVAL

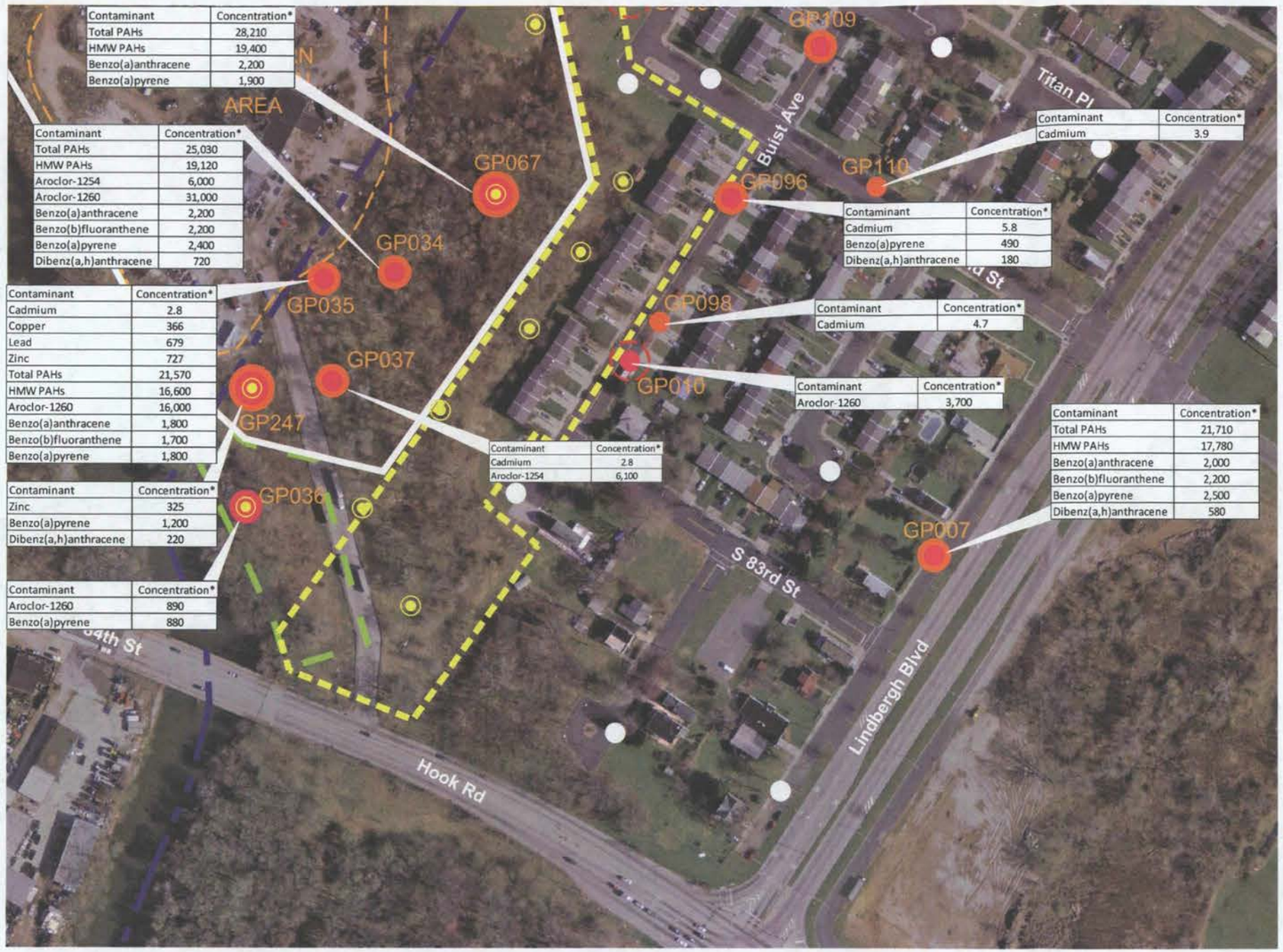
NOTE THAT SAMPLE LOCATIONS WITH COC CONCENTRATIONS THAT EXCEED ONE OR MORE PRGs, BUT ARE NOT PLANNED FOR FURTHER ACTIONS ARE BEING RISK MANAGED (SEE SECTION 2.4.3 FOR MORE DETAILS)

* SOIL BORING LOCATION WITH POTENTIAL PCB-CONTAMINATED SOILS

Table C. Controlling Cleanup Levels

COCs	ZONES 2 AND 3	
	Ecological (Top 2 feet)	Human (All Soils)
Inorganics (mg/kg)		
Cadmium	2.2	
Copper	166	
Lead	380	
Zinc	308	
PAHs (µg/kg)		
Benzo(a)anthracene		1,700
Benzo(a)pyrene		466
Benzo(b)fluoranthene		1,700
Benzo(k)fluoranthene		17,000
Dibenzo(a,h)anthracene		170
Indeno(1,2,3-cd)pyrene		1,700
Total PAHs	8,754	
HMW PAHs[3]	8,754	
PCBs (µg/kg)		
Aroclor-1254	840	1,240
Aroclor-1260	840	2,600

* Concentrations for individual sample points are the same as those used in Table C.



Contaminant	Concentration*
Total PAHs	28,210
HMW PAHs	19,400
Benzo(a)anthracene	2,200
Benzo(a)pyrene	1,900

Contaminant	Concentration*
Total PAHs	25,030
HMW PAHs	19,120
Aroclor-1254	6,000
Aroclor-1260	31,000
Benzo(a)anthracene	2,200
Benzo(b)fluoranthene	2,200
Benzo(a)pyrene	2,400
Dibenz(a,h)anthracene	720

Contaminant	Concentration*
Cadmium	2.8
Copper	366
Lead	679
Zinc	727
Total PAHs	21,570
HMW PAHs	16,600
Aroclor-1260	16,000
Benzo(a)anthracene	1,800
Benzo(b)fluoranthene	1,700
Benzo(a)pyrene	1,800

Contaminant	Concentration*
Zinc	325
Benzo(a)pyrene	1,200
Dibenz(a,h)anthracene	220

Contaminant	Concentration*
Aroclor-1260	890
Benzo(a)pyrene	880

Contaminant	Concentration*
Cadmium	3.9

Contaminant	Concentration*
Cadmium	5.8
Benzo(a)pyrene	490
Dibenz(a,h)anthracene	180

Contaminant	Concentration*
Cadmium	4.7

Contaminant	Concentration*
Aroclor-1260	3,700

Contaminant	Concentration*
Cadmium	2.8
Aroclor-1254	6,100

Contaminant	Concentration*
Total PAHs	21,710
HMW PAHs	17,780
Benzo(a)anthracene	2,000
Benzo(b)fluoranthene	2,200
Benzo(a)pyrene	2,500
Dibenz(a,h)anthracene	580

LEGEND

- SOIL BORING SAMPLES WITH NO WASTE AND NO COC CONCENTRATIONS > HH OR ECO PRGs
- SOIL BORING SAMPLES WITH CONSTRUCTION DEBRIS
- SOIL BORING SAMPLES WITH COC CONCENTRATIONS > HH PRGs (PER TABLE 2-5)
- SURFACE SOIL BORING SAMPLES WITH COC CONCENTRATIONS > ECO PRGs (PER TABLE 2-5)
- SOIL BORING SAMPLES WITH WASTE, BUT NO COC CONCENTRATIONS > PRGs
- COUNTY BOUNDARY
- LIMITS OF COVER SYSTEM

AREAS TARGETED FOR ADDITIONAL STUDY:

- TO CONFIRM THE PRESENCE OF CONSTRUCTION AND DEMOLITION (C&D) DEBRIS ONLY
- TO DELINEATE EXTENT OF WASTE
- PROPOSED ENGINEERED WETLAND/ DETENTION POND
- SOILS WITH COC CONCENTRATIONS > PRGs TO BE DELINEATED, EXCAVATED, AND CONSOLIDATED UNDER CAP
- AREAS TARGETED FOR DEMOLITION AND REMOVAL

NOTE THAT SAMPLE LOCATIONS WITH COC CONCENTRATIONS THAT EXCEED ONE OR MORE PRGs, BUT ARE NOT PLANNED FOR FURTHER ACTIONS ARE BEING RISK MANAGED (SEE SECTION 2.4.3 FOR MORE DETAILS)

* SOIL BORING LOCATION WITH POTENTIAL PCB-CONTAMINATED SOILS

Table C. Controlling Cleanup Levels

COCs	ZONES 2 AND 3	
	Ecological (Top 2 feet)	Human (All Soils)
Inorganics (mg/kg)		
Cadmium	2.2	
Copper	166	
Lead	380	
Zinc	308	
PAHs (µg/kg)		
Benzo(a)anthracene		1,700
Benzo(a)pyrene		466
Benzo(b)fluoranthene		1,700
Benzo(k)fluoranthene		17,000
Dibenzo(a,h)anthracene		170
Indeno(1,2,3-cd)pyrene		1,700
Total PAHs	8,754	
HMW PAHs[3]	8,754	
PCBs (µg/kg)		
Aroclor-1254	840	1,240
Aroclor-1260	840	2,600

* Concentrations for individual sample points are the same as those used in Table C.

N

0 200 400
SCALE IN FEET

TETRA TECH, INC.

COMMON ELEMENTS OF ALTERNATIVES 3, 4, 6, AND 7
LOWER DARBY CREEK AREA SITE (OU-1)
CLEARVIEW LANDFILL
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

FILE	SCALE
12G01067GM21	AS NOTED
FIGURE 24	REV 0 / DATE 01/13/14

Table 1.1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water from Lower Darby and Lower Cobbs Creeks

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min.	Max.									
Surface Water Lower Darby and Lower Cobbs Creeks	98862	acetophenone	0.4	J	0.4	J	ug/l	SW19	1 / 16	9.3	20	0.4	J	NA	610	nc	NA	NA	N	BSL
	85687	benzyl butyl phthalate	0.2	J	0.2	J	ug/l	SW19, SW27, SW28	3 / 16	9.3	20	0.2	J	NA	7300	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	0.6	J	5	J	ug/l	SW24	9 / 11	9.3	20	5	J	NA	48	ca	NA	NA	N	BSL
	84662	diethyl phthalate	0.5	J	0.5	J	ug/l	SW19	1 / 16	9.3	20	0.5	J	NA	29000	nc	NA	NA	N	BSL
	84742	di-n-butyl phthalate	0.3	J	0.3	J	ug/l	SW19	1 / 16	9.3	20	0.3	J	NA	3700	nc	NA	NA	N	BSL
	206440	fluoranthene	0.2	J	0.2	J	ug/l	SW19, SW22, SW28	3 / 16	9.3	20	0.2	J	NA	1500	nc	NA	NA	N	BSL
	87865	**pentachlorophenol**	10	J	10	J	ug/l	SW28	1 / 16	23.2	50	10	J	NA	5.6	ca	NA	NA	**Y**	**ASL**
	129000	pyrene	0.2	J	0.2	J	ug/l	SW19, SW28	2 / 16	9.3	20	0.2	J	NA	180	nc	NA	NA	N	BSL
	67641	acetone	6	J	140	J	ug/l	SW22	3 / 14	10	10	140	J	NA	5500	nc	NA	NA	N	BSL
	100425	styrene	0.5	J	0.5	J	ug/l	SW22	1 / 16	10	10	0.5	J	NA	1600	nc	NA	NA	N	BSL
	1634044	tert-butyl methyl ether (MTBE)	0.4	J	1	J	ug/l	SW22	2 / 10	10	10	1	J	NA	26	ca	NA	NA	N	BSL
	79345	**1,1,2,2-tetrachloroethane**	1	J	5	J	ug/l	SW22	3 / 16	10	10	5	J	NA	0.53	ca	NA	NA	**Y**	**ASL**
	127184	tetrachloroethylene(PCE)	0.8	J	0.8	J	ug/l	SW19	1 / 16	10	10	0.8	J	NA	1	ca	NA	NA	N	BSL
	108883	toluene	0.3	J	1	J	ug/l	SW24	4 / 16	10	10	1	J	NA	2300	nc	NA	NA	N	BSL
	76131	1,1,2-trichloro-1,2,2-trifluoroethane	0.5	J	0.5	J	ug/l	SW24	1 / 16	10	10	0.5	J	NA	59000	nc	NA	NA	N	BSL
	79005	1,1,2-trichloroethane	0.4	J	0.4	J	ug/l	SW22	1 / 16	10	10	0.4	J	NA	1.9	ca	NA	NA	N	BSL
	79016	**trichloroethylene (TCE)**	0.3	J	0.3	J	ug/l	SW29	1 / 14	10	10	0.3	J	NA	0.26	ca	NA	NA	**Y**	**ASL**
	7429905	**aluminum**	79.6	[]	1340	J	ug/l	LD-SW-SW31-0502	7 / 7			1340	J	NA	NA		NA	NA	**Y**	**NSL**
	7440360	antimony	2.3	[]	2.3	[]	ug/l	LD-SW-SW25-0502	1 / 15	60	60	2.3	[]	NA	15	nc	NA	NA	N	BSL
	7440382	**arsenic**	2.1	[]	4.4	L[]	ug/l	LD-SW-SW26-0502	3 / 15	10	10	4.4	L[]	NA	0.45	ca	NA	NA	**Y**	**ASL**
	7440393	barium	38.7	[]	77.3	[]	ug/l	LD-SW-SW22-0502	15 / 15			77.3	[]	NA	7300	nc	NA	NA	N	BSL
	7440439	**cadmium**	3.7	[]	21.9		ug/l	LD-SW-SW26-0502	2 / 15	5	5	21.9		NA	18	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	18100		37600		ug/l	LD-SW-SW19-0502	15 / 15			37600		NA	NA		NA	NA	N	NUT
	7440473	chromium, total [6]	1	[]	3.7	K	ug/l	LD-SW-SW31-0502	4 / 15	10	10	3.7	K	NA	110	nc	NA	NA	N	BSL
	18540299	chromium, hexavalent	6		6		ug/l	LD-SW-SW10-0502	1 / 12	10	10	6		NA	110	nc	NA	NA	N	BSL
	7440484	**cobalt**	2.1	[]	2.1	[]	ug/l	LD-SW-SW10-0502	3 / 15	50	50	2.1	[]	NA	NA		NA	NA	**Y**	**NSL**
	7440508	copper	1.3	[]	3	[]	ug/l	LD-SW-SW19-0502	3 / 8	25	25	3	[]	NA	1500	nc	NA	NA	N	BSL
	57125	cyanide	2.8	L[]	2.8	L[]	ug/l	LD-SW-SW21-0502	1 / 15	10	10	2.8	L[]	NA	730	nc	NA	NA	N	BSL
	7439896	iron	280		2290		ug/l	LD-SW-SW31-0502	15 / 15			2290		NA	11000	nc	NA	NA	N	BSL
	7439921	lead	1.1	L[]	7.4		ug/l	LD-SW-SW10-0502	4 / 15	3	3	7.4		NA	15		NA	NA	N	BSL
	7439954	magnesium	6710		14700		ug/l	LD-SW-SW22-0502	15 / 15			14700		NA	NA		NA	NA	N	NUT
	7439965	manganese	29.2		197		ug/l	LD-SW-SW31-0502	15 / 15			197		NA	730	nc	NA	NA	N	BSL
	7440020	nickel	1.4	[]	3.6	[]	ug/l	LD-SW-SW31-0502	10 / 11	40	40	3.6	[]	NA	730	nc	NA	NA	N	BSL
	7440097	potassium	2730	[]	5780		ug/l	LD-SW-SW19-0502	15 / 15			5780		NA	NA		NA	NA	N	NUT
	7440235	sodium	12800		24900	J	ug/l	LD-SW-SW19-0502	15 / 15			24900	J	NA	NA		NA	NA	N	NUT
	7440280	**thallium**	2	J	4.5	J	ug/l	LD-SW-SW20-0502	4 / 15	10	10	4.5	J	NA	2.6	nc	NA	NA	**Y**	**ASL**
	7440622	vanadium	1.2	[]	5.3	[]	ug/l	LD-SW-SW31-0502	13 / 15	50	50	5.3	[]	NA	37	nc	NA	NA	N	BSL
	7440666	zinc	2.1	L[]	14.8	[]	ug/l	LD-SW-SW22-0502	9 / 13	20	20	14.8	[]	NA	11000	nc	NA	NA	N	BSL

Footnotes

ug/l = micrograms per liter

(1) J = Analyte present. Reported value may not be accurate or precise.
K= Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Tap Water) (October, 2007). For surface water, the Tap Water RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was detected in Darby Creek surface water, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

14 Lower Darby Creek samples are in this data set, and are listed as follows: LD-SW-SW09-0502, LD-SW-SW10-0502, LD-SW-SW21-0502, LD-SW-SW22-0502, LD-SW-SW23-0502, LD-SW-SW24-0502, LD-SW-SW26-0502, LD-SW-SW260-0502, LD-SW-SW28-0502, LD-SW-SW29-0502, LD-SW-SW31-0502

2 Lower Cobbs Creek samples are also included in this data set (LD-SW-SW19-0502 and LD-SW-SW20-0502). LD-SW-SW25-0502, LD-SW-SW27-0502, LD-SW-SW30-0502

Table 1.2
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Tinicum Marsh

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Water Tinicum Marsh	1912249	atrazine	0.3	J	0.3	J	ug/l	SW35	1 / 8	9.5	10.8	0.3	J	NA	3	ca	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	1	J	1	J	ug/l	SW35	1 / 7	9.5	10.8	1	J	NA	48	ca	NA	NA	N	BSL
	84742	di-n-butyl phthalate	0.4	J	0.4	J	ug/l	SW37	1 / 8	9.5	10.8	0.4	J	NA	3700	nc	NA	NA	N	BSL
	67641	acetone	12		14		ug/l	SW36	3 / 5	10	10	14		NA	5500	nc	NA	NA	N	BSL
	71432	benzene	0.5	J	0.5	J	ug/l	SW34	1 / 8	10	10	0.5	J	NA	3.4	ca	NA	NA	N	BSL
	75354	1,1-dichloroethene	0.7	J	0.7	J	ug/l	SW34	1 / 8	10	10	0.7	J	NA	350	nc	NA	NA	N	BSL
	75092	methylene chloride	1	J	1	J	ug/l	SW32, SW33, SW36	3 / 8	10	10	1	J	NA	41	ca	NA	NA	N	BSL
	1634044	tert-butyl methyl ether (MTBE)	1	J	1	J	ug/l	SW37	1 / 6	10	10	1	J	NA	26	ca	NA	NA	N	BSL
	127184	tetrachloroethylene(PCE)	0.5	J	1	J	ug/l	SW38	2 / 8	10	10	1	J	NA	1	ca	NA	NA	N	BSL
	108883	toluene	0.5	J	0.5	J	ug/l	SW34	1 / 8	10	10	0.5	J	NA	2300	nc	NA	NA	N	BSL
	79016	**trichloroethylene (TCE)**	0.6	J	0.6	J	ug/l	SW34	1 / 8	10	10	0.6	J	NA	0.26	ca	NA	NA	**Y**	**ASL**
	7429905	**aluminum**	206		1820	J	ug/l	LD-SW-SW36-0502	7 / 7			1820	J	NA	NA		NA	NA	**Y**	**NSL**
	7440360	antimony	2.2	[]	2.2	[]	ug/l	LD-SW-SW34-0502	1 / 7	60	60	2.2	[]	NA	15	nc	NA	NA	N	BSL
	7440382	**arsenic**	2.4	[]	9.4	[]	ug/l	LD-SW-SW38-0502	6 / 7	10	10	9.4	[]	NA	0.45	ca	NA	NA	**Y**	**ASL**
	7440393	barium	34.9	[]	70.5	[]	ug/l	LD-SW-SW38-0502	7 / 7			70.5	[]	NA	7300	nc	NA	NA	N	BSL
	7440702	calcium	16300		29200		ug/l	LD-SW-SW33-0502	7 / 7			29200		NA	NA		NA	NA	N	NUT
	7440473	chromium, total [6]	1.1	[]	4.3	K	ug/l	LD-SW-SW36-0502	7 / 7			4.3	K	NA	110	nc	NA	NA	N	BSL
	18540299	chromium, hexavalent	10		10		ug/l	LD-SW-SW32-0502	1 / 7	50	50	10		NA	110	nc	NA	NA	N	BSL
	7440484	**cobalt**	2.7	K	2.7	K	ug/l	LD-SW-SW32-0502	1 / 7	10	10	2.7	K	NA	NA		NA	NA	**Y**	**NSL**
	57125	cyanide	2.1	[]	2.1	[]	ug/l	LD-SW-SW37-0502	1 / 7	10	10	2.1	[]	NA	730	nc	NA	NA	N	BSL
	7439896	iron	639		4220		ug/l	LD-SW-SW36-0502	7 / 7			4220		NA	11000	nc	NA	NA	N	BSL
	7439921	**lead**	1	K	15.1		ug/l	LD-SW-SW38-0502	6 / 7	3	3	15.1		NA	15		NA	NA	**Y**	**ASL**
	7439954	magnesium	5990		12300		ug/l	LD-SW-SW33-0502	7 / 7			12300		NA	NA		NA	NA	N	NUT
	7439965	manganese	105		596		ug/l	LD-SW-SW38-0502	7 / 7			596		NA	730	nc	NA	NA	N	BSL
	7440020	nickel	2.9	K	5.5	K	ug/l	LD-SW-SW36-0502	6 / 6			5.5	K	NA	730	nc	NA	NA	N	BSL
	7440097	potassium	2130	[]	3600	[]	ug/l	LD-SW-SW32-0502	7 / 7			3600	[]	NA	NA		NA	NA	N	NUT
	7440235	sodium	12800		48900		ug/l	LD-SW-SW38-0502	7 / 7			48900		NA	NA		NA	NA	N	NUT
	7440280	thallium	2.2	K	2.2	K	ug/l	LD-SW-SW37-0502	1 / 7	10	10	2.2	K	NA	2.6	nc	NA	NA	N	BSL
	7440622	vanadium	1.8	[]	12.5	[]	ug/l	LD-SW-SW36-0502	7 / 7			12.5	[]	NA	37	nc	NA	NA	N	BSL
	7440666	zinc	5.6	[]	48.5		ug/l	LD-SW-SW36-0502	2 / 2			48.5		NA	11000	nc	NA	NA	N	BSL

Footnotes

ug/l = micrograms per liter

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Tap Water) (October, 2007). For surface water, the Tap Water RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was detected in Tinicum Marsh surface water, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

Tinicum Marsh Surface Water Samples Include:

LD-SW-SW32-0502	LD-SW-SW34-0502	LD-SW-SW37-0502
LD-SW-SW320-0502	LD-SW-SW35-0502	LD-SW-SW38-0502
LD-SW-SW33-0502	LD-SW-SW36-0502	

Table 1.3
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Leachate (Surface Water)
Exposure Medium: Leachate Seeps

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min.	Max.									
	309002	aldrin	0.027	J	0.027	J	ug/l	SEEP4	1 / 13	0.01	0.1	0.027	J	NA	0.039	ca	NA	NA	N	BSL
	5103719	alpha-chlordane	0.011	J	0.011	J	ug/l	SEEP4	1 / 13	0.01	0.1	0.011	J	NA	1.9	ca	NA	NA	N	BSL
	319857	**beta BHC**	0.089	J	0.51	J	ug/l	LS03	8 / 13	0.01	0.1	0.51	J	NA	0.37	ca	NA	NA	**Y**	**ASL**
	60571	dieldrin	0.012	J	0.015	J	ug/l	LSLC02	2 / 13	0.02	0.2	0.015	J	NA	0.042	ca	NA	NA	N	BSL
	5103742	gamma-chlordane	0.011	J	0.022	J	ug/l	SEEP4	4 / 13	0.01	0.1	0.022	J	NA	1.9	ca	NA	NA	N	BSL
	76448	heptachlor	0.036	J	0.065	J	ug/l	SEEP5	4 / 13	0.01	0.1	0.065	J	NA	0.15	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	0.012	J	0.012	J	ug/l	SEEP4	1 / 13	0.01	0.1	0.012	J	NA	0.074	ca	NA	NA	N	BSL
	72559	p,p-DDE	0.005	J	0.02	J	ug/l	SEEP5	2 / 13	0.02	0.2	0.02	J	NA	2	ca	NA	NA	N	BSL
	91576	2-methylnaphthalene	2	J	2	J	ug/l	SEEP3	2 / 13	5	40	2	J	NA	24	nc	NA	NA	N	BSL
	83329	acenaphthene	2	J	2	J	ug/l	SEEP3	3 / 13	5	40	2	J	NA	370	nc	NA	NA	N	BSL
	120127	anthracene	2	J	2	J	ug/l	SEEP3	1 / 13	5	40	2	J	NA	1800	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	5	J	5	J	ug/l	LS04	1 / 13	5	40	5	J	NA	48	ca	NA	NA	N	BSL
	132649	**dibenzofuran**	1	J	1	J	ug/l	LS05	1 / 13	9.1	50	1	J	NA	NA		NA	NA	**Y**	**NSL**
	86737	fluorene	1	J	2	J	ug/l	SEEP3	2 / 13	5	40	2	J	NA	240	nc	NA	NA	N	BSL
	91203	naphthalene	2	J	2	J	ug/l	LS05	1 / 13	5	40	2	J	NA	6.5	nc	NA	NA	N	BSL
	85018	phenanthrene	1	J	2	J	ug/l	SEEP3	2 / 13	5	40	2	J	NA	180	nc	NA	NA	N	BSL
	67641	acetone	10	J	67	J	ug/l	LS02	5 / 7	10	10	67	J	NA	5500	nc	NA	NA	N	BSL
Leachate Seeps	71432	**benzene**	7	J	12	J	ug/l	SEEP3	2 / 11	10	50	12	J	NA	3.4	ca	NA	NA	**Y**	**ASL**
	75150	carbon disulfide	5	J	5	J	ug/l	SEEP2	1 / 11	10	50	5	J	NA	1000	nc	NA	NA	N	BSL
	108907	chlorobenzene	2	J	20	J	ug/l	SEEP3	9 / 11	10	50	20	J	NA	90	nc	NA	NA	N	BSL
	110827	cyclohexane	1	J	6	J	ug/l	SEEP3	2 / 11	10	50	6	J	NA	12000	nc	NA	NA	N	BSL
	106467	1,4-dichlorobenzene	2	J	2	J	ug/l	SEEP6	1 / 11	10	50	2	J	NA	4.7	ca	NA	NA	N	BSL
	7429905	**aluminum**	135	J	403000		ug/l	LD-LC-LS05-0702	8 / 8			403000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	antimony	1.7		3.7	L	ug/l	LD-LC-LS02-0702	4 / 12	60	60	3.7	L	NA	15	nc	NA	NA	N	BSL
	7440382	**arsenic**	3.1	J	57.9		ug/l	LD-LC-LS05-0702	8 / 11	10	10	57.9		NA	0.45	ca	NA	NA	**Y**	**ASL**
	7440393	**barium**	71.7	J	10200	L	ug/l	LD-LC-LS03-0702	12 / 12			10200	L	NA	7300	nc	NA	NA	**Y**	**ASL**
	7440417	beryllium	2.4	[]	15.1		ug/l	LD-LC-LS05-0702	5 / 12	5	5	15.1		NA	73	nc	NA	NA	N	BSL
	7440439	**cadmium**	4		24.5	L	ug/l	LD-LC-LS02-0702	5 / 12	5	5	24.5	L	NA	18	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	31100		428000	L	ug/l	LD-LC-LS03-0702	12 / 12			428000	L	NA	NA		NA	NA	N	NUT
	7440473	chromium (+3) [6]	2.4	J	723		ug/l	LD-LC-LS05-0702	10 / 12	10	10	723		NA	55000	nc	NA	NA	N	BSL
	7440484	**cobalt**	11.6	J	139		ug/l	LD-LC-LS05-0702	9 / 11	50	50	139		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	2.8	J	3040	J	ug/l	LD-LC-LS05-0702	9 / 10	25	25	3040	J	NA	1500	nc	NA	NA	**Y**	**ASL**
	57125	cyanide	1	J	299		ug/l	LD-LC-LS02-0702	10 / 11	10	10	299		NA	730	nc	NA	NA	N	BSL
	7439896	**iron**	320		396000		ug/l	LD-LC-LS05-0702	12 / 12			396000		NA	11000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	2.8	J	7270	L	ug/l	LD-LC-LS02-0702	7 / 12	10	10	7270	L	NA	15		NA	NA	**Y**	**ASL**

Table 1.3
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Leachate (Surface Water)
Exposure Medium: Leachate Seeps

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min.	Max.									
Leachate Seeps	7439954	magnesium	13300		205000	L	ug/l	LD-LC-LS02-0702	12 / 12			205000	L	NA	NA		NA	NA	N	NUT
	7439965	**manganese**	39.6		7000		ug/l	LD-LC-LS05-0702	12 / 12			7000		NA	730	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	1.4	L	54.4	L	ug/l	LD-LC-LS05-0702	5 / 7	0.2	0.2	54.4	L	NA	3.7	nc	NA	NA	**Y**	**ASL**
	7440020	nickel	1.8	J	249	J	ug/l	LD-LC-LS05-0702	11 / 12	40	40	249	J	NA	730	nc	NA	NA	N	BSL
	7440097	potassium	4200	J	224000	J	ug/l	LD-LC-LS03-0702	12 / 12			224000	J	NA	NA		NA	NA	N	NUT
	7782492	selenium	2.5	[]	7.4	J	ug/l	LDCA_LSLC05_1005	5 / 12	5	35	7.4	J	NA	180	nc	NA	NA	N	BSL
	7440224	silver	0.99	L	11.2	L	ug/l	LD-LC-LS02-0702	4 / 12	10	10	11.2	L	NA	180	nc	NA	NA	N	BSL
	7440235	sodium	25300		1280000	J	ug/l	LD-LC-LS05-0702	12 / 12			1280000	J	NA	NA		NA	NA	N	NUT
	7440280	**thallium**	6.2	J	35		ug/l	LD-LC-LS05-0702	2 / 12	10	25	35		NA	2.6	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	7.6	J	615		ug/l	LD-LC-LS05-0702	9 / 11	50	50	615		NA	37	nc	NA	NA	**Y**	**ASL**
	7440666	zinc	89.8	L	6070	J	ug/l	LD-LC-LS02-0702	6 / 9	60	60	6070	J	NA	11000	nc	NA	NA	N	BSL

Footnotes

ug/l = micrograms per liter

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Tap Water) (October, 2007). For surface water, the Tap Water RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was analyzed for but not detected in Leachate Seeps surface water, it was assumed that total chromium was only present in the trivalent state. Consequenty, the screening value for trivalent chromium was used.

Leachate Seeps Surface Water Samples Include:

LD-GW-SEEP2-0306	LD-GW-SEEP5-0306	LD-LC-LS02-0702	LD-LC-LS04-0702	LDCA_LSLC05_1005
LD-GW-SEEP3-0306	LD-GW-SEEP6-0306	LD-LC-LS15-0702	LD-LC-LS05-0702	
LD-GW-SEEP4-0306	LD-LC-LS01-0702	LD-LC-LS03-0702	LDCA_LSLC02_1005	

Table 1.4
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Lower Darby and Lower Cobbs Creeks

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Sediment Lower Darby and Lower Cobbs Creeks	5103719	alpha-chlordane	4.3	J	63	J+	ug/kg	SD23	22 / 22	1.93	6.1	63	J+	NA	18000	ca	NA	NA	N	BSL
	959988	alpha endosulfan	1.6	J	1.6	J	ug/kg	SD21	1 / 22	1.93	6.1	1.6	J	NA	470000	nc	NA	NA	N	BSL
	319857	beta BHC	1.6	J	3.3	J	ug/kg	SD25	4 / 22	1.93	6.1	3.3	J	NA	3500	ca	NA	NA	N	BSL
	60571	dieldrin	6	J	67		ug/kg	SD30	20 / 22	3.75	11.8	67		NA	400	ca	NA	NA	N	BSL
	1031078	endosulfan sulfate	6.5	J	21	J	ug/kg	SD23	3 / 22	3.75	11.8	21	J	NA	470000	nc	NA	NA	N	BSL
	72208	endrin	0.95	J	6.3	J	ug/kg	SD22	5 / 22	3.75	11.8	6.3	J	NA	23000	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	4.4	J	18	J	ug/kg	SD23	3 / 22	3.75	11.8	18	J	NA	23000	nc	NA	NA	N	BSL
	53494705	endrin ketone	1.8	J	6.5	J	ug/kg	SD25	4 / 22	3.75	11.8	6.5	J	NA	23000	nc	NA	NA	N	BSL
	5103742	gamma-chlordane	2.6		35		ug/kg	SD23	22 / 22	1.93	6.1	35		NA	18000	ca	NA	NA	N	BSL
	76448	heptachlor	1.3	J	1.3	J	ug/kg	SD28	1 / 22	1.93	6.1	1.3	J	NA	1400	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	0.58	J	8.9	J	ug/kg	SD10	19 / 22	1.93	6.1	8.9	J	NA	700	ca	NA	NA	N	BSL
	72435	methoxychlor	8.8	J	31	J	ug/kg	SD22	6 / 22	19.32	60.7	31	J	NA	390000	nc	NA	NA	N	BSL
	72548	p,p-DDD	1.4	J	33	J	ug/kg	SD30	7 / 22	3.75	11.8	33	J	NA	27000	ca	NA	NA	N	BSL
	72559	p,p-DDE	1.8	J	15	J	ug/kg	SD31	14 / 22	3.75	11.8	15	J	NA	19000	ca	NA	NA	N	BSL
	50293	p,p-DDT	2.1	J	20	J	ug/kg	SD20	9 / 22	3.75	11.8	20	J	NA	19000	ca	NA	NA	N	BSL
	11096825	PCB-1260 (Arochlor 1260)	390	J	390	J	ug/kg	SD23	1 / 22	37.5	117.9	390	J	NA	3200	ca	NA	NA	N	BSL
	83329	acenaphthene	22	J	1500		ug/kg	SD24	18 / 22	402.44	3000	1500		NA	4700000	nc	NA	NA	N	BSL
	208968	acenaphthylene	34	J	180	J	ug/kg	SD23	15 / 22	402.44	3000	180	J	NA	4700000	nc	NA	NA	N	BSL
	98862	acetophenone	29	J	42	J	ug/kg	SD19	2 / 14	402.44	3000	42	J	NA	7800000	nc	NA	NA	N	BSL
	120127	anthracene	110	J	4700		ug/kg	SD24	20 / 22	402.44	3000	4700		NA	23000000	nc	NA	NA	N	BSL
	100527	benzaldehyde	23	J	170	J	ug/kg	SD30	7 / 15	402.44	1346.9	170	J	NA	7800000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	280	J	10000		ug/kg	SD24	22 / 22	402.44	5000	10000		NA	2200	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	260	J	6300		ug/kg	SD24	22 / 22	402.44	3000	6300		NA	220	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	270	J	7900		ug/kg	SD24	22 / 22	402.44	3000	7900		NA	2200	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	130	J	2800		ug/kg	SD24	22 / 22	402.44	3000	2800		NA	2300000	nc	NA	NA	N	BSL
	207089	benzo(k)fluoranthene	260	J	4900		ug/kg	SD25	22 / 22	402.44	3000	4900		NA	22000	ca	NA	NA	N	BSL
	85687	benzyl butyl phthalate	58	J	340	J	ug/kg	SD30, SD31	15 / 22	402.44	3000	340	J	NA	16000000	nc	NA	NA	N	BSL
	92524	biphenyl (diphenyl)	32	J	180	J	ug/kg	SD24	6 / 22	402.44	3000	180	J	NA	3900000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	220	J	9900		ug/kg	SD31	20 / 20	402.44	3000	9900		NA	460000	ca	NA	NA	N	BSL
	105602	caprolactam	58	J	92	J	ug/kg	SD20	2 / 22	402.44	3000	92	J	NA	39000000	nc	NA	NA	N	BSL
	86748	carbazole	32	J	4200		ug/kg	SD24	20 / 22	402.44	3000	4200		NA	320000	ca	NA	NA	N	BSL
	218019	chrysene	320	J	11000		ug/kg	SD24	22 / 22	402.44	5000	11000		NA	220000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	71	J	1700		ug/kg	SD24	21 / 22	402.44	3000	1700		NA	220	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	18	J	1500		ug/kg	SD24	18 / 22	402.44	3000	1500		NA	NA		NA	NA	**Y**	**NSL**
	84662	diethyl phthalate	20	J	20	J	ug/kg	SD20	1 / 22	402.44	3000	20	J	NA	63000000	nc	NA	NA	N	NSL
	105679	2,4-dimethylphenol	37	J	37	J	ug/kg	SD24	1 / 22	402.44	3000	37	J	NA	1600000	nc	NA	NA	N	BSL
	131113	**dimethyl phthalate**	28	J	28	J	ug/kg	SD21	1 / 22	402.44	3000	28	J	NA	NA		NA	NA	**Y**	**NSL**
	84742	di-n-butyl phthalate	45	J	190	J	ug/kg	SD31	12 / 22	402.44	3000	190	J	NA	7800000	nc	NA	NA	N	BSL
	117840	**di-n-octylphthalate**	52	J	1000	J	ug/kg	SD26	12 / 21	402.44	3000	1000	J	NA	NA		NA	NA	**Y**	**NSL**
	206440	fluoranthene	540		25000		ug/kg	SD24	22 / 22	402.44	5000	25000		NA	3100000	nc	NA	NA	N	BSL
	86737	fluorene	40	J	1800		ug/kg	SD24	17 / 22	402.44	3000	1800		NA	3100000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	150	J	4200		ug/kg	SD24	22 / 22	402.44	3000	4200		NA	2200	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	25	J	690	J	ug/kg	SD24	13 / 22	402.44	3000	690	J	NA	310000	nc	NA	NA	N	BSL
	95487	2-methylphenol (o-cresol)	45	J	45	J	ug/kg	SD24	1 / 22	402.44	3000	45	J	NA	3900000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	120	J	5600		ug/kg	SD30	14 / 22	402.44	3000	5600		NA	390000	nc	NA	NA	N	BSL
	91203	naphthalene	12	J	1100		ug/kg	SD24	15 / 22	402.44	3000	1100		NA	1600000	nc	NA	NA	N	BSL
	85018	phenanthrene	380	J	23000		ug/kg	SD24	22 / 22	402.44	5000	23000		NA	2300000	nc	NA	NA	N	BSL
	108952	phenol	70	J	350	J	ug/kg	SD30	4 / 22	402.44	3000	350	J	NA	23000000	nc	NA	NA	N	BSL
	129000	pyrene	460		19000		ug/kg	SD24	22 / 22	402.44	5000	19000		NA	2300000	nc	NA	NA	N	BSL

Table 1.4
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Lower Darby and Lower Cobbs Creeks

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Sediment Lower Darby and Lower Cobbs Creeks	67641	acetone	25		140		ug/kg	SD30	9 / 13	12.8	45.5	140		NA	70000000	nc	NA	NA	N	BSL
	75150	carbon disulfide	0.9	J	1	J	ug/kg	SD23	2 / 16	12.8	45.5	1	J	NA	7800000	nc	NA	NA	N	BSL
	74873	**chloromethane**	0.9	J	5	J	ug/kg	SD31	8 / 16	12.8	45.5	5	J	NA	NA		NA	NA	**Y**	**NSL**
	106467	1,4-dichlorobenzene	2	J	22	J	ug/kg	SD29	5 / 12	12.8	45.5	22	J	NA	270000	ca	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	14	J	38		ug/kg	SD30	4 / 16	12.8	45.5	38		NA	47000000	nc	NA	NA	N	BSL
	108101	**methyl isobutyl ketone (4-methyl-2-pentanone)**	1	J	4	J	ug/kg	SD31	3 / 16	12.8	45.5	4	J	NA	NA		NA	NA	**Y**	**NSL**
	108883	toluene	16	J	6100		ug/kg	SD30	11 / 13	12.8	312.5	6100		NA	6300000	nc	NA	NA	N	BSL
	7429905	**aluminum**	4430000		20700000		ug/kg	SD21	22 / 22	22860	139400	20700000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	antimony	930	[]	3000	[]	ug/kg	SD29	13 / 16	15700	41800	3000	[]	NA	31000	nc	NA	NA	N	BSL
	7440382	**arsenic**	1500	[]	8100		ug/kg	SD30	22 / 22	1140	7000	8100		NA	4300	ca	NA	NA	**Y**	**ASL**
	7440393	barium	37800	[]	242000		ug/kg	SD30	22 / 22	22860	139400	242000		NA	16000000	nc	NA	NA	N	BSL
	7440417	beryllium	400	J	1100		ug/kg	SD30	7 / 12	570	2700	1100		NA	160000	nc	NA	NA	N	BSL
	7440439	cadmium	250	J	1800	[]	ug/kg	SD30	20 / 22	570	3500	1800	[]	NA	78000	nc	NA	NA	N	BSL
	7440702	calcium	1970000		13800000		ug/kg	SD30	22 / 22	571430	3484300	13800000		NA	NA		NA	NA	N	NUT
	7440473	chromium, total (as Cr+6) [6]	11900		115000		ug/kg	SD24	22 / 22	1140	7000	115000		NA	230000	nc	NA	NA	N	BSL
	7440484	**cobalt**	2600	[]	15400	[]	ug/kg	SD21	22 / 22	5710	34800	15400	[]	NA	NA		NA	NA	**Y**	**NSL**
	7440508	copper	11000	J	131000	J	ug/kg	SD20	22 / 22	2860	17400	131000	J	NA	3100000	nc	NA	NA	N	BSL
	7439896	**iron**	9310000		35400000		ug/kg	SD30	22 / 22	11430	69700	35400000		NA	23000000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	21000		411000	K	ug/kg	SD24	22 / 22	800	2100	411000	K	NA	400000		NA	NA	**Y**	**ASL**
	7439954	magnesium	2120000		11500000		ug/kg	SD20	22 / 22	571430	3484300	11500000		NA	NA		NA	NA	N	NUT
	7439965	manganese	109000		854000		ug/kg	SD21	22 / 22	1710	10500	854000		NA	1600000	nc	NA	NA	N	BSL
	7439976	mercury	80	[]	600		ug/kg	SD30	21 / 22	100	300	600		NA	7800	nc	NA	NA	N	BSL
	7440020	nickel	9000	[]	40200		ug/kg	SD30	22 / 22	4570	27900	40200		NA	1600000	nc	NA	NA	N	BSL
	7440097	potassium	901000	[]	4830000		ug/kg	SD27	22 / 22	571430	3484300	4830000		NA	NA		NA	NA	N	NUT
	7782492	selenium	1200	L[]	2800		ug/kg	SD20	5 / 15	1300	6900	2800		NA	390000	nc	NA	NA	N	BSL
	7440224	silver	430	[]	1900	[]	ug/kg	SD30	11 / 22	1140	7000	1900	[]	NA	390000	nc	NA	NA	N	BSL
	7440235	sodium	386000	K[]	937000	K[]	ug/kg	SD30	16 / 16	1305500	3484300	937000	K[]	NA	NA		NA	NA	N	NUT
	7440280	thallium	1200	J[]	3400	K[]	ug/kg	SD21	11 / 19	2600	7000	3400	K[]	NA	5500	nc	NA	NA	N	BSL
	7440622	vanadium	11000	[]	64700		ug/kg	SD30	22 / 22	5710	34800	64700		NA	78000	nc	NA	NA	N	BSL
	7440666	zinc	72200		577000	J	ug/kg	SD30	22 / 22	5200	13900	577000	J	NA	23000000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.
+= Analyte present. Actual value may be higher than reported.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). For sediment, the Residential Soil RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in sediment, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

14 Lower Darby Creek samples are in this data set, and are listed as follows:

LD-SD-SD09-0502	LD-SD-SD21-0502	LD-SD-SD22-0502	LD-SD-SD24-0502	LD-SD-SD26-0502	LDCA_SD28_1005	LDCA_SD30_1005
LD-SD-SD10-0502	LDCA_SD22_1005	LD-SD-SD23-0502	LDCA_SD25_1005	LD-SD-SD260-0502	LD-SD-SD28-0502	LD-SD-SD30-0502
		LDCA_SD24_1005	LD-SD-SD25-0502	LD-SD-SD27-0502	LD-SD-SD29-0502	LD-SD-SD31-0502

3 Lower Cobbs Creek samples are also included in this data set, and are listed as follows: LDCA_SD19_1005, LD-SD-SD19-0502, and LD-SD-SD20-0502.

Table 1.5
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Tinicum Marsh

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Sediment Tinicum Marsh	319846	alpha BHC	3.4	J	3.4	J	ug/kg	SD34	1 / 8	3.7	8.5	3.4	J	NA	1000	ca	NA	NA	N	BSL
	5103719	alpha-chlordane	6.3	J	29		ug/kg	SD34	4 / 8	3.7	8.5	29		NA	18000	ca	NA	NA	N	BSL
	60571	dieldrin	14	J	22	J	ug/kg	SD37	2 / 8	7.2	16.5	22	J	NA	400	ca	NA	NA	N	BSL
	5103742	gamma-chlordane	6.7	J	15		ug/kg	SD37	4 / 8	3.7	8.5	15		NA	18000	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	2.2	J	2.2	J	ug/kg	SD37	1 / 8	3.7	8.5	2.2	J	NA	700	ca	NA	NA	N	BSL
	72548	p,p-DDD	9.7	J	22		ug/kg	SD320	7 / 8	7.2	16.5	22		NA	27000	ca	NA	NA	N	BSL
	72559	p,p-DDE	6.4	J	22	J	ug/kg	SD320	8 / 8	7.2	16.5	22	J	NA	19000	ca	NA	NA	N	BSL
	50293	p,p-DDT	16	J	16	J	ug/kg	SD320	1 / 8	7.2	16.5	16	J	NA	19000	ca	NA	NA	N	BSL
	83329	acenaphthene	39	J	91	J	ug/kg	SD37	5 / 8	717.4	1650	91	J	NA	4700000	nc	NA	NA	N	BSL
	208968	acenaphthylene	32	J	80	J	ug/kg	SD37	5 / 8	717.4	1650	80	J	NA	4700000	nc	NA	NA	N	BSL
	98862	acetophenone	52	J	52	J	ug/kg	SD37	1 / 7	717.4	1650	52	J	NA	7800000	nc	NA	NA	N	BSL
	120127	anthracene	24	J	290	J	ug/kg	SD37	7 / 8	717.4	1650	290	J	NA	23000000	nc	NA	NA	N	BSL
	100527	benzaldehyde	27	J	100	J	ug/kg	SD35	2 / 2	717.4	1650	100	J	NA	7800000	nc	NA	NA	N	BSL
	56553	benzo(a)anthracene	120	J	1700		ug/kg	SD37	8 / 8	717.4	1650	1700		NA	2200	ca	NA	NA	N	BSL
	50328	**benzo(a)pyrene**	130	J	2000		ug/kg	SD37	8 / 8	717.4	1650	2000		NA	220	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	130	J	2700		ug/kg	SD37	8 / 8	717.4	1650	2700		NA	2200	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	210	J	1200		ug/kg	SD37	6 / 8	717.4	1650	1200		NA	2300000	nc	NA	NA	N	BSL
	207089	benzo(k)fluoranthene	110	J	1900		ug/kg	SD37	8 / 8	717.4	1650	1900		NA	22000	ca	NA	NA	N	BSL
	85687	benzyl butyl phthalate	33	J	170	J	ug/kg	SD37	6 / 8	717.4	1650	170	J	NA	16000000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	1300		2000		ug/kg	SD34	4 / 4	717.4	1650	2000		NA	460000	ca	NA	NA	N	BSL
	105602	caprolactam	48	J	110	J	ug/kg	SD36	4 / 8	717.4	1650	110	J	NA	39000000	nc	NA	NA	N	BSL
	86748	carbazole	87	J	220	J	ug/kg	SD37	4 / 8	717.4	1650	220	J	NA	320000	ca	NA	NA	N	BSL
	218019	chrysene	140	J	2400		ug/kg	SD37	8 / 8	717.4	1650	2400		NA	220000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	79	J	400	J	ug/kg	SD37	5 / 8	717.4	1650	400	J	NA	220	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	28	J	59	J	ug/kg	SD37	5 / 8	717.4	1650	59	J	NA	NA		NA	NA	**Y**	**NSL**
	84742	di-n-butyl phthalate	53	J	69	J	ug/kg	SD38	2 / 8	717.4	1650	69	J	NA	7800000	nc	NA	NA	N	BSL
	206440	fluoranthene	230	J	3600		ug/kg	SD37	8 / 8	717.4	1650	3600		NA	3100000	nc	NA	NA	N	BSL
	86737	fluorene	51	J	90	J	ug/kg	SD37	3 / 8	717.4	1650	90	J	NA	3100000	nc	NA	NA	N	BSL
	193395	indeno(1,2,3-C,D)pyrene	100	J	1500		ug/kg	SD37	8 / 8	717.4	1650	1500		NA	2200	ca	NA	NA	N	BSL
	91576	2-methylnaphthalene	34	J	59	J	ug/kg	SD34	3 / 8	717.4	1650	59	J	NA	310000	nc	NA	NA	N	BSL
	95487	2-methylphenol (o-cresol)	150	J	150	J	ug/kg	SD320	1 / 8	717.4	1650	150	J	NA	3900000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	64	J	740	J	ug/kg	SD34	4 / 8	717.4	1650	740	J	NA	390000	nc	NA	NA	N	BSL
	91203	naphthalene	36	J	82	J	ug/kg	SD34	3 / 8	717.4	1650	82	J	NA	1600000	nc	NA	NA	N	BSL
	85018	phenanthrene	110	J	1600		ug/kg	SD37	8 / 8	717.4	1650	1600		NA	2300000	nc	NA	NA	N	BSL
	129000	pyrene	230	J	3200		ug/kg	SD37	8 / 8	717.4	1650	3200		NA	2300000	nc	NA	NA	N	BSL
	67641	acetone	38		110		ug/kg	SD35	4 / 5	21.7	33.3	110		NA	70000000	nc	NA	NA	N	BSL
	75150	carbon disulfide	1	J	1	J	ug/kg	SD320	1 / 8	21.7	50	1	J	NA	7800000	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	21	J	21	J	ug/kg	SD35	1 / 8	21.7	50	21	J	NA	47000000	nc	NA	NA	N	BSL
	108883	toluene	18	J	18	J	ug/kg	SD34	1 / 4	21.7	50	18	J	NA	6300000	nc	NA	NA	N	BSL

Table 1.5
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Tinicum Marsh

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Sediment Tinicum Marsh	7429905	**aluminum**	15500000		21700000		ug/kg	SD37	8 / 8	118700	200000	21700000		NA	NA		NA	NA	**Y**	**NSL**
	7440382	**arsenic**	6400		15100		ug/kg	SD35	8 / 8	5900	10000	15100		NA	4300	ca	NA	NA	**Y**	**ASL**
	7440393	barium	145000		227000		ug/kg	SD37	8 / 8	118700	200000	227000		NA	16000000	nc	NA	NA	N	BSL
	7440439	cadmium	860	[]	1600	[]	ug/kg	SD37	4 / 8	3000	5000	1600	[]	NA	78000	nc	NA	NA	N	BSL
	7440702	calcium	3140000		10400000		ug/kg	SD37	8 / 8	2967400	5000000	10400000		NA	NA		NA	NA	N	NUT
	7440473	chromium, total (as Cr+6) [6]	42700		74300		ug/kg	SD34	8 / 8	5900	10000	74300		NA	230000	nc	NA	NA	N	BSL
	7440484	**cobalt**	10500	[]	18200	[]	ug/kg	SD35	8 / 8	29700	50000	18200	[]	NA	NA		NA	NA	**Y**	**NSL**
	7440508	copper	37500		105000	J	ug/kg	SD37	8 / 8	14800	25000	105000	J	NA	3100000	nc	NA	NA	N	BSL
	7439896	**iron**	24500000		39800000		ug/kg	SD34	8 / 8	59300	100000	39800000		NA	23000000	nc	NA	NA	**Y**	**ASL**
	7439921	lead	118000	K	237000		ug/kg	SD33	8 / 8	1800	3000	237000		NA	400000		NA	NA	N	BSL
	7439954	magnesium	4280000		10700000		ug/kg	SD37	8 / 8	2967400	5000000	10700000		NA	NA		NA	NA	N	NUT
	7439965	manganese	412000		1180000		ug/kg	SD34	8 / 8	8900	15000	1180000		NA	1600000	nc	NA	NA	N	BSL
	7439976	mercury	240	[]	430		ug/kg	SD37	3 / 8	300	500	430		NA	7800	nc	NA	NA	N	BSL
	7440020	nickel	26100		44000		ug/kg	SD320	8 / 8	23700	40000	44000		NA	1600000	nc	NA	NA	N	BSL
	7440097	potassium	1290000	[]	3550000		ug/kg	SD37	8 / 8	2967400	5000000	3550000		NA	NA		NA	NA	N	NUT
	7782492	selenium	3300	L[]	3300	L[]	ug/kg	SD37	1 / 3	3200	5000	3300	L[]	NA	390000	nc	NA	NA	N	BSL
	7440224	silver	750	[]	1400	[]	ug/kg	SD37	3 / 8	5900	10000	1400	[]	NA	390000	nc	NA	NA	N	BSL
	7440235	sodium	856000	K[]	1610000	K[]	ug/kg	SD33	8 / 8	2967400	5000000	1610000	K[]	NA	NA		NA	NA	N	NUT
	7440280	thallium	2100	L[]	3100	L[]	ug/kg	SD35	5 / 7	5900	10000	3100	L[]	NA	5500	nc	NA	NA	N	BSL
	7440622	vanadium	47300		64400		ug/kg	SD37	8 / 8	29700	50000	64400		NA	78000	nc	NA	NA	N	BSL
	7440666	zinc	136000	J	483000		ug/kg	SD37	8 / 8	11900	20000	483000		NA	23000000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). For sediment, the Residential Soil RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in sediment, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

Tinicum Marsh Sediment Samples Include:

LD-SD-SD32-0502	LD-SD-SD34-0502	LD-SD-SD37-0502
LD-SD-SD320-0502	LD-SD-SD35-0502	LD-SD-SD38-0502
LD-SD-SD33-0502	LD-SD-SD36-0502	

Table 1.6
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Leachate (Sediment)
Exposure Medium: Leachate Seeps

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Leachate Seeps	5103719	alpha-chlordane	3.6		21	J	ug/kg	LSD03	5 / 11	2.46	4	21	J	NA	18000	ca	NA	NA	N	BSL
	319857	beta BHC	2.7	J	3.5	J	ug/kg	SEEP6	2 / 11	2.46	4	3.5	J	NA	3500	ca	NA	NA	N	BSL
	319868	delta BHC	1.1	J	1.1	J	ug/kg	SEEP6	1 / 11	2.46	4	1.1	J	NA	3500	ca	NA	NA	N	BSL
	60571	dieldrin	1.7	J	60		ug/kg	LSD04	9 / 11	4.78	7.9	60		NA	400	ca	NA	NA	N	BSL
	1031078	endosulfan sulfate	3.9	J	6.2	J	ug/kg	SEEP6	2 / 11	4.78	7.9	6.2	J	NA	470000	nc	NA	NA	N	BSL
	72208	endrin	5.3	J	20	J	ug/kg	LSD04	3 / 11	4.78	7.9	20	J	NA	23000	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	2	J	18		ug/kg	LSD01	8 / 11	4.78	7.9	18		NA	23000	nc	NA	NA	N	BSL
	53494705	endrin ketone	1.7	J	54	J	ug/kg	LSD04	9 / 11	4.78	7.9	54	J	NA	23000	nc	NA	NA	N	BSL
	5103742	gamma-chlordane	0.72	J	42	J	ug/kg	LSD04	10 / 11	2.46	4	42	J	NA	18000	ca	NA	NA	N	BSL
	76448	heptachlor	0.95	J	4.4	J	ug/kg	SEEP2	5 / 11	2.46	4	4.4	J	NA	1400	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	0.95	J	3.6	J	ug/kg	SEEP2	3 / 11	2.46	4	3.6	J	NA	700	ca	NA	NA	N	BSL
	72548	p,p-DDD	1.6	J	110		ug/kg	LSD15	8 / 11	4.78	12.2	110		NA	27000	ca	NA	NA	N	BSL
	72559	p,p-DDE	1.4	J	31		ug/kg	LSD04	7 / 11	4.78	7.9	31		NA	19000	ca	NA	NA	N	BSL
	50293	p,p-DDT	2.6	J	67		ug/kg	LSD04	7 / 11	4.78	7.9	67		NA	19000	ca	NA	NA	N	BSL
	83329	acenaphthene	52	J	430	J	ug/kg	SEEP2	7 / 11	485.3	1650	430	J	NA	4700000	nc	NA	NA	N	BSL
	208968	acenaphthylene	60	J	71	J	ug/kg	LSD05	2 / 11	485.3	1650	71	J	NA	4700000	nc	NA	NA	N	BSL
	120127	anthracene	88	J	870	J	ug/kg	SEEP2	8 / 11	485.3	1650	870	J	NA	23000000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	240	J	3700		ug/kg	SEEP2	11 / 11	485.3	1650	3700		NA	2200	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	220	J	3500		ug/kg	SEEP2	11 / 11	485.3	1650	3500		NA	220	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	250	J	3800		ug/kg	SEEP2	11 / 11	485.3	1650	3800		NA	2200	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	140	J	2400		ug/kg	SEEP2	11 / 11	485.3	1650	2400		NA	2300000	nc	NA	NA	N	BSL
	207089	benzo(k)fluoranthene	250	J	3200		ug/kg	SEEP2	11 / 11	485.3	1650	3200		NA	22000	ca	NA	NA	N	BSL
	85687	benzyl butyl phthalate	100	J	100	J	ug/kg	LSD03	1 / 11	485.3	1650	100	J	NA	16000000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	290	J	3000	L	ug/kg	LSD04	6 / 6	485.3	785.7	3000	L	NA	460000	ca	NA	NA	N	BSL
	86748	carbazole	69	J	760	J	ug/kg	SEEP2	6 / 11	485.3	1650	760	J	NA	320000	ca	NA	NA	N	BSL
	218019	chrysene	330	J	4400		ug/kg	SEEP2	11 / 11	485.3	1650	4400		NA	220000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	93	J	380	J	ug/kg	SEEP3, LSD15	9 / 11	485.3	1650	380	J	NA	220	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	85	J	120	J	ug/kg	LSD02, LSD15	4 / 11	485.3	1650	120	J	NA	NA		NA	NA	**Y**	**NSL**
	84662	diethyl phthalate	120	J	120	J	ug/kg	LSD03	1 / 11	485.3	1650	120	J	NA	63000000	nc	NA	NA	N	BSL
	84742	di-n-butyl phthalate	100	J	310	J	ug/kg	LSD03	2 / 11	485.3	1650	310	J	NA	7800000	nc	NA	NA	N	BSL
	117840	**di-n-octylphthalate**	130	J	130	J	ug/kg	LSD04	1 / 11	485.3	1650	130	J	NA	NA		NA	NA	**Y**	**NSL**
	206440	fluoranthene	610		8600		ug/kg	SEEP2	11 / 11	485.3	1650	8600		NA	3100000	nc	NA	NA	N	BSL
	86737	fluorene	58	J	240	J	ug/kg	LSD02, LSD15	6 / 11	485.3	1650	240	J	NA	3100000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	160	J	2300		ug/kg	SEEP2	11 / 11	485.3	1650	2300		NA	2200	ca	NA	NA	**Y**	**ASL**
	91203	naphthalene	91	J	91	J	ug/kg	LSD02	1 / 11	485.3	1650	91	J	NA	1600000	nc	NA	NA	N	BSL
	85018	phenanthrene	340	J	5100		ug/kg	SEEP2	11 / 11	485.3	1650	5100		NA	2300000	nc	NA	NA	N	BSL
	129000	pyrene	530	J	7800		ug/kg	SEEP2	11 / 11	485.3	1650	7800		NA	2300000	nc	NA	NA	N	BSL
	67641	acetone	9	J	23		ug/kg	LSD01	5 / 7	13.33	29.37	23		NA	70000000	nc	NA	NA	N	BSL
	71432	benzene	5	J	5	J	ug/kg	LSD05	1 / 11	13.33	29.37	5	J	NA	120000	ca	NA	NA	N	BSL
	108907	chlorobenzene	2	J	24		ug/kg	LSD05	4 / 11	13.33	29.37	24		NA	1600000	nc	NA	NA	N	BSL
	110827	**cyclohexane**	2	J	2	J	ug/kg	LSD05	1 / 11	13.33	29.37	2	J	NA	NA		NA	NA	**Y**	**NSL**
	106467	1,4-dichlorobenzene	3	J	8	J	ug/kg	LSD05	4 / 11	13.33	29.37	8	J	NA	270000	ca	NA	NA	N	BSL
	100414	ethylbenzene	6	J	6	J	ug/kg	LSD04	1 / 11	13.33	29.37	6	J	NA	7800000	nc	NA	NA	N	BSL
	98828	isopropylbenzene (cumene)	3	J	12	J	ug/kg	LSD05	3 / 11	13.33	29.37	12	J	NA	7800000	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	8	J	8	J	ug/kg	LSD04	1 / 11	13.33	29.37	8	J	NA	47000000	nc	NA	NA	N	BSL
	108883	toluene	6	J	6	J	ug/kg	LSD04	1 / 11	13.33	29.37	6	J	NA	6300000	nc	NA	NA	N	BSL
	1330207	xylenes, total	2	J	20	J	ug/kg	LSD04	2 / 11	13.33	29.37	20	J	NA	16000000	nc	NA	NA	N	BSL

Table 1.6
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Leachate (Sediment)
Exposure Medium: Leachate Seeps

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Leachate Seeps	7429905	**aluminum**	7930000	J	23300000		ug/kg	LSD05	11 / 11	25610	120500	23300000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	antimony	1200	J	2200	J	ug/kg	SEEP4	5 / 5	7680	10540	2200	J	NA	31000	nc	NA	NA	N	BSL
	7440382	**arsenic**	2700		9200		ug/kg	LSD05	8 / 8	1280	3600	9200		NA	4300	ca	NA	NA	**Y**	**ASL**
	7440393	barium	97300		299000		ug/kg	LSD04	11 / 11	25610	120500	299000		NA	16000000	nc	NA	NA	N	BSL
	7440417	beryllium	330	J	1200	[]	ug/kg	LSD05	6 / 6	640	1600	1200	[]	NA	160000	nc	NA	NA	N	BSL
	7440439	cadmium	440	J	950	[]	ug/kg	LSD15	6 / 8	640	1800	950	[]	NA	78000	nc	NA	NA	N	BSL
	7440702	calcium	2360000	J	11600000	J	ug/kg	SEEP2	5 / 5	640200	878730	11600000	J	NA	NA		NA	NA	N	NUT
	7440473	chromium, total (as Cr+6) [6]	27900		65400		ug/kg	LSD05	11 / 11	1280	6000	65400		NA	230000	nc	NA	NA	N	BSL
	7440484	**cobalt**	6800	[]	13800		ug/kg	SEEP3	11 / 11	6400	30100	13800		NA	NA		NA	NA	**Y**	**NSL**
	7440508	copper	26400		153000		ug/kg	LSD04	11 / 11	3200	15100	153000		NA	3100000	nc	NA	NA	N	BSL
	57125	cyanide	1000	J	1000	J	ug/kg	SEEP2	1 / 1	4040	4040	1000	J	NA	1600000	nc	NA	NA	N	BSL
	7439896	**iron**	17100000	J	31800000		ug/kg	LSD04	11 / 11	12800	60200	31800000		NA	23000000	nc	NA	NA	**Y**	**ASL**
	7439921	lead	63700	J	335000		ug/kg	LSD04	11 / 11	1000	1800	335000		NA	400000		NA	NA	N	BSL
	7439954	magnesium	3390000	J	8350000		ug/kg	LSD04	11 / 11	640200	3012000	8350000		NA	NA		NA	NA	N	NUT
	7439965	manganese	134000	J	558000		ug/kg	LSD05	11 / 11	1920	9000	558000		NA	1600000	nc	NA	NA	N	BSL
	7439976	mercury	240		1500		ug/kg	LSD05	9 / 9	130	300	1500		NA	7800	nc	NA	NA	N	BSL
	7440020	nickel	13500	J	27700	J	ug/kg	LSD04	11 / 11	5120	24100	27700	J	NA	1600000	nc	NA	NA	N	BSL
	7440097	potassium	1580000	J	3600000	J	ug/kg	LSD04	11 / 11	640200	3012000	3600000	J	NA	NA		NA	NA	N	NUT
	7782492	selenium	1300	K[]	3400	J	ug/kg	SEEP3	7 / 11	1600	6150	3400	J	NA	390000	nc	NA	NA	N	BSL
	7440224	silver	260	[]	1000	[]	ug/kg	LSD15	3 / 11	1280	6000	1000	[]	NA	390000	nc	NA	NA	N	BSL
	7440235	sodium	479000	J	1400000		ug/kg	SEEP3	5 / 5	640200	878730	1400000		NA	NA		NA	NA	N	NUT
	7440622	vanadium	24500		55600		ug/kg	LSD05	11 / 11	6400	30100	55600		NA	78000	nc	NA	NA	N	BSL
	7440666	zinc	113000	J	520000		ug/kg	LSD04	10 / 10	6500	12000	520000		NA	23000000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). For sediment, the Residential Soil RBC was multiplied by 0.1 to account for multiple contaminants and then was multiplied by 10 to account for difference in media.
Codes used nc = noncarcinogenic, ca = carcinogenic

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in sediment, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

Leachate Seeps Sediment Samples Include:

LD-LS-LSD01-0702	LD-LS-LSD03-0702	LD-SD-SEEP2-0306	LD-SD-SEEP5-0306
LD-LS-LSD02-0702	LD-LS-LSD04-0702	LD-SD-SEEP3-0306	LD-SD-SEEP6-0306
LD-LS-LSD15-0702	LD-LS-LSD05-0702	LD-SD-SEEP4-0306	

Table 1.7
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 1 Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 1	309002	aldrin	2.3	J	15	J	ug/kg	GP251S	3 / 39	1.7	17	15	J	NA	38	ca	NA	NA	N	BSL
	319846	alpha BHC	0.27	J	2.5	J	ug/kg	GP251S	5 / 39	1.7	17	2.5	J	NA	100	ca	NA	NA	N	BSL
	5103719	alpha-chlordane	0.53	J	570	J+	ug/kg	GP239S	28 / 39	1.7	17	570	J+	NA	1800	ca	NA	NA	N	BSL
	959988	alpha endosulfan	0.36	J	820	J+	ug/kg	GP239S	17 / 39	1.7	17	820	J+	NA	47000	nc	NA	NA	N	BSL
	319857	**beta BHC**	0.34	J	1300	J+	ug/kg	GP239S	13 / 39	1.7	17	1300	J+	NA	350	ca	NA	NA	**Y**	**ASL**
	33213659	beta endosulfan	0.4	J	180	J	ug/kg	GP239S	29 / 38	3.3	33	180	J	NA	47000	nc	NA	NA	N	BSL
	319868	delta BHC	0.3	J	3.3	J	ug/kg	GP251S	10 / 39	1.7	17	3.3	J	NA	350	ca	NA	NA	N	BSL
	60571	**dieldrin**	0.54	J	3600	J+	ug/kg	GP239S	29 / 39	3.3	33	3600	J+	NA	40	ca	NA	NA	**Y**	**ASL**
	1031078	endosulfan sulfate	0.4	J	100		ug/kg	GP238S	22 / 39	3.3	33	100		NA	47000	nc	NA	NA	N	BSL
	72208	**endrin**	2.9	J	13000		ug/kg	GP239S	18 / 30	3.3	1650	13000		NA	2300	nc	NA	NA	**Y**	**ASL**
	7421934	**endrin aldehyde**	0.72	J	5700	J+	ug/kg	GP239S	27 / 38	3.3	33	5700	J+	NA	2300	nc	NA	NA	**Y**	**ASL**
	53494705	endrin ketone	0.45	J	520	J+	ug/kg	GP215S	35 / 38	3.3	33	520	J+	NA	2300	nc	NA	NA	N	BSL
	58899	gamma BHC (Lindane)	3.6	J	5.9	J	ug/kg	GP239S	5 / 38	1.7	17	5.9	J	NA	490	ca	NA	NA	N	BSL
	5103742	**gamma-chlordane**	1.1	J	6500	J+	ug/kg	GP239S	25 / 31	1.7	17	6500	J+	NA	1800	ca	NA	NA	**Y**	**ASL**
	76448	heptachlor	0.51	J	26	J	ug/kg	GP239S	4 / 39	1.7	17	26	J	NA	140	ca	NA	NA	N	BSL
	1024573	**heptachlor epoxide**	0.24	J	2000		ug/kg	GP239S	13 / 34	1.7	850	2000		NA	70	ca	NA	NA	**Y**	**ASL**
	72435	methoxychlor	0.29	J	290	J	ug/kg	GP239S	29 / 39	17	170	290	J	NA	39000	nc	NA	NA	N	BSL
	72548	p,p-DDD	0.22	J	1200	J	ug/kg	GP239S	36 / 39	3.3	64.35	1200	J	NA	2700	ca	NA	NA	N	BSL
	72559	**p,p-DDE**	0.51	J	2600		ug/kg	GP239S	31 / 39	3.3	1650	2600		NA	1900	ca	NA	NA	**Y**	**ASL**
	50293	**p,p-DDT**	2.3	J	14000		ug/kg	GP239S	34 / 34	3.3	1650	14000		NA	1900	ca	NA	NA	**Y**	**ASL**
	11097691	**PCB-1254 (Arochlor 1254)**	500	J	530	J	ug/kg	GP230S	2 / 39	32.01	33000	530	J	NA	156	nc	NA	NA	**Y**	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	44	L	280000	J	ug/kg	GP239S	28 / 38	32.34	33000	280000	J	NA	320	ca	NA	NA	**Y**	**ASL**
	11100144	**PCB-1268 (Arochlor 1268)**	550		1500		ug/kg	GP224S	2 / 37	32.01	33000	1500		NA	320	ca	NA	NA	**Y**	**ASL**
		Total 2,3,7,8-TCDD TEQ	0.469		2.3796		pg/g	GP249S	3 / 3			2.3796		NA	4.3	ca	NA	NA	N	BSL
	83329	acenaphthene	40	J	3500		ug/kg	GP219S	20 / 39	168.3	3400	3500		NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	27	J	360	J	ug/kg	GP249S	6 / 39	168.3	3400	360	J	NA	470000	nc	NA	NA	N	BSL
	98862	acetophenone	34	J	34	J	ug/kg	GP248S	1 / 39	168.3	3400	34	J	NA	780000	nc	NA	NA	N	BSL
	120127	anthracene	27	J	7500		ug/kg	GP219S	29 / 39	168.3	3400	7500		NA	2300000	nc	NA	NA	N	BSL
	100527	benzaldehyde	31	J	120	J	ug/kg	GP218S	2 / 39	168.3	3400	120	J	NA	780000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	110	J	14000		ug/kg	GP219S	37 / 39	168.3	3400	14000		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	47	J	11000		ug/kg	GP219S	39 / 39	168.3	3400	11000		NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	81	J	13000		ug/kg	GP219S	39 / 39	168.3	3400	13000		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	70	J	5400	K	ug/kg	GP227S	35 / 39	168.3	3400	5400	K	NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	36	J	6100		ug/kg	GP219S	37 / 39	168.3	3400	6100		NA	2200	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	41	J	1900	J	ug/kg	GP234S	8 / 39	168.3	3400	1900	J	NA	1600000	nc	NA	NA	N	BSL
	92524	biphenyl (diphenyl)	80	J	80	J	ug/kg	GP248S	1 / 39	168.3	3400	80	J	NA	390000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	28	J	18000		ug/kg	GP239S	19 / 34	168.3	3400	18000		NA	46000	ca	NA	NA	N	BSL
	105602	caprolactam	110	J	110	J	ug/kg	GP218S	1 / 39	168.3	3400	110	J	NA	3900000	nc	NA	NA	N	BSL
	86748	carbazole	36	J	3900		ug/kg	GP219S	23 / 39	168.3	3400	3900		NA	32000	ca	NA	NA	N	BSL
	218019	chrysene	120	J	13000		ug/kg	GP219S	37 / 39	168.3	3400	13000		NA	22000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	110	L	500	J	ug/kg	GP211S	2 / 39	168.3	3400	500	J	NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	24	J	2700		ug/kg	GP219S	15 / 39	168.3	3400	2700		NA	NA		NA	NA	**Y**	**NSL**
	84662	diethyl phthalate	22	J	22	J	ug/kg	GP238S	1 / 39	168.3	3400	22	J	NA	6300000	nc	NA	NA	N	BSL
	117840	**di-n-octylphthalate**	110	J	720	J	ug/kg	GP251S	5 / 39	168.3	3400	720	J	NA	NA		NA	NA	**Y**	**NSL**
	606202	2,6-dinitrotoluene	6800		6800		ug/kg	GP235S	1 / 39	168.3	3400	6800		NA	7800	nc	NA	NA	N	BSL
	206440	fluoranthene	200	J	27000		ug/kg	GP219S	38 / 39	168.3	3400	27000		NA	310000	nc	NA	NA	N	BSL
	86737	fluorene	50	J	4300		ug/kg	GP219S	20 / 39	168.3	3400	4300		NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	61	J	5600	K	ug/kg	GP227S	33 / 39	168.3	3400	5600	K	NA	220	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	23	J	1100	J	ug/kg	GP219S	5 / 39	168.3	3400	1100	J	NA	31000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	100	J	100	J	ug/kg	GP253S	1 / 39	168.3	3400	100	J	NA	39000	nc	NA	NA	N	BSL

Table 1.7
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 1 Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 1	91203	naphthalene	33	J	2300		ug/kg	GP219S	8 / 39	168.3	3400	2300		NA	160000	nc	NA	NA	N	BSL
	85018	phenanthrene	120	J	24000		ug/kg	GP219S	36 / 39	168.3	3400	24000		NA	230000	nc	NA	NA	N	BSL
	129000	pyrene	160	J	25000		ug/kg	GP219S	39 / 39	168.3	3400	25000		NA	230000	nc	NA	NA	N	BSL
	7429905	**aluminum**	1810000		25800000		ug/kg	GP211S	41 / 41	20530	37450	25800000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	770	J	968000	L	ug/kg	GP248S	9 / 25	6160	25350	968000	L	NA	3100	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	1700		42200		ug/kg	GP251S	41 / 41	1030	1870	42200		NA	430	ca	NA	NA	**Y**	**ASL**
	7440393	barium	26600	J	610000		ug/kg	GP227S	41 / 41	20530	37450	610000		NA	1600000	nc	NA	NA	N	BSL
	7440417	beryllium	160	J	1400		ug/kg	GP251S	41 / 41	510	940	1400		NA	16000	nc	NA	NA	N	BSL
	7440439	**cadmium**	160	J	95200		ug/kg	GP251S	32 / 35	510	940	95200		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	1440000		160000000		ug/kg	GP238S	41 / 41	534190	1646540	160000000		NA	NA		NA	NA	N	NUT
	7440473	**chromium** [6]	5900		353000	L	ug/kg	GP227S	41 / 41	1030	1870	353000	L	NA	23000	nc	NA	NA	**Y**	**ASL**
	7440484	**cobalt**	1600	J	15700		ug/kg	GP232S	41 / 41	5130	9360	15700		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	10800		2620000		ug/kg	GP248S	41 / 41	2570	4680	2620000		NA	310000	nc	NA	NA	**Y**	**ASL**
	57125	cyanide	190	J	8600	L	ug/kg	GP238S	6 / 41	2570	4680	8600	L	NA	160000	nc	NA	NA	N	BSL
	7439896	**iron**	5510000		152000000		ug/kg	GP251S	41 / 41	10270	63940	152000000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	14100		1840000		ug/kg	GP215S	41 / 41	1030	1870	1840000		NA	400000		NA	NA	**Y**	**ASL**
	7439954	magnesium	2960000		96200000		ug/kg	GP238S	41 / 41	513350	936330	96200000		NA	NA		NA	NA	N	NUT
	7439965	**manganese**	135000	L	946000	L	ug/kg	GP241S	41 / 41	1540	2810	946000	L	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	50	J	2700	J	ug/kg	GP227S	37 / 41	100	190	2700	J	NA	780	nc	NA	NA	**Y**	**ASL**
	7440020	**nickel**	5500		226000		ug/kg	GP253S	41 / 41	4110	7490	226000		NA	160000	nc	NA	NA	**Y**	**ASL**
	7440097	potassium	618000	J	4780000		ug/kg	GP226S	41 / 41	513350	936330	4780000		NA	NA		NA	NA	N	NUT
	7782492	selenium	1400	J	3800	J	ug/kg	GP248S	6 / 41	3590	6550	3800	J	NA	39000	nc	NA	NA	N	BSL
	7440224	silver	560	J	21900		ug/kg	GP248S	9 / 40	1030	1870	21900		NA	39000	nc	NA	NA	N	BSL
	7440235	sodium	403000	J	1740000		ug/kg	GP231S	8 / 8	534190	704230	1740000		NA	NA		NA	NA	N	NUT
	7440280	**thallium**	660	J	3900		ug/kg	GP251S	37 / 41	2570	4680	3900		NA	550	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	9000		93900		ug/kg	GP215S	40 / 41	5130	9360	93900		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	**zinc**	22200	L	3740000		ug/kg	GP227S	41 / 41	6160	11240	3740000		NA	2300000	nc	NA	NA	**Y**	**ASL**

Footnotes

pg/g = picograms per gram
ug/kg = micrograms per kilogram
(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
+ = Analyte present. Actual value may be higher than reported.
(2) The maximum detected concentration was used for screening.
(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.
(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)
(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.
(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

Zone 1 Surface Soil Samples Include:

LD-SS-GP211S-0106	LD-SS-GP219S-0106	LD-SS-GP226S-0106	LD-SS-GP122S-0106	LD-SS-GP121S-0106	LD-SS-GP242S-0106	LD-SS-GP248S-0106
LD-SS-GP214S-0106	LD-SS-GP220S-0106	LD-SS-GP227S-0106	LD-SS-GP232S-0106	LD-SS-GP237S-0106	LD-SS-GP243S-0106	LD-SS-GP249S-0106
LD-SS-GP215S-0106	LD-SS-GP221S-0106	LD-SS-GP228S-0106	LD-SS-GP233S-0106	LD-SS-GP238S-0106	LD-SS-GP244S-0106	LD-SS-GP250S-0106
LD-SS-GP216S-0106	LD-SS-GP222S-0106	LD-SS-GP229S-0106	LD-SS-GP234S-0106	LD-SS-GP239S-0106	LD-SS-GP245S-0106	LD-SS-GP251S-0106
LD-SS-GP217S-0106	LD-SS-GP224S-0106	LD-SS-GP230S-0106	LD-SS-GP235S-0106	LD-SS-GP240S-0106	LD-SS-GP120S-0106	LD-SS-GP253S-0106
LD-SS-GP218S-0106	LD-SS-GP225S-0106	LD-SS-GP231S-0106	LD-SS-GP236S-0106	LD-SS-GP241S-0106	LD-SS-GP246S-0106	

Table 1.8
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 2 Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 2	309002	**aldrin**	7.2		110	J	ug/kg	GP37S	5 / 49	1.8	16.95	110	J	NA	38	ca	NA	NA	**Y**	**ASL**
	5103719	alpha-chlordane	1.9	J	23	J	ug/kg	GP21S	13 / 49	1.8	16.95	23	J	NA	1800	ca	NA	NA	N	BSL
	319857	beta BHC	2.5	J	16	J	ug/kg	GP21S	3 / 49	1.8	16.95	16	J	NA	350	ca	NA	NA	N	BSL
	319868	delta BHC	1.8	J	1.8	J	ug/kg	GP33S	1 / 49	1.8	16.95	1.8	J	NA	350	ca	NA	NA	N	BSL
	60571	**dieldrin**	5.2	J	93		ug/kg	GP90S	3 / 49	3.5	37.8	93		NA	40	ca	NA	NA	**Y**	**ASL**
	1031078	endosulfan sulfate	3.8	J	6.9	J	ug/kg	GP81S	3 / 49	3.5	37.8	6.9	J	NA	47000	nc	NA	NA	N	BSL
	72208	endrin	37	J	290	J	ug/kg	GP34S	2 / 48	3.5	37.8	290	J	NA	2300	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	8.3		28		ug/kg	GP21S	2 / 49	3.5	37.8	28		NA	2300	nc	NA	NA	N	BSL
	53494705	endrin ketone	5.1	J	36		ug/kg	GP91S	6 / 49	3.5	37.8	36		NA	2300	nc	NA	NA	N	BSL
	5103742	gamma-chlordane	0.52	J	280	J	ug/kg	GP34S	21 / 49	1.8	16.95	280	J	NA	1800	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	19	J	31	J	ug/kg	GP37S	3 / 49	1.8	16.95	31	J	NA	70	ca	NA	NA	N	BSL
	72435	methoxychlor	15	J	460	J	ug/kg	GP34S	3 / 49	18.1	169.5	460	J	NA	39000	nc	NA	NA	N	BSL
	72548	p,p-DDD	2.9	J	470		ug/kg	GP34S	13 / 49	3.5	37.8	470		NA	2700	ca	NA	NA	N	BSL
	72559	p,p-DDE	3	J	130	J	ug/kg	GP34S	14 / 49	3.5	37.8	130	J	NA	1900	ca	NA	NA	N	BSL
	50293	p,p-DDT	2.6	J	610	J	ug/kg	GP34S	16 / 48	3.5	37.8	610	J	NA	1900	ca	NA	NA	N	BSL
		PCB-1242 (Arochlor 1242)	79	J	1700		ug/kg	GP21S	3 / 49	32.34	329	1700		NA	320	ca	NA	NA	**Y**	**ASL**
	11097691	**PCB-1254 (Arochlor 1254)**	35	J	6100		ug/kg	GP37S	6 / 49	32.34	329	6100		NA	156	nc	NA	NA	**Y**	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	15	J	31000	J	ug/kg	GP34S	23 / 49	32.34	3290	31000	J	NA	320	ca	NA	NA	**Y**	**ASL**
	83329	acenaphthene	44	J	1200	J	ug/kg	GP31S	10 / 49	170	3247	1200	J	NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	51	J	270	J	ug/kg	GP18S	4 / 49	170	3247	270	J	NA	470000	nc	NA	NA	N	BSL
	120127	anthracene	39	J	1700	J	ug/kg	GP18S	20 / 49	170	3247	1700	J	NA	2300000	nc	NA	NA	N	BSL
	100527	benzaldehyde	46	J	50	J	ug/kg	GP247S	2 / 49	170	3247	50	J	NA	780000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	43	J	5700		ug/kg	GP18S	38 / 49	170	3247	5700		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	41	J	4000		ug/kg	GP18S	38 / 49	170	3247	4000		NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	40	J	3300		ug/kg	GP18S	38 / 49	170	3247	3300		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	40	J	2900		ug/kg	GP31S	34 / 49	170	3247	2900		NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	38	J	4000		ug/kg	GP18S	37 / 49	170	3247	4000		NA	2200	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	75	J	2500		ug/kg	GP34S	2 / 49	170	3247	2500		NA	1600000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	68	J	29000		ug/kg	GP30S	20 / 30	170	3247	29000		NA	46000	ca	NA	NA	N	BSL
	86748	carbazole	39	J	490	J	ug/kg	GP67S	12 / 49	170	3247	490	J	NA	32000	ca	NA	NA	N	BSL
	218019	chrysene	49	J	5700		ug/kg	GP18S	38 / 49	170	3247	5700		NA	22000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	81	J	1400	J	ug/kg	GP31S	11 / 49	170	3247	1400	J	NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	54	J	390	J	ug/kg	GP67S	5 / 49	170	3247	390	J	NA	NA		NA	NA	**Y**	**NSL**
	84742	di-n-butyl phthalate	42	J	500	J	ug/kg	GP34S	4 / 48	170	3247	500	J	NA	780000	nc	NA	NA	N	BSL
	206440	fluoranthene	42	J	11000		ug/kg	GP18S	38 / 46	170	3247	11000		NA	310000	nc	NA	NA	N	BSL
	86737	fluorene	42	J	670	J	ug/kg	GP31S	10 / 49	170	3247	670	J	NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	42	J	2900		ug/kg	GP31S	32 / 49	170	3247	2900		NA	220	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	43	J	350	J	ug/kg	GP31S	7 / 49	170	3247	350	J	NA	31000	nc	NA	NA	N	BSL
	91203	naphthalene	37	J	520	J	ug/kg	GP67S	7 / 46	170	3247	520	J	NA	160000	nc	NA	NA	N	BSL
	85018	phenanthrene	40	J	6900		ug/kg	GP31S	35 / 44	170	3247	6900		NA	230000	nc	NA	NA	N	BSL
	129000	pyrene	43	J	9900		ug/kg	GP18S	40 / 47	170	3247	9900		NA	230000	nc	NA	NA	N	BSL

Table 1.8
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 2 Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 2	7429905	**aluminum**	1360000		28600000		ug/kg	GP247S	49 / 49	21200	49400	28600000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	400	J	10000	J	ug/kg	GP35S	9 / 40	6400	7100	10000	J	NA	3100	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	1400		15200		ug/kg	GP32S	48 / 49	1100	3700	15200		NA	430	ca	NA	NA	**Y**	**ASL**
	7440393	barium	11300	J	281000		ug/kg	GP35S	49 / 49	21200	49400	281000		NA	1600000	nc	NA	NA	N	BSL
	7440417	beryllium	110	J	1200		ug/kg	GP247S	32 / 32	500	1200	1200		NA	16000	nc	NA	NA	N	BSL
	7440439	cadmium	140	J	5800		ug/kg	GP96S	22 / 45	500	600	5800		NA	7800	nc	NA	NA	N	BSL
	7440702	calcium	364000	J	41100000		ug/kg	GP39S	49 / 49	530200	1234600	41100000		NA	NA		NA	NA	N	NUT
	7440473	**chromium** [6]	4800		67700	K	ug/kg	GP21S	48 / 48	1100	2500	67700	K	NA	23000	nc	NA	NA	**Y**	**ASL**
	7440484	**cobalt**	2500	J	15300		ug/kg	GP34S	49 / 49	5300	12300	15300		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	4200		366000		ug/kg	GP35S	49 / 49	2600	6200	366000		NA	310000	nc	NA	NA	**Y**	**ASL**
	7439896	**iron**	3930000		47900000		ug/kg	GP33S	49 / 49	10600	24700	47900000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	4600		8540000	J	ug/kg	GP21S	49 / 49	1100	2500	8540000	J	NA	400000		NA	NA	**Y**	**ASL**
	7439954	magnesium	582000	J	23900000		ug/kg	GP39S	49 / 49	530200	1234600	23900000		NA	NA		NA	NA	N	NUT
	7439965	**manganese**	85000	J	668000	K	ug/kg	GP19S	49 / 49	1600	3700	668000	K	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	10	J	3200		ug/kg	GP21S	41 / 46	100	120	3200		NA	780	nc	NA	NA	**Y**	**ASL**
	7440020	nickel	3700	J	41400		ug/kg	GP33S	49 / 49	4200	9900	41400		NA	160000	nc	NA	NA	N	BSL
	7440097	potassium	239000	J	4980000	J	ug/kg	GP36S	49 / 49	530200	1234600	4980000	J	NA	NA		NA	NA	N	NUT
	7782492	selenium	1000	J	2300	J	ug/kg	GP247S	3 / 48	3700	8600	2300	J	NA	39000	nc	NA	NA	N	BSL
	7440224	silver	60	J	4000	L	ug/kg	GP81S	10 / 46	1100	2500	4000	L	NA	39000	nc	NA	NA	N	BSL
	7440235	sodium	60000	J	1380000		ug/kg	GP18S	23 / 39	543500	1123600	1380000		NA	NA		NA	NA	N	NUT
	7440280	**thallium**	780	J	1600	J	ug/kg	GP98S	4 / 49	2600	6200	1600	J	NA	550	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	3800	J	60800		ug/kg	GP247S	49 / 49	5300	12300	60800		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	zinc	20000		1110000		ug/kg	GP21S	49 / 49	6400	14800	1110000		NA	2300000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

Zone 2 Surface Soil Samples Include:

LD-SS-GP01S-0203	LD-SS-GP19S-0403	LD-SS-GP26S-0403	LD-SS-GP32S-0403	LD-SS-GP39S-0403	LD-SS-GP85S-0704	LD-SS-GP93S-0704
LD-SS-GPD01S-0203	LD-SS-GP20S-0403	LD-SS-GP27S-0403	LD-SS-GP33S-0403	LD-SS-GP40S-0403	LD-SS-GP87S-0704	LD-SS-GP94S-0704
LD-SS-GP04S-0203	LD-SS-GP21S-0403	LD-SS-GP28S-0403	LD-SS-GP34S-0403	LD-SS-GP41S-0403	LD-SS-GP88S-0704	LD-SS-GP95S-0704
LD-SS-GP09S-0403	LD-SS-GP22S-0403	LD-SS-GP29S-0403	LD-SS-GP35S-0403	LD-SS-GP67S-0403	LD-SS-GP89S-0704	LD-SS-GP96S-0704
LD-SS-GP10S-0403	LD-SS-GP23S-0403	LD-SS-GP30S-0403	LD-SS-GP36S-0403	LD-SS-GP80S-0403	LD-SS-GP90S-0704	LD-SS-GP113S-0704
LD-SS-GP13S-0403	LD-SS-GP24S-0403	LD-SS-GPD05S-0403	LD-SS-GP37S-0403	LD-SS-GPD04S-0403	LD-SS-GP91S-0704	LD-SS-GP98S-0704
LD-SS-GP18S-0403	LD-SS-GP25S-0403	LD-SS-GP31S-0403	LD-SS-GP38S-0403	LD-SS-GP81S-0403	LD-SS-GP92S-0704	LD-SS-GP247S-0106

Table 1.9
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 3

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 3	5103719	alpha-chlordane	7.1		7.1		ug/kg	GP108S	1 / 25	1.9	2.1	7.1		NA	1800	ca	NA	NA	N	BSL
	7421934	endrin aldehyde	3.7		3.7		ug/kg	GP017S	1 / 25	3.6	4.1	3.7		NA	2300	nc	NA	NA	N	BSL
	53494705	endrin ketone	24		24		ug/kg	GP109S	1 / 25	3.6	4.1	24		NA	2300	nc	NA	NA	N	BSL
	5103742	gamma-chlordane	5.1	J	7.3	J	ug/kg	GP109S	2 / 25	1.9	2.1	7.3	J	NA	1800	ca	NA	NA	N	BSL
	72548	p,p-DDD	3.7	J	9		ug/kg	GP012S	5 / 25	3.6	4.1	9		NA	2700	ca	NA	NA	N	BSL
	72559	p,p-DDE	3.9		6.7	J	ug/kg	GP002S	4 / 25	3.6	4.1	6.7	J	NA	1900	ca	NA	NA	N	BSL
	50293	p,p-DDT	4.1	J	11	J	ug/kg	GP007S	3 / 25	3.6	4.1	11	J	NA	1900	ca	NA	NA	N	BSL
	11096825	**PCB-1260 (Arochlor 1260)**	35	J	370		ug/kg	GP109S	4 / 25	36	41	370		NA	320	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	46	J	270	J	ug/kg	GP002S	6 / 26	370	1900	270	J	NA	31000	nc	NA	NA	N	BSL
	83329	acenaphthene	51	J	560	J	ug/kg	GP108S	2 / 26	370	1900	560	J	NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	180	J	570	J	ug/kg	GP106S	4 / 26	370	1900	570	J	NA	470000	nc	NA	NA	N	BSL
	98862	acetophenone	40	J	40	J	ug/kg	GP006S	1 / 26	370	1900	40	J	NA	780000	nc	NA	NA	N	BSL
	120127	anthracene	39	J	1200	J	ug/kg	GP108S	8 / 26	370	1900	1200	J	NA	2300000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	48	J	3800		ug/kg	GP106S	18 / 26	370	1900	3800		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	66	J	3600		ug/kg	GP106S	17 / 26	370	1900	3600		NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	48	J	3200		ug/kg	GP106S	17 / 26	370	1900	3200		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	55	J	2500		ug/kg	GP106S	14 / 26	370	1900	2500		NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	48	J	3400		ug/kg	GP106S	16 / 26	370	1900	3400		NA	2200	ca	NA	NA	**Y**	**ASL**
	117817	bis(2-ethylhexyl) phthalate	58	J	1500		ug/kg	GP103S	12 / 15	370	1900	1500		NA	46000	ca	NA	NA	N	BSL
	86748	carbazole	51	J	780	J	ug/kg	GP108S	3 / 26	370	1900	780	J	NA	32000	ca	NA	NA	N	BSL
	218019	chrysene	45	J	4500		ug/kg	GP106S	18 / 26	370	1900	4500		NA	22000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	48	J	1000		ug/kg	GP106S	7 / 26	370	1900	1000		NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	41	J	370	J	ug/kg	GP108S	2 / 26	370	1900	370	J	NA	NA		NA	NA	**Y**	**NSL**
	206440	fluoranthene	70	J	5300	J	ug/kg	GP108S	18 / 26	370	1900	5300	J	NA	310000	nc	NA	NA	N	BSL
	86737	fluorene	38	J	570	J	ug/kg	GP108S	3 / 26	370	1900	570	J	NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	50	J	2600		ug/kg	GP106S	14 / 26	370	1900	2600		NA	220	ca	NA	NA	**Y**	**ASL**
	91203	naphthalene	41	J	200	J	ug/kg	GP108S	5 / 24	370	1900	200	J	NA	160000	nc	NA	NA	N	BSL
	87865	pentachlorophenol	98	J	98	J	ug/kg	GP003S	1 / 26	370	1900	98	J	NA	5300	ca	NA	NA	N	BSL
	85018	phenanthrene	44	J	2200		ug/kg	GP106S	16 / 23	370	1900	2200		NA	230000	nc	NA	NA	N	BSL
	129000	pyrene	62	J	5600		ug/kg	GP106S	18 / 26	370	1900	5600		NA	230000	nc	NA	NA	N	BSL

Table 1.9
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Zone 3

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface Soil Zone 3	7429905	**aluminum**	3030000		15000000		ug/kg	GP101S	26 / 26	22000	49000	15000000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	14000		14000		ug/kg	GP005S	1 / 12	6500	15000	14000		NA	3100	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	2000		20300		ug/kg	GP102S	26 / 26	1100	3700	20300		NA	430	ca	NA	NA	**Y**	**ASL**
	7440393	barium	21900	J	124000		ug/kg	GP102S	26 / 26	22000	49000	124000		NA	1600000	nc	NA	NA	N	BSL
	7440417	beryllium	180	J	1600	K	ug/kg	GP006S	19 / 19	500	1200	1600	K	NA	16000	nc	NA	NA	N	BSL
	7440439	cadmium	440	J	6700		ug/kg	GP101S	10 / 20	500	1200	6700		NA	7800	nc	NA	NA	N	BSL
	7440702	calcium	495000	J	4810000	J	ug/kg	GP108S	26 / 26	540000	1200000	4810000	J	NA	NA		NA	NA	N	NUT
	7440473	**chromium** [6]	8500		53200		ug/kg	GP102S	25 / 25	1100	2500	53200		NA	23000	nc	NA	NA	**Y**	**ASL**
	7440484	**cobalt**	3500	J	17700		ug/kg	GP014S	26 / 26	5400	12000	17700		NA	NA		NA	NA	**Y**	**NSL**
	7440508	copper	6700		42700		ug/kg	GP102S	26 / 26	2700	6200	42700		NA	310000	nc	NA	NA	N	BSL
	57125	cyanide	70	J	70	J	ug/kg	GP012S	1 / 22	600	3200	70	J	NA	160000	nc	NA	NA	N	BSL
	7439896	**iron**	6830000		38000000		ug/kg	GP006S	26 / 26	11000	25000	38000000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439921	lead	5200	J	124000	J	ug/kg	GP012S	26 / 26	1100	2500	124000	J	NA	400000		NA	NA	N	BSL
	7439954	magnesium	891000		3960000		ug/kg	GP102S	26 / 26	540000	1200000	3960000		NA	NA		NA	NA	N	NUT
	7439965	**manganese**	90500	K	730000	K	ug/kg	GP006S	26 / 26	1600	3700	730000	K	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439965	mercury	10	J	320		ug/kg	GP002S	20 / 26	110	130	320		NA	780	nc	NA	NA	N	BSL
	7440020	nickel	4300	J	21400		ug/kg	GP102S	26 / 26	4300	9900	21400		NA	160000	nc	NA	NA	N	BSL
	7440097	potassium	401000	J	1970000	J	ug/kg	GP101S	26 / 26	540000	1200000	1970000	J	NA	NA		NA	NA	N	NUT
	7440224	silver	60	J	370	J	ug/kg	GP102S	8 / 26	1100	2500	370	J	NA	39000	nc	NA	NA	N	BSL
	7440235	sodium	143000	J	905000		ug/kg	GP110S	15 / 16	540000	1200000	905000		NA	NA		NA	NA	N	NUT
	7440622	**vanadium**	6700		47300		ug/kg	GP101S	26 / 26	5400	12000	47300		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	zinc	19700		202000		ug/kg	GP102S	26 / 26	6500	15000	202000		NA	2300000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

Zone 3 Surface Soil Samples Include:

LD-SS-GP02S-0203	LD-SS-GPD02S-0403	LD-SS-GP102S-0704	LD-SS-GP110S-0704
LD-SS-GP03S-0203	LD-SS-GP15S-0403	LD-SS-GP111S-0704	LD-SS-GP112S-0704
LD-SS-GP05S-0203	LD-SS-GP16S-0403	LD-SS-GP103S-0704	LD-SB-GP112D-0704*
LD-SS-GP06S-0203	LD-SS-GP17S-0403	LD-SS-GP104S-0704	
LD-SS-GP07S-0403	LD-SS-GP82S-0704	LD-SS-GP105S-0704	
LD-SS-GP08S-0403	LD-SS-GP83S-0704	LD-SS-GP106S-0704	
LD-SS-GP11S-0403	LD-SS-GP84S-0704	LD-SS-GP107S-0704	
LD-SS-GP12S-0403	LD-SS-GP86S-0704	LD-SS-GP108S-0704	
LD-SS-GP14S-0403	LD-SS-GP101S-0704	LD-SS-GP109S-0704	

*Indicates this sample was used for the Occurrence, Distribution, and Selection of COPCs table, but was not used to determine UCLs.

Table 1.10
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 1

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 1	309002	aldrin	2.3	J	15	J	ug/kg	GP239S	3 / 39	1.7	17	15	J	NA	38	ca	NA	NA	N	BSL
	319846	alpha BHC	0.27	J	2.5	J	ug/kg	GP251S	5 / 39	1.7	17	2.5	J	NA	100	ca	NA	NA	N	BSL
	5103719	alpha-chlordane	0.53	J	570	J+	ug/kg	GP239S	28 / 39	1.7	17	570	J+	NA	1800	ca	NA	NA	N	BSL
	959988	alpha endosulfan	0.36	J	820	J+	ug/kg	GP239S	17 / 39	1.7	17	820	J+	NA	47000	nc	NA	NA	N	BSL
	1912249	atrazine	170	J	170	J	ug/kg	GP238D	1 / 100	166.6	10200	170	J	NA	2900	ca	NA	NA	N	BSL
	319857	**beta BHC**	0.34	J	1300	J+	ug/kg	GP239S	13 / 39	1.7	17	1300	J+	NA	350	ca	NA	NA	**Y**	**ASL**
	33213659	beta endosulfan	0.4	J	180	J	ug/kg	GP239S	29 / 38	3.3	33	180	J	NA	47000	nc	NA	NA	N	BSL
	319868	delta BHC	0.3	J	3.3	J	ug/kg	GP251S	10 / 39	1.7	17	3.3	J	NA	350	ca	NA	NA	N	BSL
	60571	**dieldrin**	0.54	J	3600	J+	ug/kg	GP239S	29 / 39	3.3	33	3600	J+	NA	40	ca	NA	NA	**Y**	**ASL**
	1031078	endosulfan sulfate	0.4	J	100		ug/kg	GP238S	22 / 39	3.3	33	100		NA	47000	nc	NA	NA	N	BSL
	72208	**endrin**	2.9	J	13000		ug/kg	GP239S	18 / 30	3.3	1650	13000		NA	2300	nc	NA	NA	**Y**	**ASL**
	7421934	**endrin aldehyde**	0.72	J	5700	J+	ug/kg	GP239S	27 / 38	3.3	33	5700	J+	NA	2300	nc	NA	NA	**Y**	**ASL**
	53494705	endrin ketone	0.45	J	520	J+	ug/kg	GP215S	35 / 38	3.3	33	520	J+	NA	2300	nc	NA	NA	N	BSL
	58899	gamma BHC (Lindane)	3.6	J	5.9	J	ug/kg	GP239S	5 / 38	1.7	17	5.9	J	NA	490	ca	NA	NA	N	BSL
	5103742	**gamma-chlordane**	1.1	J	6500	J+	ug/kg	GP239S	25 / 31	1.7	17	6500	J+	NA	1800	ca	NA	NA	**Y**	**ASL**
	76448	heptachlor	0.51	J	26	J	ug/kg	GP239S	4 / 39	1.7	17	26	J	NA	140	ca	NA	NA	N	BSL
	1024573	**heptachlor epoxide**	0.24	J	2000		ug/kg	GP239S	13 / 34	1.7	850	2000		NA	70	ca	NA	NA	**Y**	**ASL**
	72435	methoxychlor	0.29	J	290	J	ug/kg	GP239S	29 / 39	17	170	290	J	NA	39000	nc	NA	NA	N	BSL
	72548	p,p-DDD	0.22	J	1200	J	ug/kg	GP239S	36 / 39	3.3	64.35	1200	J	NA	2700	ca	NA	NA	N	BSL
	72559	**p,p-DDE**	0.51	J	2600		ug/kg	GP239S	31 / 39	3.3	1650	2600		NA	1900	ca	NA	NA	**Y**	**ASL**
	50293	**p,p-DDT**	2.3	J	14000		ug/kg	GP239S	34 / 34	3.3	1650	14000		NA	1900	ca	NA	NA	**Y**	**ASL**
	11097691	**PCB-1254 (Arochlor 1254)**	500	J	530	J	ug/kg	GP230S	2 / 72	32.01	33000	530	J	NA	156	nc	NA	NA	**Y**	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	28	J	2100000		ug/kg	GP245M	56 / 72	32.01	321420	2100000		NA	320	ca	NA	NA	**Y**	**ASL**
	11100144	**PCB-1268 (Arochlor 1268)**	550		1500		ug/kg	GP224S	2 / 72	32.01	33000	1500		NA	320	ca	NA	NA	**Y**	**ASL**
		Total 2,3,7,8-TCDD TEQ	0.469		49.96		pg/g	GP120D	6 / 6			49.96		NA	4.3	ca	NA	NA	**Y**	**ASL**
	83329	acenaphthene	27	J	21000		ug/kg	GP218D	63 / 100	166.6	10200	21000		NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	23	J	1000	J	ug/kg	GP121D	16 / 100	166.6	10200	1000	J	NA	470000	nc	NA	NA	N	BSL
	98862	acetophenone	21	J	1100	J	ug/kg	GP121D	6 / 100	166.6	10200	1100	J	NA	780000	nc	NA	NA	N	BSL
	120127	anthracene	24	J	68000		ug/kg	GP218D	79 / 100	166.6	10200	68000		NA	2300000	nc	NA	NA	N	BSL
	100527	benzaldehyde	29	J	140	J	ug/kg	GP240D	8 / 100	166.6	10200	140	J	NA	780000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	93	J	130000		ug/kg	GP218D	93 / 100	166.6	10200	130000		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	47	J	110000		ug/kg	GP218D	97 / 100	166.6	10200	110000		NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	81	J	37000		ug/kg	GP228M	97 / 100	166.6	10200	37000		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	39	J	57000		ug/kg	GP218D	86 / 100	166.6	10200	57000		NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	36	J	51000		ug/kg	GP218D	87 / 100	166.6	10200	51000		NA	2200	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	41	J	3900		ug/kg	GP241M	21 / 100	166.6	10200	3900		NA	1600000	nc	NA	NA	N	BSL
	92524	biphenyl (diphenyl)	80	J	2900	J	ug/kg	GP245M	6 / 100	166.6	10200	2900	J	NA	390000	nc	NA	NA	N	BSL
	111911	**bis(2-chloroethoxy) methane**	650	J	650	J	ug/kg	GP121D	1 / 100	166.6	10200	650	J	NA	NA		NA	NA	**Y**	**NSL**
	111444	**bis(2-chloroethyl) ether**	660		660		ug/kg	GP244D	1 / 77	166.6	10200	660		NA	580	ca	NA	NA	**Y**	**ASL**
	117817	**bis(2-ethylhexyl) phthalate**	28	J	290000		ug/kg	GP120M	58 / 86	166.6	10200	290000		NA	46000	ca	NA	NA	**Y**	**ASL**
	105602	caprolactam	110	J	10000		ug/kg	GP121D	2 / 100	166.6	10200	10000		NA	3900000	nc	NA	NA	N	BSL
	86748	carbazole	28	J	14000		ug/kg	GP218D	58 / 100	166.6	10200	14000		NA	32000	ca	NA	NA	N	BSL
	218019	**chrysene**	110	J	120000		ug/kg	GP218D	95 / 100	166.6	10200	120000		NA	22000	ca	NA	NA	**Y**	**ASL**
	59507	**4-chloro-3-methylphenol**	320	J	320	J	ug/kg	GP231M	1 / 100	166.6	10200	320	J	NA	NA		NA	NA	**Y**	**NSL**
	106478	4-chloroaniline	750	J	800	J	ug/kg	GP243M	2 / 99	166.6	10200	800	J	NA	31000	nc	NA	NA	N	BSL

Table 1.10
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 1

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 1	53703	**dibenz(a,h)anthracene**	31	J	2000		ug/kg	GP243M	7 / 100	166.6	10200	2000		NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	24	J	20000		ug/kg	GP218D	48 / 100	166.6	10200	20000		NA	NA		NA	NA	**Y**	**NSL**
	91941	3,3-dichlorobenzidine	640	J	710	J	ug/kg	GP121D	2 / 99	166.6	10200	710	J	NA	1400	ca	NA	NA	N	BSL
	84662	diethyl phthalate	22	J	6500		ug/kg	GP220M	4 / 100	166.6	10200	6500		NA	6300000	nc	NA	NA	N	BSL
	105679	2,4-dimethylphenol	120	J	120	J	ug/kg	GP222M	1 / 100	166.6	10200	120	J	NA	160000	nc	NA	NA	N	BSL
	131113	**dimethyl phthalate**	160	J	4200	J	ug/kg	GP121D	3 / 100	166.6	10200	4200	J	NA	NA		NA	NA	**Y**	**NSL**
	84742	di-n-butyl phthalate	700		700		ug/kg	GP240D	1 / 59	168.3	10200	700		NA	780000	nc	NA	NA	N	BSL
	117840	**di-n-octylphthalate**	110	J	920	J	ug/kg	GP217M	8 / 100	168.3	10200	920	J	NA	NA		NA	NA	**Y**	**NSL**
	534521	**4,6-dinitro-2-methylphenol**	1600	J	1600	J	ug/kg	GP121D	1 / 100	323.4	19800	1600	J	NA	NA		NA	NA	**Y**	**NSL**
	51285	2,4-dinitrophenol	790	J	790	J	ug/kg	GP121D	1 / 99	323.4	19800	790	J	NA	16000	nc	NA	NA	N	BSL
	121142	2,4-dinitrotoluene	970	J	970	J	ug/kg	GP121D	1 / 100	166.6	10200	970	J	NA	16000	nc	NA	NA	N	BSL
	606202	2,6-dinitrotoluene	770	J	6800		ug/kg	GP235S	2 / 100	166.6	10200	6800		NA	7800	nc	NA	NA	N	BSL
	206440	**fluoranthene**	200	J	360000		ug/kg	GP218D	97 / 100	166.6	33830	360000		NA	310000	nc	NA	NA	**Y**	**ASL**
	86737	fluorene	31	J	35000		ug/kg	GP218D	64 / 100	166.6	10200	35000		NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	61	J	57000		ug/kg	GP218D	83 / 100	166.6	10200	57000		NA	220	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	23	J	6500	J	ug/kg	GP121D	38 / 100	166.6	10200	6500	J	NA	31000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	31	J	740	J	ug/kg	GP228M	5 / 100	166.6	10200	740	J	NA	39000	nc	NA	NA	N	BSL
	91203	naphthalene	33	J	4800		ug/kg	GP246D	42 / 100	166.6	10200	4800		NA	160000	nc	NA	NA	N	BSL
	99092	**3-nitroaniline**	650	J	650	J	ug/kg	GP121D	1 / 99	323.4	19800	650	J	NA	NA		NA	NA	**Y**	**NSL**
	100016	**4-nitroaniline**	640	J	640	J	ug/kg	GP121D	1 / 99	323.4	19800	640	J	NA	NA		NA	NA	**Y**	**NSL**
	98953	nitrobenzene	1400	J	1400	J	ug/kg	GP121D	1 / 100	166.6	10200	1400	J	NA	3900	nc	NA	NA	N	BSL
	100027	**4-nitrophenol**	660	J	660	J	ug/kg	GP121D	1 / 99	323.4	19800	660	J	NA	NA		NA	NA	**Y**	**NSL**
	86306	n-nitrosodiphenylamine	170	J	21000		ug/kg	GP218D	3 / 100	166.6	10200	21000		NA	130000	ca	NA	NA	N	BSL
	85018	**phenanthrene**	120	J	310000		ug/kg	GP218D	94 / 100	166.6	10200	310000		NA	230000	nc	NA	NA	**Y**	**ASL**
	108952	phenol	32	J	550	J	ug/kg	GP230D	3 / 100	166.6	10200	550	J	NA	2300000	nc	NA	NA	N	BSL
	129000	**pyrene**	160	J	290000		ug/kg	GP218D	98 / 100	166.6	33830	290000		NA	230000	nc	NA	NA	**Y**	**ASL**
	95943	1,2,4,5-tetrachlorobenzene	280	J	1200	J	ug/kg	GP245M	2 / 100	166.6	10200	1200	J	NA	2300	nc	NA	NA	N	BSL
	67641	acetone	21		410	L	ug/kg	GP240D	33 / 33	4.45	27	410	L	NA	7000000	nc	NA	NA	N	BSL
	71432	benzene	0.67	J	24	L	ug/kg	GP236M	23 / 45	3.7	25	24	L	NA	12000	ca	NA	NA	N	BSL
	75150	carbon disulfide	0.63	J	44		ug/kg	GP240D	16 / 31	3.7	13.5	44		NA	780000	nc	NA	NA	N	BSL
	108907	chlorobenzene	1.1	J	3200		ug/kg	GP121M	19 / 47	3.7	234.5	3200		NA	160000	nc	NA	NA	N	BSL
	67663	chloroform	0.66	J	7		ug/kg	GP244D	6 / 44	3.7	25	7		NA	78000	nc	NA	NA	N	BSL
	110827	**cyclohexane**	1.7	J	57	L	ug/kg	GP236D	5 / 44	3.7	25	57	L	NA	NA		NA	NA	**Y**	**NSL**
	96128	1,2-dibromo-3-chloropropane	0.78	J	0.78	J	ug/kg	GP216M	1 / 45	3.7	25	0.78	J	NA	200	ca	NA	NA	N	BSL
	95501	1,2-dichlorobenzene	0.59	J	26	J	ug/kg	GP220M	15 / 50	3.7	25	26	J	NA	700000	nc	NA	NA	N	BSL
	541731	1,3-dichlorobenzene	0.69	J	87	L	ug/kg	GP240D	15 / 47	3.7	25	87	L	NA	23000	nc	NA	NA	N	BSL
	106467	1,4-dichlorobenzene	1.2	J	64	L	ug/kg	GP240D	19 / 47	3.7	25	64	L	NA	27000	ca	NA	NA	N	BSL
	107062	1,2-dichloroethane	0.88	J	0.88	J	ug/kg	GP236M	1 / 44	3.7	25	0.88	J	NA	7000	ca	NA	NA	N	BSL
	75354	1,1-dichloroethene	1.1	J	4.5	J	ug/kg	GP122M	2 / 43	3.7	25	4.5	J	NA	390000	nc	NA	NA	N	BSL
	156592	cis-1,2-dichloroethylene	1.6	J	1.6	J	ug/kg	GP233D	1 / 44	3.7	25	1.6	J	NA	78000	nc	NA	NA	N	BSL
	78875	1,2-dichloropropane	5.9	J	5.9	J	ug/kg	GP216M	1 / 45	3.7	25	5.9	J	NA	9400	ca	NA	NA	N	BSL
	10061015	cis-1,3-dichloropropene	1.1	J	2.5	J	ug/kg	GP215M	4 / 45	3.7	25	2.5	J	NA	6400	ca	NA	NA	N	BSL
	10061026	trans-1,3-dichloropropene	1	J	1.4	J	ug/kg	GP121M	2 / 42	3.7	25	1.4	J	NA	6400	ca	NA	NA	N	BSL
	123911	1,4-dioxane (p-dioxane)	24	J	170	J	ug/kg	GP238D	4 / 11	78	211	170	J	NA	58000	ca	NA	NA	N	BSL
	100414	ethylbenzene	0.71	J	5.6	J	ug/kg	GP243M	15 / 50	3.7	25	5.6	J	NA	780000	nc	NA	NA	N	BSL

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LOWER DARBY CREEK AREA RI/FS

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Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 1

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 1	98828	isopropylbenzene (cumene)	0.69	J	62	L	ug/kg	GP121M	25 / 49	3.7	25	62	L	NA	780000	nc	NA	NA	N	BSL
	79209	methyl acetate	2.4	J	11	L	ug/kg	GP229M	2 / 45	3.7	25	11	L	NA	7800000	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	2.9	J	130		ug/kg	GP240D	25 / 28	4.45	50	130		NA	4700000	nc	NA	NA	N	BSL
	108872	**methylcyclohexane**	1.9	J	330	J	ug/kg	GP236D	13 / 47	3.7	25	330	J	NA	NA		NA	NA	**Y**	**NSL**
	75092	methylene chloride	0.48	J	50	J	ug/kg	GP218D	40 / 56	3.7	25	50	J	NA	85000	ca	NA	NA	N	BSL
	1634044	tert-butyl methyl ether	0.5	J	88	L	ug/kg	GP234M	22 / 45	3.7	25	88	L	NA	160000	ca	NA	NA	N	BSL
	79345	1,1,2,2-tetrachloroethane	0.48	J	13	J	ug/kg	GP220M	4 / 48	3.7	25	13	J	NA	3200	ca	NA	NA	N	BSL
	108883	toluene	0.71	J	3.9	J	ug/kg	GP231M	20 / 46	3.7	25	3.9	J	NA	630000	nc	NA	NA	N	BSL
	87616	1,2,3-trichlorobenzene	1.9	J	9.9	L	ug/kg	GP120D	4 / 42	3.85	25	9.9	L	NA	78000	nc	NA	NA	N	BSL
	120821	1,2,4-trichlorobenzene	0.53	J	29	L	ug/kg	GP120D	12 / 41	3.85	25	29	L	NA	78000	nc	NA	NA	N	BSL
		m,p-xylene (sum of isomers)	0.61	J	9.7	J	ug/kg	GP220M	28 / 48	3.7	25	9.7	J	NA	1600000	nc	NA	NA	N	BSL
	95476	o-xylene (1,2-dimethylbenzene)	0.45	J	5.6	J	ug/kg	GP246M	20 / 48	3.7	25	5.6	J	NA	1600000	nc	NA	NA	N	BSL
	7429905	**aluminum**	1810000		25800000		ug/kg	GP211S	41 / 41	20530	37450	25800000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	770	J	968000	L	ug/kg	GP248S	9 / 25	6160	25350	968000	L	NA	3100	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	1700		42200		ug/kg	GP251S	41 / 41	1030	1870	42200		NA	430	ca	NA	NA	**Y**	**ASL**
	7440393	barium	26600	J	610000		ug/kg	GP227S	41 / 41	20530	37450	610000		NA	1600000	nc	NA	NA	N	BSL
	7440417	beryllium	160	J	1400		ug/kg	GP251S	41 / 41	510	940	1400		NA	16000	nc	NA	NA	N	BSL
	7440439	**cadmium**	160	J	95200		ug/kg	GP251S	32 / 35	510	940	95200		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	1440000		160000000		ug/kg	GP238S	41 / 41	534190	1646540	160000000		NA	NA		NA	NA	N	NUT
	7440473	**chromium** [6]	5900		353000	L	ug/kg	GP227S	41 / 41	1030	1870	353000	L	NA	23000	nc	NA	NA	**Y**	**ASL**
	7440484	**cobalt**	1600	J	15700		ug/kg	GP232S	41 / 41	5130	9360	15700		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	10800		2620000		ug/kg	GP248S	41 / 41	2570	4680	2620000		NA	310000	nc	NA	NA	**Y**	**ASL**
	57125	cyanide	190	J	8600	L	ug/kg	GP238S	6 / 41	2570	4680	8600	L	NA	160000	nc	NA	NA	N	BSL
	7439896	**iron**	5510000		152000000		ug/kg	GP251S	41 / 41	10270	63940	152000000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	14100		1840000		ug/kg	GP215S	41 / 41	1030	1870	1840000		NA	400000		NA	NA	**Y**	**ASL**
	7439954	magnesium	2960000		96200000		ug/kg	GP238S	41 / 41	513350	936330	96200000		NA	NA		NA	NA	N	NUT
	7439965	**manganese**	135000	L	946000	L	ug/kg	GP241S	41 / 41	1540	2810	946000	L	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	50	J	2700	J	ug/kg	GP227S	37 / 41	100	190	2700	J	NA	780	nc	NA	NA	**Y**	**ASL**
	7440020	**nickel**	5500		226000		ug/kg	GP253S	41 / 41	4110	7490	226000		NA	160000	nc	NA	NA	**Y**	**ASL**
	7440097	potassium	618000	J	4780000		ug/kg	GP226S	41 / 41	513350	936330	4780000		NA	NA		NA	NA	N	NUT
	7782492	selenium	1400	J	3800	J	ug/kg	GP248S	6 / 41	3590	6550	3800	J	NA	39000	nc	NA	NA	N	BSL
	7440224	silver	560	J	21900		ug/kg	GP248S	9 / 40	1030	1870	21900		NA	39000	nc	NA	NA	N	BSL
	7440235	sodium	403000	J	1740000		ug/kg	GP231S	8 / 8	534190	704230	1740000		NA	NA		NA	NA	N	NUT
	7440280	**thallium**	660	J	3900		ug/kg	GP251S	37 / 41	2570	4680	3900		NA	550	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	9000		93900		ug/kg	GP215S	40 / 41	5130	9360	93900		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	**zinc**	22200	L	3740000		ug/kg	GP227S	41 / 41	6160	11240	3740000		NA	2300000	nc	NA	NA	**Y**	**ASL**

Footnotes

pg/g = picograms per gram
ug/kg = micrograms per kilogram
(1) J = Analyte present. Reported value may not be accurate or precise.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
+ = Analyte present. Actual value may be higher than reported.
(2) The maximum detected concentration was used for screening.
(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.
(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)
(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.
(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

Table 1.10
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 1

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (nc/ca) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
								Min	Max							
Zone 1 Surface and Subsurface Soil Samples Include:			LD-SS-GP211S-0106	LD-SS-GP233S-0106		LD-SS-GP253S-0106		LD-SB-GP227D-0106		LD-SB-GP121M-0106		LD-SB-GP246D-0106				
			LD-SS-GP214S-0106	LD-SS-GP234S-0106		LD-SB-GP211D-0106		LD-SB-GP227M-0106		LD-SB-GP2237D-0106		LD-SB-GP246M-0106				
			LD-SS-GP215S-0106	LD-SS-GP235S-0106		LD-SB-GP211M-0106		LD-SB-GP228M-0106		LD-SB-GP237M-0106						
			LD-SS-GP216S-0106	LD-SS-GP236S-0106		LD-SB-GP213D-0106		LD-SB-GP229M-0106		LD-SB-GP238D-0106						
			LD-SS-GP217S-0106	LD-SS-GP121S-0106		LD-SB-GP213M-0106		LD-SB-GP230D-0106		LD-SB-GP238M-0106						
			LD-SS-GP218S-0106	LD-SS-GP237S-0106		LD-SB-GP214D-0106		LD-SB-GP230M-0106		LD-SB-GP239M-0106						
			LD-SS-GP219S-0106	LD-SS-GP238S-0106		LD-SB-GP214M-0106		LD-SB-GP231D-0106		LD-SB-GP240D-0106						
			LD-SS-GP220S-0106	LD-SS-GP239S-0106		LD-SB-GP215M-0106		LD-SB-GP122D-0106		LD-SB-GP240M-0106						
			LD-SS-GP221S-0106	LD-SS-GP240S-0106		LD-SB-GP217M-0106		LD-SB-GP231M-0106		LD-SB-GP241D-0106						
			LD-SS-GP222S-0106	LD-SS-GP241S-0106		LD-SB-GP218D-0106		LD-SB-GP122M-0106		LD-SB-GP241M-0106						
			LD-SS-GP224S-0106	LD-SS-GP242S-0106		LD-SB-GP218M-0106		LD-SB-GP232D-0106		LD-SB-GP242D-0106						
			LD-SS-GP225S-0106	LD-SS-GP243S-0106		LD-SB-GP219D-0106		LD-SB-GP232M-0106		LD-SB-GP242M-0106						
			LD-SS-GP226S-0106	LD-SS-GP244S-0106		LD-SB-GP219M-0106		LD-SB-GP233D-0106		LD-SB-GP243D-0106						
			LD-SS-GP227S-0106	LD-SS-GP245S-0106		LD-SB-GP220M-0106		LD-SB-GP233M-0106		LD-SB-GP243M-0106						
			LD-SS-GP228S-0106	LD-SS-GP120S-0106		LD-SB-GP221M-0106		LD-SB-GP234M-0106		LD-SB-GP244D-0106						
			LD-SS-GP229S-0106	LD-SS-GP246S-0106		LD-SB-GP222M-0106		LD-SB-GP235D-0106		LD-SB-GP244M-0106						
			LD-SS-GP230S-0106	LD-SS-GP248S-0106		LD-SB-GP224D-0106		LD-SB-GP235M-0106		LD-SB-GP245D-0106						
			LD-SS-GP231S-0106	LD-SS-GP249S-0106		LD-SB-GP224M-0106		LD-SB-GP236D-0106		LD-SB-GP120D-0106						
			LD-SS-GP122S-0106	LD-SS-GP250S-0106		LD-SB-GP225M-0106		LD-SB-GP121D-0106		LD-SB-GP245M-0106						
			LD-SS-GP232S-0106	LD-SS-GP251S-0106		LD-SB-GP226M-0106		LD-SB-GP236M-0106		LD-SB-GP120M-0106						

Table 1.11
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 2

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 2	309002	**aldrin**	6.2		110	J	ug/kg	GP37S	7 / 116	1.8	17	110	J	NA	38	ca	NA	NA	**Y**	**ASL**
	319846	alpha BHC	3.6	J	3.6	J	ug/kg	GPD08	1 / 116	1.8	16.95	3.6	J	NA	100	ca	NA	NA	N	BSL
	5103719	alpha-chlordane	1.9	J	23	J	ug/kg	GP21S	16 / 116	1.8	16.95	23	J	NA	1800	ca	NA	NA	N	BSL
	959988	alpha endosulfan	2.8	J	2.8	J	ug/kg	GPD08	1 / 116	1.8	16.95	2.8	J	NA	47000	nc	NA	NA	N	BSL
	319857	beta BHC	2.5	J	16	J	ug/kg	GP21S	5 / 116	1.8	16.95	16	J	NA	350	ca	NA	NA	N	BSL
	319868	delta BHC	1.8	J	1.8	J	ug/kg	GP33S	1 / 116	1.8	16.95	1.8	J	NA	350	ca	NA	NA	N	BSL
	60571	**dieldrin**	5.2	J	93		ug/kg	GP90S	4 / 116	3.5	37.8	93		NA	40	ca	NA	NA	**Y**	**ASL**
	1031078	endosulfan sulfate	3.8	J	6.9	J	ug/kg	GP81S	4 / 116	3.5	37.8	6.9	J	NA	47000	nc	NA	NA	N	BSL
	72208	endrin	4.7		290	J	ug/kg	GP34S	4 / 116	3.5	37.8	290	J	NA	2300	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	4.1	J	28		ug/kg	GP21S	3 / 116	3.5	37.8	28		NA	2300	nc	NA	NA	N	BSL
	53494705	endrin ketone	4.3	J	36		ug/kg	GP91S	10 / 116	3.5	37.8	36		NA	2300	nc	NA	NA	N	BSL
	58899	gamma BHC (Lindane)	2.1	J	2.1	J	ug/kg	GP49	1 / 116	1.8	16.95	2.1	J	NA	490	ca	NA	NA	N	BSL
	5103742	gamma-chlordane	0.52	J	280	J	ug/kg	GP34S	31 / 116	1.8	16.95	280	J	NA	1800	ca	NA	NA	N	BSL
	76448	heptachlor	3.4	J	4.8	J	ug/kg	GP18M	2 / 116	1.8	16.95	4.8	J	NA	140	ca	NA	NA	N	BSL
	1024573	heptachlor epoxide	19	J	31	J	ug/kg	GP37S	3 / 116	1.8	16.95	31	J	NA	70	ca	NA	NA	N	BSL
	72435	methoxychlor	15	J	460	J	ug/kg	GP34S	3 / 116	18.1	169.49	460	J	NA	39000	nc	NA	NA	N	BSL
	72548	p,p-DDD	2.6	J	930		ug/kg	GP18D	36 / 116	3.5	329	930		NA	2700	ca	NA	NA	N	BSL
	72559	p,p-DDE	2	J	670		ug/kg	GP18D	29 / 116	3.5	329	670		NA	1900	ca	NA	NA	N	BSL
	50293	p,p-DDT	2.6	J	610	J	ug/kg	GP34S	25 / 115	3.5	37.8	610	J	NA	1900	ca	NA	NA	N	BSL
	53469219	**PCB-1242 (Arochlor 1242)**	79	J	1700		ug/kg	GP21S	5 / 116	32.34	330	1700		NA	320	ca	NA	NA	**Y**	**ASL**
	11097691	**PCB-1254 (Arochlor 1254)**	35	J	6100		ug/kg	GP37S	8 / 116	32.34	330	6100		NA	156	nc	NA	NA	**Y**	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	15	J	31000	J	ug/kg	GP34S	36 / 116	32.34	3290	31000	J	NA	320	ca	NA	NA	**Y**	**ASL**
	83329	acenaphthene	44	J	5000	J	ug/kg	GP94D	14 / 118	170	11511.6	5000	J	NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	51	J	270	J	ug/kg	GP18S	5 / 118	170	11511.6	270	J	NA	470000	nc	NA	NA	N	BSL
	98862	acetophenone	41	J	56	J	ug/kg	GP04D	2 / 118	170	11511.6	56	J	NA	780000	nc	NA	NA	N	BSL
	120127	anthracene	28	J	12000	J	ug/kg	GP94D	35 / 118	170	11511.6	12000	J	NA	2300000	nc	NA	NA	N	BSL
	100527	benzaldehyde	43	J	50	J	ug/kg	GP247S	4 / 118	170	11511.6	50	J	NA	780000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	39	J	16000		ug/kg	GPD08	68 / 118	170	11511.6	16000		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	39	J	13000	J	ug/kg	GP94D	65 / 118	170	11511.6	13000	J	NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	39	J	11000		ug/kg	GPD08	62 / 118	170	11511.6	11000		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	40	J	8500	J	ug/kg	GP94D	49 / 118	170	11511.6	8500	J	NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	38	J	11000	J	ug/kg	GP94D	62 / 118	170	11511.6	11000	J	NA	2200	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	75	J	2500		ug/kg	GP34S	2 / 118	170	11511.6	2500		NA	1600000	nc	NA	NA	N	BSL
	92524	biphenyl (diphenyl)	240	J	240	J	ug/kg	GP18D	1 / 118	170	11511.6	240	J	NA	390000	nc	NA	NA	N	BSL
	117817	bis(2-ethylhexyl) phthalate	29	J	29000		ug/kg	GP30S	52 / 78	170	11511.6	29000		NA	46000	ca	NA	NA	N	BSL
	86748	carbazole	39	J	4200		ug/kg	GPD08	17 / 118	170	11511.6	4200		NA	32000	ca	NA	NA	N	BSL
	218019	chrysene	38	J	15000		ug/kg	GPD08	74 / 118	170	11511.6	15000		NA	22000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	44	J	3500	J	ug/kg	GP94D	20 / 118	170	11511.6	3500	J	NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	54	J	4200	J	ug/kg	GP94D	10 / 118	170	11511.6	4200	J	NA	NA		NA	NA	**Y**	**NSL**
	84662	diethyl phthalate	2200		2200		ug/kg	GP49	1 / 118	170	11511.6	2200		NA	6300000	nc	NA	NA	N	BSL
	84742	di-n-butyl phthalate	42	J	500	J	ug/kg	GP34S	7 / 116	351.1	11511.6	500	J	NA	780000	nc	NA	NA	N	BSL

Table 1.11
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 2

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 2	206440	fluoranthene	42	J	35000	J	ug/kg	GP94D	77 / 113	170	11511.6	35000	J	NA	310000	nc	NA	NA	N	BSL
	86737	fluorene	42	J	5900	J	ug/kg	GP94D	17 / 113	170	11511.6	5900	J	NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	39	J	7300	J	ug/kg	GP94D	49 / 118	170	11511.6	7300	J	NA	220	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	43	J	1600	J	ug/kg	GP18M	14 / 118	170	11511.6	1600	J	NA	31000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	59	J	150	J	ug/kg	GP93M	2 / 118	170	11511.6	150	J	NA	39000	nc	NA	NA	N	BSL
	91203	naphthalene	24	J	2600	J	ug/kg	GPD08	13 / 112	170	11511.6	2600	J	NA	160000	nc	NA	NA	N	BSL
	85018	phenanthrene	38	J	34000		ug/kg	GPD08	73 / 110	170	11511.6	34000		NA	230000	nc	NA	NA	N	BSL
	129000	pyrene	40	J	36000	J	ug/kg	GP94D	83 / 115	170	11511.6	36000	J	NA	230000	nc	NA	NA	N	BSL
	67641	acetone	7	J	370	J	ug/kg	GP18D	32 / 43	10.9	1220	370	J	NA	7000000	nc	NA	NA	N	BSL
	71432	benzene	0.95	J	1	J	ug/kg	GP27M	2 / 69	6	1220	1	J	NA	12000	ca	NA	NA	N	BSL
	75150	carbon disulfide	1	J	3	J	ug/kg	GP53	5 / 69	6	1220	3	J	NA	780000	nc	NA	NA	N	BSL
	108907	chlorobenzene	2	J	490	J	ug/kg	GP18D	5 / 69	6	1220	490	J	NA	160000	nc	NA	NA	N	BSL
	110827	**cyclohexane**	7	J	7	J	ug/kg	GP27M	1 / 69	6	1220	7	J	NA	NA		NA	NA	**Y**	**NSL**
	95501	1,2-dichlorobenzene	37	J	840	J	ug/kg	GP18D	2 / 69	6	1220	840	J	NA	700000	nc	NA	NA	N	BSL
	107062	1,2-dichloroethane	33	J	380	J	ug/kg	GP18D	2 / 69	6	1220	380	J	NA	7000	ca	NA	NA	N	BSL
	156592	cis-1,2-dichloroethylene	1	J	1	J	ug/kg	GP94D	1 / 69	6	1220	1	J	NA	78000	nc	NA	NA	N	BSL
	100414	ethylbenzene	780		16000	J	ug/kg	GP18D	2 / 69	6	1220	16000	J	NA	780000	nc	NA	NA	N	BSL
	98828	isopropylbenzene (cumene)	30		4000	J	ug/kg	GP18D	3 / 69	6	1220	4000	J	NA	780000	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	8	J	26	J	ug/kg	GP95M	14 / 69	6	1220	26	J	NA	4700000	nc	NA	NA	N	BSL
	108872	**methylcyclohexane**	2	J	3800	J	ug/kg	GP18D	4 / 69	6	1220	3800	J	NA	NA		NA	NA	**Y**	**NSL**
	75092	methylene chloride	1.2	J	270	J	ug/kg	GPD08	10 / 11	6	1220	270	J	NA	85000	ca	NA	NA	N	BSL
	100425	styrene	8	J	8	J	ug/kg	GP18M	1 / 69	6	1220	8	J	NA	1600000	nc	NA	NA	N	BSL
	127184	tetrachloroethylene(PCE)	130		490	J	ug/kg	GP18D	2 / 69	6	1220	490	J	NA	1200	ca	NA	NA	N	BSL
	108883	toluene	1	J	26	J	ug/kg	GP18M	11 / 69	6	1220	26	J	NA	630000	nc	NA	NA	N	BSL
	79016	trichloroethylene (TCE)	8	J	8	J	ug/kg	GP18M	1 / 69	6	1220	8	J	NA	1600	ca	NA	NA	N	BSL
	75694	trichlorofluoromethane	1	J	3	J	ug/kg	GP24M	8 / 69	6	1220	3	J	NA	2300000	nc	NA	NA	N	BSL
	1330207	xylenes, total	2	J	280		ug/kg	GP18M	5 / 69	10.5	1220	280		NA	1600000	nc	NA	NA	N	BSL
	7429905	**aluminum**	1360000		28600000		ug/kg	GP247S	63 / 63	21200	49400	28600000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	400	J	10000	J	ug/kg	GP35S	10 / 41	6400	7100	10000	J	NA	3100	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	1400		15200		ug/kg	GP32S	62 / 63	1100	3700	15200		NA	430	ca	NA	NA	**Y**	**ASL**
	7440393	barium	11300	J	281000		ug/kg	GP35S	63 / 63	21200	49400	281000		NA	1600000	nc	NA	NA	N	BSL
	7440417	beryllium	110	J	1200		ug/kg	GP247S	46 / 46	500	1200	1200		NA	16000	nc	NA	NA	N	BSL
	7440439	cadmium	140	J	5800		ug/kg	GP96S	36 / 59	500	600	5800		NA	7800	nc	NA	NA	N	BSL
	7440702	calcium	247000	J	41100000		ug/kg	GP39S	63 / 63	530200	1234600	41100000		NA	NA		NA	NA	N	NUT
	7440473	**chromium** [6]	4800		67700	K	ug/kg	GP21S	62 / 62	1100	2500	67700	K	NA	23000	nc	NA	NA	**Y**	**ASL**
	7440484	**cobalt**	2500	J	15300		ug/kg	GP34S	63 / 63	5300	12300	15300		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	3400	J	366000		ug/kg	GP35S	63 / 63	2600	6200	366000		NA	310000	nc	NA	NA	**Y**	**ASL**
	57125	cyanide	380	J	730	J	ug/kg	GP43	2 / 63	2700	3000	730	J	NA	160000	nc	NA	NA	N	BSL

Table 1.11
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 2

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 2	7439896	**iron**	3930000		47900000		ug/kg	GP33S	63 / 63	10600	24700	47900000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	4600		8540000	J	ug/kg	GP21S	63 / 63	1100	2500	8540000	J	NA	400000		NA	NA	**Y**	**ASL**
	7439954	magnesium	582000	J	23900000		ug/kg	GP39S	63 / 63	530200	1234600	23900000		NA	NA		NA	NA	N	NUT
	7439965	**manganese**	79600		668000	K	ug/kg	GP19S	63 / 63	1600	3700	668000	K	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	10	J	3200		ug/kg	GP21S	51 / 60	100	120	3200		NA	780	nc	NA	NA	**Y**	**ASL**
	7440020	nickel	3700	J	41400		ug/kg	GP33S	63 / 63	4200	9900	41400		NA	160000	nc	NA	NA	N	BSL
	7440097	potassium	239000	J	4980000	J	ug/kg	GP36S	63 / 63	530200	1234600	4980000	J	NA	NA		NA	NA	N	NUT
	7782492	selenium	1000	J	2300	J	ug/kg	GP247S	3 / 62	3700	8600	2300	J	NA	39000	nc	NA	NA	N	BSL
	7440224	silver	60	J	4000	L	ug/kg	GP81S	12 / 60	1100	2500	4000	L	NA	39000	nc	NA	NA	N	BSL
	7440235	sodium	60000	J	1380000		ug/kg	GP18S	23 / 39	543500	1123600	1380000		NA	NA		NA	NA	N	NUT
	7440280	**thallium**	640	J	2400	J	ug/kg	GPD08	14 / 61	2600	6200	2400	J	NA	550	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	3800	J	60800		ug/kg	GP247S	63 / 63	5300	12300	60800		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	zinc	20000		1110000		ug/kg	GP21S	63 / 63	6400	14800	1110000		NA	2300000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequenty, the screening value for hexavalent chromium was used.

Zone 2 Surface and Subsurface Soil Samples Include:

LD-SS-GP01S-0203	LD-SS-GP31S-0403	LD-SS-GP91S-0704	LD-SB-GP27M-0403	LD-SB-GP47-0403	LD-SB-GP90D-0704
LD-SS-GPD01S-0203	LD-SS-GP32S-0403	LD-SS-GP92S-0704	LD-SB-GP28M-0403	LD-SB-GPD08-0403	LD-SB-GP90M-0704
LD-SS-GP04S-0203	LD-SS-GP33S-0403	LD-SS-GP93S-0704	LD-SB-GP29M-0403	LD-SB-GP48-0403	LD-SB-GP91M-0704
LD-SS-GP09S-0403	LD-SS-GP34S-0403	LD-SS-GP94S-0704	LD-SB-GP30M-0403	LD-SB-GP49-0403	LD-SB-GP92D-0704
LD-SS-GP10S-0403	LD-SS-GP35S-0403	LD-SS-GP95S-0704	LD-SB-GPD05M-0403	LD-SB-GP51-0403	LD-SB-GP92M-0704
LD-SS-GP13S-0403	LD-SS-GP36S-0403	LD-SS-GP96S-0704	LD-SB-GP31D-0403	LD-SB-GP52-0403	LD-SB-GP111M-0704
LD-SS-GP18S-0403	LD-SS-GP37S-0403	LD-SS-GP113S-0704	LD-SB-GP31M-0403	LD-SB-GP53-0403	LD-SB-GP93M-0704
LD-SS-GP19S-0403	LD-SS-GP38S-0403	LD-SS-GP98S-0704	LD-SB-GPD03M-0403	LD-SB-GP55-0403	LD-SB-GP94D-0704
LD-SS-GP20S-0403	LD-SS-GP39S-0403	LD-SS-GP247S-0106	LD-SB-GP34M-0403	LD-SB-GP56-0403	LD-SB-GP95D-0704
LD-SS-GP21S-0403	LD-SS-GP40S-0403	LD-SB-GP01M-0203	LD-SB-GP36M-0403	LD-SB-GP58-0403	LD-SB-GP95M-0704
LD-SS-GP22S-0403	LD-SS-GP41S-0403	LD-SB-GP04D-0203	LD-SB-GP37M-0403	LD-SB-GP67M-0403	LD-SB-GP96M-0704
LD-SS-GP23S-0403	LD-SS-GP67S-0403	LD-SB-GPD01D-0203	LD-SB-GP38M-0403	LD-SB-GP80M-0403	LD-SB-GP113M-0704
LD-SS-GP24S-0403	LD-SS-GP80S-0403	LD-SB-GP13M-0403	LD-SB-GP39M-0403	LD-SB-GPD04M-0403	LD-SB-GP98M-0704
LD-SS-GP25S-0403	LD-SS-GPD04S-0403	LD-SB-GP18D-0403	LD-SB-GP40D-0403	LD-SB-GP81M-0403	LD-SB-GP112M-0704
LD-SS-GP26S-0403	LD-SS-GP81S-0403	LD-SB-GP18M-0403	LD-SB-GP40M-0403	LD-SB-GP85D-0704	LD-SB-GP247D-0106
LD-SS-GP27S-0403	LD-SS-GP85S-0704	LD-SB-GP22M-0403	LD-SB-GP41M-0403	LD-SB-GP85M-0704	LD-SB-GP247M-0106
LD-SS-GP28S-0403	LD-SS-GP87S-0704	LD-SB-GP24M-0403	LD-SB-GP42-0403	LD-SB-GP87D-0704	LD-SB-GP111D-0704*
LD-SS-GP29S-0403	LD-SS-GP88S-0704	LD-SB-GP25D-0403	LD-SB-GP43-0403	LD-SB-GP87M-0704	LD-SB-GP113D-0704*
LD-SS-GP30S-0403	LD-SS-GP89S-0704	LD-SB-GP25M-0403	LD-SB-GP44-0403	LD-SB-GP88M-0704	
LD-SS-GPD05S-0403	LD-SS-GP90S-0704	LD-SB-GP26M-0403	LD-SB-GP45-0403	LD-SB-GP89M-0704	

*Indicates this sample was used for the Occurrence, Distribution, and Selection of COPCs table, but was not used to determine UCLs.

Table 1.12
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 3

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 3	5103719	alpha-chlordane	7.1		7.1		ug/kg	GP108S	1 / 59	1.8	16.83	7.1		NA	1800	ca	NA	NA	N	BSL
	60571	**dieldrin**	60	J	60	J	ug/kg	GP02D	1 / 59	3.5	32.67	60	J	NA	40	ca	NA	NA	**Y**	**ASL**
	7421934	endrin aldehyde	3.7		7.8	J	ug/kg	GP84M	2 / 59	3.5	32.67	7.8	J	NA	2300	nc	NA	NA	N	BSL
	53494705	endrin ketone	3.6	J	24		ug/kg	GP109S	2 / 59	3.5	32.67	24		NA	2300	nc	NA	NA	N	BSL
	5103742	gamma-chlordane	2.2		7.3	J	ug/kg	GP109S	3 / 59	1.8	16.83	7.3	J	NA	1800	ca	NA	NA	N	BSL
	72548	**p,p-DDD**	3.7	J	5600		ug/kg	GP02D	8 / 59	3.5	326.7	5600		NA	2700	ca	NA	NA	**Y**	**ASL**
	72559	p,p-DDE	3.9		75		ug/kg	GP02D	7 / 59	3.5	32.67	75		NA	1900	ca	NA	NA	N	BSL
	50293	p,p-DDT	4.1	J	18		ug/kg	GP86D	4 / 59	3.5	32.67	18		NA	1900	ca	NA	NA	N	BSL
	11096825	**PCB-1260 (Arochlor 1260)**	35	J	370		ug/kg	GP109S	4 / 59	35.2	326.7	370		NA	320	ca	NA	NA	**Y**	**ASL**
	83329	acenaphthene	51	J	560	J	ug/kg	GP108S	2 / 61	355.1	6600	560	J	NA	470000	nc	NA	NA	N	BSL
	208968	acenaphthylene	180	J	570	J	ug/kg	GP106S	4 / 61	355.1	6600	570	J	NA	470000	nc	NA	NA	N	BSL
	98862	acetophenone	40	J	40	J	ug/kg	GP06S	1 / 61	355.1	6600	40	J	NA	780000	nc	NA	NA	N	BSL
	120127	anthracene	39	J	1200	J	ug/kg	GP108S	9 / 61	355.1	6600	1200	J	NA	2300000	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	48	J	3800		ug/kg	GP106S	25 / 61	355.1	6600	3800		NA	220	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	55	J	3600		ug/kg	GP106S	24 / 61	355.1	6600	3600		NA	22	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	46	J	3200		ug/kg	GP106S	25 / 61	355.1	6600	3200		NA	220	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	55	J	2500		ug/kg	GP106S	18 / 61	355.1	6600	2500		NA	230000	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	48	J	3400		ug/kg	GP106S	22 / 61	355.1	6600	3400		NA	2200	ca	NA	NA	**Y**	**ASL**
	117817	bis(2-ethylhexyl) phthalate	58	J	1500		ug/kg	GP103S	27 / 32	355.1	6600	1500		NA	46000	ca	NA	NA	N	BSL
	86748	carbazole	51	J	780	J	ug/kg	GP108S	3 / 61	355.1	6600	780	J	NA	32000	ca	NA	NA	N	BSL
	218019	chrysene	45	J	4500		ug/kg	GP106S	25 / 61	355.1	6600	4500		NA	22000	ca	NA	NA	N	BSL
	53703	**dibenz(a,h)anthracene**	48	J	1000		ug/kg	GP106S	7 / 61	355.1	6600	1000		NA	22	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	41	J	370	J	ug/kg	GP108S	2 / 61	355.1	6600	370	J	NA	NA		NA	NA	**Y**	**NSL**
	206440	fluoranthene	45	J	5300	J	ug/kg	GP108S	26 / 61	355.1	6600	5300	J	NA	310000	nc	NA	NA	N	BSL
	86737	fluorene	38	J	570	J	ug/kg	GP108S	4 / 61	355.1	6600	570	J	NA	310000	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	50	J	2600		ug/kg	GP106S	18 / 61	355.1	6600	2600		NA	220	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	46	J	270	J	ug/kg	GP02S	7 / 61	355.1	6600	270	J	NA	31000	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	69	J	69	J	ug/kg	GP83M	1 / 61	355.1	6600	69	J	NA	39000	nc	NA	NA	N	BSL
	91203	naphthalene	41	J	200	J	ug/kg	GP108S	6 / 58	355.1	6600	200	J	NA	160000	nc	NA	NA	N	BSL
	87865	pentachlorophenol	98	J	98	J	ug/kg	GP03S	1 / 61	355.1	16600	98	J	NA	5300	ca	NA	NA	N	BSL
	85018	phenanthrene	44	J	3500	J	ug/kg	GP02D	20 / 61	355.1	6600	3500	J	NA	230000	nc	NA	NA	N	BSL
	129000	pyrene	47	J	5600		ug/kg	GP106S	26 / 61	355.1	6600	5600		NA	230000	nc	NA	NA	N	BSL
	67641	acetone	6	J	260	J	ug/kg	GP84M	10 / 20	10.3	13.9	260	J	NA	7000000	nc	NA	NA	N	BSL
	75150	carbon disulfide	2	J	2	J	ug/kg	GP02D	1 / 32	10.3	13.9	2	J	NA	780000	nc	NA	NA	N	BSL
	108907	chlorobenzene	2	J	2	J	ug/kg	GP02D	1 / 32	10.3	13.9	2	J	NA	160000	nc	NA	NA	N	BSL
	95501	1,2-dichlorobenzene	7	J	7	J	ug/kg	GP12M	1 / 32	10.3	13.9	7	J	NA	700000	nc	NA	NA	N	BSL
	541731	1,3-dichlorobenzene	2	J	2	J	ug/kg	GP12M	1 / 32	10.3	13.9	2	J	NA	23000	nc	NA	NA	N	BSL
	106467	1,4-dichlorobenzene	1	J	1	J	ug/kg	GP12M	1 / 32	10.3	13.9	1	J	NA	27000	ca	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	15	J	33	J	ug/kg	GP105M	5 / 32	10.3	13.9	33	J	NA	4700000	nc	NA	NA	N	BSL
	108883	toluene	2	J	2	J	ug/kg	GP86D	1 / 32	10.3	13.9	2	J	NA	630000	nc	NA	NA	N	BSL

Table 1.12
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Zone 3

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (4)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Surface and Subsurface Soil Combined Zone 3	7429905	**aluminum**	3030000		15000000		ug/kg	GP101S	29 / 29	21600	48400	15000000		NA	NA		NA	NA	**Y**	**NSL**
	7440360	**arsenic**	2000		20300		ug/kg	GP102S	29 / 29	1100	3600	20300		NA	430	ca	NA	NA	**Y**	**ASL**
	7440382	barium	21900	J	124000		ug/kg	GP102S	29 / 29	21600	48400	124000		NA	1600000	nc	NA	NA	N	BSL
	7440393	beryllium	180	J	1600	K	ug/kg	GP06S	21 / 21	500	1200	1600	K	NA	16000	nc	NA	NA	N	BSL
	7440417	cadmium	440	J	6700		ug/kg	GP101S	12 / 23	600	1200	6700		NA	7800	nc	NA	NA	N	BSL
	7440439	calcium	495000	J	4810000	J	ug/kg	GP108S	29 / 29	541100	1210700	4810000	J	NA	NA		NA	NA	N	NUT
	7440702	**chromium** [6]	8500		53200		ug/kg	GP102S	28 / 28	1100	2400	53200		NA	23000	nc	NA	NA	**Y**	**ASL**
	7440473	**cobalt**	3500	J	17700		ug/kg	GP14S	29 / 29	5400	12100	17700		NA	NA		NA	NA	**Y**	**NSL**
	7440484	copper	6700		42700		ug/kg	GP102S	29 / 29	2700	6100	42700		NA	310000	nc	NA	NA	N	BSL
	7440508	cyanide	70	J	70	J	ug/kg	GP12S	1 / 24	2700	3200	70	J	NA	160000	nc	NA	NA	N	BSL
	57125	**iron**	6830000		38000000		ug/kg	GP06S	29 / 29	10800	24200	38000000		NA	2300000	nc	NA	NA	**Y**	**ASL**
	7439896	lead	5200	J	124000	J	ug/kg	GP12S	29 / 29	1100	2400	124000	J	NA	400000		NA	NA	N	BSL
	7439921	magnesium	891000		3960000		ug/kg	GP102S	29 / 29	541100	1210700	3960000		NA	NA		NA	NA	N	NUT
	7439954	**manganese**	90500	K	730000	K	ug/kg	GP06S	29 / 29	1600	3600	730000	K	NA	160000	nc	NA	NA	**Y**	**ASL**
	7439965	mercury	10	J	320		ug/kg	GP02S	23 / 29	100	100	320		NA	780	nc	NA	NA	N	BSL
	7439976	nickel	4300	J	21400		ug/kg	GP102S	29 / 29	4300	9700	21400		NA	160000	nc	NA	NA	N	BSL
	7440020	potassium	401000	J	1970000	J	ug/kg	GP101S	29 / 29	541100	1210700	1970000	J	NA	NA		NA	NA	N	NUT
	7440097	silver	60	J	370	J	ug/kg	GP102S	9 / 29	1100	2400	370	J	NA	39000	nc	NA	NA	N	BSL
	7782492	sodium	143000	J	905000		ug/kg	GP110S	17 / 18	580700	1210700	905000		NA	NA		NA	NA	N	NUT
	7440224	**vanadium**	6700		47300		ug/kg	GP101S	29 / 29	5400	12100	47300		NA	7800	nc	NA	NA	**Y**	**ASL**
	7440666	zinc	19700		202000		ug/kg	GP102S	29 / 29	6500	14500	202000		NA	2300000	nc	NA	NA	N	BSL

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

(2) The maximum detected concentration was used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Residential Soil) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1)

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(6) Since hexavalent chromium was not analyzed in soil, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

Zone 3 Surface and Subsurface Soil Samples Include:

LD-SB-GP02D-0203	LD-SB-GPD02M-0403	LD-SB-GP101D-0704	LD-SB-GP108M-0704	LD-SS-GP14S-0403	LD-SS-GP111S-0704
LD-SB-GP02M-0203	LD-SB-GP16M-0403	LD-SB-GP101M-0704	LD-SB-GP110M-0704	LD-SS-GPD02S-0403	LD-SS-GP103S-0704
LD-SB-GP03D-0203	LD-SB-GP82D-0704	LD-SB-GP102M-0704	LD-SS-GP02S-0203	LD-SS-GP15S-0403	LD-SS-GP104S-0704
LD-SB-GP03M-0203	LD-SB-GP82M-0704	LD-SB-GP103M-0704	LD-SS-GP03S-0203	LD-SS-GP16S-0403	LD-SS-GP105S-0704
LD-SB-GP05M-0203	LD-SB-GP83D-0704	LD-SB-GP104M-0704	LD-SS-GP05S-0203	LD-SS-GP17S-0403	LD-SS-GP106S-0704
LD-SB-GP06M-0203	LD-SB-GP83M-0704	LD-SB-GP105M-0704	LD-SS-GP06S-0203	LD-SS-GP82S-0704	LD-SS-GP107S-0704
LD-SB-GP07M-0403	LD-SB-GP84D-0704	LD-SB-GP106M-0704	LD-SS-GP07S-0403	LD-SS-GP83S-0704	LD-SS-GP108S-0704
LD-SB-GP08M-0403	LD-SB-GP84M-0704	LD-SB-GP107M-0704	LD-SS-GP08S-0403	LD-SS-GP84S-0704	LD-SS-GP109S-0704
LD-SB-GP12M-0403	LD-SB-GP86D-0704	LD-SB-GP107S-0704	LD-SS-GP11S-0403	LD-SS-GP86S-0704	LD-SS-GP110S-0704
LD-SB-GP14M-0403	LD-SB-GP86M-0704	LD-SB-GP108D-0704	LD-SS-GP12S-0403	LD-SS-GP101S-0704	LD-SS-GP112S-0704
				LD-SS-GP102S-0704	LD-SB-GP112D-0704*

*Indicates this sample was used for the Occurrence, Distribution, and Selection of COPCs table, but was not used to determine UCLs.

Table 1.13
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Soil Gas
Exposure Medium: Zone 1

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
										Min	Max									
Soil Gas Zone 1	67641	acetone	16		290		ug/m^3	GP238	18 / 18	2.55	5.45	2.9		NA	330	nc	NA	NA	N	BSL
	71432	**benzene**	4.4		1200		ug/m^3	GP230	33 / 37	3.44	14.66	12		NA	0.23	ca	NA	NA	**Y**	**ASL**
	74839	bromomethane	4.1		4.1		ug/m^3	GP211	1 / 37	3.77	17.82	0.041		NA	0.51	nc	NA	NA	N	BSL
	75150	carbon disulfide	3.7		1000		ug/m^3	GP230	27 / 37	3.33	14.2	10		NA	73	nc	NA	NA	N	BSL
	108907	**chlorobenzene**	18		3500		ug/m^3	GP220	18 / 37	5	51.98	35		NA	5.1	nc	NA	NA	**Y**	**ASL**
	75003	chloroethane	7.3		24		ug/m^3	GP246	4 / 37	2.66	11.88	0.24		NA	2.2	ca	NA	NA	N	BSL
	74873	chloromethane	2.5		12		ug/m^3	GP230	2 / 37	2.22	9.6	0.12		NA	9.5	nc	NA	NA	N	BSL
	95501	1,2-dichlorobenzene	8.2	J	86		ug/m^3	GP217	8 / 37	6.55	27.42	0.86		NA	15	nc	NA	NA	N	BSL
	541731	1,3-dichlorobenzene	8.4	J	100		ug/m^3	GP220	8 / 37	6.55	27.42	1		NA	1.1	nc	NA	NA	N	BSL
	106467	**1,4-dichlorobenzene**	8.1	J	550		ug/m^3	GP217	23 / 37	6.55	27.42	5.5		NA	0.28	ca	NA	NA	**Y**	**ASL**
	75718	dichlorodifluoromethane	6.6		1400		ug/m^3	GP216	26 / 37	5.54	22.39	14		NA	18	nc	NA	NA	N	BSL
	75343	1,1-dichloroethane	6.8		12		ug/m^3	GP235	2 / 37	4.33	18.28	0.12		NA	51	nc	NA	NA	N	BSL
	156592	cis-1,2-dichloroethylene	5.2		30		ug/m^3	GP230	10 / 37	4.33	18.28	0.3		NA	3.7	nc	NA	NA	N	BSL
	156605	trans-1,2-dichloroethene	8.7		11		ug/m^3	GP215	2 / 37	4.52	18.28	0.11		NA	7.3	nc	NA	NA	N	BSL
	100414	ethylbenzene	7.2		210		ug/m^3	GP230	15 / 37	4.66	19.65	2.1		NA	110	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	6.8		810	J+	ug/m^3	GP243	34 / 37	3.22	13.25	8.1	J+	NA	510	nc	NA	NA	N	BSL
	75092	methylene chloride	4.5	J	4.5	J	ug/m^3	GP122	1 / 37	3.77	16	0.045	J	NA	3.8	ca	NA	NA	N	BSL
	100425	styrene	23	J	81		ug/m^3	GP220	3 / 37	4.66	19.65	0.81		NA	100	nc	NA	NA	N	BSL
	1634044	**tert-butyl methyl ether**	5.1		960		ug/m^3	GP233	24 / 37	3.88	16.88	9.6		NA	1.6	ca	NA	NA	**Y**	**ASL**
	127184	**tetrachloroethylene(PCE)**	25		67		ug/m^3	GP217	2 / 37	7.33	31.08	0.67		NA	0.31	ca	NA	NA	**Y**	**ASL**
	811972	1,1,1,2-tetrafluoroethane	9.4	J	9.4	J	ug/m^3	GP243	1 / 37	4.55	19.19	0.094	J	NA	8400	nc	NA	NA	N	BSL
	108883	toluene	5.2		300		ug/m^3	GP234	37 / 37	4.11	17.37	3		NA	510	nc	NA	NA	N	BSL
	120821	1,2,4-trichlorobenzene	55		55		ug/m^3	GP231	1 / 37	8.36	33.82	0.55		NA	3.7	nc	NA	NA	N	BSL
	79016	**trichloroethylene (TCE)**	7.1	J	12		ug/m^3	GP239	2 / 37	5.77	24.68	0.12		NA	0.016	ca	NA	NA	**Y**	**ASL**
	75694	trichlorofluoromethane	7.1		32		ug/m^3	GP230	5 / 37	6.1	25.59	0.32		NA	73	nc	NA	NA	N	BSL
	95636	**1,2,4-trimethylbenzene**	6.1	J	720	J	ug/m^3	GP230	28 / 37	5.33	22.39	7.2	J	NA	NA		NA	NA	**Y**	**NSL**
	108678	**1,3,5-trimethylbenzene (mesitylene)**	6.1		350	J	ug/m^3	GP230	20 / 37	5.33	22.39	3.5	J	NA	NA		NA	NA	**Y**	**NSL**
	108054	vinyl acetate	14		21		ug/m^3	GP220	2 / 37	1.33	16	0.21		NA	21	nc	NA	NA	N	BSL
	75014	**vinyl chloride**	4.4		85		ug/m^3	GP221	24 / 37	2.78	11.88	0.85		NA	0.072	ca	NA	NA	**Y**	**ASL**

Footnotes

ug/m^3 = micrograms per cubic meter

(1) J = Analyte present. Reported value may not be accurate or precise.
+ = Analyte present. Actual value may be higher than reported.

(2) The EPA Subsurface Vapor Intrusion Guidance default attenuation factor of 0.01 was applied to the maximum detected concentration to estimate the maximum indoor air concentration used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Ambient Air) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1).

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level

Zone 1 Soil Gas Samples Include:

LD-SG-GP211-0106	LD-SG-GP218-0106	LD-SG-GP225-0106	LD-SG-GP231-0106	LD-SG-GP236-0106	LD-SG-GP241-0106	LD-SG-GP246-0106
LD-SG-GP213-0106	LD-SG-GP219-0106	LD-SG-GP226-0106	LD-SG-GP122-0106	LD-SG-GP121-0106	LD-SG-GP242-0106	
LD-SG-GP214-0106	LD-SG-GP220-0106	LD-SG-GP227-0106	LD-SG-GP232-0106	LD-SG-GP237-0106	LD-SG-GP243-0106	
LD-SG-GP215-0106	LD-SG-GP221-0106	LD-SG-GP228-0106	LD-SG-GP233-0106	LD-SG-GP238-0106	LD-SG-GP244-0106	
LD-SG-GP216-0106	LD-SG-GP222-0106	LD-SG-GP229-0106	LD-SG-GP234-0106	LD-SG-GP239-0106	LD-SG-GP245-0106	
LD-SG-GP217-0106	LD-SG-GP224-0106	LD-SG-GP230-0106	LD-SG-GP235-0106	LD-SG-GP240-0106	LD-SG-GP120-0106	

Table 1.14
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Soil Gas
Exposure Medium: Zone 2

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Leel (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Soil Gas Zone 2	67641	acetone	12		1100		ug/m^3	GP56	53 / 73	0.4	26.8	11		NA	330	nc	NA	NA	N	BSL
	71432	**benzene**	1.5	J	680	J	ug/m^3	GP32	67 / 76	0.6	44.7	6.8	J	NA	0.23	ca	NA	NA	**Y**	**ASL**
	100447	**benzyl chloride**	16	J	16	J	ug/m^3	GP13	1 / 76	0.7	25	0.16	J	NA	0.037	ca	NA	NA	**Y**	**ASL**
	74839	bromomethane	3.6	J	3.6	J	ug/m^3	VM01	1 / 76	0.9	20	0.036	J	NA	0.51	nc	NA	NA	N	BSL
	75150	carbon disulfide	0.68	J	89	J	ug/m^3	GP47	25 / 76	0.5	15	0.89	J	NA	73	nc	NA	NA	N	BSL
	56235	**carbon tetrachloride**	32	J	32	J	ug/m^3	GP20	1 / 76	1.3	30	0.32	J	NA	0.12	ca	NA	NA	**Y**	**ASL**
	108907	**chlorobenzene**	4	J	3200		ug/m^3	GP35	23 / 76	1	670	32		NA	5.1	nc	NA	NA	**Y**	**ASL**
	75003	chloroethane	8.4		68	J	ug/m^3	GP31	4 / 76	0.9	15	0.68	J	NA	2.2	ca	NA	NA	N	BSL
	67663	chloroform	1.5	J	3.2	J	ug/m^3	GP98	2 / 76	0.4	25	0.032	J	NA	0.077	ca	NA	NA	N	BSL
	74873	chloromethane	1.1	J	62		ug/m^3	VM01	23 / 76	0.6	10	0.62		NA	9.5	nc	NA	NA	N	BSL
	95501	1,2-dichlorobenzene	24	J	24	J	ug/m^3	GP22, GP32	2 / 76	1.1	30	0.24	J	NA	15	nc	NA	NA	N	BSL
	541731	1,3-dichlorobenzene	24	J	24	J	ug/m^3	GP35	1 / 76	1.6	30	0.24	J	NA	1.1	nc	NA	NA	N	BSL
	106467	**1,4-dichlorobenzene**	1.8	J	240	J	ug/m^3	GP32	17 / 76	1.1	30	2.4	J	NA	0.28	ca	NA	NA	**Y**	**ASL**
	75718	**dichlorodifluoromethane**	2.2	J	11000	J	ug/m^3	GP33	26 / 76	1	695	110	J	NA	18	nc	NA	NA	**Y**	**ASL**
	75343	1,1-dichloroethane	12	J	93		ug/m^3	GP95	2 / 76	0.9	20	0.93		NA	51	nc	NA	NA	N	BSL
	107062	1,2-dichloroethane	1.3	J	1.3	J	ug/m^3	VM01	1 / 76	0.8	20	0.013	J	NA	0.069	ca	NA	NA	N	BSL
	75354	1,1-dichloroethene	8	J	8	J	ug/m^3	GP32	1 / 76	0.6	20	0.08	J	NA	22	nc	NA	NA	N	BSL
	156592	cis-1,2-dichloroethylene	0.95	J	52		ug/m^3	GP09	8 / 76	0.9	20	0.52		NA	3.7	nc	NA	NA	N	BSL
	156605	trans-1,2-dichloroethene	4	J	12	J	ug/m^3	GP32	3 / 76	0.6	20	0.12	J	NA	7.3	nc	NA	NA	N	BSL
	76142	**1,2-dichlorotetrafluoroethane**	1.6	J	160	J	ug/m^3	GP33	10 / 64	1.5	12.6	1.6	J	NA	NA		NA	NA	**Y**	**NSL**
	100414	ethylbenzene	1.1	J	78		ug/m^3	GP98	32 / 76	0.9	20	0.78		NA	110	nc	NA	NA	N	BSL
	622968	**4-ethyltoluene**	1.1	J	1000		ug/m^3	GP31	34 / 72	0.9	67	10		NA	NA		NA	NA	**Y**	**NSL**
	78933	methyl ethyl ketone (2-butanone)	2.2	J	13000	E	ug/m^3	VM03	36 / 73	0.6	15	130	E	NA	510	nc	NA	NA	N	BSL
	108101	methyl isobutyl ketone (4-methyl-2-pentanone)	54		54		ug/m^3	GP18	1 / 73	0.6	20	0.54		NA	310	nc	NA	NA	N	BSL
	75092	methylene chloride	0.73	J	46		ug/m^3	GP36	16 / 76	0.5	20	0.46		NA	3.8	ca	NA	NA	N	BSL
	100425	styrene	0.89	J	35		ug/m^3	GP19	11 / 76	0.5	20	0.35		NA	100	nc	NA	NA	N	BSL
	1634044	tert-butyl methyl ether	2.2	J	61		ug/m^3	GP94	9 / 22	0.6	3.99	0.61		NA	1.6	ca	NA	NA	N	BSL
	127184	**tetrachloroethylene(PCE)**	1.5	J	150		ug/m^3	GP19	20 / 76	1.1	35	1.5		NA	0.31	ca	NA	NA	**Y**	**ASL**
	811972	1,1,1,2-tetrafluoroethane	16		85	J	ug/m^3	GP23	5 / 12	4.67	35	0.85	J	NA	8400	nc	NA	NA	N	BSL
	108883	toluene	3	J	600		ug/m^3	GP98	73 / 76	0.4	20	6		NA	510	nc	NA	NA	N	BSL
	71556	1,1,1-trichloroethane	2	J	11	J	ug/m^3	GP10	3 / 76	1.4	30	0.11	J	NA	100	nc	NA	NA	N	BSL
	79005	**1,1,2-trichloroethane**	220	J	220	J	ug/m^3	GP35	1 / 76	1.4	30	2.2	J	NA	0.11	ca	NA	NA	**Y**	**ASL**
	79016	**trichloroethylene (TCE)**	1.6	J	44		ug/m^3	GP09	11 / 76	0.9	25	0.44		NA	0.016	ca	NA	NA	**Y**	**ASL**
	75694	trichlorofluoromethane	1.5	J	96		ug/m^3	GP113	18 / 76	17	30	0.96		NA	73	nc	NA	NA	N	BSL
	76131	1,1,2-trichloro-1,2,2-trifluoroethane	1.8	J	1.8	J	ug/m^3	GP88	1 / 76	1.6	40	0.018	J	NA	3100	nc	NA	NA	N	BSL
	95636	**1,2,4-trimethylbenzene**	1.3	J	1200		ug/m^3	GP31	57 / 76	1	67	12		NA	NA		NA	NA	**Y**	**NSL**
	108678	**1,3,5-trimethylbenzene (mesitylene)**	1	J	290	J	ug/m^3	GP31	20 / 76	0.8	25	2.9	J	NA	NA		NA	NA	**Y**	**NSL**
	75014	**vinyl chloride**	1.1	J	34		ug/m^3	GP09	8 / 76	0.5	15	0.34		NA	0.072	ca	NA	NA	**Y**	**ASL**
		m,p-xylene (sum of isomers)	2	J	430		ug/m^3	GP98	67 / 76	1.3	20	4.3		NA	11	nc	NA	NA	N	BSL
		o-xylene (1,2-dimethylbenzene)	1.4	J	220		ug/m^3	GP98	35 / 76	0.8	20	2.2		NA	11	nc	NA	NA	N	BSL

Footnotes

ug/m^3 = micrograms per cubic meter

(1) E = Analyte present. Reported value exceeds a theoretically greater value. However the difference is within the expected precision of the analytical techniques and is not statistically significant
J = Analyte present. Reported value may not be accurate or precise.

(2) The EPA Subsurface Vapor Intrusion Guidance default attenuation factor of 0.01 was applied to the maximum detected concentration to estimate the maximum indoor air concentration used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Ambient Air) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1).

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level

Zone 2 Soil Gas Samples Include:

LD-SG-GP01-0203	LD-SG-GP23-0403	LD-SG-GP33-0403	LD-SG-GP44-0403	LD-SG-GP54-0403	LD-SG-GP87-0704	LD-SG-GP96-0704
LD-SG-GP04-0203	LD-SG-GP24-0403	LD-SG-GP34-0403	LD-SG-GP45-0403	LD-SG-GP55-0403	LD-SG-GP88-0704	LD-SG-GP98-0704
LD-SG-GPD01-0203	LD-SG-GP25-0403	LD-SG-GP35-0403	LD-SG-GP46-0403	LD-SG-GP56-0403	LD-SG-GP89-0704	LD-SG-GP247-0106
LD-SG-GP09-0403	LD-SG-GP26-0403	LD-SG-GP36-0403	LD-SG-GP47-0403	LD-SG-GP57-0403	LD-SG-GP113-0704	LD-SG-VM01-0704
LD-SG-GP10-0403	LD-SG-GP27-0403	LD-SG-GP37-0403	LD-SG-GP48-0403	LD-SG-GPD09-0403	LD-SG-GP90-0704	LD-SG-VM02-0704

Table 1.14
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Soil Gas
Exposure Medium: Zone 2

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)	Background Leel (3)	Screening Toxicity Value (nc/ca) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
								Min	Max							
			LD-SG-GP13-0403	LD-SG-GP28-0403			LD-SG-GP38-0403	LD-SG-GPD08-0403		LD-SG-GP58-0403		LD-SG-GP91-0704			LD-SG-VM03-0704	
			LD-SG-GP18-0403	LD-SG-GP29-0403			LD-SG-GP39-0403	LD-SG-GP49-0403		LD-SG-GP67-0403		LD-SG-GP111-0704			LD-SG-VM04-0704	
			LD-SG-GP19-0403	LD-SG-GP30-0403			LD-SG-GP40-0403	LD-SG-GP50-0403		LD-SG-GP80-0403		LD-SG-GP92-0704			LD-SG-VM05-0704	
			LD-SG-GP20-0403	LD-SG-GPD05-0403			LD-SG-GP41-0403	LD-SG-GP51-0403		LD-SG-GPD04-0403		LD-SG-GP93-0704			LD-SG-VM06-0704	
			LD-SG-GP21-0403	LD-SG-GP31-0403			LD-SG-GP42-0403	LD-SG-GP52-0403		LD-SG-GP81-0403		LD-SG-GP94-0704			LD-SG-VM07-0704	
			LD-SG-GP22-0403	LD-SG-GP32-0403			LD-SG-GP43-0403	LD-SG-GP53-0403		LD-SG-GP85-0704		LD-SG-GP95-0704				

Table 1.15
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Soil Gas
Exposure Medium: Zone 3

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Level (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Soil Gas Zone 3	67641	acetone	24		150		ug/m^3	GP84	21 / 24	0.4	26.8	1.5		NA	330	nc	NA	NA	N	BSL
	71432	**benzene**	1.2	J	97		ug/m^3	GP16	24 / 28	0.6	40.2	0.97		NA	0.23	ca	NA	NA	**Y**	**ASL**
	75150	carbon disulfide	1.2	J	53		ug/m^3	GP83	10 / 24	0.5	40.2	0.53		NA	73	nc	NA	NA	N	BSL
	108907	chlorobenzene	1.3	J	38	J	ug/m^3	GP12	2 / 28	1	67	0.38	J	NA	5.1	nc	NA	NA	N	BSL
	75003	chloroethane	1.6	J	1.6	J	ug/m^3	GP03	1 / 28	0.9	40.2	0.016	J	NA	2.2	ca	NA	NA	N	BSL
	67663	**chloroform**	1.1	J	640		ug/m^3	GP16	12 / 28	0.4	67	6.4		NA	0.077	ca	NA	NA	**Y**	**ASL**
	74873	chloromethane	0.91	J	9.1		ug/m^3	GP105	15 / 28	0.6	26.8	0.091		NA	9.5	nc	NA	NA	N	BSL
	106467	**1,4-dichlorobenzene**	1.4	J	43	J	ug/m^3	GP12	14 / 28	1.1	80.4	0.43	J	NA	0.28	ca	NA	NA	**Y**	**ASL**
	75718	dichlorodifluoromethane	1.2	J	46		ug/m^3	GP82	16 / 28	1	67	0.46		NA	18	nc	NA	NA	N	BSL
	75343	1,1-dichloroethane	1.4	J	65		ug/m^3	GP86	2 / 28	0.9	53.6	0.65		NA	51	nc	NA	NA	N	BSL
	156592	cis-1,2-dichloroethylene	8	J	8	J	ug/m^3	GP11	1 / 28	0.9	53.6	0.08	J	NA	3.7	nc	NA	NA	N	BSL
	76142	**1,2-dichlorotetrafluoroethane**	1.8	J	1.8	J	ug/m^3	GP83,GP84	2 / 19	1.5	7	0.018	J	NA	NA		NA	NA	**Y**	**NSL**
	100414	ethylbenzene	1.4	J	35		ug/m^3	GP107	19 / 28	0.9	53.6	0.35		NA	110	nc	NA	NA	N	BSL
	622968	**4-ethyltoluene**	1.2	J	20		ug/m^3	GP107	14 / 24	0.9	67	0.2		NA	NA		NA	NA	**Y**	**NSL**
	591786	**2-hexanone**	9.8		9.8		ug/m3	GP84	1 / 24	0.8	53.6	0.098		NA	NA		NA	NA	**Y**	**NSL**
	78933	methyl ethyl ketone (2-butanone)	1.3	J	130		ug/m^3	GP101	15 / 24	0.6	40.2	1.3		NA	510	nc	NA	NA	N	BSL
	108101	methyl isobutyl ketone (4-methyl-2-pentanone)	18		18		ug/m^3	GP83	1 / 24	0.6	53.6	0.18		NA	310	nc	NA	NA	N	BSL
	75092	methylene chloride	0.69	J	2	J	ug/m^3	GP84	8 / 28	0.5	53.6	0.02	J	NA	3.8	ca	NA	NA	N	BSL
	100425	styrene	0.94	J	18		ug/m^3	GP107	11 / 28	0.5	53.6	0.18		NA	100	nc	NA	NA	N	BSL
	1634044	tert-butyl methyl ether	0.76	J	76		ug/m^3	GP83	10 / 15	0.6	5.8	0.76		NA	1.6	ca	NA	NA	N	BSL
	79345	**1,1,2,2-tetrachloroethane**	5	J	5	J	ug/m^3	GP112	1 / 28	1	93.8	0.05	J	NA	0.031	ca	NA	NA	**Y**	**ASL**
	127184	**tetrachloroethylene(PCE)**	1.4	J	43		ug/m^3	GP104	17 / 28	1.1	93.8	0.43		NA	0.31	ca	NA	NA	**Y**	**ASL**
	108883	toluene	2.6	J	98		ug/m^3	GP107	26 / 28	0.4	53.6	0.98		NA	510	nc	NA	NA	N	BSL
	71556	1,1,1-trichloroethane	2	J	110		ug/m^3	GP86	8 / 28	1.4	80.4	1.1		NA	100	nc	NA	NA	N	BSL
	79005	1,1,2-trichloroethane	5.1	J	5.1	J	ug/m^3	GP104	1 / 28	1.4	80.4	0.051	J	NA	0.11	ca	NA	NA	N	BSL
	79016	**trichloroethylene (TCE)**	1.4	J	11	J	ug/m^3	GP11	6 / 28	0.9	67	0.11	J	NA	0.016	ca	NA	NA	**Y**	**ASL**
	75694	trichlorofluoromethane	1.5	J	670		ug/m^3	GP82	13 / 28	0.7	80.4	6.7		NA	73	nc	NA	NA	N	BSL
	76131	1,1,2-trichloro-1,2,2-trifluoroethane	1.7	J	1.7	J	ug/m^3	GP84	1 / 28	1.6	107.2	0.017	J	NA	3100	nc	NA	NA	N	BSL
	95636	**1,2,4-trimethylbenzene**	2.4	J	69		ug/m^3	GP107	24 / 28	1	67	0.69		NA	NA		NA	NA	**Y**	**NSL**
	108678	**1,3,5-trimethylbenzene (mesitylene)**	1.2	J	24		ug/m^3	GP107	16 / 28	0.8	67	0.24		NA	NA		NA	NA	**Y**	**NSL**
	108054	vinyl acetate	2.8	J	35		ug/m^3	GP105	5 / 15	0.7	1.4	0.35		NA	21	nc	NA	NA	N	BSL
		m,p-xylene (sum of isomers)	4	J	150		ug/m^3	GP107	24 / 28	1.3	53.6	1.5		NA	11	nc	NA	NA	N	BSL
		o-xylene (1,2-dimethylbenzene)	2.1	J	43		ug/m3	GP107	20 / 28	0.8	53.6	0.43		NA	11	nc	NA	NA	N	BSL

Footnotes

ug/m^3 = micrograms per cubic meter

(1) J = Analyte present. Reported value may not be accurate or precise.

(2) The EPA Subsurface Vapor Intrusion Guidance default attenuation factor of 0.01 was applied to the maximum detected concentration to estimate the maximum indoor air concentration used for screening.

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Ambient Air) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic (Cancer risk at 1E-06, Non-Cancer Hazard at HI = 0.1).

(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level

Zone 3 Soil Gas Samples Include:

LD-SG-GP02-0203	LD-SG-GP07-0403	LD-SG-GP14-0403	LD-SG-GP17-0403	LD-SG-GP86-0704	LD-SG-GP104-0704	LD-SG-GP108-0704
LD-SG-GP03-0203	LD-SG-GP08-0403	LD-SG-GPD02-0403	LD-SG-GP82-0704	LD-SG-GP101-0704	LD-SG-GP105-0704	LD-SG-GP109-0704
LD-SG-GP05-0203	LD-SG-GP11-0403	LD-SG-GP15-0403	LD-SG-GP83-0704	LD-SG-GP102-0704	LD-SG-GP106-0704	LD-SG-GP112-0704
LD-SG-GP06-0203	LD-SG-GP12-0403	LD-SG-GP16-0403	LD-SG-GP84-0704	LD-SG-GP103-0704	LD-SG-GP107-0704	LD-SG-GP110-0704

Table 1.16
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
	309002	**aldrin**	0.0034	J	1.3	J	ug/l	GP243	12 / 94	0.05	0.5	1.3	J	NA	0.0039	ca	NA	NA	Y	**ASL**
	319846	**alpha BHC**	0.0069	J	0.042	J	ug/l	MW14	9 / 94	0.05	0.5	0.042	J	NA	0.011	ca	NA	NA	Y	**ASL**
	959988	alpha endosulfan	0.002	J	0.15	J	ug/l	GP236	8 / 94	0.05	0.5	0.15	J	NA	22	nc	NA	NA	N	BSL
	5103719	**alpha-chlordane**	0.0012	J	0.26	J	ug/l	GP243	7 / 96	0.05	0.5	0.26	J	NA	0.19	ca	NA	NA	Y	**ASL**
	1912249	**atrazine**	3.3	J	3.3	J	ug/l	GP237	1 / 122	5	40	3.3	J	NA	0.3	ca	NA	NA	Y	**ASL**
	319857	**beta BHC**	0.0082	J	0.51	J	ug/l	MW10	25 / 100	0.05	0.5	0.51	J	NA	0.037	ca	NA	NA	Y	**ASL**
	33213659	beta endosulfan	0.00053	J	0.65	J	ug/l	GP243	11 / 96	0.09	1	0.65	J	NA	22	nc	NA	NA	N	BSL
	319868	**delta BHC**	0.0039	J	1.9	J	ug/l	GP243	14 / 99	0.05	0.5	1.9	J	NA	0.037	ca	NA	NA	Y	**ASL**
	60571	**dieldrin**	0.0026	J	0.39	J	ug/l	GP243	16 / 98	0.09	1	0.39	J	NA	0.0042	ca	NA	NA	Y	**ASL**
	1031078	endosulfan sulfate	0.0055	J	0.87	J	ug/l	GP243	8 / 96	0.09	1	0.87	J	NA	22	nc	NA	NA	N	BSL
	72208	endrin	0.013	J	0.1	L	ug/l	MW12	7 / 94	0.09	1	0.1	L	NA	1.1	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	0.0072	J	0.6	J	ug/l	GP37	13 / 98	0.09	1	0.6	J	NA	1.1	nc	NA	NA	N	BSL
	53494705	**endrin ketone**	0.014	J	1.6	J	ug/l	GP243	14 / 99	0.09	1	1.6	J	NA	1.1	nc	NA	NA	Y	**ASL**
	58899	**gamma BHC (Lindane)**	0.0023	J	0.18	J	ug/l	GP214	21 / 103	0.05	0.5	0.18	J	NA	0.052	ca	NA	NA	Y	**ASL**
	5103742	**gamma-chlordane**	0.046	J	0.45	L	ug/l	GP233	12 / 96	0.05	0.5	0.45	L	NA	0.19	ca	NA	NA	Y	**ASL**
	76448	**heptachlor**	0.00023	J	0.082	J	ug/l	GP213	12 / 97	0.05	0.5	0.082	J	NA	0.015	ca	NA	NA	Y	**ASL**
	1024573	**heptachlor epoxide**	0.0024	J	0.13		ug/l	GP218	15 / 99	0.05	0.5	0.13		NA	0.0074	ca	NA	NA	Y	**ASL**
	72435	methoxychlor	0.0095	J	0.19	J	ug/l	GP237	8 / 96	0.46	5	0.19	J	NA	18	nc	NA	NA	N	BSL
	72548	**p,p-DDD**	0.0011	J	0.84		ug/l	GP67	14 / 94	0.09	1	0.84		NA	0.28	ca	NA	NA	Y	**ASL**
	72559	**p,p-DDE**	0.0018	J	0.35	J	ug/l	GP243	19 / 99	0.09	1	0.35	J	NA	0.2	ca	NA	NA	Y	**ASL**
	50293	**p,p-DDT**	0.002	J	0.67	J	ug/l	GP67	18 / 96	0.09	1	0.67	J	NA	0.2	ca	NA	NA	Y	**ASL**
	12674112	**PCB-1016 (Arochlor 1016)**	6.7	L	6.7	L	ug/l	MW11	1 / 90	0.93	1.03	6.7	L	NA	0.255	nc	NA	NA	Y	**ASL**
	53469219	**PCB-1242 (Arochlor 1242)**	1.4		11	J	ug/l	GPD06	6 / 90	0.93	1.03	11	J	NA	0.033	ca	NA	NA	Y	**ASL**
Groundwater	12672296	**PCB-1248 (Arochlor 1248)**	1.3	L	4.4	J	ug/l	MW20	2 / 91	0.93	1.03	4.4	J	NA	0.033	ca	NA	NA	Y	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	0.42	J	54		ug/l	GP243	21 / 99	0.93	5	54		NA	0.033	ca	NA	NA	Y	**ASL**
	DIOXINS	**Total 2,3,7,8-TCDD TEQ**	4.1187		70.66		pg/l	GP238	5 / 5			70.66		NA	0.45	ca	NA	NA	Y	**ASL**
	95578	2-chlorophenol	0.24	J	2.8	J	ug/l	GP243	7 / 122	5	40	2.8	J	NA	3	nc	NA	NA	N	BSL
	91941	**3,3-dichlorobenzidine**	4.3	J	4.3	J	ug/l	GP238	1 / 121	5	40	4.3	J	NA	0.15	ca	NA	NA	Y	**ASL**
	120832	2,4-dichlorophenol	0.61	J	0.61	J	ug/l	GP233	1 / 122	5	40	0.61	J	NA	11	nc	NA	NA	N	BSL
	105679	2,4-dimethylphenol	2	J	14		ug/l	MW12	5 / 122	5	40	14		NA	73	nc	NA	NA	N	BSL
	534521	**4,6-dinitro-2-methylphenol**	3.7	J	3.9	J	ug/l	GP237	2 / 107	10	100	3.9	J	NA	NA		NA	NA	Y	**NSL**
	121142	**2,4-dinitrotoluene**	35		35		ug/l	GP232, GP238	2 / 122	5	40	35		NA	7.3	nc	NA	NA	Y	**ASL**
	606202	**2,6-dinitrotoluene**	3.6	J	48		ug/l	GP237	2 / 122	5	40	48		NA	3.7	nc	NA	NA	Y	**ASL**
	91576	**2-methylnaphthalene**	0.58	J	27	J	ug/l	GP121	28 / 122	5	40	27	J	NA	2.4	nc	NA	NA	Y	**ASL**
	95487	2-methylphenol (o-cresol)	1	J	2.7	J	ug/l	GP238	2 / 122	5	40	2.7	J	NA	180	nc	NA	NA	N	BSL
	106445	4-methylphenol (p-cresol)	0.16	J	18		ug/l	MW13	18 / 122	5	40	18		NA	18	nc	NA	NA	N	BSL
	88744	**2-nitroaniline**	3.4	J	4.5	J	ug/l	GP232, GP238	2 / 120	10	100	4.5	J	NA	NA		NA	NA	Y	**NSL**
	99092	**3-nitroaniline**	4.7	J	12	J	ug/l	GP238	3 / 120	10	100	12	J	NA	NA		NA	NA	Y	**NSL**
	100016	**4-nitroaniline**	3.4	J	5.4	J	ug/l	GP232	2 / 120	10	100	5.4	J	NA	NA		NA	NA	Y	**NSL**
	100027	**4-nitrophenol**	2.6	J	3	J	ug/l	GP237	3 / 114	10	100	3	J	NA	NA		NA	NA	Y	**NSL**
	83329	acenaphthene	0.63	J	14		ug/l	GP239	42 / 122	5	40	14		NA	37	nc	NA	NA	N	BSL
	208968	acenaphthylene	0.44	J	1.7	J	ug/l	MW10	2 / 122	5	40	1.7	J	NA	37	nc	NA	NA	N	BSL
	98862	acetophenone	1.1	J	2.3	J	ug/l	GP247	2 / 122	5	40	2.3	J	NA	61	nc	NA	NA	N	BSL
	120127	anthracene	0.2	J	7.3	J	ug/l	GP218	27 / 122	5	40	7.3	J	NA	180	nc	NA	NA	N	BSL
	100527	benzaldehyde	0.69	J	2	J	ug/l	GP27	6 / 113	5	40	2	J	NA	370	nc	NA	NA	N	BSL
	56553	**benzo(a)anthracene**	0.47	J	11		ug/l	GP120	17 / 122	5	40	11		NA	0.03	ca	NA	NA	Y	**ASL**
	50328	**benzo(a)pyrene**	0.33	J	11		ug/l	GP120	17 / 122	5	40	11		NA	0.003	ca	NA	NA	Y	**ASL**

Table 1.16
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
	205992	**benzo(b)fluoranthene**	0.39	J	15		ug/l	GP120	19 / 122	5	40	15		NA	0.03	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	0.29	J	5.9	J	ug/l	GP218	12 / 122	5	40	5.9	J	NA	18	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	0.18	J	16	J	ug/l	GP243	16 / 122	5	40	16	J	NA	0.3	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	2.8	J	6	J	ug/l	GP87	2 / 112	5	40	6	J	NA	730	nc	NA	NA	N	BSL
	92524	biphenyl (diphenyl)	0.23	J	1.1	J	ug/l	MW20	4 / 122	5	40	1.1	J	NA	30	nc	NA	NA	N	BSL
	108601	**bis(2-chloroisopropyl) ether**	3.2	J	14	J	ug/l	GP238	2 / 122	5	40	14	J	NA	0.26	ca	NA	NA	**Y**	**ASL**
	117817	**bis(2-ethylhexyl) phthalate**	0.52	J	370		ug/l	GP33	33 / 102	5	40	370		NA	4.8	ca	NA	NA	**Y**	**ASL**
	105602	caprolactam	0.37	J	9	J	ug/l	MW12	16 / 121	5	40	9	J	NA	1800	nc	NA	NA	N	BSL
	86748	**carbazole**	0.21	J	5	J	ug/l	MW10	18 / 122	5	40	5	J	NA	3.3	ca	NA	NA	**Y**	**ASL**
	218019	**chrysene**	0.4	J	12		ug/l	GP120	18 / 122	5	40	12		NA	3	ca	NA	NA	**Y**	**ASL**
	53703	**dibenz(a,h)anthracene**	0.61	J	1.8	J	ug/l	GP120	2 / 116	5	40	1.8	J	NA	0.003	ca	NA	NA	**Y**	**ASL**
	132649	**dibenzofuran**	0.24	J	9		ug/l	GP239	25 / 122	5	40	9		NA	NA		NA	NA	**Y**	**NSL**
	84662	diethyl phthalate	0.25	J	7.3		ug/l	GP236	6 / 122	5	40	7.3		NA	2900	nc	NA	NA	N	BSL
	84742	di-n-butyl phthalate	0.55	J	30	J	ug/l	GP33	8 / 109	5	40	30	J	NA	370	nc	NA	NA	N	BSL
	206440	fluoranthene	0.34	J	28		ug/l	GP120	31 / 118	5	40	28		NA	150	nc	NA	NA	N	BSL
	86737	fluorene	0.46	J	18		ug/l	GP239	37 / 122	5	40	18		NA	24	nc	NA	NA	N	BSL
	77474	hexachlorocyclopentadiene	3.1	J	3.1	J	ug/l	GP237	1 / 121	5	40	3.1	J	NA	22	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	0.37	J	5.4		ug/l	GP120	10 / 117	5	40	5.4		NA	0.03	ca	NA	NA	**Y**	**ASL**
	78591	isophorone	9.4		29		ug/l	GP243	4 / 122	5	40	29		NA	70	ca	NA	NA	N	BSL
	91203	**naphthalene**	0.23	J	20		ug/l	MW20	33 / 122	5	40	20		NA	0.65	nc	NA	NA	**Y**	**ASL**
	98953	**nitrobenzene**	3.8	J	3.8	J	ug/l	GP232	1 / 122	5	40	3.8	J	NA	0.35	nc	NA	NA	**Y**	**ASL**
	621647	**n-nitrosodi-n-propylamine**	6.2	J	8.4	J	ug/l	GP238	2 / 122	5	40	8.4	J	NA	0.0096	ca	NA	NA	**Y**	**ASL**
	86306	n-nitrosodiphenylamine	0.25	J	5.1	J	ug/l	GP232	16 / 122	5	40	5.1	J	NA	14	ca	NA	NA	N	BSL
Groundwater	85018	**phenanthrene**	0.43	J	32		ug/l	GP218	40 / 116	5	40	32		NA	18	nc	NA	NA	**Y**	**ASL**
	108952	phenol	0.21	J	6	J	ug/l	GP20	12 / 122	5	40	6	J	NA	1100	nc	NA	NA	N	BSL
	129000	**pyrene**	0.25	J	29		ug/l	GP120	30 / 119	5	40	29		NA	18	nc	NA	NA	**Y**	**ASL**
	67641	acetone	2	J	21	J	ug/l	GP42, GP58	11 / 52	5	50	21	J	NA	550	nc	NA	NA	N	BSL
	71432	**benzene**	1	J	18		ug/l	GP243	26 / 131	5	50	18		NA	0.34	ca	NA	NA	**Y**	**ASL**
	75274	**bromodichloromethane**	4	J	4	J	ug/l	GP16	1 / 133	5	50	4	J	NA	0.17	ca	NA	NA	**Y**	**ASL**
	75150	carbon disulfide	1	J	3	J	ug/l	GP33	3 / 130	5	50	3	J	NA	100	nc	NA	NA	N	BSL
	56235	**carbon tetrachloride**	1	J	1	J	ug/l	GP20	1 / 133	5	50	1	J	NA	0.16	ca	NA	NA	**Y**	**ASL**
	108907	**chlorobenzene**	0.82	J	190		ug/l	GP243	57 / 133	5	50	190		NA	9	nc	NA	NA	**Y**	**ASL**
	67663	**chloroform**	0.64	J	19		ug/l	GP16	2 / 131	5	50	19		NA	0.15	ca	NA	NA	**Y**	**ASL**
	74873	chloromethane	0.8	J	0.8	J	ug/l	GP218	1 / 133	5	50	0.8	J	NA	19	nc	NA	NA	N	BSL
	110827	cyclohexane	0.62	J	4	J	ug/l	GP247	3 / 131	5	50	4	J	NA	1200	nc	NA	NA	N	BSL
	95501	1,2-dichlorobenzene	0.22	J	1	J	ug/l	GP19,GP32,GPD06,MW11	15 / 133	5	50	1	J	NA	27	nc	NA	NA	N	BSL
	541731	**1,3-dichlorobenzene**	0.15	J	2.9	J	ug/l	GP243	17 / 129	5	50	2.9	J	NA	1.8	nc	NA	NA	**Y**	**ASL**
	106467	**1,4-dichlorobenzene**	1	J	18		ug/l	GP243	34 / 130	5	50	18		NA	0.47	ca	NA	NA	**Y**	**ASL**
	123911	**1,4-dioxane (p-dioxane)**	48	J	1000	J	ug/l	MW11	21 / 32	5	100	1000	J	NA	6.1	ca	NA	NA	**Y**	**ASL**
	75354	1,1-dichloroethene	0.53	J	0.65	J	ug/l	GP244	2 / 133	5	50	0.65	J	NA	35	nc	NA	NA	N	BSL
	156592	**cis-1,2-dichloroethylene**	2	J	9	J	ug/l	GP08	7 / 133	5	50	9	J	NA	6.1	nc	NA	NA	**Y**	**ASL**
	100414	ethylbenzene	0.19	J	2.3	J	ug/l	MW10	9 / 133	5	50	2.3	J	NA	130	nc	NA	NA	N	BSL
	98828	isopropylbenzene (cumene)	0.28	J	15		ug/l	MW04	36 / 133	5	50	15		NA	66	nc	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	0.66	J	3.6	J	ug/l	GP231	4 / 133	5	50	3.6	J	NA	700	nc	NA	NA	N	BSL
	108872	methylcyclohexane	0.63	J	4.8	J	ug/l	GP121	7 / 133	5	50	4.8	J	NA	630	nc	NA	NA	N	BSL
	75092	methylene chloride	1	J	1	J	ug/l	GP82, GP84	2 / 108	5	50	1	J	NA	4.1	ca	NA	NA	N	BSL
	1634044	**tert-butyl methyl ether (MTBE)**	1	J	120	L	ug/l	GP241	50 / 130	5	50	120	L	NA	2.6	ca	NA	NA	**Y**	**ASL**

Table 1.16
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)		Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)		Background Value (3)	Screening Toxicity Value (nc/ca) (4)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
										Min	Max									
Groundwater	127184	**tetrachloroethylene(PCE)**	1	J	4	J	ug/l	GP08	3 / 133	5	50	4	J	NA	0.1	ca	NA	NA	**Y**	**ASL**
	108883	toluene	0.17	J	60		ug/l	GP20	13 / 127	5	50	60		NA	230	nc	NA	NA	N	BSL
	87616	1,2,3-trichlorobenzene	0.87	J	0.99	J	ug/l	GP245	2 / 34	5	5	0.99	J	NA	6.1	nc	NA	NA	N	BSL
	120821	1,2,4-trichlorobenzene	0.53	J	2.5	J	ug/l	GP245	3 / 133	5	50	2.5	J	NA	6.1	nc	NA	NA	N	BSL
	76131	1,1,2-trichloro-1,2,2-trifluoroethane	0.34	J	0.34	J	ug/l	MW6	1 / 132	5	50	0.34	J	NA	5900	nc	NA	NA	N	BSL
	79016	**trichloroethylene (TCE)**	0.64	J	5	J	ug/l	GP08	4 / 133	5	50	5	J	NA	0.026	ca	NA	NA	**Y**	**ASL**
	75014	**vinyl chloride**	1	J	2	J	ug/l	GP10	2 / 133	5	50	2	J	NA	0.015	ca	NA	NA	**Y**	**ASL**
	MPXYL	m,p-xylene (sum of isomers)	0.5	J	3.7	J	ug/l	MW10	12 / 34	5	5	3.7	J	NA	21	nc	NA	NA	N	BSL
	95476	o-xylene (1,2-dimethylbenzene)	0.19	J	2.4	J	ug/l	MW10	11 / 34	5	5	2.4	J	NA	21	nc	NA	NA	N	BSL
	1330207	xylenes, total	1	J	5	J	ug/l	GP20	3 / 133	10	50	5	J	NA	21	nc	NA	NA	N	BSL
	7429905	**aluminum**	13.1	J	312000	L	ug/l	GP241	88 / 108	200	200	312000	L	NA	NA		NA	NA	**Y**	**NSL**
	7440360	**antimony**	5	J	271	L	ug/l	GP239	14 / 164	60	60	271	L	NA	1.5	nc	NA	NA	**Y**	**ASL**
	7440382	**arsenic**	1.4	J	241		ug/l	GP67	98 / 192	10	15	241		NA	0.045	ca	NA	NA	**Y**	**ASL**
	7440393	**barium**	22.3	J	12800	L	ug/l	MW11	203 / 204	200	200	12800	L	NA	730	nc	NA	NA	**Y**	**ASL**
	7440417	**beryllium**	0.12	J	25.7		ug/l	GP67	32 / 137	5	5	25.7		NA	7.3	nc	NA	NA	**Y**	**ASL**
	7440439	**cadmium**	0.37	J	109	L	ug/l	MW11	53 / 200	5	5	109	L	NA	1.8	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	23800		382000	L	ug/l	MW11	203 / 204	5000	5000	382000	L	NA	NA		NA	NA	N	NUT
	7440473	chromium (as Cr+3) [6]	0.59	J	2090	L	ug/l	MW11	135 / 173	10	10	2090	L	NA	5500	nc	NA	NA	N	BSL
	7440484	**cobalt**	0.7	J	300		ug/l	GP67	171 / 193	50	50	300		NA	NA		NA	NA	**Y**	**NSL**
	7440508	**copper**	1.2	J	12500	L	ug/l	GP241	104 / 203	25	25	12500	L	NA	150	nc	NA	NA	**Y**	**ASL**
	57125	**cyanide**	1.5	J	208	L	ug/l	MW11	32 / 110	10	10	208	L	NA	73	nc	NA	NA	**Y**	**ASL**
	7439896	**iron**	27.4	J	770000	L	ug/l	MW11	192 / 200	100	300	770000	L	NA	1100	nc	NA	NA	**Y**	**ASL**
	7439921	**lead**	2.8	J	26500	L	ug/l	MW11	79 / 200	10	10	26500	L	NA	15		NA	NA	**Y**	**ASL**
	7439954	magnesium	10100		243000	L	ug/l	GP240	203 / 204	5000	5000	243000	L	NA	NA		NA	NA	N	NUT
	7439965	**manganese**	11.6	J	13800		ug/l	GP67	203 / 204	15	15	13800		NA	73	nc	NA	NA	**Y**	**ASL**
	7439976	**mercury**	0.04	J	36.2	J	ug/l	MW11	55 / 177	0.2	1	36.2	J	NA	0.37	nc	NA	NA	**Y**	**ASL**
	7440020	**nickel**	1.1	J	1480	L	ug/l	GP29	143 / 180	40	40	1480	L	NA	73	nc	NA	NA	**Y**	**ASL**
	7440097	potassium	2080	J	295000	L	ug/l	MW20	203 / 203	5000	60000	295000	L	NA	NA		NA	NA	N	NUT
	7782492	**selenium**	2	J	51.5	L	ug/l	MW11	18 / 202	35	35	51.5	L	NA	18	nc	NA	NA	**Y**	**ASL**
	7440224	**silver**	0.76	J	130	L	ug/l	GP241	43 / 198	10	10	130	L	NA	18	nc	NA	NA	**Y**	**ASL**
	7440235	sodium	4330	J	1450000	L	ug/l	MW20	203 / 204	5000	100000	1450000	L	NA	NA		NA	NA	N	NUT
	7440280	**thallium**	3.5	J	28.9		ug/l	MW05D	23 / 195	25	25	28.9		NA	0.26	nc	NA	NA	**Y**	**ASL**
	7440622	**vanadium**	0.52	J	5000	L	ug/l	GP241	164 / 200	50	50	5000	L	NA	3.7	nc	NA	NA	**Y**	**ASL**
	7440666	**zinc**	0.82	J	26300	L	ug/l	MW11	98 / 166	60	60	26300	L	NA	1100	nc	NA	NA	**Y**	**ASL**

Table 1.16
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits		Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (nc/ca) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
								Min	Max							

Footnotes

pg/l = picograms per liter
ug/l = micrograms per liter
(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
C = The analyst made an additional comment regarding this result (see analytical report narrative)
< = Less than
(2) The maximum detected concentration was used for screening.
(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.
(4) The toxicity screening values were obtained from the USEPA Region III RBC Tables (Tap Water) (October, 2007). Codes used nc = noncarcinogenic, ca = carcinogenic
(5) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.
(6) Since hexavalent chromium was analyzed for but not detected in groundwater, it was assumed that total chromium was only present in the trivalent state. Consequently, the screening value for trivalent chromium was used.

Groundwater samples include:

LD-GW-GP01-0203	LD-GW-GP24-0403	LD-GW-GP46-0403	LD-GW-GP85-0704	LD-GW-GP211-0106	LD-GW-GP244-0106	LD-GW-MW05S-0306
LD-GW-GP02-0203	LD-GW-GP25-0403	LD-GW-GP47-0403	LD-GW-GP86-0704	LD-GW-GP213-0106	LD-GW-GP245-0106	LDCA-GW-MW5S-0606
LD-GW-GP07-0403	LD-GW-GP26-0403	LD-GW-GP48-0403	LD-GW-GP87-0704	LD-GW-GP214-0106	LD-GW-GP120-0106	LD-GW-MW06-0306
LD-GW-GP08-0403	LD-GW-GP27-0403	LD-GW-GPD08-0403	LD-GW-GP89-0704	LD-GW-GP215-0106	LD-GW-GP246-0106	LDCA-GW-MW6-0606
LD-GW-GP09-0403	LD-GW-GP28-0403	LD-GW-GP49-0403	LD-GW-GP90-0704	LD-GW-GP218-0106	LD-GW-GP247-0106	LDCA-GW-MW7D-0606
LD-GW-GP10-0403	LD-GW-GP29-0403	LD-GW-GP50-0403	LD-GW-GP91-0704	LD-GW-GP224-0106	LD-GW-MW01D-0306	LD-GW-MW07S-0306
LD-GW-GP11-0403	LD-GW-GP30-0403	LD-GW-GP51-0403	LD-GW-GP111-0704	LD-GW-GP227-0106	LD-GW-MW1D-0503	LDCA-GW-MW7S-0606
LD-GW-GP12-0403	LD-GW-GP31-0403	LD-GW-GP52-0403	LD-GW-GP92-0704	LD-GW-GP230-0106	LD-GW-MW01S-0306	LD-GW-MW08-0306
LD-GW-GP13-0403	LD-GW-GP32-0403	LD-GW-GP53-0403	LD-GW-GP93-0704	LD-GW-GP231-0106	LD-GW-MW1S-0503	LD-GW-MW8-0503
LD-GW-GP14-0403	LD-GW-GPD06-0403	LD-GW-GP54-0403	LD-GW-GP96-0704	LD-GW-GP232-0106	LD-GW-MW02-0306	LD-GW-MW09-0306
LD-GW-GPD02-0403	LD-GW-GP33-0403	LD-GW-GP55-0403	LD-GW-GP98-0704	LD-GW-GP233-0106	LD-GW-MW2-0503	LD-GW-MW9-0503
LD-GW-GP15-0403	LD-GW-GP34-0403	LD-GW-GP57-0403	LD-GW-GP112-0704	LD-GW-GP236-0106	LD-GW-MW03-0306	LD-GW-MW10-0306
LD-GW-GP16-0403	LD-GW-GP35-0403	LD-GW-GPD09-0403	LD-GW-GP102-0704	LD-GW-GP121-0106	LD-GW-MW3-0503	LD-GW-MW14-0306
LD-GW-GP17-0403	LD-GW-GP36-0403	LD-GW-GP58-0403	LD-GW-GP105-0704	LD-GW-GP237-0106	LD-GW-MW30-0503	LDCA-GW-MW10-0606
LD-GW-GP18-0403	LD-GW-GP37-0403	LD-GW-GP67-0403	LD-GW-GP106-0704	LD-GW-GP238-0106	LD-GW-MW04-0306	LD-GW-MW11-0306
LD-GW-GP19-0403	LD-GW-GP38-0403	LD-GW-GP81-0403	LD-GW-GP107-0704	LD-GW-GP239-0106	LD-GW-MW13-0306	LDCA-GW-MW11-0606
LD-GW-GP20-0403	LD-GW-GP41-0403	LD-GW-GP82-0704	LD-GW-GP108-0704	LD-GW-GP240-0106	LDCA-GW-MW4-0606	LD-GW-MW12-0306
LD-GW-GP21-0403	LD-GW-GP42-0403	LD-GW-GP83-0704	LD-GW-GP109-0704	LD-GW-GP241-0106	LD-GW-MW05D-0306	LDCA-GW-MW12-0606
LD-GW-GP22-0403	LD-GW-GP43-0403	LD-GW-GP84-0704	LD-GW-GP110-0704	LD-GW-GP243-0106	LDCA-GW-MW5D-0606	LDCA-GW-MW20-0606

Table 1.17
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

38 Important Bioaccumulative Compounds highlighted

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue from Lower Darby and Lower Cobbs Creeks

Exposure Point	CAS Number	Chemical (38 Important Bioaccumulative Compounds are highlighted)	Sediment Minimum Concentration (Qualifier) (1)		Sediment Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Sediment Detection Limits		Fish Tissue Modeled Concentration Used for Screening (2)		Background Value (3)	Fish Tissue BSAF (4) (unitless)	BSAF Source (unitless)	Fish Tissue RBC Screening Toxicity Value (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
										Min	Max							(nc/ca)				
Fish Tissue Lower Darby and Lower Cobbs Creeks	5103719	**alpha-chlordane**	4.3	J	63	J+	ug/kg	SD23	22 / 22	1.93	6.1	341		NA	4.77	(USEPA, 2004)	9	ca	NA	NA	Y	**ASL**
	959988	alpha endosulfan	1.6	J	1.6	J	ug/kg	SD21	1 / 22	1.93	6.1	3.3		NA	1.8	(USEPA, 2004)	810	nc	NA	NA	N	BSL
	319857	**beta BHC**	1.6	J	3.3	J	ug/kg	SD25	4 / 22	1.93	6.1	6.8		NA	1.8	(USEPA, 2004)	1.8	ca	NA	NA	Y	**ASL**
	60571	**dieldrin**	6	J	67		ug/kg	SD30	20 / 22	3.75	11.8	137		NA	1.8	(USEPA, 2004)	0.2	ca	NA	NA	Y	**ASL**
	1031078	endosulfan sulfate	6.5	J	21	J	ug/kg	SD23	3 / 22	3.75	11.8	43		NA	1.8	(USEPA, 2004)			NA	NA	N	NTX
	72208	endrin	0.95	J	6.3	J	ug/kg	SD22	5 / 22	3.75	11.8	13		NA	1.8	(USEPA, 2004)	41	nc	NA	NA	N	BSL
	7421934	endrin aldehyde	4.4	J	18	J	ug/kg	SD23	3 / 22	3.75	11.8	37		NA	1.8	(USEPA, 2004)			NA	NA	N	NTX
	53494705	endrin ketone	1.8	J	6.5	J	ug/kg	SD25	4 / 22	3.75	11.8	13		NA	1.8	(USEPA, 2004)			NA	NA	N	NTX
	5103742	**gamma-chlordane**	2.6		35		ug/kg	SD23	22 / 22	1.93	6.1	88		NA	2.22	(USEPA, 2004)	9	ca	NA	NA	Y	**ASL**
	76448	**heptachlor**	1.3	J	1.3	J	ug/kg	SD28	1 / 22	1.93	6.1	2.7		NA	1.8	(USEPA, 2004)	0.7	ca	NA	NA	Y	**ASL**
	1024573	**heptachlor epoxide**	0.58	J	8.9	J	ug/kg	SD10	19 / 22	1.93	6.1	18		NA	1.8	(USEPA, 2004)	0.35	ca	NA	NA	Y	**ASL**
	72435	methoxychlor	8.8	J	31	J	ug/kg	SD22	6 / 22	19.32	60.7	63		NA	1.8	(USEPA, 2004)	680	nc	NA	NA	N	BSL
	72548	p,p-DDD	1.4	J	33	J	ug/kg	SD30	7 / 22	3.75	11.8	11		NA	0.28	(USEPA, 2004)	13	ca	NA	NA	N	BSL
	72559	**p,p-DDE**	1.8	J	15	J	ug/kg	SD31	14 / 22	3.75	11.8	131		NA	7.7	(USEPA, 2004)	9.3	ca	NA	NA	Y	**ASL**
	50293	**p,p-DDT**	2.1	J	20	J	ug/kg	SD20	9 / 22	3.75	11.8	38		NA	1.67	(USEPA, 2004)	9.3	ca	NA	NA	Y	**ASL**
	11096825	**PCB-1260 (Arochlor 1260)**	390	J	390	J	ug/kg	SD23	1 / 22	37.5	117.9	820		NA	1.85	(USEPA, 2004)	1.6	ca	NA	NA	Y	**ASL**
	83329	acenaphthene	22	J	1500		ug/kg	SD24	18 / 22	402.44	3000	494		NA	0.29	(USEPA, 2004)	8100	nc	NA	NA	N	BSL
	208968	acenaphthylene	34	J	180	J	ug/kg	SD23	15 / 22	402.44	3000	59		NA	0.29	(USEPA, 2004)	8100	nc	NA	NA	N	BSL
	98862	acetophenone	29	J	42	J	ug/kg	SD19	2 / 14	402.44	3000			NA	NA				NA	NA	N	NTX
	120127	anthracene	110	J	4700		ug/kg	SD24	20 / 22	402.44	3000	1549		NA	0.29	(USEPA, 2004)	41000	nc	NA	NA	N	BSL
	100527	benzaldehyde	23	J	170	J	ug/kg	SD30	7 / 15	402.44	1346.9			NA	NA				NA	NA	N	NTX
	56553	**benzo(a)anthracene**	280	J	10000		ug/kg	SD24	22 / 22	402.44	5000	3295		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	Y	**ASL**
	50328	**benzo(a)pyrene**	260	J	6300		ug/kg	SD24	22 / 22	402.44	3000	2076		NA	0.29	(USEPA, 2004)	0.43	ca	NA	NA	Y	**ASL**
	205992	**benzo(b)fluoranthene**	270	J	7900		ug/kg	SD24	22 / 22	402.44	3000	2603		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	Y	**ASL**
	191242	benzo(g,h,i)perylene	130	J	2800		ug/kg	SD24	22 / 22	402.44	3000	923		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	260	J	4900		ug/kg	SD25	22 / 22	402.44	3000	1615		NA	0.29	(USEPA, 2004)	43	ca	NA	NA	Y	**ASL**
	85687	benzyl butyl phthalate	58	J	340	J	ug/kg	SD30, SD31	15 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	92524	biphenyl (diphenyl)	32	J	180	J	ug/kg	SD24	6 / 22	402.44	3000			NA	0.29*	(USEPA, 2004)			NA	NA	N	NTX
	117817	bis(2-ethylhexyl) phthalate	220	J	9900		ug/kg	SD31	20 / 20	402.44	3000			NA	NA				NA	NA	N	NTX
	105602	caprolactam	58	J	92	J	ug/kg	SD20	2 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	86748	carbazole	32	J	4200		ug/kg	SD24	20 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	218019	**chrysene**	320	J	11000		ug/kg	SD24	22 / 22	402.44	5000	3625		NA	0.29	(USEPA, 2004)	430	ca	NA	NA	Y	**ASL**
	53703	**dibenz(a,h)anthracene**	71	J	1700		ug/kg	SD24	21 / 22	402.44	3000	560		NA	0.29	(USEPA, 2004)	0.43	ca	NA	NA	Y	**ASL**
	132649	dibenzofuran	18	J	1500		ug/kg	SD24	18 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	84662	diethyl phthalate	20	J	20	J	ug/kg	SD20	1 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	105679	2,4-dimethylphenol	37	J	37	J	ug/kg	SD24	1 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	131113	dimethyl phthalate	28	J	28	J	ug/kg	SD21	1 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	84742	di-n-butyl phthalate	45	J	190	J	ug/kg	SD31	12 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	117840	di-n-octylphthalate	52	J	1000	J	ug/kg	SD26	12 / 21	402.44	3000			NA	NA				NA	NA	N	NTX
	206440	**fluoranthene**	540		25000		ug/kg	SD24	22 / 22	402.44	5000	8239		NA	0.29	(USEPA, 2004)	5400	nc	NA	NA	Y	**ASL**
	86737	fluorene	40	J	1800		ug/kg	SD24	17 / 22	402.44	3000	593		NA	0.29	(USEPA, 2004)	5400	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	150	J	4200		ug/kg	SD24	22 / 22	402.44	3000	1384		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	Y	**ASL**
	91576	2-methylnaphthalene	25	J	690	J	ug/kg	SD24	13 / 22	402.44	3000			NA	0.29*	(USEPA, 2004)			NA	NA	N	NTX
	95487	2-methylphenol (o-cresol)	45	J	45	J	ug/kg	SD24	1 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	106445	4-methylphenol (p-cresol)	120	J	5600		ug/kg	SD30	14 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	91203	naphthalene	12	J	1100		ug/kg	SD24	15 / 22	402.44	3000			NA	0.29*	(USEPA, 2004)			NA	NA	N	NTX
	85018	**phenanthrene**	380	J	23000		ug/kg	SD24	22 / 22	402.44	5000	7580		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	Y	**ASL**
	108952	phenol	70	J	350	J	ug/kg	SD30	4 / 22	402.44	3000			NA	NA				NA	NA	N	NTX
	129000	**pyrene**	460		19000		ug/kg	SD24	22 / 22	402.44	5000	6261		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	Y	**ASL**
	67641	acetone	25		140		ug/kg	SD30	9 / 13	12.8	45.5			NA	NA				NA	NA	N	NTX
	75150	carbon disulfide	0.9	J	1	J	ug/kg	SD23	2 / 16	12.8	45.5			NA	NA				NA	NA	N	NTX
	74873	chloromethane	0.9	J	5	J	ug/kg	SD31	8 / 16	12.8	45.5			NA	NA				NA	NA	N	NTX
	106467	1,4-dichlorobenzene	2	J	22	J	ug/kg	SD29	5 / 12	12.8	45.5	25		NA	1	default	580	ca	NA	NA	N	BSL
	78933	methyl ethyl ketone (2-butanone)	14	J	38		ug/kg	SD30	4 / 16	12.8	45.5			NA	NA				NA	NA	N	NTX
	108101	methyl isobutyl ketone (4-methyl-2-pentanone)	1	J	4	J	ug/kg	SD31	3 / 16	12.8	45.5			NA	NA				NA	NA	N	NTX
	108883	toluene	16	J	6100		ug/kg	SD30	11 / 13	12.8	312.5			NA	NA				NA	NA	N	NTX
	7429905	aluminum	4430000		20700000		ug/kg	SD21	22 / 22	22860	139400			NA	NA				NA	NA	N	NTX

Table 1.17
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

38 Important Bioaccumulative Compounds highlighted

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue from Lower Darby and Lower Cobbs Creeks

Exposure Point	CAS Number	Chemical (38 Important Bioaccumulative Compounds are highlighted)	Sediment Minimum Concentration (Qualifier) (1)		Sediment Maximum Concentration (Qualifier) (1)		Units	Location of Maximum Concentration	Detection Frequency	Range of Sediment Detection Limits Min	Range of Sediment Detection Limits Max	Fish Tissue Modeled Concentration Used for Screening (2)		Background Value (3)	Fish Tissue BSAF (4) (unitless)	BSAF Source (unitless)	Fish Tissue RBC Screening Toxicity Value (5)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
Fish Tissue Lower Darby and Lower Cobbs Creeks	7440360	antimony	930	[]	3000	[]	ug/kg	SD29	13 / 16	15700	41800			NA	NA				NA	NA	N	NTX
	7440382	**arsenic**	1500	[]	8100		ug/kg	SD30	22 / 22	1140	7000	5589		NA	0.69	(ORNL, 1998)	2.1	ca	NA	NA	**Y**	**ASL**
	7440393	barium	37800	[]	242000		ug/kg	SD30	22 / 22	22860	139400			NA	NA				NA	NA	N	NTX
	7440417	beryllium	400	J	1100		ug/kg	SD30	7 / 12	570	2700			NA	NA				NA	NA	N	NTX
	7440439	**cadmium**	250	J	1800	[]	ug/kg	SD30	20 / 22	570	3500	14382		NA	7.99	(ORNL, 1998)	140	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	1970000		13800000		ug/kg	SD30	22 / 22	571430	3484300			NA	NA				NA	NA	N	NTX
	7440473	**chromium, total (as Cr+6) [7]**	11900		115000		ug/kg	SD24	22 / 22	1140	7000	53820		NA	0.468	(ORNL, 1998)	410	nc	NA	NA	**Y**	**ASL**
	7440484	cobalt	2600	[]	15400	[]	ug/kg	SD21	22 / 22	5710	34800			NA	NA				NA	NA	N	NTX
	7440508	**copper**	11000	J	131000	J	ug/kg	SD20	22 / 22	2860	17400	687750		NA	5.25	(ORNL, 1998)	5400	nc	NA	NA	**Y**	**ASL**
	7439896	iron	9310000		35400000		ug/kg	SD30	22 / 22	11430	69700			NA	NA				NA	NA	N	NTX
	7439921	**lead**	21000		411000	K	ug/kg	SD24	22 / 22	800	2100	249477		NA	0.607	(ORNL, 1998)			NA	NA	**Y**	**NSL**
	7439954	magnesium	2120000		11500000		ug/kg	SD20	22 / 22	571430	3484300			NA	NA				NA	NA	N	NTX
	7439965	manganese	109000		854000		ug/kg	SD21	22 / 22	1710	10500			NA	NA				NA	NA	N	NTX
	7439976	**mercury**	80	[]	600		ug/kg	SD30	21 / 22	100	300	1721		NA	2.868	(ORNL, 1998)	14	nc	NA	NA	**Y**	**ASL**
	7440020	**nickel**	9000	[]	40200		ug/kg	SD30	22 / 22	4570	27900	93264		NA	2.32	(ORNL, 1998)	2700	nc	NA	NA	**Y**	**ASL**
	7440097	potassium	901000	[]	4830000		ug/kg	SD27	22 / 22	571430	3484300			NA	NA				NA	NA	N	NTX
	7782492	**selenium**	1200	L[]	2800		ug/kg	SD20	5 / 15	1300	6900	2800		NA	1	default	680	nc	NA	NA	**Y**	**ASL**
	7440224	**silver**	430	[]	1900	[]	ug/kg	SD30	11 / 22	1140	7000	1900		NA	1	default	680	nc	NA	NA	**Y**	**ASL**
	7440235	sodium	386000	K[]	937000	K[]	ug/kg	SD30	16 / 16	1305500	3484300			NA	NA				NA	NA	N	NTX
	7440280	thallium	1200	J[]	3400	K[]	ug/kg	SD21	11 / 19	2600	7000			NA	NA				NA	NA	N	NTX
	7440622	vanadium	11000	[]	64700		ug/kg	SD30	22 / 22	5710	34800			NA	NA				NA	NA	N	NTX
	7440666	**zinc**	72200		577000	J	ug/kg	SD30	22 / 22	5200	13900	4343079		NA	7.527	(ORNL, 1998)	41000	nc	NA	NA	**Y**	**ASL**

Footnotes

ug/kg = micrograms per kilogram
NA = Not available or not applicable

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.
+= Analyte present. Actual value may be higher than reported.

(2) The fish tissue concentration for the organic chemicals was estimated using the following equation: FC = (SC*BSAF*%L/%TOC)
Where:
FC = Fish tissue concentration
SC = Maximum sediment concentration
BSAF - Biota-Sediment Accumulation Factor
%L = Percent lipids (used 3 percent from USEPA, 2004)
% TOC - Percent Total Organic Carbon (used 2.64 percent which is the average TOC for Lower Darby Creek)
The fish tissue concentration for the inorganic chemicals was estimated using the following equation: FC = (SC*BSAF)

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) BSAF = Biological Sediment Accumulation Factor, an estimate of the ratio of fish tissue concentrations divided by sediment concentrations for the appropriate trophic level organism (EPA, 2000).
Sources of information used to derive each chemical-specific BSAF are provided in an attached appendix. BSAFs were only presented for chemicals considered to be important bioaccumulative chemicals.
Values for chemicals not considered important bioaccumulatve chemicals are noted with an "*" and fish tissue concentrations were not modeled for those chemicals. Also, surrogate BSAFs were used for some chemicals.

(5) The toxicity screening values were obtained from the USEPA Region III RBC Tables (fish tissue) (October, 2007). For non-carcinogenic substances, the RBC was multiplied by 0.1 to account for multiple contaminants.
Codes used nc = noncarcinogenic, ca = carcinogenic

(6) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(7) Since hexavalent chromium was not analyzed in sediment, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

14 Lower Darby Creek samples are in this data set, and are listed as follows: LD-SD-SD09-0502, LD-SD-SD10-0502, LD-SD-SD21-0502, LDCA_SD22_1005, LD-SD-SD22-0502, LD-SD-SD23-0502, LDCA_SD24_1005, LD-SD-SD24-0502, LDCA_SD25_1005, LD-SD-SD25-0502, LD-SD-SD26-0502, LD-SD-SD260-0502, LD-SD-SD27-0502, LDCA_SD28_1005, LD-SD-SD28-0502, LD-SD-SD29-0502, LDCA_SD30_1005, LD-SD-SD30-0502, LD-SD-SD31-0502

3 Lower Cobbs Creek samples are also included in this data set, and are listed as follows: LDCA_SD19_1005, LD-SD-SD19-0502, and LD-SD-SD20-0502.

References

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

USEPA (U.S. Environmental Protection Agency), 2004. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1:National Sediment Quality Survey: Second Edition. Office of Science and Technology. Washington, D.C. EPA 823-R-04-007. November.

Table 1.18
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

38 Important Bioaccumulative Compounds highlighted

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Chemical	Sediment Minimum Concentration (Qualifier) (1)		Sediment Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Sediment Detection Limits		Fish Tissue Modeled Concentration Used for Screening (2)		Background Value (3)	Fish Tissue BSAF (4) (unitless)	BSAF Source (unitless)	Fish Tissue RBC Screening Toxicity Value (nc/ca) (5)		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
										Min	Max											
Fish Tissue Tinicum Marsh	319846	**alpha BHC**	3.4	J	3.4	J	ug/kg	SD34	1 / 8	3.7	8.5	10	J	NA	1.8	(USEPA, 2004)	0.5	ca	NA	NA	**Y**	**ASL**
	5103719	**alpha-chlordane**	6.3	J	29		ug/kg	SD34	4 / 8	3.7	8.5	228.0		NA	4.77	(USEPA, 2004)	9	ca	NA	NA	**Y**	**ASL**
	60571	**dieldrin**	14	J	22	J	ug/kg	SD37	2 / 8	7.2	16.5	65.3	J	NA	1.8	(USEPA, 2004)	0.2	ca	NA	NA	**Y**	**ASL**
	5103742	**gamma-chlordane**	6.7	J	15		ug/kg	SD37	4 / 8	3.7	8.5	54.9		NA	2.22	(USEPA, 2004)	9	ca	NA	NA	**Y**	**ASL**
	1024573	**heptachlor epoxide**	2.2	J	2.2	J	ug/kg	SD37	1 / 8	3.7	8.5	6.5	J	NA	1.8	(USEPA, 2004)	0.35	ca	NA	NA	**Y**	**ASL**
	72548	p,p-DDD	9.7	J	22		ug/kg	SD320	7 / 8	7.2	16.5	10.2		NA	0.28	(USEPA, 2004)	13	ca	NA	NA	N	BSL
	72559	**p,p-DDE**	6.4	J	22	J	ug/kg	SD320	8 / 8	7.2	16.5	279.2	J	NA	7.7	(USEPA, 2004)	9.3	ca	NA	NA	**Y**	**ASL**
	50293	**p,p-DDT**	16	J	16	J	ug/kg	SD320	1 / 8	7.2	16.5	44.0	J	NA	1.67	(USEPA, 2004)	9.3	ca	NA	NA	**Y**	**ASL**
	83329	acenaphthene	39	J	91	J	ug/kg	SD37	5 / 8	717.4	1650	43.5	J	NA	0.29	(USEPA, 2004)	8100	nc	NA	NA	N	BSL
	208968	acenaphthylene	32	J	80	J	ug/kg	SD37	5 / 8	717.4	1650	38.2	J	NA	0.29	(USEPA, 2004)	8100	nc	NA	NA	N	BSL
	98862	acetophenone	52	J	52	J	ug/kg	SD37	1 / 7	717.4	1650			NA	NA				NA	NA	N	NTX
	120127	anthracene	24	J	290	J	ug/kg	SD37	7 / 8	717.4	1650	138.6	J	NA	0.29	(USEPA, 2004)	41000	nc	NA	NA	N	BSL
	100527	benzaldehyde	27	J	100	J	ug/kg	SD35	2 / 2	717.4	1650			NA	NA				NA	NA	N	NTX
	56553	**benzo(a)anthracene**	120	J	1700		ug/kg	SD37	8 / 8	717.4	1650	812.6		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	**Y**	**ASL**
	50328	**benzo(a)pyrene**	130	J	2000		ug/kg	SD37	8 / 8	717.4	1650	956.0		NA	0.29	(USEPA, 2004)	0.43	ca	NA	NA	**Y**	**ASL**
	205992	**benzo(b)fluoranthene**	130	J	2700		ug/kg	SD37	8 / 8	717.4	1650	1290.7		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	**Y**	**ASL**
	191242	benzo(g,h,i)perylene	210	J	1200		ug/kg	SD37	6 / 8	717.4	1650	573.6		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	N	BSL
	207089	**benzo(k)fluoranthene**	110	J	1900		ug/kg	SD37	8 / 8	717.4	1650	908.2		NA	0.29	(USEPA, 2004)	43	ca	NA	NA	**Y**	**ASL**
	85687	benzyl butyl phthalate	33	J	170	J	ug/kg	SD37	6 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	117817	bis(2-ethylhexyl) phthalate	1300		2000		ug/kg	SD34	4 / 4	717.4	1650			NA	NA				NA	NA	N	NTX
	105602	caprolactam	48	J	110	J	ug/kg	SD36	4 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	86748	carbazole	87	J	220	J	ug/kg	SD37	4 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	218019	**chrysene**	140	J	2400		ug/kg	SD37	8 / 8	717.4	1650	1147.3		NA	0.29	(USEPA, 2004)	430	ca	NA	NA	**Y**	**ASL**
	53703	**dibenz(a,h)anthracene**	79	J	400	J	ug/kg	SD37	5 / 8	717.4	1650	191.2	J	NA	0.29	(USEPA, 2004)	0.43	ca	NA	NA	**Y**	**ASL**
	132649	dibenzofuran	28	J	59	J	ug/kg	SD37	5 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	84742	di-n-butyl phthalate	53	J	69	J	ug/kg	SD38	2 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	206440	fluoranthene	230	J	3600		ug/kg	SD37	8 / 8	717.4	1650	1720.9		NA	0.29	(USEPA, 2004)	5400	nc	NA	NA	N	BSL
	86737	fluorene	51	J	90	J	ug/kg	SD37	3 / 8	717.4	1650	43.0	J	NA	0.29	(USEPA, 2004)	5400	nc	NA	NA	N	BSL
	193395	**indeno(1,2,3-C,D)pyrene**	100	J	1500		ug/kg	SD37	8 / 8	717.4	1650	717.0		NA	0.29	(USEPA, 2004)	4.3	ca	NA	NA	**Y**	**ASL**
	91576	2-methylnaphthalene	34	J	59	J	ug/kg	SD34	3 / 8	717.4	1650			NA	0.29*	(USEPA, 2004)			NA	NA	N	NTX
	95487	2-methylphenol (o-cresol)	150	J	150	J	ug/kg	SD320	1 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	106445	4-methylphenol (p-cresol)	64	J	740	J	ug/kg	SD34	4 / 8	717.4	1650			NA	NA				NA	NA	N	NTX
	91203	naphthalene	36	J	82	J	ug/kg	SD34	3 / 8	717.4	1650			NA	0.29*	(USEPA, 2004)			NA	NA	N	NTX
	85018	phenanthrene	110	J	1600		ug/kg	SD37	8 / 8	717.4	1650	764.8		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	N	BSL
	129000	pyrene	230	J	3200		ug/kg	SD37	8 / 8	717.4	1650	1529.7		NA	0.29	(USEPA, 2004)	4100	nc	NA	NA	N	BSL
	67641	acetone	38		110		ug/kg	SD35	4 / 5	21.7	33.3			NA	NA				NA	NA	N	NTX
	75150	carbon disulfide	1	J	1	J	ug/kg	SD320	1 / 8	21.7	50			NA	NA				NA	NA	N	NTX
	78933	methyl ethyl ketone (2-butanone)	21	J	21	J	ug/kg	SD35	1 / 8	21.7	50			NA	NA				NA	NA	N	NTX
	108883	toluene	18	J	18	J	ug/kg	SD34	1 / 4	21.7	50			NA	NA				NA	NA	N	NTX
	7429905	aluminum	15500000		21700000		ug/kg	SD37	8 / 8	118700	200000			NA	NA				NA	NA	N	NTX
	7440382	**arsenic**	6400		15100		ug/kg	SD35	8 / 8	5900	10000	10419.0		NA	0.69	(ORNL, 1998)	2.1	ca	NA	NA	**Y**	**ASL**
	7440393	barium	145000		227000		ug/kg	SD37	8 / 8	118700	200000			NA	NA				NA	NA	N	NTX
	7440439	**cadmium**	860	[]	1600	[]	ug/kg	SD37	4 / 8	3000	5000	12784.0	[]	NA	7.99	(ORNL, 1998)	140	nc	NA	NA	**Y**	**ASL**
	7440702	calcium	3140000		10400000		ug/kg	SD37	8 / 8	2967400	5000000			NA	NA				NA	NA	N	NTX
	7440473	**chromium, total (as Cr+6)** [6]	42700		74300		ug/kg	SD34	8 / 8	5900	10000	34772.4		NA	0.468	(ORNL, 1998)	410	nc	NA	NA	**Y**	**ASL**
	7440484	cobalt	10500	[]	18200	[]	ug/kg	SD35	8 / 8	29700	50000			NA	NA				NA	NA	N	NTX
	7440508	**copper**	37500		105000	J	ug/kg	SD37	8 / 8	14800	25000	551250.0	J	NA	5.25	(ORNL, 1998)	5400	nc	NA	NA	**Y**	**ASL**

Table 1.18
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
LOWER DARBY CREEK AREA RI/FS

38 Important Bioaccumulative Compounds highlighted

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Chemical	Sediment Minimum Concentration (Qualifier) (1)		Sediment Maximum Concentration (Qualifier) (1)		Units	Location Of Maximum Concentration	Detection Frequency	Range of Sediment Detection Limits		Fish Tissue Modeled Concentration Used for Screening (2)		Background Value (3)	Fish Tissue BSAF (4) (unitless)	BSAF Source (unitless)	Fish Tissue RBC Screening Toxicity Value (5)	(nc/ca)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (6)
										Min	Max											
Fish Tissue Tinicum Marsh	7439896	iron	24500000		39800000		ug/kg	SD34	8 / 8	59300	100000			NA	NA				NA	NA	N	NTX
	7439921	**lead**	118000	K	237000		ug/kg	SD33	8 / 8	1800	3000	143859.0		NA	0.607	(ORNL, 1998)			NA	NA	**Y**	**NSL**
	7439954	magnesium	4280000		10700000		ug/kg	SD37	8 / 8	2967400	5000000			NA	NA				NA	NA	N	NTX
	7439965	manganese	412000		1180000		ug/kg	SD34	8 / 8	8900	15000			NA	NA				NA	NA	N	NTX
	7439976	**mercury**	240	[]	430		ug/kg	SD37	3 / 8	300	500	1233.2		NA	2.868	(ORNL, 1998)	14	nc	NA	NA	**Y**	**ASL**
	7440020	**nickel**	26100		44000		ug/kg	SD320	8 / 8	23700	40000	102080.0		NA	2.32	(ORNL, 1998)	2700	nc	NA	NA	**Y**	**ASL**
	7440097	potassium	1290000	[]	3550000		ug/kg	SD37	8 / 8	2967400	5000000			NA	NA				NA	NA	N	NTX
	7782492	**selenium**	3300	L[]	3300	L[]	ug/kg	SD37	1 / 3	3200	5000	3300.0	L[]	NA	1	default	680	nc	NA	NA	**Y**	**ASL**
	7440224	**silver**	750	[]	1400	[]	ug/kg	SD37	3 / 8	5900	10000	1400.0	[]	NA	1	default	680	nc	NA	NA	**Y**	**ASL**
	7440235	sodium	856000	K[]	1610000	K[]	ug/kg	SD33	8 / 8	2967400	5000000			NA	NA				NA	NA	N	NTX
	7440280	thallium	2100	L[]	3100	L[]	ug/kg	SD35	5 / 7	5900	10000			NA	NA				NA	NA	N	NTX
	7440622	vanadium	47300		64400		ug/kg	SD37	8 / 8	29700	50000			NA	NA				NA	NA	N	NTX
	7440666	**zinc**	136000	J	483000		ug/kg	SD37	8 / 8	11900	20000	3635541		NA	7.527	(ORNL, 1998)	41000	nc	NA	NA	**Y**	**ASL**

Footnotes

ug/kg = micrograms per kilogram

(1) J = Analyte present. Reported value may not be accurate or precise.
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the IDL the quantitation may not be accurate.

(2) The fish tissue concentration for the organic chemicals was estimated using the following equation: FC = (SC*BSAF*%L/%TOC)
Where:
FC = Fish tissue concentration
SC = Maximum sediment concentration
BSAF - Biota-Sediment Accumulation Factor
%L = Percent lipids (used 3 percent from USEPA, 2004)
% TOC - Percent Total Organic Carbon (used 1.82 percent which is the average TOC for Tinicum Marsh)
The fish tissue concentration for the inorganic chemicals was estimated using the following equation: FC = (SC*BSAF)

(3) Background values were not appropriate for purposes of this screening. "NA" = not available at time of screening.

(4) BSAF = Biological Sediment Accumulation Factor, an estimate of the ratio of fish tissue concentrations divided by sediment concentrations for the appropriate trophic level organism (EPA, 2000).
Sources of information used to derive each chemical-specific BSAF are provided in an attached appendix. BSAFs were only presented for chemicals considered to be important bioaccumulative chemicals.
Values for chemicals not considered important bioaccumulatve chemicals are noted with an "*" and fish tissue concentrations were not modeled for those chemicals. Also, surrogate BSAFs were used for some chemicals.

(5) The toxicity screening values were obtained from the USEPA Region III RBC Tables (fish tissue) (October, 2007). For non-carcinogenic substances, the RBC was multiplied by 0.1 to account for multiple contaminants.
Codes used nc = noncarcinogenic, ca = carcinogenic

(6) Codes used for the "Rationale for Selection or Deletion": "BSL" = Below Screening Level, "ASL" = Above Screening Level, "NSL" = No Screening Level, "NUT" = Essential Nutrient.

(7) Since hexavalent chromium was not analyzed in sediment, it was assumed that total chromium could be present in the form of hexavalent chromium. Consequently, the screening value for hexavalent chromium was used.

Tinicum Marsh Sediment Samples Include:

LD-SD-SD32-0502	LD-SD-SD34-0502	LD-SD-SD37-0502
LD-SD-SD320-0502	LD-SD-SD35-0502	LD-SD-SD38-0502
LD-SD-SD33-0502	LD-SD-SD36-0502	

References

ORNL (Oak Ridge National Laboratory). 1998. Empirical Model for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-133. September.

USEPA (U.S. Environmental Protection Agency), 2004. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1:National Sediment Quality Survey: Second Edition. Office of Science and Technology. Washington, D.C. EPA 823-R-04-007. November.

TABLE 2.1

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Zone 1 Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 1	beta BHC	ug/kg	41.5	389 (NP-C_{99})	1300 J+	389	UCL-C_{99}	(1)	389	UCL-C_{99}	(2)
	Dieldrin	ug/kg	136	1110 (NP-C_{99})	3600 J+	1110	UCL-C_{99}	(1)	1110	UCL-C_{99}	(2)
	Endrin	ug/kg	466	4920 (NP-C_{99})	13000	4920	UCL-C_{99}	(1)	4920	UCL-C_{99}	(2)
	Endrin Aldehyde	ug/kg	176	1710 (NP-C_{99})	5700 J+	1710	UCL-C_{99}	(1)	1710	UCL-C_{99}	(2)
	gamma-Chlordane	ug/kg	231	2380 (NP-C_{99})	6500 J+	2380	UCL-C_{99}	(1)	2380	UCL-C_{99}	(2)
	Heptachlor Epoxide	ug/kg	67.2	668 (NP-C_{99})	2000	668	UCL-C_{99}	(1)	668	UCL-C_{99}	(2)
	p,p-DDE	ug/kg	98.2	794 (NP-C_{99})	2600	794	UCL-C_{99}	(1)	794	UCL-C_{99}	(2)
	p,p-DDT	ug/kg	541	739 (T-C_{95})	14000	739	UCL-C_{95}	(3)	739	UCL-C_{95}	(2)
	Arochlor 1254	ug/kg	612	5220 (NP-C_{99})	530 J	530	Max	(4)	530	Max	(2)
	Arochlor 1260	ug/kg	9790	87900 (NP-C_{99})	280000 J	87900	UCL-C_{99}	(1)	87900	UCL-C_{99}	(2)
	Arochlor 1268	ug/kg	642	5260 (NP-C_{99})	1500	1500	Max	(4)	1500	Max	(2)
	Benzo(a)anthracene	ug/kg	1730	2300 (G)	14000	2300	UCL-G	(6)	2300	UCL-G	(2)
	Benzo(a)pyrene	ug/kg	1550	2080 (G)	11000	2080	UCL-G	(6)	2080	UCL-G	(2)
	Benzo(b)fluoranthene	ug/kg	2110	2820 (G)	13000	2820	UCL-G	(6)	2820	UCL-G	(2)
	Benzo(k)fluoranthene	ug/kg	928	1220 (G)	6100	1220	UCL-G	(6)	1220	UCL-G	(2)
	Dibenzo(a,h)anthracene	ug/kg	518	817 (NP-C_{95})	500 J	500	Max	(4)	500	Max	(2)
	Dibenzofuran	ug/kg	502	945 (T-H)	2700	945	UCL-H	(7)	945	UCL-H	(2)
	Di-n-octylphthalate	ug/kg	470	732 (NP-C_{95})	720 J	720	Max	(4)	720	Max	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	974	1250 (G)	5600 K	1250	UCL-G	(6)	1250	UCL-G	(2)
	Aluminum	ug/kg	12300000	13600000 (N)	25800000	13600000	UCL-N	(8)	13600000	UCL-N	(2)
	Antimony	ug/kg	46000	463000 (NP-C_{99})	968000 L	463000	UCL-C_{99}	(1)	463000	UCL-C_{99}	(2)
	Arsenic	ug/kg	7280	8760 (T-H)	42200	8760	UCL-H	(7)	8760	UCL-H	(2)
	Cadmium	ug/kg	5290	33900 (NP-C_{99})	95200	33900	UCL-C_{99}	(1)	33900	UCL-C_{99}	(2)
	Chromium	ug/kg	47700	59800 (G)	353000 L	59800	UCL-G	(6)	59800	UCL-G	(2)
	Cobalt	ug/kg	8160	8990 (N)	15700	8990	UCL-N	(8)	8990	UCL-N	(2)
	Copper	ug/kg	254000	1100000 (NP-C_{99})	2620000	1100000	UCL-C_{99}	(1)	1100000	UCL-C_{99}	(2)
	Iron	ug/kg	33900000	42900000 (T-H)	152000000	42900000	UCL-H	(7)	42900000	UCL-H	(2)
	Lead	ug/kg	372000	504000 (G)	1840000	372000	Mean	(9)	372000	Mean	(9)
	Manganese	ug/kg	395000	450000 (G)	946000 L	450000	UCL-G	(6)	450000	UCL-G	(2)
	Mercury	ug/kg	478	629 (G)	2700 J	629	UCL-G	(6)	629	UCL-G	(2)
	Nickel	ug/kg	33800	61500 (NP-C_{95})	226000	61500	UCL-C_{95}	(5)	61500	UCL-C_{95}	(2)
	Thallium	ug/kg	2010	2280 (G)	3900	2280	UCL-G	(6)	2280	UCL-G	(2)
	Vanadium	ug/kg	35300	46700 (NP-C_{95})	93900	46700	UCL-C_{95}	(5)	46700	UCL-C_{95}	(2)
	Zinc	ug/kg	589000	982000 (T-H)	3740000	982000	UCL-H	(7)	982000	UCL-H	(2)

TABLE 2.1

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Zone 1 Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Notes:

EPC = Exposure Point Concentration
J = estimated value
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
+ = Analyte present. Actual value may be higher.
UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 99% Chebyshev method.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 95% UCL computed based on lognormal data using EPA's ProUCL 95% Chebyshev method.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(8) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(9) Arithmetic mean used for lead EPC because the model utilizes the mean concentration to estimate the upper range of blood lead in a population distribution.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(T) The log-transformed data conform to a normal distribution as determined by the Lilliefors or Shapiro-Wilk normality test.

TABLE 2.2
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Zone 2 Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 2	Aldrin	ug/kg	5.83	32.3 (NP-C_{99})	110 J	32.3	UCL-C_{99}	(1)	32.3	UCL-C_{99}	(2)
	Dieldrin	ug/kg	4.85	14 (NP-C_{95})	93	14	UCL-C_{95}	(3)	14	UCL-C_{95}	(2)
	Arochlor 1242	ug/kg	69.1	234 (NP-C_{95})	1700	234	UCL-C_{95}	(3)	234	UCL-C_{95}	(2)
	Arochlor 1254	ug/kg	303	2170 (NP-C_{99})	6100	2170	UCL-C_{99}	(1)	2170	UCL-C_{99}	(2)
	Arochlor 1260	ug/kg	1190	8830 (NP-C_{99})	31000 J	8830	UCL-C_{99}	(1)	8830	UCL-C_{99}	(2)
	Benzo(a)anthracene	ug/kg	694	2340 (NP-C_{99})	5700	2340	UCL-C_{99}	(1)	2340	UCL-C_{99}	(2)
	Benzo(a)pyrene	ug/kg	657	2060 (NP-C_{99})	4000	2060	UCL-C_{99}	(1)	2060	UCL-C_{99}	(2)
	Benzo(b)fluoranthene	ug/kg	582	1750 (NP-C_{99})	3300	1750	UCL-C_{99}	(1)	1750	UCL-C_{99}	(2)
	Benzo(k)fluoranthene	ug/kg	615	1900 (NP-C_{99})	4000	1900	UCL-C_{99}	(1)	1900	UCL-C_{99}	(2)
	Dibenzo(a,h)anthracene	ug/kg	344	578 (NP-C_{95})	1400 J	578	UCL-C_{95}	(3)	578	UCL-C_{95}	(2)
	Dibenzofuran	ug/kg	321	532 (NP-C_{95})	390 J	390	Max	(4)	390	Max	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	451	1380 (NP-C_{99})	2900	1380	UCL-C_{99}	(1)	1380	UCL-C_{99}	(2)
	Aluminum	ug/kg	6210000	7210000 (G)	28600000	7210000	UCL-G	(5)	7210000	UCL-G	(2)
	Antimony	ug/kg	4920	6270 (NP-C_{95})	10000 J	6270	UCL-C_{95}	(3)	6270	UCL-C_{95}	(2)
	Arsenic	ug/kg	4960	5650 (G)	15200	5650	UCL-G	(5)	5650	UCL-G	(2)
	Chromium	ug/kg	19200	22300 (G)	67700 K	22300	UCL-G	(5)	22300	UCL-G	(2)
	Cobalt	ug/kg	6930	7730 (G)	15300	7730	UCL-G	(5)	7730	UCL-G	(2)
	Copper	ug/kg	42800	145000 (NP-C_{99})	366000	145000	UCL-C_{99}	(1)	145000	UCL-C_{99}	(2)
	Iron	ug/kg	14500000	16700000 (G)	47900000	16700000	UCL-G	(5)	16700000	UCL-G	(2)
	Lead	ug/kg	282000	2160000 (NP-C_{99})	8540000 J	282000	Mean	(8)	282000	Mean	(8)
	Manganese	ug/kg	287000	320000 (N)	668000 K	320000	UCL-N	(6)	320000	UCL-N	(2)
	Mercury	ug/kg	338	521 (T-H)	3200	521	UCL-H	(7)	521	UCL-H	(2)
	Thallium	ug/kg	2180	2320 (NP-Mt)	1600 J	1600	Max	(4)	1600	Max	(2)
	Vanadium	ug/kg	21800	26000 (G)	60800	26000	UCL-G	(5)	26000	UCL-G	(2)

TABLE 2.2

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Zone 2 Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Notes:

EPC = Exposure Point Concentration
J = estimated value
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 99% Chebyshev method.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(6) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(7) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(8) Arithmetic mean used for lead EPC because the model utilizes the mean concentration to estimate the upper range of blood lead in a population distribution.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(T) The log-transformed data conform to a normal distribution as determined by the Lilliefors or Shapiro-Wilk normality test.

TABLE 2.3
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)**	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 3	Arochlor 1260	ug/kg	124	370 (NP-C_{95})	370	370	UCL-95 KM (BCA)	(8)	370	UCL-95 KM (BCA)	(2)
	Benzo(a)anthracene	ug/kg	703	1770 (NP-$C_{97.5}$)	3800	1770	UCL-97.5 KM (cheby)	(12)	1770	UCL-97.5 KM (cheby)	(2)
	Benzo(a)pyrene	ug/kg	763	1770 (NP-$C_{97.5}$)	3600	1770	UCL-97.5 KM (cheby)	(12)	1770	UCL-97.5 KM (cheby)	(2)
	Benzo(b)fluoranthene	ug/kg	658	1500 (NP-$C_{97.5}$)	3200	1500	UCL-97.5 KM (cheby)	(12)	1500	UCL-97.5 KM (cheby)	(2)
	Benzo(k)fluoranthene	ug/kg	727	2320 (NP-C_{99})	3400	2320	UCL-99 KM (cheby)	(9)	2320	UCL-99 KM (cheby)	(2)
	Dibenzo(a,h)anthracene	ug/kg	495	366 (NP-C_{95})	1000	366	UCL-95 KM %bootstrap	(10)	366	UCL-95 KM %bootstrap	(2)
	Dibenzofuran	ug/kg	206	192 (NP-$C_{97.5}$)	370 J	192	UCL-97.5 KM (cheby)	(3)	192	UCL-97.5 KM (cheby)	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	609	1240 (NP-$C_{97.5}$)	2600	1240	UCL-97.5 KM (cheby)	(3)	1240	UCL-97.5 KM (cheby)	(2)
	Aluminum	ug/kg	7710000	9130000 (G)	15000000	9130000	UCL-G	(6)	9130000	UCL-G	(2)
	Antimony	ug/kg	NC	NC	14000	14000	Max	(11)	14000	Max	(2)
	Arsenic	ug/kg	4690	5490 (G)	11700	5490	UCL-G	(6)	5490	UCL-G	(2)
	Chromium	ug/kg	17800	19900 (N)	31100	19900	UCL-N	(7)	19900	UCL-N	(2)
	Cobalt	ug/kg	7360	8340 (G)	17000	8340	UCL-G	(6)	8340	UCL-G	(2)
	Iron	ug/kg	15200000	17600000 (G)	38000000	17600000	UCL-G	(6)	17600000	UCL-G	(2)
	Manganese	ug/kg	276000	318000 (G)	730000 K	318000	UCL-G	(6)	318000	UCL-G	(2)
	Vanadium	ug/kg	22900	26700 (N)	47300	26700	UCL-N	(7)	26700	UCL-N	(2)

Notes:

EPC = Exposure Point Concentration
J = estimated value
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.
UCL = upper confidence limit
ug/kg = micrograms per kilogram
NC = Not calculated.

** The maximum concentrations presented in this column represent the average value in the cases where a field duplicate pair exhibits the maximum concentration.
This may differ slightly from Table 2.9 where the individual duplicate samples were listed if the maximum concentration occurred for a field duplicate.

(1) 95% UCL computed based on nonparametric data using EPA's ProUCL Modified t.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 97.5% UCL computed based on non-parametric data using EPA's ProUCL 97.5% Chebyshev method.
(4) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(5) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(8) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% KM (BCA) method.
(9) 99% UCL computed based on non-parametric data using EPA's ProUCL 99% KM (Chebyshev) method.
(10) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% KM Percentile Bootstrap method.
(11) Maximum concentration used, UCL was not calculated because there was only one positive result.
(12) 97.5% UCL computed based on non-parametric data using EPA's ProUCL 97.5% KM (Chebyshev) method.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.

TABLE 2.4
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 1	beta BHC	ug/kg	41.5	389 (NP-C_{99})	1300 J+	389	UCL-C_{99}	(1)	389	UCL-C_{99}	(2)
	Dieldrin	ug/kg	136	1110 (NP-C_{99})	3600 J+	1110	UCL-C_{99}	(1)	1110	UCL-C_{99}	(2)
	Endrin	ug/kg	466	4920 (NP-C_{99})	13000	4920	UCL-C_{99}	(1)	4920	UCL-C_{99}	(2)
	Endrin Aldehyde	ug/kg	176	1710 (NP-C_{99})	5700 J+	1710	UCL-C_{99}	(1)	1710	UCL-C_{99}	(2)
	gamma-Chlordane	ug/kg	231	2380 (NP-C_{99})	6500 J+	2380	UCL-C_{99}	(1)	2380	UCL-C_{99}	(2)
	Heptachlor Epoxide	ug/kg	67.2	668 (NP-C_{99})	2000	668	UCL-C_{99}	(1)	668	UCL-C_{99}	(2)
	p,p-DDE	ug/kg	98.2	794 (NP-C_{99})	2600	794	UCL-C_{99}	(1)	794	UCL-C_{99}	(2)
	p,p-DDT	ug/kg	541	739 (T-C_{95})	14000	739	UCL-C_{95}	(3)	739	UCL-C_{95}	(2)
	Arochlor 1254	ug/kg	620	2470 (NP-$C_{97.5}$)	530 J	530	Max	(4)	530	Max	(2)
	Arochlor 1260	ug/kg	40400	350000 (NP-C_{99})	2100000	350000	UCL-C_{99}	(1)	350000	UCL-C_{99}	(2)
	Arochlor 1268	ug/kg	636	2490 (NP-$C_{97.5}$)	1500	1500	Max	(4)	1500	Max	(2)
	Total 2,3,7,8-TCDD TEQ	ug/kg	0.0144	0.0347 (N)	0.04996	0.0347	UCL-N	(6)	0.0347	UCL-N	(2)
	Benzo(a)anthracene	ug/kg	4370	4810 (T-H)	130000	4810	UCL-H	(7)	4810	UCL-H	(2)
	Benzo(a)pyrene	ug/kg	3640	4180 (T-H)	110000	4180	UCL-H	(7)	4180	UCL-H	(2)
	Benzo(b)fluoranthene	ug/kg	3660	5240 (T-H)	37000	5240	UCL-H	(7)	5240	UCL-H	(2)
	Benzo(k)fluoranthene	ug/kg	1980	2360 (T-H)	51000	2360	UCL-H	(7)	2360	UCL-H	(2)
	Bis(2-chloroethoxy methane	ug/kg	611	1070 (NP-$C_{97.5}$)	650 J	650	Max	(4)	650	Max	(2)
	Bis(2-chloroethyl) ether	ug/kg	733	1340 (NP-$C_{97.5}$)	660	660	Max	(4)	660	Max	(2)
	Bis(2-ethylhexyl) phthalate	ug/kg	7550	9250 (T-H)	290000	9250	UCL-H	(7)	9250	UCL-H	(2)
	Chrysene	ug/kg	4380	4770 (T-H)	120000	4770	UCL-H	(7)	4770	UCL-H	(2)
	4-Chloro-3-methylphenol	ug/kg	626	1100 (NP-$C_{97.5}$)	320 J	320	Max	(4)	320	Max	(2)
	Dibenzo(a,h)anthracene	ug/kg	631	1100 (NP-$C_{97.5}$)	2000	1100	UCL-$C_{97.5}$	(8)	1100	UCL-$C_{97.5}$	(2)
	Dibenzofuran	ug/kg	1080	1420 (T-H)	20000	1420	UCL-H	(7)	1420	UCL-H	(2)
	Dimethyl phthalate	ug/kg	671	1214 (NP-$C_{97.5}$)	4200 J	1214	UCL-$C_{97.5}$	(8)	1214	UCL-$C_{97.5}$	(2)
	Di-n-octylphthalate	ug/kg	609	1080 (NP-$C_{97.5}$)	920 J	920	Max	(4)	920	Max	(2)
	4,6-Dinitro-2-methylphenol	ug/kg	1190	2070 (NP-$C_{97.5}$)	1600 J	1600	Max	(4)	1600	Max	(2)

TABLE 2.4
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
	Fluoranthene	ug/kg	11600	12600 (T-H)	360000	12600	UCL-H	(7)	12600	UCL-H	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	2120	6220 (NP-$C_{97.5}$)	57000	6220	UCL-$C_{97.5}$	(8)	6220	UCL-$C_{97.5}$	(2)
	3-Nitroaniline	ug/kg	1190	2080 (NP-$C_{97.5}$)	650 J	650	Max	(4)	650	Max	(2)
	4-Nitroaniline	ug/kg	1190	2080 (NP-$C_{97.5}$)	640 J	640	Max	(4)	640	Max	(2)
	4-Nitrophenol	ug/kg	1190	2080 (NP-$C_{97.5}$)	660 J	660	Max	(4)	660	Max	(2)
	Phenanthrene	ug/kg	8710	30900 (NP-$C_{97.5}$)	310000	30900	UCL-$C_{97.5}$	(8)	30900	UCL-$C_{97.5}$	(2)
	Pyrene	ug/kg	9110	10000 (T-H)	290000	10000	UCL-H	(7)	10000	UCL-H	(2)
	Cyclohexane	ug/kg	5.65	13.1 (NP-C_{95})	57 L	13.1	UCL-C_{95}	(9)	13.1	UCL-C_{95}	(2)
	Methylcyclohexane	ug/kg	18.1	109 (NP-C_{99})	330 J	109.0	UCL-C_{99}	(1)	109.0	UCL-C_{99}	(2)
	Aluminum	ug/kg	12300000	13600000 (N)	25800000	13600000	UCL-N	(6)	13600000	UCL-N	(2)
	Antimony	ug/kg	46000	463000 (NP-C_{99})	968000 L	463000	UCL-C_{99}	(1)	463000	UCL-C_{99}	(2)
	Arsenic	ug/kg	7280	8760 (T-H)	42200	8760	UCL-H	(7)	8760	UCL-H	(2)
	Cadmium	ug/kg	5290	33900 (NP-C_{99})	95200	33900	UCL-C_{99}	(1)	33900	UCL-C_{99}	(2)
	Chromium	ug/kg	47700	59800 (G)	353000 L	59800	UCL-G	(5)	59800	UCL-G	(2)
	Cobalt	ug/kg	8160	8990 (N)	15700	8990	UCL-N	(6)	8990	UCL-N	(2)
	Copper	ug/kg	254000	1100000 (NP-C_{99})	2620000	1100000	UCL-C_{99}	(1)	1100000	UCL-C_{99}	(2)
	Iron	ug/kg	33900000	42900000 (T-H)	152000000	42900000	UCL-H	(7)	42900000	UCL-H	(2)
	Lead	ug/kg	372000	504000 (G)	1840000	372000	Mean	(10)	372000	Mean	(10)
	Manganese	ug/kg	395000	450000 (G)	946000 L	450000	UCL-G	(5)	450000	UCL-G	(2)
	Mercury	ug/kg	478	629 (G)	2700 J	629	UCL-G	(5)	629	UCL-G	(2)
	Nickel	ug/kg	33800	61500 (NP-C_{95})	226000	61500	UCL-C_{95}	(9)	61500	UCL-C_{95}	(2)
	Thallium	ug/kg	2010	2280 (G)	3900	2280	UCL-G	(5)	2280	UCL-G	(2)
	Vanadium	ug/kg	35300	46700 (NP-C_{95})	93900	46700	UCL-C_{95}	(9)	46700	UCL-C_{95}	(2)
	Zinc	ug/kg	589000	982000 (T-H)	3740000	982000	UCL-H	(7)	982000	UCL-H	(2)

TABLE 2.4

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Notes:

EPC = Exposure Point Concentration
J = estimated value
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.
[] = Analyte present. As values approach the Instrument Detection Limit (IDL), the quantitation may not be accurate.

+ = Analyte present. Actual value may be higher.
pg/g = picograms per gram
UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 99% Chebyshev method.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 95% UCL computed based on lognormal data using EPA's ProUCL 95% Chebyshev method.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(6) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(7) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(8) 95% UCL computed based on non-parametric data using EPA's ProUCL 97.5% Chebyshev method.
(9) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(10) Arithmetic mean used for lead EPC because the model utilizes the mean concentration to estimate the upper range of blood lead in a population distribution.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(T) The log-transformed data conform to a normal distribution as determined by the Shapiro-Wilk normality test.

TABLE 2.5
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 2	Aldrin	ug/kg	3.41	8.72 (NP-C_{95})	110 J	8.72	UCL-C_{95}	(1)	8.72	UCL-C_{95}	(2)
	Dieldrin	ug/kg	3.31	7.4 (NP-C_{95})	93	7.4	UCL-C_{95}	(1)	7.4	UCL-C_{95}	(2)
	Arochlor 1242	ug/kg	49.3	128 (NP-C_{95})	1700	128	UCL-C_{95}	(1)	128	UCL-C_{95}	(2)
	Arochlor 1254	ug/kg	145	505 (NP-C_{95})	6100	505	UCL-C_{95}	(1)	505	UCL-C_{95}	(2)
	Arochlor 1260	ug/kg	552	2660 (NP-$C_{97.5}$)	31000 J	2660	UCL-$C_{97.5}$	(3)	2660	UCL-$C_{97.5}$	(2)
	Benzo(a)anthracene	ug/kg	812	2230 (NP-$C_{97.5}$)	16000	2230	UCL-$C_{97.5}$	(3)	2230	UCL-$C_{97.5}$	(2)
	Benzo(a)pyrene	ug/kg	730	1870 (NP-$C_{97.5}$)	13000 J	1870	UCL-$C_{97.5}$	(3)	1870	UCL-$C_{97.5}$	(2)
	Benzo(b)fluoranthene	ug/kg	674	1630 (NP-$C_{97.5}$)	11000	1630	UCL-$C_{97.5}$	(3)	1630	UCL-$C_{97.5}$	(2)
	Benzo(k)fluoranthene	ug/kg	682	1650 (NP-$C_{97.5}$)	11000 J	1650	UCL-$C_{97.5}$	(3)	1650	UCL-$C_{97.5}$	(2)
	Dibenzo(a,h)anthracene	ug/kg	393	663 (NP-C_{95})	3500 J	663	UCL-C_{95}	(1)	663	UCL-C_{95}	(2)
	Dibenzofuran	ug/kg	402	694 (NP-C_{95})	4200 J	694	UCL-C_{95}	(1)	694	UCL-C_{95}	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	522	1190 (NP-$C_{97.5}$)	7300 J	1190	UCL-$C_{97.5}$	(3)	1190	UCL-$C_{97.5}$	(2)
	Cyclohexane	ug/kg	15.9	60.5 (NP-C_{95})	7 J	7	Max	(4)	7	Max	(2)
	Methylcyclohexane	ug/kg	70.7	351 (NP-C_{95})	3800 J	351.0	UCL-C_{95}	(1)	351.0	UCL-C_{95}	(2)
	Aluminum	ug/kg	6710000	7690000 (G)	28600000	7690000	UCL-G	(6)	7690000	UCL-G	(2)
	Antimony	ug/kg	4920	6230 (NP-C_{95})	10000 J	6230	UCL-C_{95}	(1)	6230	UCL-C_{95}	(2)
	Arsenic	ug/kg	4610	5150 (N)	15200	5150	UCL-N	(7)	5150	UCL-N	(2)
	Chromium	ug/kg	18900	21600 (T-H)	67700 K	21600	UCL-H	(8)	21600	UCL-H	(2)
	Cobalt	ug/kg	6590	7230 (N)	15300	7230	UCL-N	(7)	7230	UCL-N	(2)
	Copper	ug/kg	35800	86600 (NP-$C_{97.5}$)	366000	86600	UCL-$C_{97.5}$	(3)	86600	UCL-$C_{97.5}$	(2)
	Iron	ug/kg	14200000	16000000 (G)	47900000	16000000	UCL-G	(6)	16000000	UCL-G	(2)
	Lead	ug/kg	227000	1140000 (NP-$C_{97.5}$)	8540000 J	227000	Mean	(9)	227000	Mean	(9)
	Manganese	ug/kg	281000	311000 (N)	668000 K	311000	UCL-N	(7)	311000	UCL-N	(2)
	Mercury	ug/kg	300	765 (NP-$C_{97.5}$)	3200	765	UCL-$C_{97.5}$	(3)	765	UCL-$C_{97.5}$	(2)
	Thallium	ug/kg	2030	2180 (NP-Mt)	2400 J	2180	UCL-Mt	(5)	2180	UCL-Mt	(2)
	Vanadium	ug/kg	21200	24600 (G)	60800	24600	UCL-G	(6)	24600	UCL-G	(2)

TABLE 2.5
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Notes:

EPC = Exposure Point Concentration
J = estimated value
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 95% UCL computed based on non-parametric data using EPA's ProUCL 97.5% Chebyshev method.
(4) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(5) 95% UCL computed based on nonparametric data using EPA's ProUCL Modified t.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(8) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(9) Arithmetic mean used for lead EPC because the model utilizes the mean concentration to estimate the upper range of blood lead in a population distribution.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(T) The log-transformed data conform to a normal distribution as determined by the Shapiro-Wilk normality test.

TABLE 2.6
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Future
Medium: Surface and Subsurface Soil Combined
Exposure Medium: Surface and Subsurface Soil Combined

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Zone 3	Dieldrin	ug/kg	2.9	4.89 (NP-Mt)	60 J	4.89	UCL-Mt	(1)	4.89	UCL-Mt	(2)
	p,p-DDD	ug/kg	106	753 (NP-$C_{97.5}$)	5600	753	UCL-$C_{97.5}$	(3)	753	UCL-$C_{97.5}$	(2)
	Arochlor 1260	ug/kg	28.8	59.4 (NP-C_{95})	370	59.4	UCL-C_{95}	(4)	59.4	UCL-C_{95}	(2)
	Benzo(a)anthracene	ug/kg	380	809 (NP-C_{95})	3800	809	UCL-C_{95}	(4)	809	UCL-C_{95}	(2)
	Benzo(a)pyrene	ug/kg	387	811 (NP-C_{95})	3600	811	UCL-C_{95}	(4)	811	UCL-C_{95}	(2)
	Benzo(b)fluoranthene	ug/kg	367	731 (NP-C_{95})	3200	731	UCL-C_{95}	(4)	731	UCL-C_{95}	(2)
	Benzo(k)fluoranthene	ug/kg	380	781 (NP-C_{95})	3400	781	UCL-C_{95}	(4)	781	UCL-C_{95}	(2)
	Dibenzo(a,h)anthracene	ug/kg	297	560 (NP-C_{95})	1000	560	UCL-C_{95}	(4)	560	UCL-C_{95}	(2)
	Dibenzofuran	ug/kg	275	525 (NP-C_{95})	370 J	370	Max	(5)	370	Max	(2)
	Indeno(1,2,3-cd)pyrene	ug/kg	317	602 (NP-C_{95})	2600	602	UCL-C_{95}	(4)	602	UCL-C_{95}	(2)
	Aluminum	ug/kg	7870000	9340000 (G)	15000000	9340000	UCL-G	(6)	9340000	UCL-G	(2)
	Arsenic	ug/kg	5060	6120 (G)	20300	6120	UCL-G	(6)	6120	UCL-G	(2)
	Chromium	ug/kg	18700	21700 (G)	53200	21700	UCL-G	(6)	21700	UCL-G	(2)
	Cobalt	ug/kg	7760	8940 (G)	17700	8940	UCL-G	(6)	8940	UCL-G	(2)
	Iron	ug/kg	15700000	18200000 (G)	38000000	18200000	UCL-G	(6)	18200000	UCL-G	(2)
	Manganese	ug/kg	288000	334000 (G)	730000 K	334000	UCL-G	(6)	334000	UCL-G	(2)
	Vanadium	ug/kg	23500	27400 (N)	47300	27400	UCL-N	(7)	27400	UCL-N	(2)

Notes:
EPC = Exposure Point Concentration
J = estimated value
K = Analyte present. Reported value may be biased high. Actual value is expected to be lower.

UCL = upper confidence limit
ug/kg = micrograms per kilogram

(1) 95% UCL computed based on nonparametric data using EPA's ProUCL Modified t.
(2) The RME EPC was used for the Central Tendency EPC.
(3) 95% UCL computed based on non-parametric data using EPA's ProUCL 97.5% Chebyshev method.
(4) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(5) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(6) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.

TABLE 2.7
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Lower Darby Creek Area	Aldrin	ug/L	0.0626	0.133 (NP-C_{95})	1.3 J	0.133	UCL-C_{95}	(1)	0.133	UCL-C_{95}	(2)
	alpha-BHC	ug/L	0.0405	0.0681 (NP-C_{95})	0.042 J	0.042	Max	(3)	0.042	Max	(2)
	alpha-Chlordane	ug/L	0.0429	0.0708 (NP-C_{95})	0.26 J	0.0708	UCL-C_{95}	(1)	0.0708	UCL-C_{95}	(2)
	Atrazine	ug/L	5.58	6.47 (NP-Mt)	3.3 J	3.3	Max	(3)	3.3	Max	(2)
	beta-BHC	ug/L	0.0566	0.0926 (NP-C_{95})	0.51 J	0.0926	UCL-C_{95}	(1)	0.0926	UCL-C_{95}	(2)
	delta-BHC	ug/L	0.0644	0.159 (NP-C_{95})	1.9 J	0.159	UCL-C_{95}	(1)	0.159	UCL-C_{95}	(2)
	Dieldrin	ug/L	0.0738	0.121 (NP-C_{95})	0.39 J	0.121	UCL-C_{95}	(1)	0.121	UCL-C_{95}	(2)
	Endrin Ketone	ug/L	0.0832	0.165 (NP-C_{95})	1.6 J	0.165	UCL-C_{95}	(1)	0.165	UCL-C_{95}	(2)
	gamma-BHC (Lindane)	ug/L	0.045	0.0723 (NP-C_{95})	0.18 J	0.0723	UCL-C_{95}	(1)	0.0723	UCL-C_{95}	(2)
	gamma-Chlordane	ug/L	0.0542	0.0928 (NP-C_{95})	0.45 L	0.0928	UCL-C_{95}	(1)	0.0928	UCL-C_{95}	(2)
	Heptachlor	ug/L	0.0417	0.0804 (NP-$C_{97.5}$)	0.082 J	0.0804	UCL-$C_{97.5}$	(5)	0.0804	UCL-$C_{97.5}$	(2)
	Heptachlor Epoxide	ug/L	0.0436	0.069 (NP-C_{95})	0.13	0.069	UCL-C_{95}	(1)	0.069	UCL-C_{95}	(2)
	p,p-DDD	ug/L	0.102	0.176 (NP-C_{95})	0.84	0.176	UCL-C_{95}	(1)	0.176	UCL-C_{95}	(2)
	p,p-DDE	ug/L	0.0798	0.128 (NP-C_{95})	0.35 J	0.128	UCL-C_{95}	(1)	0.128	UCL-C_{95}	(2)
	p,p-DDT	ug/L	0.0955	0.161 (NP-C_{95})	0.67 J	0.161	UCL-C_{95}	(1)	0.161	UCL-C_{95}	(2)
	Arochlor 1016	ug/L	0.582	0.721 (NP-Mt)	6.7 L	0.721	UCL-Mt	(6)	0.721	UCL-Mt	(2)
	Arochlor 1242	ug/L	0.733	0.98 (NP-Mt)	11 J	0.98	UCL-Mt	(6)	0.98	UCL-Mt	(2)
	Arochlor 1248	ug/L	0.563	0.65 (NP-Mt)	4.4 J	0.65	UCL-Mt	(6)	0.65	UCL-Mt	(2)
	Arochlor 1260	ug/L	1.57	4.27 (NP-C_{95})	54	4.27	UCL-C_{95}	(1)	4.27	UCL-C_{95}	(2)
	Total 2,3,7,8-TCDD TEQ	pg/L	27.9	54.1 (N)	70.66	54.1	UCL-N	(7)	54.1	UCL-N	(2)
	3,3-Dichlorobenzidine	ug/L	5.62	6.51 (NP-Mt)	4.3 J	4.3	Max	(3)	4.3	Max	(2)
	4,6-Dinitro-2-methylphenol	ug/L	13.4	19.6 (NP-C_{95})	3.9 J	3.9	Max	(3)	3.9	Max	(2)
	2,4-Dinitrotoluene	ug/L	6.06	8.79 (NP-C_{95})	35	8.79	UCL-C_{95}	(1)	8.79	UCL-C_{95}	(2)
	2,6-Dinitrotoluene	ug/L	5.9	8.65 (NP-C_{95})	48	8.65	UCL-C_{95}	(1)	8.65	UCL-C_{95}	(2)
	2-Methylnaphthalene	ug/L	5.93	8.33 (NP-C_{95})	27 J	8.33	UCL-C_{95}	(1)	8.33	UCL-C_{95}	(2)
	2-Nitroaniline	ug/L	13.4	19 (NP-C_{95})	4.5 J	4.5	Max	(3)	4.5	Max	(2)

TABLE 2.7
EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Lower Darby Creek Area	3-Nitroaniline	ug/L	13.3	18.8 (NP-C_{95})	12 J	12	Max	(3)	12	Max	(2)
	4-Nitroaniline	ug/L	13.4	19 (NP-C_{95})	5.4 J	5.4	Max	(3)	5.4	Max	(2)
	4-Nitrophenol	ug/L	13.6	19.5 (NP-C_{95})	3 J	3	Max	(3)	3	Max	(2)
	Benzo(a)anthracene	ug/L	5.23	7.29 (NP-C_{95})	11	7.29	UCL-C_{95}	(1)	7.29	UCL-C_{95}	(2)
	Benzo(a)pyrene	ug/L	5.33	7.47 (NP-C_{95})	11	7.47	UCL-C_{95}	(1)	7.47	UCL-C_{95}	(2)
	Benzo(b)fluoranthene	ug/L	5.4	7.56 (NP-C_{95})	15	7.56	UCL-C_{95}	(1)	7.56	UCL-C_{95}	(2)
	Benzo(k)fluoranthene	ug/L	5.31	7.49 (NP-C_{95})	16 J	7.49	UCL-C_{95}	(1)	7.49	UCL-C_{95}	(2)
	Bis(2-chloroisopropyl) ether	ug/L	5.59	6.48 (NP-Mt)	14 J	6.48	UCL-Mt	(6)	6.48	UCL-Mt	(2)
	Bis(2-ethylhexyl) phthalate	ug/L	14.5	37 (NP-C_{95})	370	37	UCL-C_{95}	(1)	37	UCL-C_{95}	(2)
	Carbazole	ug/L	5.39	7.63 (NP-C_{95})	5 J	5	Max	(3)	5	Max	(2)
	Chrysene	ug/L	5.25	7.34 (NP-C_{95})	12	7.34	UCL-C_{95}	(1)	7.34	UCL-C_{95}	(2)
	Dibenzo(a,h)anthracene	ug/L	5.81	8.16 (NP-C_{95})	1.8 J	1.8	Max	(3)	1.8	Max	(2)
	Dibenzofuran	ug/L	5.27	7.54 (NP-C_{95})	9	7.54	UCL-C_{95}	(1)	7.54	UCL-C_{95}	(2)
	Indeno(1,2,3-cd)pyrene	ug/L	5.54	7.84 (NP-C_{95})	5.4	5.4	Max	(3)	5.4	Max	(2)
	Naphthalene	ug/L	5.7	8.14 (NP-C_{95})	20	8.14	UCL-C_{95}	(1)	8.14	UCL-C_{95}	(2)
	Nitrobenzene	ug/L	5.58	6.47 (NP-Mt)	3.8 J	3.8	Max	(3)	3.8	Max	(2)
	N-nitrosodi-n-propylamine	ug/L	5.57	6.45 (NP-Mt)	8.4 J	6.45	UCL-Mt	(6)	6.45	UCL-Mt	(2)
	Phenanthrene	ug/L	5.77	7.98 (NP-C_{95})	32	7.98	UCL-C_{95}	(1)	7.98	UCL-C_{95}	(2)
	Pyrene	ug/L	5.45	7.77 (NP-C_{95})	29	7.77	UCL-C_{95}	(1)	7.77	UCL-C_{95}	(2)
	Benzene	ug/L	5	5.53 (NP-Mt)	18	5.53	UCL-Mt	(6)	5.53	UCL-Mt	(2)
	Bromodichloromethane	ug/L	4.84	5.37 (NP-Mt)	4 J	4	Max	(3)	4	Max	(2)
	Carbon Tetrachloride	ug/L	4.81	5.35 (NP-Mt)	1 J	1	Max	(3)	1	Max	(2)
	Chlorobenzene	ug/L	13	22.8 (NP-C_{95})	190	22.8	UCL-C_{95}	(1)	22.8	UCL-C_{95}	(2)
	Chloroform	ug/L	4.94	5.52 (NP-Mt)	19	5.52	UCL-Mt	(6)	5.52	UCL-Mt	(2)
	1,3-Dichlorobenzene	ug/L	4.49	5.73 (NP-C_{95})	2.9 J	2.9	Max	(3)	2.9	Max	(2)
	1,4-Dichlorobenzene	ug/L	4.85	5.35 (NP-Mt)	18	5.35	UCL-Mt	(6)	5.35	UCL-Mt	(2)

TABLE 2.7

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Lower Darby Creek Area	1,4-Dioxane (p-Dioxane)	ug/L	181	6.12 (NP-C_{99})	1000 J	6.12	UCL-C_{99}	(8)	6.12	UCL-C_{99}	(2)
	Cis-1,2-Dichloroethylene	ug/L	4.79	5.33 (NP-Mt)	9 J	5.33	UCL-Mt	(6)	5.33	UCL-Mt	(2)
	Tert-butyl methyl ether (MTBE)	ug/L	7.24	12.5 (NP-C_{95})	120 L	12.5	UCL-C_{95}	(1)	12.5	UCL-C_{95}	(2)
	Tetrachloroethylene (PCE)	ug/L	4.76	5.3 (NP-Mt)	4 J	4	Max	(3)	4	Max	(2)
	Trichloroethylene (TCE)	ug/L	4.79	5.33 (NP-Mt)	5 J	5	Max	(3)	5	Max	(2)
	Vinyl Chloride	ug/L	4.79	5.33 (NP-Mt)	2 J	2	Max	(3)	2	Max	(2)
	Aluminum	ug/L	19700	36900 (T-H)	312000 L	36900	UCL-H	(4)	36900	UCL-H	(2)
	Antimony	ug/L	34.8	40.4 (NP-Mt)	271 L	40.4	UCL-Mt	(6)	40.4	UCL-Mt	(2)
	Arsenic	ug/L	20.2	37.7 (NP-C_{95})	241	37.7	UCL-C_{95}	(1)	37.7	UCL-C_{95}	(2)
	Barium	ug/L	1040	1280 (T-H)	12800 L	1280	UCL-H	(4)	1280	UCL-H	(2)
	Beryllium	ug/L	2.89	5.18 (NP-C_{95})	25.7	5.18	UCL-C_{95}	(1)	5.18	UCL-C_{95}	(2)
	Cadmium	ug/L	7.08	13.7 (NP-C_{95})	109 L	13.7	UCL-C_{95}	(1)	13.7	UCL-C_{95}	(2)
	Cobalt	ug/L	25.6	57.1 (NP-$C_{97.5}$)	300	57.1	UCL-$C_{97.5}$	(5)	57.1	UCL-$C_{97.5}$	(2)
	Copper	ug/L	341	1220 (NP-$C_{97.5}$)	12500 L	1220	UCL-$C_{97.5}$	(5)	1220	UCL-$C_{97.5}$	(2)
	Cyanide	ug/L	17.2	43 (NP-$C_{97.5}$)	208 L	43	UCL-$C_{97.5}$	(5)	43	UCL-$C_{97.5}$	(2)
	Iron	ug/L	57700	128000 (NP-$C_{97.5}$)	770000 L	128000	UCL-$C_{97.5}$	(5)	128000	UCL-$C_{97.5}$	(2)
	Lead	ug/L	1150	4540 (NP-C_{99})	26500 L	1150	Mean	(9)	1150	Mean	(9)
	Manganese	ug/L	2000	2840 (T-H)	13800	2840	UCL-H	(4)	2840	UCL-H	(2)
	Mercury	ug/L	1.3	4.58 (NP-$C_{97.5}$)	36.2 J	4.58	UCL-$C_{97.5}$	(5)	4.58	UCL-$C_{97.5}$	(2)
	Nickel	ug/L	90.3	253 (NP-$C_{97.5}$)	1480 L	253	UCL-$C_{97.5}$	(5)	253	UCL-$C_{97.5}$	(2)
	Seleniuim	ug/L	16.7	17.6 (NP-Mt)	51.5 L	17.6	UCL-Mt	(6)	17.6	UCL-Mt	(2)
	Silver	ug/L	8.54	16.4 (NP-C_{95})	130 L	16.4	UCL-C_{95}	(1)	16.4	UCL-C_{95}	(2)
	Thallium	ug/L	12.3	12.8 (NP-Mt)	28.9	12.8	UCL-Mt	(6)	12.8	UCL-Mt	(2)
	Vanadium	ug/L	138	135 (T-H)	5000 L	135	UCL-H	(4)	135	UCL-H	(2)
	Zinc	ug/L	1310	3720 (NP-$C_{97.5}$)	26300 L	3720	UCL-$C_{97.5}$	(5)	3720	UCL-$C_{97.5}$	(2)

TABLE 2.7

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Notes:
C = The analyst made an additional comment regarding this result (see analytical report narrative)
EPC = Exposure Point Concentration
J = estimated value
L = Analyte present. Reported value may be biased low. Actual value is expected to be higher.

< = Less than
pg/L = picograms per liter
UCL = upper confidence limit
ug/L = micrograms per liter

(1) 95% UCL computed based on nonparametric data using EPA's ProUCL 95% Chebyshev method.
(2) The RME EPC was used for the Central Tendency EPC.
(3) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(4) 95% UCL computed based on lognormal data using EPA's ProUCL H statistic.
(5) 95% UCL computed based on nonparametric data using EPA's ProUCL 97.5% Chebyshev method.
(6) UCL computed based on non-parametric data using EPA's ProUCL Modified-t method.
(7) 95% UCL computed based on normal data using EPA's ProUCL Student's t.
(8) 95% UCL computed based on nonparametric data using EPA's ProUCL 99% Chebyshev method.
(9) Arithmetic mean used for lead EPC because the model utilizes the mean concentration to estimate the upper range of blood lead in a population distribution.

(C_{95}) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
($C_{97.5}$) Recommended UCL was computed using EPA's ProUCL 97.5% Chebyshev method.
(C_{99}) Recommended UCL was computed using EPA's ProUCL 99% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(H) The UCL was computed using EPA's ProUCL H-statistic method.
(Mt) Recommended UCL was computed using EPA's ProUCL Modified t
(N) The data are normal at 5% significance level.
(NP) The data are neither normal or lognormal. A nonparametric UCL was computed using EPA's ProUCL software.
(T) The data follow the Lognormal Distribution.

TABLE 2.8

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Fish Tissue
Exposure Medium: Fish Tissue

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Concentration (Qualifier)	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Lower Darby and Lower Cobbs Creeks	Arsenic	ug/kg	3243	3752	5589	3752	UCL-N	(5)	3752	UCL-N	(1)
	Cadmium	ug/kg	7559	8861	14382	8861	UCL-N	(5)	8861	UCL-N	(1)
	Chromium	ug/kg	22000	25650	53820	25650	UCL-N	(5)	25650	UCL-N	(1)
	Copper	ug/kg	364900	427800	687800	427800	UCL-N	(5)	427800	UCL-N	(1)
	Lead	ug/kg	90440	NA	249480	90440	Mean	IEUBK uses mean	90440	Mean	(1)
	Mercury	ug/kg	731	924	1721	924	UCL-G	(4)	924	UCL-G	(1)
	Nickel	ug/kg	61940	70320	93260	70320	UCL-N	(5)	70320	UCL-N	(1)
	Selenium	ug/kg	1880	2274	2800	2274	UCL-N	(5)	2274	UCL-N	(1)
	Silver	ug/kg	1120	1297	1900	1297	UCL-N	(5)	1297	UCL-N	(1)
	Zinc	ug/kg	2190000	2573000	4343000	2573000	UCL-N	(5)	2573000	UCL-N	(1)
	4,4'-DDE	ug/kg	54.0	69.1	131	69.1	UCL-G	(4)	69.1	UCL-G	(1)
	4,4'-DDT	ug/kg	10.9	20.3	38.0	20.3	UCL-C_{95}	(2)	20.3	UCL-C95	(1)
	Alpha-Chlordane	ug/kg	159	197	341	197	UCL-N	(5)	197	UCL-N	(1)
	Aroclor-1260	ug/kg	103	261	820	820	Max	(3)	820	Max	(1)
	Beta-BHC	ug/kg	3.72	4.18	6.75	4.18	UCL-N	(5)	4.18	UCL-N	(1)
	Dieldrin	ug/kg	58.7	74.2	137	74.2	UCL-N	(5)	74.2	UCL-N	(1)
	Gamma-Chlordane	ug/kg	35.1	43.2	88.3	43.2	UCL-N	(5)	43.2	UCL-N	(1)
	Heptachlor	ug/kg	3.38	3.82	2.66	2.66	Max	(3)	2.66	Max	(1)
	Heptachlor Epoxide	ug/kg	7.08	8.89	18.2	8.89	UCL-N	(5)	8.89	UCL-N	(1)
	Benz(a)anthracene	ug/kg	916	1265	3295	1265	UCL-G	(4)	1265	UCL-G	(1)
	Benzo(a)pyrene	ug/kg	870	1068	2076	1068	UCL-N	(5)	1068	UCL-N	(1)
	Benzo(b)fluoranthene	ug/kg	1074	1329	2603	1329	UCL-N	(5)	1329	UCL-N	(1)
	Benzo(k)fluoranthene	ug/kg	840	1009	1615	1009	UCL-N	(5)	1009	UCL-N	(1)
	Chrysene	ug/kg	1186	1493	3625	1493	UCL-N	(5)	1493	UCL-N	(1)
	Dibenz(a,h)anthracene	ug/kg	211	260	560	260	UCL-N	(5)	260	UCL-N	(1)
	Fluoranthene	ug/kg	2135	2977	8239	2977	UCL-G	(4)	2977	UCL-G	(1)
	Indeno(1,2,3-cd)pyrene	ug/kg	636	777	1384	777	UCL-N	(5)	777	UCL-N	(1)
	Phenanthrene	ug/kg	1430	2021	7580	2021	UCL-G	(4)	2021	UCL-G	(1)
	Pyrene	ug/kg	1822	2512	6261	2512	UCL-G	(4)	2512	UCL-G	(1)

Notes:
EPC = Exposure Point Concentration
ug/kg = micrograms per kilogram
UCL = upper confidence limit

Values presented are modeled concentrations. Statistical values expressed in sediment concentration units were multiplied by the BSAFs in Table 2-17 to yield the fish tissue concentrations shown in this table.
Fish tissue concentration for the organic chemicals was estimated using the following equation: Fish Concentration = (Sediment Concentration)*BSAF*(3% Lipids)/(2.64% Total Organic Carbon).
For inorganics, Fish Concentration = Sediment Concentration*BSAF

(1) The RME EPC was used for the Central Tendency EPC.
(2) 95% UCL computed based on non-parametric data using EPA's ProUCL 95% Chebyshev method.
(3) Maximum concentration used, UCL was not used because there was only one positive result.
(4) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(5) 95% UCL computed based on normal data using EPA's ProUCL Student's t.

(C95) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(N) The data are normal at 5% significance level.

TABLE 2.9

EXPOSURE POINT CONCENTRATION SUMMARY
LOWER DARBY CREEK AREA RI/FS

Scenario Timeframe: Current/Future
Medium: Fish Tissue
Exposure Medium: Fish Tissue

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL	Maximum Concentration (Qualifier)**	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Tinicum Marsh	Arsenic	ug/kg	7590	9060	10419	9060	UCL-N	(5)	9060	(5)	(1)
	Cadmium	ug/kg	12940	16530	12780	12780	Max	(2)	12780	(2)	(1)
	Chromium	ug/kg	28270	32090	34770	32090	UCL-N	(5)	32090	(5)	(1)
	Copper	ug/kg	353900	439600	551300	439600	UCL-N	(5)	439600	(5)	(1)
	Lead	ug/kg	111700	NA	143900	111700	Mean	IEUBK uses mean	111700	IEUBK uses mean	(1)
	Mercury	ug/kg	728	933	1233	933	UCL-N	(5)	933	(5)	(1)
	Nickel	ug/kg	84910	92920	91520	91520	Max	(2)	91520	(2)	(1)
	Selenium	ug/kg	2470	NA	3300	3300	Max	(3)	3300	(3)	(1)
	Silver	ug/kg	2770	4010	1400	1400	Max	(2)	1400	(2)	(1)
	Zinc	ug/kg	2138000	2860000	3636000	2860000	UCL-N	(5)	2860000	(5)	(1)
	4,4'-DDE	ug/kg	213	258	254	254	Max	(2)	254	(2)	(1)
	4,4'-DDT	ug/kg	17.8	22.8	29.1	29.1	Max	(3)	29.1	(3)	(1)
	Alpha-BHC	ug/kg	9.05	11.0	10.1	10.1	Max	(3)	10.1	(3)	(1)
	Alpha-Chlordane	ug/kg	103	278	228	228	Max	(2)	228	(2)	(1)
	Dieldrin	ug/kg	28.5	46.9	65.3	46.9	UCL-G	(4)	46.9	(4)	(1)
	Gamma-Chlordane	ug/kg	24.8	36.4	54.9	36.4	UCL-N	(5)	36.4	(5)	(1)
	Heptachlor Epoxide	ug/kg	8.87	10.63	6.53	6.53	Max	(2)	6.53	(2)	(1)
	Benz(a)anthracene	ug/kg	305	508	813	508	UCL-N	(5)	508	(5)	(1)
	Benzo(a)pyrene	ug/kg	338	575	956	575	UCL-N	(5)	575	(5)	(1)
	Benzo(b)fluoranthene	ug/kg	416	741	1291	741	UCL-N	(5)	741	(5)	(1)
	Benzo(k)fluoranthene	ug/kg	345	582	908	582	UCL-N	(5)	582	(5)	(1)
	Chrysene	ug/kg	427	721	1147	721	UCL-N	(5)	721	(5)	(1)
	Dibenz(a,h)anthracene	ug/kg	210	302	191	191	Max	(2)	191	(2)	(1)
	Indeno(1,2,3-cd)pyrene	ug/kg	274	457	717	457	UCL-N	(5)	457	(5)	(1)

Notes:
EPC = Exposure Point Concentration
ug/kg = micrograms per kilogram
NC = Not Calculated

Values presented are modeled concentrations. Statistical values expressed in sediment concentration units were multiplied by the BSAFs in Table 2-18 to yield the fish tissue concentrations shown in this table.
Fish tissue concentration for the organic chemicals was estimated using the following equation: Fish Concentration = (Sediment Concentration)*BSAF*(3% Lipids)/(1.82% Total Organic Carbon).
For inorganics, Fish Concentration = Sediment Concentration*BSAF
** The maximum concentrations presented in this column represent the average value in the cases where a field duplicate pair exhibits the maximum concentration.
This may differ slightly from Table 2.18 where the individual duplicate samples were listed if the maximum concentration occurred for a field duplicate.

(1) The RME EPC was used for the Central Tendency EPC.
(2) Maximum concentration used because the calculated UCL exceeds maximum detected concentration.
(3) Maximum concentration used, UCL was not used because there was only one positive result.
(4) UCL computed based on gamma distribution using EPA's ProUCL Approximate Gamma.
(5) 95% UCL computed based on normal data using EPA's ProUCL Student's t.

(C95) Recommended UCL was computed using EPA's ProUCL 95% Chebyshev method.
(G) The data follow the gamma distribution. Recommended UCL was computed using EPA's ProUCL Approximate Gamma
(N) The data are normal at 5% significance level.

TABLE 3

INITIAL SET OF CHEMICALS OF CONCERN (COCs)
LOWER DARBY CREEK AREA SITE OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA
PAGE 1 OF 2

CHEMICAL OF CONCERN (COC)	HUMAN HEALTH									ECOLOGICAL (TERRESTRIAL)			ECOLOGICAL (AQUATIC)		
	SURFACE SOIL			TOTAL SOIL			GROUNDWATER	INDOOR AIR	FISH TISSUE	INVERTEBRATES	PLANTS	MAMMALS/BIRDS	INVERTEBRATES	PLANTS	MAMMALS/BIRDS
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3									
INORGANICS / METALS															
Aluminum							X						X		
Antimony	X	BG	BG	X	X		X			X	X	X (Mammal Only)	X		
Arsenic	X	BG	BG	X	BG	BG	X		X				X	X	
Barium							X						X		
Beryllium										X			X		
Cadmium							X		X	X	X	X	X		
Chromium									X	X	X	X	X		
Cobalt	BG	BG	BG		BG		X						X		
Copper	X						X		X	X	X	X	X		
Iron	X	BG	BG		BG		X						X		
Lead	X			X	BG		X		X	X	X	X	X		X (Bird Only)
Manganese							X			X	X	X	X		
Mercury							X		X	X	X	X	X		X (Bird Only)
Nickel									X	X	X	X	X		X (Mammal Only)
Selenium									X				X		X
Silver									X	X	X	X	X		
Thallium	BG						X						X		
Vanadium							X			X	X	X	X		
Zinc							X		X	X	X	X	X		
PAHs / SVOCs															
Acenaphthene										X					
Acenaphthylene										X	X				
Anthracene										X	X				
Benzo(a)anthracene	X	X	X	X	X	X	X		X		X				
Benzo(a)pyrene	X	X	X	X	X	X	X		X		X				
Benzo(b)fluoranthene	X	X	X	X	X	X	X		X		X				
Benzo(g,h,i)perylene										X	X				
Benzo(k)fluoranthene		X	X		X		X		X	X	X				
Benzyl butyl phthalate										X	X				
Chrysene							X		X		X				
Dibenz(a,h)anthracene	X	X	X	X	X	X	X		X		X				
Dibenzofuran													X		X (Bird Only)
Fluoranthene									X	X	X				
Fluorene											X				
Indeno(1,2,3-cd)pyrene	X	X	X	X	X	X	X		X		X				
Bis(2-ethylhexyl)phthalate							X			X	X				
4-Methylphenol													X		
Naphthalene							X			X	X				
Nitrobenzene							X								
N-Nitroso-di-n-propylamine							X								
Phenanthrene									X	X					
Pyrene									X	X					
HMW PAHs												X			
Total PAHs										X	X		X		

TABLE 3

INITIAL SET OF CHEMICALS OF CONCERN (COCs)
LOWER DARBY CREEK AREA SITE OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA
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CHEMICAL OF CONCERN (COC)	HUMAN HEALTH									ECOLOGICAL (TERRESTRIAL)			ECOLOGICAL (AQUATIC)		
	SURFACE SOIL			TOTAL SOIL			GROUNDWATER	INDOOR AIR	FISH TISSUE	INVERTEBRATES	PLANTS	MAMMALS/BIRDS	INVERTEBRATES	PLANTS	MAMMALS/BIRDS
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3									
VOCs															
Benzene							X	X							
Chloroform			X (SG)			X (SG)	X	X							
2,2'-oxybis(1-chloropropane)							X								
PCE							X								
Carbon Tetrachloride							X								
1.4-Dichlorobenzene							X								
Vinyl Chloride							X								
PESTICIDES															
Aldrin		X					X			X	X				
Atrazine							X								
Beta-BHC	X								X						
DDD											X				
DDE									X		X				
DDT									X		X				
Total DDT										X	X		X		
Dieldrin	X			X			X		X				X		
2,4-Dinitrotoluene							X								
2,6-Dinitrotoluene							X								
3,3'-Dichlorobenzidine							X								
Endosulfan I and II										X	X				
Endosulfan sulfate										X	X				
Endrin	X														
Endrin aldehyde										X	X				
Alpha-chlordane									X						
Gamma-chlordane	X								X	X	X				
Total chlordane										X	X				
Heptachlor									X						
Heptachlor epoxide	X			X			X		X						
Methoxychlor										X	X				
PCBs															
Arochlor-1016															
Arochlor-1254	X	X			X		X		X	X		X			
Arochlor-1260	X	X	X	X	X		X		X	X		X			
Arochlor-1268	X			X			X		X						
DIOXINS															
Total 2,3,7,8-TCDD TEQ				X			X								

BG = Concentrations of the specific risk driver were demonstrated to be not greater than background based on statistical tests.
SG = Based on soil gas sample results.

TABLE 4
SELECTION OF EXPOSURE PATHWAYS
Lower Darby Creek Area
Page 1 of 3

Scenario Timeframe	Medium	Exposure Medium	Exposure Point(s)	Receptor Population	Receptor Age	Exposure Route	On-Site / Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Water	Surface Water	Lower Darby and Lower Cobbs Creeks	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek surface water).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek surface water).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek surface water).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Cobbs Creek (incidental ingestion of creek surface water).
			Tinicum Marsh	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh surface water).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh surface water).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh surface water).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Tinicum Marsh (incidental ingestion of marsh surface water).
			Leachate Ponds/Seeps	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate only).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate only).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate only).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate only).
		Vapors (outside vapor emissions from leachate seeps)	Leachate Ponds/Seeps	Construction Worker	Adult	Inhalation	On/Off-site	Quant	Adult Construction Workers may be exposed to vapors from leachate seeps.
				Recreational User	Adult	Inhalation	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in vapors from leachate seeps.
					Child	Inhalation	On/Off-site	Quant	Child recreational users may be exposed to contaminants in vapors from leachate seeps.
					Adult/Child	Inhalation	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in vapors from leachate seeps.
	Sediment	Sediment	Lower Darby and Lower Cobbs Creeks	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek sediment).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek sediment).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Cobbs Creek (incidental ingestion of creek sediment).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Cobbs Creek.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Cobbs Creek (incidental ingestion of creek sediment).
			Tinicum Marsh	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult Construction Workers may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh sediment).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh sediment).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Tinicum Marsh (incidental ingestion of marsh sediment).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Tinicum Marsh.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Tinicum Marsh (incidental ingestion of marsh sediment).
			Leachate Ponds/Seeps	Construction Worker	Adult	Dermal Absorption	On/Off-site	Quant	Construction Workers may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Construction Workers may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate sediment).
				Recreational User	Adult	Dermal Absorption	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Adult recreational users may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate sediment).
					Child	Dermal Absorption	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Child recreational users may be exposed to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate sediment).
					Adult/Child	Dermal Absorption	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Leachate Ponds/Seeps.
						Ingestion	On/Off-site	Quant	Adult/child cancer risk combined for exposure to contaminants in Leachate Ponds/Seeps (incidental ingestion of leachate sediment

TABLE 4
SELECTION OF EXPOSURE PATHWAYS
Lower Darby Creek Area
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Scenario Timeframe	Medium	Exposure Medium	Exposure Point(s)	Receptor Population	Receptor Age	Exposure Route	On-Site / Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Tissue	Fish Tissue	Tinicum Marsh	Subsistence Fisher	Adult	Ingestion	Off-site	Quant	Adult subsistence fisher may consume fish harvested from Tinicum Marsh.
					Child	Ingestion	Off-site	Quant	Child subsistence fisher may consume fish harvested from Tinicum Marsh.
					Adult/Child	Ingestion	Off-site	Quant	Adult/child cancer risk combined for subsistence fisher consumption of fish harvested from Tinicum Marsh.
				Recreational Fisher	Adult	Ingestion	Off-site	Quant	Adult recreational fisher may consume fish harvested from Tinicum Marsh
					Child	Ingestion	Off-site	Quant	Child recreational fisher may consume fish harvested from Tinicum Marsh.
					Adult/Child	Ingestion	Off-site	Quant	Adult/child cancer risk combined for recreational fisher consumption of fish harvested from Tinicum Marsh.
		Fish Tissue	Lower Darby and Lower Cobbs Creeks	Subsistence Fisher	Adult	Ingestion	Off-site	Quant	Adult subsistence fisher may consume fish harvested from Darby Creek.
					Child	Ingestion	Off-site	Quant	Child subsistence fisher may consume fish harvested from Darby Creek.
					Adult/Child	Ingestion	Off-site	Quant	Adult/child cancer risk combined for subsistence fisher consumption of fish harvested from Darby Creek.
				Recreational Fisher	Adult	Ingestion	Off-site	Quant	Adult recreational fisher may consume fish harvested from Darby Creek.
					Child	Ingestion	Off-site	Quant	Child recreational fisher may consume fish harvested from Darby Creek.
					Adult/Child	Ingestion	Off-site	Quant	Adult/child cancer risk combined for recreational fisher consumption of fish harvested from Darby Creek.
	Soil	Surface Soil	Zone 1 (Landfill Area)	Recreational (Current Only)	Adult	Dermal Absorption	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
					Child	Dermal Absorption	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
				Resident (Current Only)	Adult	Dermal Absorption	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
					Child	Dermal Absorption	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
			Zone 2 (City Park)	Recreational (Current Only)	Adult	Dermal Absorption	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
					Child	Dermal Absorption	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
				Resident (Current Only)	Adult	Dermal Absorption	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
					Child	Dermal Absorption	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
			Zone 3 (Residential Neighborhood)	Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Workers may be exposed during outdoor activities.
						Ingestion	On-site	Quant	Workers may be exposed during outdoor activities.
				Resident	Adult	Dermal Absorption	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult Residents may be exposed to contaminants in surface soil.
					Child	Dermal Absorption	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Child Residents may be exposed to contaminants in surface soil.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in surface soil.
	Soil	Total Soil (Surface + Subsurface Soil)	Zone 1 (Landfill Area)	Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
						Ingestion	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
				Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
						Ingestion	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
			Zone 2 (City Park)	Recreational (Future Only)	Adult	Dermal Absorption	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Adult Recreational Users may be exposed during activities on the site.
					Child	Dermal Absorption	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
						Ingestion	On-site	Quant	Child Recreational Users may be exposed during activities on the site.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Recreational Users exposed during activities on the site.
				Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
						Ingestion	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
				Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
						Ingestion	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
				Resident (Future Only)	Adult	Dermal Absorption	On-site	Quant	Adult Residents may be exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Adult Residents may be exposed to contaminants in combined surface and subsurface soil.
					Child	Dermal Absorption	On-site	Quant	Child Residents may be exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Child Residents may be exposed to contaminants in combined surface and subsurface soil.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in combined surface and subsurface soil.

TABLE 4
SELECTION OF EXPOSURE PATHWAYS
Lower Darby Creek Area
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Scenario Timeframe	Medium	Exposure Medium	Exposure Point(s)	Receptor Population	Receptor Age	Exposure Route	On-Site / Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
	Soil	Total Soil (Surface + Subsurface Soil)	Zone 3 (Residential Neighborhood)	Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
						Ingestion	On-site	Quant	Workers may be exposed during outdoor light excavation activities (e.g., utility and plumbing excavations).
				Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
						Ingestion	On-site	Quant	Construction workers may be exposed to contaminants while performing heavy excavation activities (e.g., building foundations).
				Resident	Adult	Dermal Absorption	On-site	Quant	Adult Residents may be exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Adult Residents may be exposed to contaminants in combined surface and subsurface soil.
					Child	Dermal Absorption	On-site	Quant	Child Residents may be exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Child Residents may be exposed to contaminants in combined surface and subsurface soil.
					Adult/Child	Dermal Absorption	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in combined surface and subsurface soil.
						Ingestion	On-site	Quant	Adult/child cancer risk combined for Residents exposed to contaminants in combined surface and subsurface soil.
Current/Future	Soil Gas	Vapors (outside vapors)	Zone 1 (Landfill Area)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Construction Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Recreational	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Child	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for exposure to vapors in air during outdoor activities.
				Resident	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Child	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for exposure to vapors in air during outdoor activities.
			Zone 2 (City Park)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Construction Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Recreational	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Child	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for exposure to vapors in air during outdoor activities.
				Resident	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Child	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for exposure to vapors in air during outdoor activities.
			Zone 3 (Residential Neighborhood)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Construction Worker	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
				Resident	Adult	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Child	Inhalation	On-site	Quant	Vapors in air are available for exposure during outdoor activities.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for exposure to vapors in air during outdoor activities.
		Vapor intrusion into Buildings (indoor vapors)	Zone 1 (Landfill Area)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
				Resident	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Child	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for vapors in indoor air (vapor intrusion into buildings).
			Zone 2 (City Park)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
				Resident	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Child	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for vapors in indoor air (vapor intrusion into buildings).
			Zone 3 (Residential Neighborhood)	Industrial Worker	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
				Resident	Adult	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Child	Inhalation	On-site	Quant	Vapor intrusion into buildings.
					Adult/Child	Inhalation	On-site	Quant	Adult/child cancer risk combined for vapors in indoor air (vapor intrusion into buildings).
Future	Water	Groundwater	On-site (Clearview Landfill)	Industrial Worker	Adult	Dermal Absorption	On-site	Quant	Exposure to groundwater in excavations.
						Ingestion	On-site	Quant	Exposure to groundwater in excavations.
				Construction Worker	Adult	Dermal Absorption	On-site	Quant	Exposure to groundwater in excavations.
						Ingestion	On-site	Quant	Exposure to groundwater in excavations.
				Resident	Adult	Dermal Absorption	On-site	Quant	Residents may install hypothetical private well in future.
						Ingestion	On-site	Quant	Residents may install hypothetical private well in future.
					Child	Dermal Absorption	On-site	Quant	Residents may install hypothetical private well in future.
						Ingestion	On-site	Quant	Residents may install hypothetical private well in future.
					Adult/Child	Dermal Absorption	On-site	Quant	Cancer risk combined for adult/child resident who may install hypothetical private well in future.
						Ingestion	On-site	Quant	Cancer risk combined for adult/child resident who may install hypothetical private well in future.
		Air (Vapors from groundwater in excavations)	On-site (Clearview Landfill)	Industrial Worker	Adult	Inhalation	On-site	Quant	Exposure to vapors from groundwater in excavations.
				Construction Worker	Adult	Inhalation	On-site	Quant	Exposure to vapors from groundwater in excavations.
		Air (Vapors from Showerhead)	On-site (Clearview Landfill)	Resident	Adult	Inhalation	On-site	Quant	Hypothetical on-site residents may install private well in the event of future onsite residential development.

Notes:

Industrial Worker is defined as the worker who maintains the grounds (groundskeeper), lawn mower and other light industrial activities.
Construction Worker is defined as the worker who is involved with earth moving activities such as plumbiing pipe repairs, cable line installations, building construction activites.
Exposure to resident through inhalation of vapors from showerhead is only evaluated for adults. Children aged 0 to 6 are not expected to take showers.

TABLE 5.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral to Dermal Adjustment Factor	Adjusted Dermal Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units	(1)	Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1	1.7E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Atrazine	2.30E-01	$(mg/kg\text{-}day)^{-1}$	1	2.3E-01	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	12/4/2008
alpha-BHC	6.3E+00	$(mg/kg\text{-}day)^{-1}$	1	6.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
beta-BHC	1.8E+00	$(mg/kg\text{-}day)^{-1}$	1	1.8E+00	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/26/2007
delta-BHC	1.8E+00	$(mg/kg\text{-}day)^{-1}$	1	1.8E+00	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/26/2007
gamma-BHC (Lindane)	1.1E+00	$(mg/kg\text{-}day)^{-1}$	1	1.1E+00	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	12/4/2008
alpha-Chlordane	3.5E-01	$(mg/kg\text{-}day)^{-1}$	1	3.5E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
gamma-Chlordane	3.5E-01	$(mg/kg\text{-}day)^{-1}$	1	3.5E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Dieldrin	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1	1.6E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Endrin	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/4/2008
Endrin Aldehyde	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/4/2008
Endrin Ketone	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/4/2008
Heptachlor	4.5E+00	$(mg/kg\text{-}day)^{-1}$	1	4.5E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Heptachlor Epoxide	9.1E+00	$(mg/kg\text{-}day)^{-1}$	1	9.1E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
p,p-DDD	2.4E-01	$(mg/kg\text{-}day)^{-1}$	1	2.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
p,p-DDE	3.4E-01	$(mg/kg\text{-}day)^{-1}$	1	3.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
p,p-DDT	3.4E-01	$(mg/kg\text{-}day)^{-1}$	1	3.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
PCB-1016 (aroclor 1016)	7.0E-02	$(mg/kg\text{-}day)^{-1}$	1	7.0E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/4/2008
PCBs (soil, food, sediment, dust; all except PCB-1016)	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
PCBs (water; all except PCB-1016)	4.0E-01	$(mg/kg\text{-}day)^{-1}$	1	4.0E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Benzene	5.5E-02	$(mg/kg\text{-}day)^{-1}$	1	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/26/2007
Benzyl Chloride	1.7E-01	$(mg/kg\text{-}day)^{-1}$	1	1.7E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Bromodichloromethane	6.2E-02	$(mg/kg\text{-}day)^{-1}$	1	6.2E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Carbon Tetrachloride	1.3E-01	$(mg/kg\text{-}day)^{-1}$	1	1.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
Chlorobenzene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/4/2008
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1	3.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	12/4/2008
Chloromethane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Cyclohexane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
1,3-Dichlorobenzene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
1,4-Dichlorobenzene	5.4E-03	$(mg/kg\text{-}day)^{-1}$	1	5.4E-03	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	12/4/2008
Dichlorodifluoromethane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
1,2-Dichlorotetrafluoroethane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
1,4-Dioxane (p-Dioxane)	1.1E-02	$(mg/kg\text{-}day)^{-1}$	1	1.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/26/2007
cis-1,2-Dichloroethylene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
4-Ethyltoluene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
2-Hexanone	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
methylcyclohexane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Methyl isobutyl ketone (MIBK)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Methyl tert-butyl ether	1.8E-03	$(mg/kg\text{-}day)^{-1}$	1	1.8E-03	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	12/4/2008

TABLE 5.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral to Dermal Adjustment Factor	Adjusted Dermal Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units	(1)	Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
1,1,2,2-Tetrachloroethane	2.00E-01	$(mg/kg\text{-}day)^{-1}$	1	2.0E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/26/2007
Tetrachloroethylene (PCE)	5.40E-01	$(mg/kg\text{-}day)^{-1}$	1	5.40E-01	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	11/10/2005
1,1,2-Trichloroethane	5.70E-02	$(mg/kg\text{-}day)^{-1}$	1	5.70E-02	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/29/2007
Trichloroethylene (TCE)	1.3E-02	$(mg/kg\text{-}day)^{-1}$	1	1.3E-02	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	12/04/2008
1,2,4-Trimethylbenzene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
1,3,5-Trimethylbenzene (mesitylene)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Vinyl Chloride (including early life)	1.4E+00*	$(mg/kg\text{-}day)^{-1}$	1	1.4E+00*	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/29/2007
Vinyl Chloride (not including early life)	7.2E-01**	$(mg/kg\text{-}day)^{-1}$	1	7.2E-01**	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/29/2007
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
Benzo(k)fluoranthene	7.3E-02	$(mg/kg\text{-}day)^{-1}$	1	7.3E-02	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
Bis(2-chloroethoxy)methane	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Bis(2-chloroethyl) ether	1.1E+00	$(mg/kg\text{-}day)^{-1}$	1	1.1E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Bis(2-chloroisopropyl) ether	7.0E-02	$(mg/kg\text{-}day)^{-1}$	1	7.0E-02	$(mg/kg\text{-}day)^{-1}$	C	HEAST	07/31/1997
Bis(2-ethylhexyl)phthalate	1.4E-02	$(mg/kg\text{-}day)^{-1}$	1	1.4E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Carbazole	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Chrysene	7.3E-03	$(mg/kg\text{-}day)^{-1}$	1	7.3E-03	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
Dibenzo(a,h)anthracene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
Dibenzofuran	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
3,3-Dichlorobenzidine	4.5E-01	$(mg/kg\text{-}day)^{-1}$	1	4.5E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Dimethyl Phthalate	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
2,4-Dinitrotoluene (Dinitrotoluene mixture)	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
2,6-Dinitrotoluene (Dinitrotoluene mixture)	6.8E-01	$(mg/kg\text{-}day)^{-1}$	1	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Di-n-octylphthalate	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Fluoranthene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	1/29/2007
2-Methylnaphthalene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
4,6-Dinitro-2-Methylphenol	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
4-Chloro-3-Methylphenol	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Naphthalene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
2-Nitroaniline	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
3-Nitroaniline	2.1E-02	$(mg/kg\text{-}day)^{-1}$	1	2.1E-02	$(mg/kg\text{-}day)^{-1}$	N/A	PPRTV	12/4/2008
4-Nitroaniline	2.1E-02	$(mg/kg\text{-}day)^{-1}$	1	2.1E-02	$(mg/kg\text{-}day)^{-1}$	N/A	PPRTV	12/4/2008
Nitrobenzene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
4-Nitrophenol	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
N-nitrosodi-n-propylamine	7.0E+00	$(mg/kg\text{-}day)^{-1}$	1	7.0E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Pentachlorophenol	1.2E-01	$(mg/kg\text{-}day)^{-1}$	1	1.2E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Phenanthrene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Pyrene	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Total 2,3,7,8-TCDD TEQ	1.3E+05	$(mg/kg\text{-}day)^{-1}$	1	1.3E+05	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	12/4/2008

TABLE 5.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
Aluminum	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Antimony	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/29/2007
Barium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Beryllium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	IRIS	12/4/2008
Cadmium (Food)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	IRIS	12/4/2008
Cadmium (Water)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	IRIS	12/4/2008
Chromium III	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Chromium VI	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Cobalt	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	PPRTV	09/02/2004
Copper	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Cyanide	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Iron	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/29/2007
Manganese (Food)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Manganese (NonFood)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Mercuric Chloride	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/29/2007
Mercury (Elemental)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Mercury (Methyl)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/29/2007
Nitrite	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Nickel (Soluble Salts)	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Selenium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Silver	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	1/29/2007
Thallium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Zinc	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A

*=Lifetime exposure from birth. Note that because all the exposures in this BLRA are less than lifetime, the vinyl chloride slope factors for "lifetime exposure from birth" will not be used. Rather, only the lower slope factors are used, but exposure during early life incorporates a non-pro-rated risk as well as the more typical pro-rated risk.

**=Lifetime exposure during adulthood

CSF - Cancer Slope Factor
N/A - Not Available
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
mg/kg-day - milligrams per kilogram per day
NCEA - National Center for Environmental Assessment
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

EPA Group:
A - Human carcinogen
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D -Not Classified

(1) RAGS A (1989); RAGS E (2004); see explanation of derivation provided in the text. Note: Oral to Dermal Adjustment Factor from Exhibit 4-1, RAGS E 2004
(2) Adjusted Dermal Slope Factor (1/mg/kg/day) = Oral Cancer Slope Factor (1/mg/kg/day) divided by Oral to Dermal Adjustment Factor
(3) IRIS values obtained from the IRIS database (Date Indicated); HEAST values obtained from HEAST, July 1997; NCEA values obtained from NCEA (Date Indicated)

TABLE 5.2

CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Unit Risk (1)		Inhalation Cancer Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	4.9E-03	$(ug/m^3)^{-1}$	1.7E+01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Atrazine	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
alpha-BHC	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
beta-BHC	5.3E-04	$(ug/m^3)^{-1}$	1.8E+00	$(mg/kg/-day/)^{-1}$	C	IRIS	1/29/2007
delta-BHC	5.3E-04	$(ug/m^3)^{-1}$	1.8E+00	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
gamma-BHC (Lindane)	3.1E-04	$(ug/m^3)^{-1}$	1.1E+00	$(mg/kg/-day/)^{-1}$	B2-C	Cal EPA	12/4/2008
alpha-Chlordane	1.0E-04	$(ug/m^3)^{-1}$	3.5E-01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
gamma-Chlordane	1.0E-04	$(ug/m^3)^{-1}$	3.5E-01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Dieldrin	4.6E-03	$(ug/m^3)^{-1}$	1.6E+01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Endrin	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	N/A	N/A
Endrin Aldehyde	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	N/A	N/A
Endrin Ketone	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	N/A	N/A
Heptachlor	1.3E-03	$(ug/m^3)^{-1}$	4.5E+00	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Heptachlor Epoxide	2.6E-03	$(ug/m^3)^{-1}$	9.1E+00	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
p,p-DDD	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
p,p-DDE	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
p,p-DDT	9.7E-05	$(ug/m^3)^{-1}$	3.4E-01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
PCB-1016 (aroclor 1016)	2.0E-05	$(ug/m^3)^{-1}$	7.0E-02	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
PCBs (dust; all except PCB-1016)	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
PCBs (vapor; all except PCB-1016	1.0E-04	$(ug/m^3)^{-1}$	4.0E-01	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Benzene	7.8E-06	$(ug/m^3)^{-1}$	2.7E-02	$(mg/kg/-day/)^{-1}$	A	IRIS	1/29/2007
Benzyl Chloride	N/A	$(ug/m^3)^{-1}$	NA	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Bromodichloromethane	N/A	$(ug/m^3)^{-1}$	NA	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Carbon Tetrachloride	1.5E-05	$(ug/m^3)^{-1}$	5.3E-02	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Chlorobenzene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.1E-02	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Chloromethane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Cyclohexane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
1,3-Dichlorobenzene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
1,4-Dichlorobenzene	1.1E-05	$(ug/m^3)^{-1}$	3.9E-02	$(mg/kg/-day/)^{-1}$	C	CalEPA	12/4/2008
Dichlorodifluoromethane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
1,2-Dichlorotetrafluoroethane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
1,4-Dioxane (p-Dioxane)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
cis-1,2-Dichloroethylene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
4-Ethyltoluene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
2-Hexanone	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
methylcyclohexane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Methyl isobutyl ketone (MIBK)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Methyl tert-butyl ether	2.60E-07	$(ug/m^3)^{-1}$	9.10E-04	$(mg/kg/-day/)^{-1}$	N/A	CalEPA	12/4/2008

TABLE 5.2

CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Unit Risk (1)		Inhalation Cancer Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
1,1,2,2-Tetrachloroethane	5.80E-05	$(ug/m^3)^{-1}$	2.0E-01	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Tetrachloroethylene (PCE)	5.9E-06	$(ug/m^3)^{-1}$	2.1E-02	$(mg/kg/-day/)^{-1}$	N/A	CalEPA	12/4/2008
1,1,2-Trichloroethane	1.60E-05	$(ug/m^3)^{-1}$	5.6E-02	$(mg/kg/-day/)^{-1}$	C	IRIS	1/29/2007
Trichloroethylene (TCE)	2.0E-06	$(ug/m^3)^{-1}$	7.0E-03	$(mg/kg/-day/)^{-1}$	N/A	CalEPA	12/4/2008
1,2,4-Trimethylbenzene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
1,3,5-Trimethylbenzene (mesitylen	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
Vinyl Choride (includes early life)	8.8E-06	$(ug/m^3)^{-1}$	3.1E-02	$(mg/kg/-day/)^{-1}$	A	IRIS	1/29/2007
Vinyl Choride (not including early li	4.4E-06	$(ug/m^3)^{-1}$	1.5E-02	$(mg/kg/-day/)^{-1}$	A	IRIS	1/29/2007
Benzo(a)anthracene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Benzo(a)pyrene	1.1E-03	$(ug/m^3)^{-1}$	3.9E+00	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Benzo(b)fluoranthene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Benzo(k)fluoranthene	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Bis(2-chloroethoxy) methane	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	NA	N/A
Bis(2-chloroethyl) ether	3.3E-04	$(ug/m^3)^{-1}$	1.1E+00	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Bis(2-chloroisopropyl) ether	1.0E-05	$(ug/m^3)^{-1}$	3.5E-02	$(mg/kg/-day/)^{-1}$	C	HEAST	07/31/1997
Bis(2-ethylhexyl)phthalate	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Carbazole	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Chrysene	1.10E-05	$(ug/m^3)^{-1}$	3.85E-02	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Dibenzo(a,h)anthracene	1.20E-03	$(ug/m^3)^{-1}$	4.20E+00	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
Dibenzofuran	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
3,3-Dichlorobenzidine	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Dimethyl Phthalate	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	N/A
2,4-Dinitrotoluene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	N/A
2,6-Dinitrotoluene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	N/A
Di-n-octylphthalate	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
Fluoranthene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	NA	N/A
Indeno(1,2,3-cd)pyrene	1.10E-04	$(ug/m^3)^{-1}$	3.85E-01	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008
2-Methylnaphthalene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
4,6-Dinitro-2-Methylphenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
4-Chloro-3-Methylphenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	NA	N/A
Naphthalene	3.4E-05	$(ug/m^3)^{-1}$	1.2E-01	$(mg/kg/-day/)^{-1}$	N/A	CalEPA	12/4/2008
2-Nitroaniline	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
3-Nitroaniline	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
4-Nitroaniline	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Nitrobenzene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
4-Nitrophenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
N-nitrosodi-n-propylamine	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Pentachlorophenol	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Phenanthrene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	N/A	N/A
Pyrene	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Total 2,3,7,8-TCDD TEQ	3.8E+01	$(ug/m^3)^{-1}$	1.3E+05	$(mg/kg/-day/)^{-1}$	B2	CalEPA	12/4/2008

TABLE 5.2

CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Unit Risk (1)		Inhalation Cancer Slope Factor (2)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Source(s) (3)	Date(s) (MM/DD/YYYY)
Aluminum	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Antimony	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg/-day/)^{-1}$	A	IRIS	1/29/2007
Barium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Beryllium	2.4E-03	$(ug/m^3)^{-1}$	8.4E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	1/29/2007
Cadmium (Food)	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	1/29/2007
Cadmium (Water)	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/-day/)^{-1}$	B1	IRIS	1/29/2007
Chromium III	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Chromium VI	8.4E-02	$(ug/m^3)^{-1}$	2.9E+02	$(mg/kg/-day/)^{-1}$	A	IRIS	12/4/2008
Cobalt	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Copper	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Cyanide	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007
Iron	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Lead	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	B2	IRIS	1/29/2007
Manganese (Food)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Manganese (NonFood)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Mercuric Chloride	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	C	IRIS	1/29/2007
Mercury (Elemental)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Mercury (Methyl)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	C	IRIS	1/29/2007
Nitrite	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Nickel (Soluble Salts)	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Selenium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Silver	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	D	IRIS	1/29/2007
Thallium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Vanadium	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	N/A	N/A
Zinc	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg/-day/)^{-1}$	N/A	IRIS	1/29/2007

NOTE: Not all COPCs were used to estimate inhalation risks. Only VOCs with sufficient Henry's Law and molecular weight were used to model volatilization.

*=Lifetime exposure from birth. Note that because all the exposures in this BLRA are less than lifetime, the vinyl chloride slope factors for "lifetime exposure from birth" will not be
Rather, only the lower slope factors are used, but exposure during early life incorporates a non-pro-rated risk as well as the more typical pro-rated risk

**=Lifetime exposure during adulthood
CSF - Cancer Slope Factor
N/A - Not Available
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
mg/kg-day - milligrams per kilogram per day
NCEA - National Center for Environmental Assessment
ug/m^3 - micrograms per cubic meter
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - Indicates limited human data are available
B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not Classified

(1) Refer to RAGS, Part F and text for an explanation. All risk calculations used the IURs in this column.
(2) Adjusted Inhalation SF $(mg/kg/day)^{-1}$ = Inhalation IUR $(ug/m3)^{-1}$ x 70 kg / 20 (m3/day) x 1000 ug/mg. Shown for illustration only -- no risk calculations employed SFs in this co
(3) IRIS values obtained from the IRIS database (Date Indicated); NCEA values obtained from NCEA (Date Indicated)

TABLE 6.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Adjustment Factor	Adjusted Dermal RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)		Dermal Absorption Factor for Soil
		Value	Units	(1)	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)	
Aldrin	Chronic	3.0E-05	mg/kg-day	1	3.0E-05	mg/kg-day	Liver	1000	IRIS	1/5/2007	0.1
Atrazine	Chronic	3.5E-02	mg/kg-day	1	3.5E-02	mg/kg-day	Body Weight	100	IRIS	1/5/2007	0.1
alpha-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
beta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
delta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
gamma-BHC (Lindane)	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Liver and Kidney	1000	IRIS	1/5/2007	0.04
alpha-Chlordane	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Liver	300	IRIS	1/5/2007	0.04
gamma-Chlordane	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Liver	300	IRIS	1/5/2007	0.04
Dieldrin	Chronic	5.0E-05	mg/kg-day	1	5.0E-05	mg/kg-day	Liver	100	IRIS	1/5/2007	0.1
Endrin	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Liver and convulsions	100	IRIS	1/5/2007	0.1
Endrin Aldehyde	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Liver and convulsions	100	IRIS	1/5/2007	0.1
Endrin Ketone	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Liver and convulsions	100	IRIS	1/5/2007	0.1
Heptachlor	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Increased Liver Weight	300	IRIS	1/5/2007	0.1
Heptachlor Epoxide	Chronic	1.3E-05	mg/kg-day	1	1.3E-05	mg/kg-day	Increased Liver Weight	1000	IRIS	1/5/2007	0.1
p,p-DDD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
p,p-DDE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
p,p-DDT	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Liver	100	IRIS	1/5/2007	0.03
PCB-1016 (aroclor 1016)	Chronic	7.0E-05	mg/kg-day	1	7.0E-05	mg/kg-day	Reduced Birth Weight	100	IRIS	1/5/2007	0.14
PCB-1242 (aroclor 1242)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14
PCB-1248 (aroclor 1248)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14
PCB-1254 (aroclor 1254)	Chronic	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	Eyes, nails, blood	300	IRIS	1/5/2007	0.14
PCB-1260 (aroclor 1260)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14
PCB-1268 (aroclor 1268)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.14
Benzene	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Blood/Immune	300	IRIS	1/5/2007	0.0005
Benzyl Chloride	Chronic	2.0E-03	mg/kg-day	1	2.0E-03	mg/kg-day		N/A	PPRTV	9/12/2008	0.03
Bromodichloromethane	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Kidney	1000	IRIS	1/5/2007	0.03
Carbon Tetrachloride	Chronic	7.0E-04	mg/kg-day	1	7.0E-04	mg/kg-day	Liver	1000	IRIS	1/5/2007	0.0005
Chlorobenzene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Liver	1000	IRIS	1/5/2007	0.03
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	1000	IRIS	1/5/2007	0.0005
Chloromethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0005
Cyclohexane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0005
1,3-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
1,4-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
Dichlorodifluoromethane	Chronic	2.0E-01	mg/kg-day	1	2.0E-01	mg/kg-day	Reduced Body Weight	100	IRIS	1/5/2007	0.0005
1,2-Dichlorotetrafluoroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0005
1,4-Dioxane (p-Dioxane)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
cis-1,2-Dichloroethylene	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Blood	3000	PPRTV	1/5/2007	0.0005
4-Ethyltoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
Methylcyclohexane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
Methyl isobutyl ketone (MIBK)	Chronic	8.0E-02	mg/kg-day	1	8.0E-02	mg/kg-day			HEAST	1997	0.03
Methyl tert-butyl ether (MTBE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0005

TABLE 6.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)		Dermal Absorption Factor for Soil
		Value	Units		Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)	
1,1,2,2-Tetrachloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
Tetrachloroethylene (PCE)	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver/Body Weight	1000	IRIS	1/5/2007	0.03
1,1,2-Trichloroethane	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Liver/Red Blood Cells/Immune)	1000	IRIS	1/5/2007	0.03
Trichloroethylene (TCE)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.03
1,2,4-Trimethylbenzene	Chronic	5.0E-02	mg/kg-day	1	5.0E-02	mg/kg-day	Body Weight	3000	NCEA	06/09/2006	0.03
1,3,5-Trimethylbenzene (mesit	Chronic	5.0E-02	mg/kg-day	1	5.0E-02	mg/kg-day	Body Weight	3000	PPRTV	06/09/2006	0.03
Vinyl Chloride	Chronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day	Liver Cell Polymorphism	30	IRIS	1/5/2007	0.0005
Benzo(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Benzo(k)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Bis(2-chloroethoxy) methane	Chronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day	Liver	3000	NCEA	1/5/2007	0.1
Bis(2-chloroethoxy) methane	Subchronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver	3000	NCEA	1/5/2007	0.1
Bis(2-chloroethyl) ether	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Bis(2-chloroisopropyl) ether	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	Blood	1000	IRIS	1/5/2007	0.1
Bis(2-ethylhexyl) phthalate	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Increased Liver Weight	1000	IRIS	1/5/2007	0.1
Carbazole	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
4-Chloro-3-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Chrysene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
Dibenzofuran	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Dibenzofuran	Subchronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day			PPRTV		0.1
3,3-Dichlorobenzidine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Dimethyl Phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
4,6-Dinitro-2-methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
2,4-Dinitrotoluene	Chronic	2.0E-03	mg/kg-day	1	2.0E-03	mg/kg-day	CNS/Heinz Bodies/Bile Tract	100	IRIS	1/5/2007	0.1
2,6-Dinitrotoluene	Chronic	1.0E-03	mg/kg-day	1	1.0E-03	mg/kg-day	CNS, Blood, Liver	3000	PPRTV	1/5/2007	0.1
Di-n-octylphthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Fluoranthene	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	Liver, Kidney, Blood	3000	IRIS	1/5/2007	0.13
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.13
2-Methylnaphthalene	Chronic	4.0E-03	mg/kg-day	1	4.0E-03	mg/kg-day	Respiratory System	1000	IRIS	1/5/2007	0.13
Naphthalene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight	3000	IRIS	1/5/2007	0.13
2-Nitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
3-Nitroaniline	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day			PPRTV	9/12/2008	0.1
4-Nitroaniline	Chronic	3.0E-03	mg/kg-day	1	3.0E-03	mg/kg-day			PPRTV	9/12/2008	0.1
Nitrobenzene	Chronic	5.0E-04	mg/kg-day	1	5.0E-04	mg/kg-day	Blood, Adrenal, Liver, Kidney	10000	IRIS	1/5/2007	0.1
4-Nitrophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
N-nitrosodi-n-propylamine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Pentachlorophenol	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Liver, Kidney	100	IRIS	1/5/2007	0.25
Phenanthrene (4)	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Kidney	3000	IRIS	1/5/2007	0.13
Pyrene	Chronic	3.0E-02	mg/kg-day	1	3.0E-02	mg/kg-day	Kidney	3000	IRIS	1/5/2007	0.13
Total 2,3,7,8-TCDD TEQ	Chronic	1.0E-09	mg/kg-day	1	1.0E-09	mg/kg-day	Developmental	90	ATSDR	12/4/2008	0.03

TABLE 6.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)		Dermal Absorption Factor for Soil
		Value	Units		Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)	
Aluminum	Chronic	1.0E+00	mg/kg-day	1	1.0E+00	mg/kg-day	CNS-(Developmental)	90	PPRTV	12/1/1998	0.01
Antimony	Chronic	4.0E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Blood / Liver	1000	IRIS	1/5/2007	0.01
Arsenic	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin, Vascular	3	IRIS	1/5/2007	0.03
Barium	Chronic	2.0E-01	mg/kg-day	0.07	1.4E-02	mg/kg-day	Kidney	300	IRIS	1/5/2007	0.01
Beryllium	Chronic	2.0E-03	mg/kg-day	0.007	1.4E-05	mg/kg-day	GI Tract	300	IRIS	1/5/2007	0.01
Cadmium (Food)	Chronic	1.0E-03	mg/kg-day	0.025	2.5E-05	mg/kg-day	Proteinuria	10	IRIS	1/5/2007	0.001
Cadmium (Water)	Chronic	5.0E-04	mg/kg-day	0.05	2.5E-05	mg/kg-day	Proteinuria	10	IRIS	1/5/2007	0.001
Chromium III	Chronic	1.5E+00	mg/kg-day	0.013	2.0E-02	mg/kg-day	Liver / Spleen	100	IRIS	1/5/2007	0.01
Chromium VI	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	Fetus (Developmental) / Gastrointestinal	300	IRIS	1/5/2007	0.01
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Blood	10	PPRTV	9/12/2008	0.01
Copper	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	GI Tract	N/A	HEAST	7/31/1997	0.01
Cyanide	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight/Thyroid/Myelin	100	IRIS	12/4/2008	0.01
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	Blood / Liver / GI	1	PPRTV	12/4/2008	0.01
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.01
Manganese (Food)	Chronic	1.4E-01	mg/kg-day	1	1.4E-01	mg/kg-day	CNS Effects	1	IRIS	12/4/2008	0.01
Manganese (NonFood)	Chronic	2.4E-02	mg/kg-day	0.04	9.6E-04	mg/kg-day	CNS Effects	3	IRIS	12/4/2008	0.01
Mercuric Chloride	Chronic	3.0E-04	mg/kg-day	0.07	2.1E-05	mg/kg-day	Autoimmune Effects	1000	IRIS	1/5/2007	0.01
Mercury (Methyl)	Chronic	1.0E-04	mg/kg-day	1	1.0E-04	mg/kg-day	Developmental, neuropsychological impairment	10	IRIS	1/5/2007	0.01
Nickel (Soluble Salts)	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Decreased Body Weight/Organ Weight	300	IRIS	1/5/2007	0.01
Selenium	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Nails/Hair/Blood/Skin/CNS	3	IRIS	1/5/2007	0.01
Silver	Chronic	5.0E-03	mg/kg-day	0.04	2.0E-04	mg/kg-day	Skin	3	IRIS	1/5/2007	0.01
Thallium	Chronic	6.5E-05	mg/kg-day	1	6.5E-05	mg/kg-day	Liver	3000	EPA OW	9/12/2008	0.01
Vanadium	Chronic	5.0E-03	mg/kg-day	0.026	1.3E-04	mg/kg-day	Kidney	300	HEAST	1997	0.01
Zinc	Chronic	3.0E-01	mg/kg-day	1	3.0E-01	mg/kg-day	ESOD (Blood)	3	IRIS	1/5/2007	0.01

N/A - Not Available
ATSDR - Agency for Toxic Substances and Disease Registry
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment
OW - Office of Water
PPRTV - Provisional Peer Reviewed Toxicity Value
ESOD - Erythrocyte Superoxide Dismutase
CNS - Central Nervous System
GI - Gastrointestinal
mg/kg-day - milligrams per killogram per day
RfD - Reference Dose
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

(1) Refer to RAGS Part E (2004) and text for explanation. Note: Oral to Dermal Adjustment Factors from Exhibit 4-1, RAGS Part E, 2004
(2) See RAGS Part E (2004), Page 4-3. Note: Dermal RfD (mg/kg) = Oral RfD (mg/kg) x Oral to Dermal Adjustment Factor
(3) IRIS values obtained from the IRIS database (Date Indicated); HEAST values obtained from HEAST, July 1997; NCEA values obtained from NCEA (Date Indicated)
(4) Used pyrene as a surrogate.

TABLE 6.2

NON-CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC:Target Organ(s)	
		Value	Units	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Aldrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Atrazine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
alpha-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
beta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
delta-BHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
gamma-BHC (Lindane)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
alpha-Chlordane	Chronic	7.0E-04	mg/m^3	2.0E-04	mg/kg-day	Liver	1000	IRIS	1/9/2007
gamma-Chlordane	Chronic	7.0E-04	mg/m^3	2.0E-04	mg/kg-day	Liver	1000	IRIS	1/9/2007
Dieldrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endrin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endrin Aldehyde	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Endrin Ketone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heptachlor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heptachlor Epoxide	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p,p-DDD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p,p-DDE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p,p-DDT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1016 (aroclor 1016)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1242 (aroclor 1242)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1248 (aroclor 1248)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1254 (aroclor 1254)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1260 (aroclor 1260)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-1268 (aroclor 1268)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	3.0E-02	mg/m^3	8.6E-03	mg/kg-day	Blood / Immune	300	IRIS	1/25/2007
Benzyl Chloride	Chronic	1.0E-03	mg/m^3	2.9E-04	mg/kg-day			PPRTV	9/12/2008
Bromodichloromethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Tetrachloride	Chronic	1.9E-01	mg/m^3	5.4E-02	mg/kg-day	Liver	30	ATSDR	12//2006
Chlorobenzene	Chronic	5.0E-02	mg/m^3	1.4E-02	mg/kg-day	Liver, Kidney	1000	PPRTV	9/12/2008
Chloroform	Chronic	9.8E-02	mg/m^3	2.8E-02	mg/kg-day	CNS/Liver/Kidney		ATSDR	12/4/2008
Chloromethane	Chronic	9.0E-02	mg/m^3	2.6E-02	mg/kg-day	Central Nervous System	1000	IRIS	1/25/2007
Cyclohexane	Chronic	6.0E+00	mg/m^3	1.7E+00	mg/kg-day	educed body weight (Reproductic	300	IRIS	1/25/2007
1,3-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	Chronic	8.0E-01	mg/m^3	2.3E-01	mg/kg-day	Increased Liver Weight	100	IRIS	1/25/2007
Dichlorodifluoromethane	Chronic	2.0E-01	mg/m^3	5.0E-02	mg/kg-day	Liver	10000	HEAST	07/31/1997
1,2-Dichlorotetrafluoroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dioxane (p-Dioxane)	Chronic	3.6E+00	mg/m^3	1.0E+00	mg/kg-day	Liver	30	ATSDR	12/4/2008
cis-1,2-Dichloroethylene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Ethyltoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
methylcyclohexane	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Kidney	100	HEAST	07/31/1997
Methyl isobutyl ketone (MIBK)	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Fetal (BW/Skeleton/Mortality)	300	IRIS	1/25/2007
Methyl tert-butyl ether (MTBE)	Chronic	3.0E+00	mg/m^3	8.6E-01	mg/kg-day	Liver/Kidney	100	IRIS	1/25/2007

TABLE 6.2

NON-CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC:Target Organ(s)	
		Value	Units	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
1,1,2,2-Tetrachloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene (PCE)	Chronic	2.7E-01	mg/m^3	7.7E-02	mg/kg-day	Neurologic Effects	100	ATSDR	9//1997
1,1,2-Trichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethylene (TCE)	Chronic	N/A	N/A	NA	N/A	N/A	N/A	N/A	N/A
1,2,4-Trimethylbenzene	Chronic	7.0E-03	mg/m^3	2.0E-03	mg/kg-day	CNS, Respiratory, Blood		PPRTV	9/12/2008
1,3,5-Trimethylbenzene (mesitylene	Chronic	6.0E-03	mg/m^3	1.7E-03	mg/kg-day	CNS, Respiratory, Blood	3000	NCEA	06/09/2006
Vinyl Chloride	Chronic	1.0E-01	mg/m^3	2.8E-02	mg/kg-day	Liver Cell Polymorphism	30	IRIS	1/25/2007
Benzo(a)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroethoxy) methane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroethyl) ether	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-chloroisopropyl) ether	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bis(2-ethylhexyl) phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbazole	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chrysene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)anthracene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzofuran	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,3-Dichlorobenzidine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimethyl Phthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-2-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Chloro-3-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	Chronic	3.0E-03	mg/m^3	8.6E-04	mg/kg-day	Nasal Effects	3000	IRIS	1/25/2007
2-Nitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-Nitroaniline	Chronic	1.0E-03	mg/m^3	2.9E-04	mg/kg-day			PPRTV	9/12/2008
4-Nitroaniline	Chronic	4.0E-03	mg/m^3	1.1E-03	mg/kg-day			PPRTV	9/12/2008
Nitrobenzene	Chronic	2.0E-03	mg/m^3	5.7E-04	mg/kg-day	Liver/Kidney/Adrenal/Blood	10000	HEAST	07/31/1997
4-Nitrophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N-nitrosodi-n-propylamine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenanthrene (4)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total 2,3,7,8-TCDD TEQ	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 6.2

NON-CANCER TOXICITY DATA -- INHALATION

Lower Darby Creek Area RI/FS

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC:Target Organ(s)	
		Value	Units	Value	Units			Source(s) (3)	Date(s) (MM/DD/YYYY)
Aluminum	Chronic	5.0E-03	mg/m^3	1.4E-03	mg/kg-day	CNS	300	PPRTV	6/10/2004
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	3.0E-05	mg/m^3	1.4E-04	mg/kg-day			CalEPA	12/4/2008
Barium	Chronic	5.0E-04	mg/m^3	1.4E-04	mg/kg-day	Reproduction	1000	HEAST	07/31/1997
Beryllium	Chronic	2.0E-05	mg/m^3	5.7E-06	mg/kg-day	Lung, Immune System	10	IRIS	1/25/2007
Cadmium (Food)	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium (Water)	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium III	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium VI	Chronic	1.0E-04	mg/m^3	3.0E-05	mg/kg-day	Respiratory System	300	IRIS	1/25/2007
Cobalt	Chronic	6.0E-06	mg/m^3	1.7E-06	mg/kg-day	Respiratory System		PPRTV	9/12/2008
Copper	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cyanide	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese (Food)	Chronic	5.0E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1000	IRIS	1/25/2007
Manganese (NonFood)	Chronic	5.0E-05	mg/m^3	1.4E-05	mg/kg-day	CNS	1000	IRIS	1/25/2007
Mercuric Chloride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mercury (Elemental)	Chronic	3.0E-04	mg/m^3	8.6E-05	mg/kg-day	CNS/Autonomic Dysfunction	30	IRIS	1/25/2007
Mercury (Methyl)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel (Soluble Salts)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTE: Not all COPCs in this table were used to estimate inhalation risks. Only VOCs with sufficient Henry's Law and molecular weight were used to model volatilization.

N/A - Not Available
ATSDR - Agency for Toxic Substances and Disease Registry
CalEPA - California Environmental Protection Agency
IRIS - Integrated Risk Information System
HEAST - Health Effects Assessment Summary Tables
NCEA - National Center for Environmental Assessment
PPRTV - Provisional Peer Reviewed Toxicity Value
CNS - Central Nervous System
RfC - Reference Concentration
RfD - Reference Dose
mg/m^3 - milligrams per cubic meter
mg/kg-day - milligrams per kilogram per day
2,3,7,8-TCDD TEQ - 2,3,7,8-Tetrachlorodibenzo-p-dioxin toxic equivalents

(1) Refer to RAGS, Part F and text for an explanation. All risk calculations used the RfCs in this column.
(2) Adjusted Inhalation RfD (mg/kg/day) = Inhalation RfC (mg/m3) x 20 (m3/day) / 70 kg. Shown for illustration only -- no risk calculations employed the extrapolated RfDs in this column
(3) IRIS values obtained from the IRIS database (Date Indicated); HEAST values obtained from HEAST, July 1997; NCEA values obtained from NCEA (Date Indicated)
(4) Used pyrene as a surrogate.

TABLE 7
SUMMARY OF HUMAN HEALTH RISKS FOR LOWER DARBY CREEK AREA

MEDIA OF CONCERN Receptors --\/	Cumulative Cancer Risk	Maximum Target Organ HI	Population % Lead >10ug/dl	Contributors to unacceptable risk listed if cancer risk > 1E-6, noncancer HQ > 0.2, or blood lead > 10 ug/dL for > 5% of population Lifetime receptor-- only cancer risk COCs; "BG"-- levels similar to background
TINICUM MARSH - FISH TISSUE				
Lifetime Subsistence Fisher	3.7E-02	--	--	arsenic, DDE, DDT, alpha- and gamma-chlordane, alpha-BHC, dieldrin, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Subsistence Fisher	1.9E-02	319	100% > 10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha- and gamma-chlordane, dieldrin, heptachlor epoxide, DDT
Adult Subsistence Fisher	1.8E-02	76	100% > 10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha-chlordane, dieldrin, heptachlor epoxide
Lifetime Recreational Fisher	5.4E-03	--	--	arsenic, DDE, DDT, alpha- and gamma-chlordane, alpha-BHC, dieldrin, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Recreational Fisher	2.8E-03	47	100% > 10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha-chlordane, dieldrin, heptachlor epoxide
Adult Recreational Fisher	2.6E-03	11	100% > 10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc
ZONE 1 - SURFACE SOIL				
Lifetime Resident	6.7E-04	--	--	arsenic, PCBs, dieldrin, heptachlor epoxide, beta-BHC, gamma-chlordane, benz(a)anthracene, BAP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Resident	4.8E-04	18	6.3% >10ug/dl	Noncancer: lead, antimony, heptachlor epoxide, dieldrin, endrin, Aroclor-1254, cobalt (BG), copper, iron, thallium (BG)
Adult Resident	1.8E-04	2.0	--	Noncancer: antimony
Lifetime Recreational	1.3E-04	--	--	arsenic, PCBs, dieldrin, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Recreational Child	8.9E-05	2.7	--	Noncancer: antimony
Recreational Adult	3.8E-05	<1	1.3% >10ug/dl	
ZONE 1 - TOTAL SOIL (COMBINED SURFACE AND SUBSURFACE)				
Construction Worker	5.2E-05	4.7	19% >10ug/dl	Noncancer: antimony, heptachlor epoxide, lead
Industrial Worker	3.9E-04	1.1	1.8% >10ug/dl	Cancer: arsenic, PCBs, dieldrin, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, TCDD, plus antimony for noncancer
ZONE 2 - SURFACE SOIL				
Lifetime Resident	2.8E-04	--	--	arsenic (BG), PCBs, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, aldrin
Child Resident	2.2E-04	2.5	3.0% >10ug/dl	Noncancer: Aroclor-1254 -- plus small % contribution from cobalt (BG), iron (BG), and antimony (BG)
Adult Resident	5.1E-05	<1	--	
Lifetime Recreational	5.5E-05	--	--	
Recreational Child	4.2E-05	<1	--	
Recreational Adult	1.2E-05	<1	1.1% >10ug/dl	
ZONE 2 - TOTAL SOIL (COMBINED SURFACE AND SUBSURFACE)				
Lifetime Resident	2.3E-04	--	--	arsenic (BG), PCBs, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Resident	1.9E-04	1.2	1.6% >10ug/dl	Noncancer: Aroclor-1254 -- plus small % contribution from cobalt (BG), iron (BG), and antimony
Adult Resident	3.7E-05	<1	--	
Lifetime Recreational	4.6E-05	--	--	
Recreational Child	3.6E-05	<1	--	
Recreational Adult	9.7E-06	<1	1.0% >10ug/dl	
Construction Worker	2.3E-06	<1	9.3% >10ug/dl	lead (BG)
Industrial Worker	1.6E-05	<1	1.3% >10ug/dl	
ZONE 3 - SURFACE SOIL				
Lifetime Resident	1.9E-04	--	not a COPC	arsenic (BG), benz(a)anthracene, BAP, benzo(b)- and benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, PCBs
Child Resident	1.6E-04	1.1	not a COPC	Noncancer: antimony (BG), cobalt (BG), and iron (BG)
Adult Resident	2.9E-05	<1	not a COPC	
Industrial Worker	1.1E-05	<1	not a COPC	
ZONE 3 - TOTAL SOIL (COMBINED SURFACE AND SUBSURFACE)				
Lifetime Resident	1.2E-04	--	not a COPC	arsenic (BG), benz(a)anthracene, BAP, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Resident	1.0E-04	<1	not a COPC	
Adult Resident	1.8E-05	<1	not a COPC	
Construction Worker	1.2E-06	<1	not a COPC	
Industrial Worker	7.9E-06	<1	not a COPC	

In this table, risk drivers are listed for any receptor only if the cumulative cancer risk for all substances exceeds 1 x 10^{-4} or if the HI for any target organ exceeds 1. When these thresholds are exceeded, then all contributing chemicals are listed with individual cancer risks greater than 1 x 10^{-6} or an HQ that is a signficant contributor to the target organ HI exceeding 1.

TABLE 7
SUMMARY OF HUMAN HEALTH RISKS FOR LOWER DARBY CREEK AREA

MEDIA OF CONCERN Receptors --\/	Cumulative Cancer Risk	Maximum Target Organ HI	Population % Lead >10ug/dl	Contributors to unacceptable risk listed if cancer risk > 1E-6, noncancer HQ > 0.2, or blood lead > 10 ug/dL for > 5% of population Lifetime receptor-- only cancer risk COCs; "BG"-- levels similar to background
GROUNDWATER				
Lifetime Resident	6.6E-02	--	--	TCDD, arsenic, PCBs, atrazine, aldrin, dieldrin, heptachlor epoxide, 2,4- and 2,6-dinitrotoluene, 3,3'-dichlorobenzidine, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, bis(2-ethylhexyl) phthalate, N-Nitroso-di-n-propylamine, PCE, vinyl chloride, 4,4'-DDT, 2,2'-oxybis(1-chloropropane), heptachlor, delta-BHC, benzene, chloroform, naphthalene, alpha-BHC, 4,4'-DDD, bromodichloromethane, 4,4'-DDE, 3-nitroaniline, beta-BHC, carbon tetrachloride, 1,4-dichlorobenzene, 4-nitroaniline, gamma-BHC (Lindane), TCE, gamma-chlordane, alpha-chlordane
Child Resident	3.1E-02	43	100% >10ug/dl	Noncancer: TCDD, aldrin, heptachlor epoxide, Aroclor-1016, 2,6- and 2,4-dinitrotoluene, 3-nitroaniline, nitrobenzene, aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, iron, lead, manganese, mercury, vanadium, thallium, zinc
Adult Resident	3.5E-02	31	--	(similar to noncancer risk drivers for residential child)
Contruction Worker	1.0E-05	< 1	--	
Industrial Worker	2.5E-04	< 1	--	Cancer: TCDD, PCBs, 2,2'-oxybis(1-chloropropane), benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, benzene, chloroform, PCE, 1,4-dichlorobenzene
SURFACE WATER - LOWER DARBY AND LOWER COBBS CREEKS				
Lifetime Recreational	9.1E-06	--	not a COPC	
Recreational Child	4.3E-06	<1	not a COPC	
Recreational Adult	4.8E-06	<1	not a COPC	
Contruction Worker	<1.0E-06	<1	not a COPC	
SEDIMENT - LOWER DARBY AND LOWER COBBS CREEKS				
Lifetime Recreational	2.1E-05	--	--	
Recreational Child	1.6E-05	<1	--	
Recreational Adult	5.0E-06	<1	--	
Contruction Worker	<1.0E-06	<1	--	
SURFACE WATER - TINICUM MARSH				
Lifetime Recreational	<1.0E-06	--	--	
Recreational Child	<1.0E-06	<1	--	
Recreational Adult	<1.0E-06	<1	--	
Contruction Worker	<1.0E-06	<1	--	
SEDIMENT - TINICUM MARSH				
Lifetime Recreational	8.4E-06	--	not a COPC	
Recreational Child	6.3E-06	<1	not a COPC	
Recreational Adult	2.1E-06	<1	not a COPC	
Contruction Worker	<1.0E-06	<1	not a COPC	
SURFACE WATER - LEACHATE SEEPS				
Lifetime Recreational	<1.0E-06	--	--	
Recreational Child	<1.0E-06	<1	--	
Recreational Adult	<1.0E-06	<1	--	
Contruction Worker	<1.0E-06	<1	--	
SEDIMENT - LEACHATE SEEPS				
Lifetime Recreational	6.1E-06	--	not a COPC	
Recreational Child	<1.0E-06	<1	not a COPC	
Recreational Adult	<1.0E-06	<1	not a COPC	
Contruction Worker	<1.0E-06	<1	not a COPC	
FISH TISSUE - LOWER DARBY AND LOWER COBBS CREEKS				
Lifetime Subsistence Fisher	3.6E-02	--		arsenic, PCBs, DDE, DDT, alpha- and gamma-chlordane, beta-BHC, dieldrin, heptachlor, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Subsistence Fisher	1.8E-02	197	100% >10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha- and gamma-chlordane, dieldrin, heptachlor epoxide, DDT, fluoranthene, phenanthrene, pyrene
Adult Subsistence Fisher	1.7E-02	47	100% >10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha- and gamma-chlordane, dieldrin, heptachlor epoxide
Lifetime Recreational Fisher	5.3E-03	--		arsenic, PCBs, DDE, DDT, alpha- and gamma-chlordane, beta-BHC, dieldrin, heptachlor, heptachlor epoxide, benz(a)anthracene, BAP, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene
Child Recreational Fisher	2.7E-03	29	100% >10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, alpha-chlordane, dieldrin, heptachlor epoxide
Adult Recreational Fisher	2.6E-03	6.9	100% >10ug/dl	Noncancer: arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc

In this table, risk drivers are listed for any receptor only if the cumulative cancer risk for all substances exceeds 1 x 10^{-4} or if the HI for any target organ exceeds 1. When these thresholds are exceeded, then all contributing chemicals are listed with individual cancer risks greater than 1 x 10^{-6} or an HQ that is a signficant contributor to the target organ HI exceeding 1.

Table 8.1 Risk Assessment Summary
Child Resident RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 1 (Landfill Area)	Arochlor 1260	0.000174	NA	6.82E-05	2.4E-04	Antimony	Blood, Liver	1.3E+01	NA	2.5E+00	1.6E+01
			Benzo(a)pyrene	8.77E-05	NA	3.19E-05	1.2E-04	Heptachlor Epoxide	Liver	5.9E-01	NA	1.7E-01	7.6E-01
			Dibenzo(a,h)anthracene	2.11E-05	NA	7.67E-06	2.9E-05	Iron	Blood, Liver, GI Tract	7.1E-01	NA	2.0E-02	7.3E-01
			Dieldrin	1.76E-05	NA	4.92E-06	2.3E-05	Arochlor 1254	Eyes, Nails, Blood	3.1E-01	NA	1.2E-01	4.3E-01
			Benzo(b)fluoranthene	1.19E-05	NA	4.33E-06	1.6E-05	Thallium (BG)	Liver	4.1E-01	NA	1.1E-02	4.2E-01
			Arsenic	1.3E-05	NA	1.09E-06	1.4E-05	Cobalt (BG)	Blood	3.5E-01	NA	9.7E-03	3.6E-01
			Benzo(a)anthracene	9.7E-06	NA	3.53E-06	1.3E-05	Dieldrin	Liver	2.6E-01	NA	7.2E-02	3.3E-01
			Heptachlor Epoxide	6.02E-06	NA	1.69E-06	7.7E-06	Copper	GI Tract	3.2E-01	NA	8.9E-03	3.3E-01
			Indeno(1,2,3-cd)pyrene	5.27E-06	NA	1.92E-06	7.2E-06	Endrin	Liver, convulsions (CNS)	1.9E-01	NA	5.3E-02	2.4E-01
			Arochlor 1268	2.97E-06	NA	1.16E-06	4.1E-06						
			Arochlor 1254	1.05E-06	NA	4.11E-07	1.5E-06						
			(Total ##)	3.5E-04	NC	1.3E-04	4.8E-04	(Total **)		1.6E+01	NC	3.0E+00	1.9E+01
Soil Gas	Indoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	4.8E-04	Total Hazard Index Across Soil (Surface Only) **	1.9E+01
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	4.8E-04	Total Hazard Index Across All Media and All Exposure Routes **	1.9E+01
Total Adult Risk Across All Media and All Exposure Routes ##	1.8E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	6.6E-04		

Notes:
NA = not available
pr = prorated
NC = not calculated

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
BG -- Concentrations of the inorganic risk drivers thallium and cobalt were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 8.2 Risk Assessment Summary
Adult Resident RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 1 (Landfill Area)	Arochlor 1260	8.3E-05	NA	4.6E-05	1.3E-04	Antimony	Blood, Liver	1.6E+00	NA	4.2E-01	2.0E+00
			Benzo(a)pyrene	1.3E-05	NA	6.8E-06	2.0E-05						
			Dieldrin	8.3E-06	NA	3.3E-06	1.2E-05						
			Arsenic	6.2E-06	NA	7.4E-07	6.9E-06						
			Dibenzo(a,h)anthracene	3.1E-06	NA	1.6E-06	4.8E-06						
			Heptachlor Epoxide	2.9E-06	NA	1.1E-06	4.0E-06						
			Benzo(b)fluoranthene	1.8E-06	NA	9.2E-07	2.7E-06						
			Arochlor 1268	1.4E-06	NA	7.9E-07	2.2E-06						
			Benzo(a)anthracene	1.4E-06	NA	7.5E-07	2.2E-06						
			Indeno(1,2,3-cd)pyrene	7.9E-07	NA	4.1E-07	1.2E-06						
			(Total ##)	1.2E-04	NC	6.3E-05	1.8E-04	(Total **)		1.6E+00	NC	4.2E-01	2.0E+00
Soil Gas	Indoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	1.8E-04	Total Hazard Index Across Soil (Surface Only) **	2.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	1.8E-04	Total Hazard Index Across All Media and All Exposure Routes **	2.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	4.8E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	6.6E-04		

Notes:
NA = not available
NC = not calculated

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 8.3 Risk Assessment Summary
Lifetime Resident RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Zone 1 (Landfill Area)	Arochlor 1260	2.6E-04	NA	1.1E-04	3.7E-04						
			Benzo(a)pyrene	1.0E-04	NA	3.9E-05	1.4E-04						
			Dieldrin	2.6E-05	NA	8.3E-06	3.4E-05						
			Dibenzo(a,h)anthracene	2.4E-05	NA	9.3E-06	3.4E-05						
			Arsenic	1.9E-05	NA	1.8E-06	2.1E-05						
			Benzo(b)fluoranthene	1.4E-05	NA	5.2E-06	1.9E-05						
			Benzo(a)anthracene	1.1E-05	NA	4.3E-06	1.5E-05						
			Heptachlor Epoxide	8.9E-06	NA	2.8E-06	1.2E-05						
			Indeno(1,2,3-cd)pyrene	6.1E-06	NA	2.3E-06	8.4E-06						
			Arochlor 1268	4.4E-06	NA	2.0E-06	6.3E-06						
			Arochlor 1254	1.5E-06	NA	6.9E-07	2.2E-06						
			gamma-Chlordane	1.2E-06	NA	1.5E-07	1.4E-06						
			beta BHC	1.0E-06	NA	3.3E-07	1.3E-06						
			(Total ##)	4.8E-04	NC	1.9E-04	6.7E-04	(Total)		--	--	--	--
Soil Gas	Indoor Vapors	Zone 1 (Landfill Area)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--

Total Risk Across Soil (Surface Only) ##	6.7E-04	Total Hazard Index Across Soil (Surface Only)	--
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors)	--
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors)	--
Total Lifetime Risk Across All Media and All Exposure Routes ##	6.7E-04	Total Hazard Index Across All Media and All Exposure Routes	--

Notes:
-- = Not available
NA = not applicable
NC = not calculable

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

Table 8.4 Risk Assessment Summary
Child Recreational RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 1 (Landfill Area)	Arochlor 1260	2.6E-05	NA	2.0E-05	4.6E-05	Antimony	Blood, Liver	2.0E+00	NA	7.4E-01	2.7E+00
			Benzo(a)pyrene	1.3E-05	NA	9.5E-06	2.3E-05						
			Dibenzo(a,h)anthracene	3.1E-06	NA	2.3E-06	5.4E-06						
			Dieldrin	2.6E-06	NA	1.5E-06	4.1E-06						
			Benzo(b)fluoranthene	1.8E-06	NA	1.3E-06	3.1E-06						
			Benzo(a)anthracene	1.4E-06	NA	1.0E-06	2.5E-06						
			Arsenic	1.9E-06	NA	3.2E-07	2.3E-06						
			Heptachlor Epoxide	8.9E-07	NA	5.0E-07	1.4E-06						
			Indeno(1,2,3-cd)pyrene	7.8E-07	NA	5.7E-07	1.4E-06						
			Arochlor 1268	4.4E-07	NA	3.5E-07	7.9E-07						
			(Total ##)	5.2E-05	NC	3.8E-05	8.9E-05	(Total **)		2.0E+00	NC	7.4E-01	2.7E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	8.9E-05	Total Hazard Index Across Soil (Surface Only) **	2.7E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	8.9E-05	Total Hazard Index Across All Media and All Exposure Routes **	2.7E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.8E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.3E-04		

Notes:
NA = not available
pr = prorated
NC = not calculated

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 8.5 Risk Assessment Summary
Adult Recreational RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 1 (Landfill Area)	Arochlor 1260	6.1E-06	NA	2.0E-05	2.6E-05						
			Benzo(a)pyrene	1.4E-06	NA	4.2E-06	5.6E-06						
			Dieldrin	6.2E-07	NA	1.4E-06	2.0E-06						
			Dibenzo(a,h)anthracene	3.4E-07	NA	1.0E-06	1.3E-06						
			Arsenic	4.6E-07	NA	3.1E-07	7.7E-07						
			Benzo(b)fluoranthene	1.9E-07	NA	5.7E-07	7.6E-07						
			Heptachlor Epoxide	2.1E-07	NA	4.8E-07	7.0E-07						
			Benzo(a)anthracene	1.6E-07	NA	4.6E-07	6.2E-07						
			Arochlor 1268	1.0E-07	NA	3.3E-07	4.4E-07						
			Indeno(1,2,3-cd)pyrene	8.5E-08	NA	2.5E-07	3.4E-07						
			(Total ##)	9.7E-06	NC	2.9E-05	3.8E-05	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	3.8E-05	Total Hazard Index Across Soil (Surface Only) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.8E-05	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	8.9E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.3E-04		

Notes:
NA = not available
NC = not calculated

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 9.1 Risk Assessment Summary
Construction Worker RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 1 (Landfill Area)						Antimony	Blood, Liver	3.7E+00	NA	7.6E-01	4.5E+00
								Heptachlor Epoxide	Liver	1.7E-01	NA	5.0E-02	2.2E-01
			(Total ##)	0.0E+00	NC	0.0E+00	0.0E+00	(Total **)		3.9E+00	NC	8.1E-01	4.7E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	0.0E+00	Total Hazard Index Across Soil (Surface + Subsurface) **	4.7E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Risk Across All Media and All Exposure Routes ##	0.0E+00	Total Hazard Index Across All Media and All Exposure Routes **	4.7E+00

Notes:
NA = not available
NC = not calculated
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 9.2 Risk Assessment Summary
Industrial Worker RME at Zone 1 (Landfill Area)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 1 (Landfill Area)	Arochlor 1260	1.2E-04	NA	2.3E-04	3.5E-04	Antimony	Blood, Liver	5.7E-01	NA	5.0E-01	1.1E+00
			Benzo(a)pyrene	5.3E-06	NA	9.1E-06	1.4E-05						
			Dieldrin	3.1E-06	NA	4.1E-06	7.2E-06						
			Dibenzo(a,h)anthracene	1.4E-06	NA	2.4E-06	3.8E-06						
			Arsenic	2.3E-06	NA	9.1E-07	3.2E-06						
			Heptachlor Epoxide	1.1E-06	NA	1.4E-06	2.5E-06						
			Indeno(1,2,3-cd)pyrene	7.9E-07	NA	1.4E-06	2.2E-06						
			Benzo(b)fluoranthene	6.7E-07	NA	1.1E-06	1.8E-06						
			Benzo(a)anthracene	6.1E-07	NA	1.1E-06	1.7E-06						
			Arochlor 1268	5.2E-07	NA	9.7E-07	1.5E-06						
			Total 2,3,7,8-TCDD TEQ	7.9E-07	NA	3.1E-07	1.1E-06						
			(Total ##)	1.4E-04	NC	2.5E-04	3.9E-04	(Total **)		5.7E-01	NC	5.0E-01	1.1E+00
Soil Gas	Indoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 1 (Landfill Area)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	3.9E-04	Total Hazard Index Across Soil (Surface + Subsurface) **	1.1E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Risk Across All Media and All Exposure Routes ##	3.9E-04	Total Hazard Index Across All Media and All Exposure Routes **	1.1E+00

Notes:
NA = not available
NC = not calculated

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 10.1 Risk Assessment Summary
Child Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 2 (City Park)	Benzo(a)pyrene	8.7E-05	NA	3.2E-05	1.2E-04	Arochlor 1254	Eyes, Nails, Blood	1.3E+00	NA	4.9E-01	1.7E+00
			Dibenzo(a,h)anthracene	2.4E-05	NA	8.9E-06	3.3E-05	Cobalt (BG)	Blood	3.0E-01	NA	8.3E-03	3.1E-01
			Arochlor 1260	1.7E-05	NA	6.9E-06	2.4E-05	Iron (BG)	Blood, Liver, GI	2.8E-01	NA	7.7E-03	2.8E-01
			Benzo(a)anthracene	9.9E-06	NA	3.6E-06	1.3E-05	Antimony (BG)	Blood, Liver	1.8E-01	NA	3.4E-02	2.1E-01
			Benzo(b)fluoranthene	7.4E-06	NA	2.7E-06	1.0E-05						
			Arsenic (BG)	8.4E-06	NA	7.0E-07	9.1E-06						
			Indeno(1,2,3-cd)pyrene	5.8E-06	NA	2.1E-06	7.9E-06						
			Arochlor 1254	4.3E-06	NA	1.7E-06	6.0E-06						
			Benzo(k)fluoranthene	8.0E-07	NA	2.9E-07	1.1E-06						
			(Total ##)	1.7E-04	NC	5.8E-05	2.2E-04	(Total **)		2.0E+00	NC	5.4E-01	2.5E+00
Soil Gas	Indoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	2.2E-04	Total Hazard Index Across Soil (Surface Only) **	2.5E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	2.2E-04	Total Hazard Index Across All Media and All Exposure Routes **	2.5E+00
Total Adult Risk Across All Media and All Exposure Routes ##	5.1E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	2.7E-04		

Notes:
NA = not available
pr = prorated

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
(BG) -- Concentrations of the inorganic risk drivers antimony, arsenic, cobalt, and iron were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 10.2 Risk Assessment Summary
Adult Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 2	Benzo(a)pyrene	1.3E-05	NA	6.7E-06	2.0E-05						
			Arochlor 1260	8.3E-06	NA	4.6E-06	1.3E-05						
			Dibenzo(a,h)anthracene	3.6E-06	NA	1.9E-06	5.5E-06						
			Arsenic (BG)	4.0E-06	NA	4.8E-07	4.5E-06						
			Arochlor 1254	2.0E-06	NA	1.1E-06	3.2E-06						
			Benzo(a)anthracene	1.5E-06	NA	7.6E-07	2.2E-06						
			Benzo(b)fluoranthene	1.1E-06	NA	5.7E-07	1.7E-06						
			Indeno(1,2,3-cd)pyrene	8.7E-07	NA	4.5E-07	1.3E-06						
		(City Park)	(Total ##)	3.4E-05	NC	1.7E-05	5.1E-05	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Indoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface Only) ##	5.1E-05	Total Hazard Index Across Soil (Surface Only) **	0.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	5.1E-05	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	2.2E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	2.7E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 10.3 Risk Assessment Summary
Lifetime Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Zone 2 (City Park)	Benzo(a)pyrene	1.0E-04	NA	3.8E-05	1.4E-04						
			Dibenzo(a,h)anthracene	2.8E-05	NA	1.1E-05	3.9E-05						
			Arochlor 1260	2.6E-05	NA	1.1E-05	3.7E-05						
			Benzo(a)anthracene	1.1E-05	NA	4.4E-06	1.6E-05						
			Arsenic (BG)	1.2E-05	NA	1.2E-06	1.4E-05						
			Benzo(b)fluoranthene	8.5E-06	NA	3.3E-06	1.2E-05						
			Indeno(1,2,3-cd)pyrene	6.7E-06	NA	2.6E-06	9.3E-06						
			Arochlor 1254	6.3E-06	NA	2.8E-06	9.2E-06						
			Benzo(k)fluoranthene	9.2E-07	NA	3.5E-07	1.3E-06						
			Aldrin	8.0E-07	NA	2.6E-07	1.1E-06						
			(Total ##)	2.0E-04	NC	7.5E-05	2.8E-04	(Total)		--	--	--	--
Soil Gas	Indoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--
Soil Gas	Outdoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--

Total Risk Across Soil (Surface Only) ##	2.8E-04	Total Hazard Index Across Soil (Surface Only)	--
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors)	--
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors)	--
Total Lifetime Risk Across All Media and All Exposure Routes ##	2.8E-04	Total Hazard Index Across All Media and All Exposure Routes	--

Notes:
-- = not available
NA = not applicable
NC = not calculable
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

Table 11.1 Risk Assessment Summary
Child Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 2 (City Park)	Benzo(a)pyrene	7.9E-05	NA	2.9E-05	1.1E-04	Arochlor 1254	Eyes, Nails, Blood	2.9E-01	NA	1.1E-01	4.1E-01
			Dibenzo(a,h)anthracene	2.8E-05	NA	1.0E-05	3.8E-05	Cobalt (BG)	Blood	2.8E-01	NA	7.8E-03	2.9E-01
			Benzo(a)anthracene	9.4E-06	NA	3.4E-06	1.3E-05	Iron (BG)	Blood, Liver, GI Tract	2.6E-01	NA	7.4E-03	2.7E-01
			Benzo(b)fluoranthene	6.9E-06	NA	2.5E-06	9.4E-06	Antimony	Blood, Liver	1.8E-01	NA	3.4E-02	2.1E-01
			Arsenic (BG)	7.6E-06	NA	6.4E-07	8.3E-06						
			Arochlor 1260	5.3E-06	NA	2.1E-06	7.3E-06						
			Indeno(1,2,3-cd)pyrene	5.0E-06	NA	1.8E-06	6.8E-06						
			Arochlor 1254	1.0E-06	NA	3.9E-07	1.4E-06						
			(Total ##)	1.4E-04	NC	5.0E-05	1.9E-04	(Total **)		1.0E+00	NC	1.6E-01	1.2E+00
Soil Gas	Indoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	1.9E-04	Total Hazard Index Across Soil (Surface + Subsurface) **	1.2E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.9E-04	Total Hazard Index Across All Media and All Exposure Routes **	1.2E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.7E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	2.3E-04		

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
(BG) -- Concentrations of the inorganic risk drivers cobalt and iron were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 11.2 Risk Assessment Summary
Adult Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 2 (City Park)	Benzo(a)pyrene	1.2E-05	NA	6.1E-06	1.8E-05						
			Dibenzo(a,h)anthracene	4.2E-06	NA	2.2E-06	6.3E-06						
			Arsenic (BG)	3.6E-06	NA	4.3E-07	4.1E-06						
			Arochlor 1260	2.5E-06	NA	1.4E-06	3.9E-06						
			Benzo(a)anthracene	1.4E-06	NA	7.3E-07	2.1E-06						
			Benzo(b)fluoranthene	1.0E-06	NA	5.3E-07	1.6E-06						
			Indeno(1,2,3-cd)pyrene	7.5E-07	NA	3.9E-07	1.1E-06						
			(Total ##)	2.5E-05	NC	1.2E-05	3.7E-05	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Indoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 2 (City Park)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	3.7E-05	Total Hazard Index Across Soil (Surface + Subsurface) **	0.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.7E-05	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.9E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	2.3E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 11.3 Risk Assessment Summary
Lifetime Resident RME at Zone 2 (City Park)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	Zone 2 (City Park)	Benzo(a)pyrene	9.1E-05	NA	3.5E-05	1.3E-04						
			Dibenzo(a,h)anthracene	3.2E-05	NA	1.2E-05	4.4E-05						
			Benzo(a)anthracene	1.1E-05	NA	4.1E-06	1.5E-05						
			Arsenic (BG)	1.1E-05	NA	1.1E-06	1.2E-05						
			Arochlor 1260	7.8E-06	NA	3.5E-06	1.1E-05						
			Benzo(b)fluoranthene	7.9E-06	NA	3.0E-06	1.1E-05						
			Indeno(1,2,3-cd)pyrene	5.8E-06	NA	2.2E-06	8.0E-06						
			Arochlor 1254	1.5E-06	NA	6.6E-07	2.1E-06						
			Benzo(k)fluoranthene	8.0E-07	NA	3.1E-07	1.1E-06						
			(Total ##)	1.7E-04	NC	6.2E-05	2.3E-04	(Total)		--	--	--	--
Soil Gas	Indoor Vapors	Zone 2 (City Park)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--
Soil Gas	Outdoor Vapors	Zone 2 (City Park)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--

Total Risk Across Soil (Surface + Subsurface) ##	2.3E-04	Total Hazard Index Across Soil (Surface + Subsurface)	--
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors)	--
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors)	--
Total Lifetime Risk Across All Media and All Exposure Routes ##	2.3E-04	Total Hazard Index Across All Media and All Exposure Routes	--

Notes:
-- = not available
NA = not applicable
NC = not calculable
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.

Table 12.1 Risk Assessment Summary
Child Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	7.5E-05	NA	2.7E-05	1.0E-04	Antimony (BG)	Blood, Liver	4.0E-01	NA	7.5E-02	4.8E-01
			Dibenzo(a,h)anthracene	1.5E-05	NA	5.6E-06	2.1E-05	Cobalt (BG)	Blood	3.2E-01	NA	9.0E-03	3.3E-01
			Benzo(a)anthracene	7.5E-06	NA	2.7E-06	1.0E-05	Iron (BG)	Blood, Liver, GI	2.9E-01	NA	8.1E-03	3.0E-01
			Arsenic (BG)	8.2E-06	NA	6.9E-07	8.8E-06						
			Benzo(b)fluoranthene	6.3E-06	NA	2.3E-06	8.6E-06						
			Indeno(1,2,3-cd)pyrene	5.2E-06	NA	1.9E-06	7.1E-06						
			Benzo(k)fluoranthene	9.8E-07	NA	3.6E-07	1.3E-06						
			Aroclor-1260	7.3E-07	NA	2.9E-07	1.0E-06						
			(Total ##)	1.2E-04	NC	4.1E-05	1.6E-04	(Total **)		1.0E+00	NC	9.3E-02	1.1E+00
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Surface Soil ##	1.6E-04	Total Hazard Index Across Surface Soil **	1.1E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.6E-04	Total Hazard Index Across All Media and All Exposure Routes **	1.1E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.1E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.9E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk drivers arsenic, cobalt, and iron were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 12.2 Risk Assessment Summary
Adult Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Surface Soil	Surface Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	1.1E-05	NA	5.8E-06	1.7E-05						
			Arsenic (BG)	3.9E-06	NA	4.6E-07	4.3E-06						
			Dibenzo(a,h)anthracene	2.3E-06	NA	1.2E-06	3.5E-06						
			Benzo(a)anthracene	1.1E-06	NA	5.8E-07	1.7E-06						
			Benzo(b)fluoranthene	9.4E-07	NA	4.9E-07	1.4E-06						
			Indeno(1,2,3-cd)pyrene	7.8E-07	NA	4.0E-07	1.2E-06						
			(Total ##)	2.0E-05	NC	8.9E-06	2.9E-05	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	Chloroform	NA	2.2E-06	NA	2.2E-06						
			(Total ##)	NC	2.2E-06	NC	2.2E-06	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Surface Soil ##	2.9E-05	Total Hazard Index Across Surface Soil **	0.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	2.2E-06	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	3.1E-05	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.6E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.9E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 12.3 Risk Assessment Summary
Lifetime Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Soil	Surface Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	8.6E-05	NA	3.3E-05	1.2E-04						
			Dibenzo(a,h)anthracene	1.8E-05	NA	6.8E-06	2.5E-05						
			Arsenic (BG)	1.2E-05	NA	1.1E-06	1.3E-05						
			Benzo(a)anthracene	8.6E-06	NA	3.3E-06	1.2E-05						
			Benzo(b)fluoranthene	7.3E-06	NA	2.8E-06	1.0E-05						
			Indeno(1,2,3-cd)pyrene	6.0E-06	NA	2.3E-06	8.3E-06						
			Arochlor 1260	1.1E-06	NA	4.8E-07	1.6E-06						
			Benzo(k)fluoranthene	1.1E-06	NA	4.3E-07	1.6E-06						
			(Total ##)	1.4E-04	NC	5.0E-05	1.9E-04	(Total)		---	---	---	---
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	Chloroform	NA	2.7E-06	NA	2.7E-06						
			(Total ##)	NC	2.7E-06	NC	2.7E-06	(Total)		---	---	---	---
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total)		---	---	---	---

Total Risk Across Surface Soil ##	1.9E-04	Total Hazard Index Across Surface Soil	---
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors)	---
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors)	---
Total Lifetime Risk Across All Media and All Exposure Routes ##	1.9E-04	Total Hazard Index Across All Media and All Exposure Routes	---

Notes:
-- = not available
NA = not applicable
NC = not calculable
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

Table 13.1 Risk Assessment Summary
Child Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	3.4E-05	NA	1.2E-05	4.7E-05						
			Dibenzo(a,h)anthracene	2.4E-05	NA	8.6E-06	3.2E-05						
			Arsenic (BG)	9.1E-06	NA	7.6E-07	9.9E-06						
			Benzo(a)anthracene	3.4E-06	NA	1.2E-06	4.7E-06						
			Benzo(b)fluoranthene	3.1E-06	NA	1.1E-06	4.2E-06						
			Indeno(1,2,3-cd)pyrene	2.5E-06	NA	9.2E-07	3.5E-06						
			(Total ##)	7.6E-05	NC	2.5E-05	1.0E-04	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)	(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	1.0E-04	Total Hazard Index Across Soil (Surface + Subsurface) **	0.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.0E-04	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	2.0E-05		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.2E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 13.2 Risk Assessment Summary
Adult Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Total Soil	Total Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	5.1E-06	NA	2.6E-06	7.7E-06						
			Dibenzo(a,h)anthracene	3.5E-06	NA	1.8E-06	5.3E-06						
			Arsenic (BG)	4.3E-06	NA	5.2E-07	4.8E-06						
			(Total ##)	1.3E-05	NC	5.0E-06	1.8E-05	(Total **)		0.0E+00	NC	0.0E+00	0.0E+00
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	Chloroform	NA	2.2E-06	NA	2.2E-06						
			(Total ##)	NC	2.2E-06	NC	2.2E-06	(Total **)		NC	0.0E+00	NC	0.0E+00
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)											
			(Total ##)	NC	0.0E+00	NC	0.0E+00	(Total **)		NC	0.0E+00	NC	0.0E+00

Total Risk Across Soil (Surface + Subsurface) ##	1.8E-05	Total Hazard Index Across Soil (Surface + Subsurface) **	0.0E+00
Total Risk Across Soil Gas (Indoor Vapors) ##	2.2E-06	Total Hazard Index Across Soil Gas (Indoor Vapors) **	0.0E+00
Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) **	0.0E+00
Total Adult Risk Across All Media and All Exposure Routes ##	2.0E-05	Total Hazard Index Across All Media and All Exposure Routes **	0.0E+00
Total Child Risk Across All Media and All Exposure Routes ##	1.0E-04		
Total Adult and Child Risk Across All Media and All Exposure Routes ##	1.2E-04		

Notes:
NA = not available

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 13.3 Risk Assessment Summary
Lifetime Resident RME at Zone 3 (Residential Neighborhood)
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Total Soil	Total Soil	Zone 3 (Residential Neighborhood)	Benzo(a)pyrene	3.9E-05	NA	1.5E-05	5.4E-05						
			Dibenzo(a,h)anthracene	2.7E-05	NA	1.0E-05	3.8E-05						
			Arsenic (BG)	1.3E-05	NA	1.3E-06	1.5E-05						
			Benzo(a)anthracene	3.9E-06	NA	1.5E-06	5.4E-06						
			Benzo(b)fluoranthene	3.5E-06	NA	1.4E-06	4.9E-06						
			Indeno(1,2,3-cd)pyrene	2.9E-06	NA	1.1E-06	4.0E-06						
			(Total)	9.0E-05	NC	3.1E-05	1.2E-04	(Total)		--	--	--	--
Soil Gas	Indoor Vapors	Zone 3 (Residential Neighborhood)	Chloroform	NA	2.7E-06	NA	2.7E-06						
			(Total)	NC	2.7E-06	NC	2.7E-06	(Total)		--	--	--	--
Soil Gas	Outdoor Vapors	Zone 3 (Residential Neighborhood)											
			(Total)	NC	0.0E+00	NC	0.0E+00	(Total)		--	--	--	--

Notes:	Total Risk Across Soil (Surface + Subsurface) ##	1.2E-04	Total Hazard Index Across Soil (Surface + Subsurface) --
NA = not available	Total Risk Across Soil Gas (Indoor Vapors) ##	2.7E-06	Total Hazard Index Across Soil Gas (Indoor Vapors) --
NA = not available	Total Risk Across Soil Gas (Outdoor Vapors) ##	0.0E+00	Total Hazard Index Across Soil Gas (Outdoor Vapors) --
NA = not available	Total Lifetime Risk Across All Media and All Exposure Routes ##	1.2E-04	Total Hazard Index Across All Media and All Exposure Routes --

(BG) -- Concentrations of the inorganic risk driver arsenic were demonstrated to be not greater than background based on statistical tests.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

Table 14.1 Risk Assessment Summary
Child RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Groundwater	Groundwater	Tap Water Contact with Groundwater	Benzo(a)pyrene	1.44E-03	--	1.73E-02	1.88E-02	Total 2,3,7,8-TCDD TEQ	Developmental	3.13E+00	--	3.46E+01	3.78E+01
			Dibenz(a,h)anthracene	3.47E-04	--	6.45E-03	6.79E-03	Thallium	Liver	1.14E+01	--	2.48E-02	1.14E+01
			Benzo(b)fluoranthene	1.46E-04	--	1.78E-03	1.92E-03	Cobalt	Blood	1.10E+01	--	9.58E-03	1.10E+01
			Indeno(1,2,3-cd)pyrene	1.04E-04	--	1.27E-03	1.38E-03	Iron	Liver/Blood/GI Tract	1.06E+01	--	2.30E-02	1.06E+01
			Benz(a)anthracene	1.41E-04	--	9.86E-04	1.13E-03	Arsenic	Skin/Vascular	7.26E+00	--	1.58E-02	7.27E+00
			Total 2,3,7,8-TCDD TEQ	3.48E-05	--	3.86E-04	4.21E-04	Manganese	CNS	6.84E+00	--	3.72E-01	7.21E+00
			Arsenic	2.80E-04	--	6.10E-07	2.81E-04	Antimony	Blood/Liver	5.83E+00	--	8.47E-02	5.92E+00
			N-Nitroso-di-n-propylamine	2.24E-04	--	4.07E-06	2.28E-04	Aroclor-1016	Reduced Birth Weight	5.95E-01	--	4.50E+00	5.10E+00
			Benzo(k)fluoranthene	1.44E-05	--	1.76E-04	1.91E-04	Mercury	Developmental/Neurological	2.65E+00	--	5.76E-03	2.65E+00
			Vinyl Chloride	9.03E-05	--	2.60E-06	9.29E-05	3-Nitroaniline		2.31E+00	--	NA	2.31E+00
			Aroclor-1260	8.46E-06	--	6.40E-05	7.25E-05	Aluminum	CNS (Developmental)	2.13E+00	--	4.64E-03	2.14E+00
			2,4-Dinitrotoluene	2.96E-05	--	1.02E-06	3.06E-05	Copper	GI Tract	1.76E+00	--	3.84E-03	1.77E+00
			2,6-Dinitrotoluene	2.91E-05	--	6.78E-07	2.98E-05	Vanadium	Kidney	1.56E+00	--	1.31E-01	1.69E+00
			Aroclor-1242	1.94E-06	--	1.47E-05	1.66E-05	Cadmium	Kidney	1.58E+00	--	6.89E-02	1.65E+00
			Tetrachloroethene	1.07E-05	--	3.53E-06	1.42E-05	Zinc	Blood	7.16E-01	--	9.36E-04	7.17E-01
			Dieldrin	9.59E-06	--	3.69E-06	1.33E-05	2,6-Dinitrotoluene	CNS/Blood/Liver	5.00E-01	--	1.16E-02	5.11E-01
			Aldrin	1.12E-05	--	5.66E-07	1.18E-05	Nitrobenzene	Blood/Adrenal/Liver/Kidney	4.39E-01	--	7.99E-03	4.47E-01
			3,3'-Dichlorobenzidine	9.58E-06	--	2.18E-06	1.18E-05	Heptachlor Epoxide	Liver	3.07E-01	--	8.05E-02	3.87E-01
			Chrysene	1.41E-06	--	9.93E-06	1.13E-05	Barium	Kidney	3.70E-01	--	1.15E-02	3.81E-01
			Aroclor-1248	1.29E-06	--	9.75E-06	1.10E-05	Aldrin	Liver	2.56E-01	--	1.30E-02	2.69E-01
			Bis(2-ethylhexyl) Phthalate	2.56E-06	--	2.19E-06	4.76E-06	2,4-Dinitrotoluene	CNS/Heinz Bodies/Liver	2.54E-01	--	8.73E-03	2.63E-01
			Atrazine	3.76E-06	--	2.69E-07	4.03E-06						
			Heptachlor Epoxide	3.11E-06	--	8.17E-07	3.93E-06						
			2,2'-Oxybis(1-chloropropane)	2.25E-06	--	1.76E-07	2.42E-06						
			Heptachlor	1.79E-06	--	4.70E-07	2.26E-06						
			Aroclor-1016	2.50E-07	--	1.89E-06	2.14E-06						

Table 14.1 Risk Assessment Summary
Child RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
			Delta-BHC	1.42E-06	--	6.67E-07	2.08E-06						
			4,4'-DDT	2.71E-07	--	1.74E-06	2.01E-06						
			Alpha-BHC	1.31E-06	--	3.52E-07	1.66E-06						
			Benzene	1.51E-06	--	1.27E-07	1.63E-06						
			Bromodichloromethane	1.23E-06	--	5.55E-08	1.28E-06						
			3-Nitroaniline	1.25E-06	--	NA	1.25E-06						
			Beta-BHC	8.25E-07	--	2.22E-07	1.05E-06						
			4,4'-DDD	2.09E-07	--	8.14E-07	1.02E-06						
			4,4'-DDE	2.15E-07	--	7.36E-07	9.51E-07						
			Chloroform	8.47E-07	--	4.27E-08	8.90E-07						
			Carbon Tetrachloride	6.44E-07	--	9.53E-08	7.39E-07						
			4-Nitroaniline	5.61E-07	--	NA	5.61E-07						
			Gamma-BHC (Lindane)	3.94E-07	--	8.73E-08	4.81E-07						
			Trichloroethene	3.22E-07	--	3.08E-08	3.53E-07						
			Gamma-Chlordane	1.61E-07	--	1.85E-07	3.46E-07						
			1,4-Dichlorobenzene	1.43E-07	--	5.30E-08	1.96E-07						
			(Total ##)	3.0E-03	--	2.85E-02	3.15E-02	(Total **)		7.1E+01	--	4.0E+01	1.11E+02
						Total Risk Across Groundwater ##	3.1E-02					Total Hazard Index Across Groundwater **	1.11E+02
						Total Child Risk Across All Media and All Exposure Routes ##	3.1E-02					Total Hazard Index Across All Media and All Exposure Routes **	1.11E+02

Total Adult Risk Across All Media and All Exposure Routes ##	3.5E-02
Total Adult and Child Risk Across All Media and All Exposure Routes ##	6.65E-02

Notes: YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.

NA = not available

All carcinogenic chemicals are omitted and total cancer risks for a medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for a medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for a medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 14.2 Risk Assessment Summary
Adult RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Groundwater	Groundwater	Tap Water Contact with Groundwater	Benzo(a)pyrene	9.4E-04	--	1.9E-02	2.0E-02	Total 2,3,7,8-TCDD TEQ	Developmental	1.5E+00	--	2.8E+01	2.9E+01
			Dibenz(a,h)anthracene	2.3E-04	--	7.1E-03	7.3E-03	Thallium	Liver	5.4E+00	--	2.4E-02	5.4E+00
			Benzo(b)fluoranthene	9.5E-05	--	2.0E-03	2.0E-03	Cobalt	Blood	5.2E+00	--	9.4E-03	5.2E+00
			Indeno(1,2,3-cd)pyrene	6.8E-05	--	1.4E-03	1.5E-03	Iron	Liver/Blood/GI Tract	5.0E+00	--	2.3E-02	5.0E+00
			Total 2,3,7,8-TCDD TEQ	6.6E-05	--	1.2E-03	1.3E-03	Aroclor-1016	Reduced Birth Weight	2.8E-01	--	3.6E+00	3.9E+00
			Benz(a)anthracene	9.2E-05	--	1.1E-03	1.2E-03	Manganese	CNS	3.2E+00	--	3.7E-01	3.6E+00
			Arsenic	5.3E-04	--	2.4E-06	5.3E-04	Arsenic	Skin/Vascular	3.4E+00	--	1.6E-02	3.5E+00
			N-Nitroso-di-n-propylamine	4.2E-04	--	1.3E-05	4.4E-04	Antimony	Blood/Liver	2.8E+00	--	8.3E-02	2.9E+00
			Aroclor-1260	1.6E-05	--	2.0E-04	2.2E-04	Mercury	Developmental/Neurological	1.3E+00	--	5.7E-03	1.3E+00
			Benzo(k)fluoranthene	9.4E-06	--	1.9E-04	2.0E-04	3-Nitroaniline		1.1E+00	--	NA	1.1E+00
			2,4-Dinitrotoluene	5.6E-05	--	3.2E-06	5.9E-05	Aluminum	CNS (Developmental)	1.0E+00	--	4.6E-03	1.0E+00
			2,6-Dinitrotoluene	5.5E-05	--	2.2E-06	5.7E-05	Vanadium	Kidney	7.4E-01	--	1.3E-01	8.7E-01
			Aroclor-1242	3.7E-06	--	4.7E-05	5.1E-05	Copper	GI Tract	8.4E-01	--	3.8E-03	8.4E-01
			Aroclor-1248	2.4E-06	--	3.1E-05	3.4E-05	Cadmium	Kidney	7.5E-01	--	6.8E-02	8.2E-01
			Tetrachloroethene	2.0E-05	--	1.0E-05	3.0E-05	Zinc	Blood	3.4E-01	--	9.2E-04	3.4E-01
			Dieldrin	1.8E-05	--	1.2E-05	3.0E-05	2,6-Dinitrotoluene	CNS/Blood/Liver	2.4E-01	--	9.3E-03	2.5E-01
			3,3'-Dichlorobenzidine	1.8E-05	--	7.0E-06	2.5E-05	Nitrobenzene	Blood/Adrenal/Liver/Kidney	2.1E-01	--	6.1E-03	2.1E-01
			Aldrin	2.1E-05	--	1.8E-06	2.3E-05	Heptachlor Epoxide	Liver	1.5E-01	--	6.4E-02	2.1E-01
			Vinyl Chloride	1.4E-05	--	5.4E-07	1.4E-05						
			Bis(2-ethylhexyl) Phthalate	4.9E-06	--	7.0E-06	1.2E-05						
			Chrysene	9.2E-07	--	1.1E-05	1.2E-05						
			Heptachlor Epoxide	5.9E-06	--	2.6E-06	8.5E-06						
			Atrazine	7.1E-06	--	8.6E-07	8.0E-06						
			Aroclor-1016	4.7E-07	--	6.0E-06	6.5E-06						
			4,4'-DDT	5.1E-07	--	5.5E-06	6.0E-06						
			Heptachlor	3.4E-06	--	1.5E-06	4.9E-06						
			Delta-BHC	2.7E-06	--	2.1E-06	4.8E-06						
			2,2'-Oxybis(1-chloropropane)	4.3E-06	--	5.3E-07	4.8E-06						
			Alpha-BHC	2.5E-06	--	1.1E-06	3.6E-06						
			Benzene	2.9E-06	--	3.4E-07	3.2E-06						
			4,4'-DDD	4.0E-07	--	2.6E-06	3.0E-06						

Table 14.2 Risk Assessment Summary
Adult RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
			4,4'-DDE	4.1E-07	--	2.3E-06	2.8E-06						
			Bromodichloromethane	2.3E-06	--	1.6E-07	2.5E-06						
			3-Nitroaniline	2.4E-06	--	NA	2.4E-06						
			Beta-BHC	1.6E-06	--	7.1E-07	2.3E-06						
			Chloroform	1.6E-06	--	1.2E-07	1.7E-06						
			Carbon Tetrachloride	1.2E-06	--	2.7E-07	1.5E-06						
			4-Nitroaniline	1.1E-06	--	NA	1.1E-06						
			Gamma-BHC (Lindane)	7.5E-07	--	2.8E-07	1.0E-06						
			Gamma-Chlordane	3.1E-07	--	5.9E-07	8.9E-07						
			Trichloroethene	6.1E-07	--	8.6E-08	7.0E-07						
			1,4-Dichlorobenzene	2.7E-07	--	1.5E-07	4.2E-07						
			(Total ##)	2.7E-03	--	3.2E-02	3.5E-02	(Total **)		3.3E+01	--	3.2E+01	6.5E+01
	Air	Inhalation of Groundwater Vapors During Showering	Naphthalene	--	5.4E-06	--	5.4E-06						
			Chloroform	--	2.8E-06	--	2.8E-06						
			1,4-Dichlorobenzene	--	1.2E-06	--	1.2E-06						
			Benzene	--	1.2E-06	--	1.2E-06						
			2,2'-Oxybis(1-chloropropane)	--	5.8E-07	--	5.8E-07						
			Tetrachloroethene	--	4.6E-07	--	4.6E-07						
			Carbon Tetrachloride	--	3.0E-07	--	3.0E-07						
			Vinyl Chloride	--	2.7E-07	--	2.7E-07						
			Trichloroethene	--	2.2E-07	--	2.2E-07						
			(Total ##)	--	1.2E-05	--	1.2E-05	(Total **)		--	0.0E+00	--	0.0E+00
						Total Risk Across Groundwater ##	3.5E-02					Total Hazard Index Across Groundwater **	6.5E+01
						Total Adult Risk Across All Media and All Exposure Routes ##	3.5E-02					Total Hazard Index Across All Media and All Exposure Routes **	6.5E+01

Total Child Risk Across All Media and All Exposure Routes ##	3.1E-02
Total Adult and Child Risk Across All Media and All Exposure Routes ##	6.6E-02

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.

All carcinogenic chemicals are omitted and total cancer risks for a medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for a medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for a medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 14.3 Risk Assessment Summary
Lifetime RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact with Groundwater											
			Benzo(a)pyrene	2.4E-03	--	3.6E-02	3.9E-02						
			Dibenz(a,h)anthracene	5.7E-04	--	1.4E-02	1.4E-02						
			Benzo(b)fluoranthene	2.4E-04	--	3.7E-03	4.0E-03						
			Indeno(1,2,3-cd)pyrene	1.7E-04	--	2.7E-03	2.8E-03						
			Benz(a)anthracene	2.3E-04	--	2.1E-03	2.3E-03						
			Total 2,3,7,8-TCDD TEQ	1.0E-04	--	1.6E-03	1.7E-03						
			Arsenic	8.1E-04	--	3.0E-06	8.1E-04						
			N-Nitroso-di-n-propylamine	6.5E-04	--	1.7E-05	6.6E-04						
			Benzo(k)fluoranthene	2.4E-05	--	3.7E-04	3.9E-04						
			Aroclor-1260	2.5E-05	--	2.7E-04	2.9E-04						
			Vinyl Chloride	1.0E-04	--	3.1E-06	1.1E-04						
			2,4-Dinitrotoluene	8.6E-05	--	4.3E-06	9.0E-05						
			2,6-Dinitrotoluene	8.4E-05	--	2.8E-06	8.7E-05						
			Aroclor-1242	5.6E-06	--	6.1E-05	6.7E-05						
			Tetrachloroethene	3.1E-05	--	1.4E-05	4.5E-05						
			Aroclor-1248	3.7E-06	--	4.1E-05	4.5E-05						
			Dieldrin	2.8E-05	--	1.5E-05	4.3E-05						
			3,3'-Dichlorobenzidine	2.8E-05	--	9.1E-06	3.7E-05						
			Aldrin	3.2E-05	--	2.4E-06	3.5E-05						
			Chrysene	2.3E-06	--	2.1E-05	2.3E-05						
			Bis(2-ethylhexyl) Phthalate	7.4E-06	--	9.2E-06	1.7E-05						
			Heptachlor Epoxide	9.0E-06	--	3.4E-06	1.2E-05						
			Atrazine	1.1E-05	--	1.1E-06	1.2E-05						
			Aroclor-1016	7.2E-07	--	7.9E-06	8.6E-06						
			4,4'-DDT	7.9E-07	--	7.3E-06	8.0E-06						
			2,2'-Oxybis(1-chloropropane)	6.5E-06	--	7.1E-07	7.2E-06						
			Heptachlor	5.2E-06	--	2.0E-06	7.2E-06						
			Delta-BHC	4.1E-06	--	2.8E-06	6.9E-06						

Table 14.3 Risk Assessment Summary
Lifetime RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Alpha-BHC	3.8E-06	--	1.5E-06	5.3E-06						
			Benzene	4.4E-06	--	4.7E-07	4.8E-06						
			4,4'-DDD	6.1E-07	--	3.4E-06	4.0E-06						
			Bromodichloromethane	3.6E-06	--	2.1E-07	3.8E-06						
			4,4'-DDE	6.2E-07	--	3.1E-06	3.7E-06						
			3-Nitroaniline	3.6E-06	--	NA	3.6E-06						
			Beta-BHC	2.4E-06	--	9.3E-07	3.3E-06						
			Chloroform	2.5E-06	--	1.6E-07	2.6E-06						
			Carbon Tetrachloride	1.9E-06	--	3.6E-07	2.2E-06						
			4-Nitroaniline	1.6E-06	--	NA	1.6E-06						
			Gamma-BHC (Lindane)	1.1E-06	--	3.7E-07	1.5E-06						
			Gamma-Chlordane	4.7E-07	--	7.7E-07	1.2E-06						
			Trichloroethene	9.3E-07	--	1.2E-07	1.0E-06						
			Alpha-Chlordane	3.6E-07	--	6.6E-07	1.0E-06						
			(Total)	5.7E-03	--	6.1E-02	6.6E-02	(Total)		--	--	--	--
	Air	Inhalation of Groundwater Vapors During Showering	Naphthalene	--	5.4E-06	--	5.4E-06						
			Chloroform	--	2.8E-06	--	2.8E-06						
			1,4-Dichlorobenzene	--	1.2E-06	--	1.2E-06						
			Benzene	--	1.2E-06	--	1.2E-06						
			2,2'-Oxybis(1-chloropropane)	--	5.8E-07	--	5.8E-07						
			Tetrachloroethene	--	4.6E-07	--	4.6E-07						
			Carbon Tetrachloride	--	3.0E-07	--	3.0E-07						
			Vinyl Chloride	--	2.7E-07	--	2.7E-07						
			Trichloroethene	--	2.2E-07	--	2.2E-07						
			(Total)	--	1.2E-05	--	1.2E-05	(Total)		--	--	--	--
						Total Risk Across Groundwater	6.6E-02					Total Hazard Index Across Groundwater	--
						Total Risk Across All Media and All Exposure Routes	6.6E-02					Total Hazard Index Across All Media and All Exposure Routes	--

Table 14.4 Risk Assessment Summary
Industrial Worker RME Groundwater
Lower Darby Creek Area RI/FS

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Groundwater	Groundwater	Contact With Groundwater During Excavation	Benzo(a)pyrene	2.29E-07	--	1.20E-04	1.20E-04						
			Dibenz(a,h)anthracene	5.51E-08	--	4.45E-05	4.46E-05						
			Total 2,3,7,8-TCDD TEQ	2.95E-08	--	1.42E-05	1.43E-05						
			Benzo(b)fluoranthene	2.31E-08	--	1.23E-05	1.23E-05						
			Indeno(1,2,3-cd)pyrene	1.65E-08	--	8.79E-06	8.81E-06						
			Benz(a)anthracene	2.23E-08	--	6.82E-06	6.84E-06						
			Aroclor-1260	7.16E-09	--	2.36E-06	2.37E-06						
			Benzo(k)fluoranthene	2.29E-09	--	1.22E-06	1.22E-06						
			(Total ##)	3.85E-07	--	2.10E-04	2.10E-04	(Total **)		0.00E+00	--	0.00E+00	0.00E+00
	Air	Vapors from Groundwater in Excavation	Naphthalene	--	1.72E-05	--	1.72E-05						
			Chloroform	--	8.96E-06	--	8.96E-06						
			Benzene	--	3.78E-06	--	3.78E-06						
			1,4-Dichlorobenzene	--	3.71E-06	--	3.71E-06						
			2,2'-Oxybis(1-chloropropane)	--	3.61E-06	--	3.61E-06						
			Tetrachloroethene	--	1.43E-06	--	1.43E-06						
			(Total ##)	--	3.87E-05	--	3.87E-05	(Total **)		--	0.00E+00	--	0.00E+00
						Total Risk Across Groundwater ##	2.49E-04					Total Hazard Index Across Groundwater **	0.00E+00
						Total Risk Across All Media and All Exposure Routes ##	2.49E-04					Total Hazard Index Across All Media and All Exposure Routes **	0.00E+00

YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.

All carcinogenic chemicals are omitted and total cancer risks for a medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor are <= 1.0E-04.
If cumulative cancer risk for a medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor.

Notes:
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for a medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
NA = not available
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 15.1 Risk Assessment Summary
Child Subsistence Fisher RME Lower Darby and Lower Cobbs Creeks
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Lower Darby and Lower Cobbs Creeks	Benzo(a)pyrene	6.8E-03	NA	NA	6.8E-03	Arsenic	Skin, Vascular	1.3E+02	NA	NA	1.3E+02
			Arsenic	4.9E-03	NA	NA	4.9E-03	Copper	GI Tract	1.1E+02	NA	NA	1.1E+02
			Dibenz(a,h)anthracene	1.7E-03	NA	NA	1.7E-03	Mercury	Developmental, neuropsychological impairment	9.5E+01	NA	NA	9.5E+01
			Aroclor-1260	1.4E-03	NA	NA	1.4E-03	Cadmium	Proteinuria	9.1E+01	NA	NA	9.1E+01
			Dieldrin	1.0E-03	NA	NA	1.0E-03	Zinc	ESOD (Blood)	8.8E+01	NA	NA	8.8E+01
			Benzo(b)fluoranthene	8.5E-04	NA	NA	8.5E-04	Chromium	Fetus (Developmental) / GI Tract	8.8E+01	NA	NA	8.8E+01
			Benz(a)anthracene	8.1E-04	NA	NA	8.1E-04	Nickel	Decreased Body Weight/Organ Weight	3.6E+01	NA	NA	3.6E+01
			Indeno(1,2,3-cd)pyrene	5.0E-04	NA	NA	5.0E-04	Dieldrin	Liver	1.5E+01	NA	NA	1.5E+01
			Heptachlor Epoxide	7.1E-05	NA	NA	7.1E-05	Heptachlor Epoxide	Increased Liver Weight	7.0E+00	NA	NA	7.0E+00
			Benzo(k)fluoranthene	6.5E-05	NA	NA	6.5E-05	Selenium	Nails/Hair/Blood/Skin/CNS	4.7E+00	NA	NA	4.7E+00
			Alpha-Chlordane	6.0E-05	NA	NA	6.0E-05	Alpha-Chlordane	Liver	4.0E+00	NA	NA	4.0E+00
			4,4'-DDE	2.1E-05	NA	NA	2.1E-05	Silver	Skin	2.7E+00	NA	NA	2.7E+00
			Gamma-Chlordane	1.3E-05	NA	NA	1.3E-05	Gamma-Chlordane	Liver	8.9E-01	NA	NA	8.9E-01
			Heptachlor	1.1E-05	NA	NA	1.1E-05	Pyrene	Kidney	8.6E-01	NA	NA	8.6E-01
			Chrysene	9.6E-06	NA	NA	9.6E-06	Fluoranthene	Liver, Kidney, Blood	7.6E-01	NA	NA	7.6E-01
			Beta-BHC	6.6E-06	NA	NA	6.6E-06	Phenanthrene	Kidney	6.9E-01	NA	NA	6.9E-01
			4,4'-DDT	6.0E-06	NA	NA	6.0E-06	4,4'-DDT	Liver	4.1E-01	NA	NA	4.1E-01
			(Total ##)	1.8E-02	NA	NA	1.8E-02	(Total **)		6.7E+02	NA	NA	6.7E+02
						Total Risk ##	1.8E-02					Total Hazard Index Associated with Fish **	6.7E+02
						Total Child Risk Associated with Fish ##	1.8E-02						
						Total Adult Risk Associated with Fish ##	1.7E-02						
						Total Adult and Child Risk Associated with Fish ##	3.6E-02						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 15.2 Risk Assessment Summary
Adult Subsistence Fisher RME Lower Darby and Lower Cobbs Creeks
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Lower Darby and Lower Cobbs Creeks	Benzo(a)pyrene	6.5E-03	NA	NA	6.5E-03	Arsenic	Skin, Vascular	3.0E+01	NA	NA	3.0E+01
			Arsenic	4.7E-03	NA	NA	4.7E-03	Copper	GI Tract	2.6E+01	NA	NA	2.6E+01
			Dibenz(a,h)anthracene	1.6E-03	NA	NA	1.6E-03	Mercury	Developmental, neuropsychological impairment	2.2E+01	NA	NA	2.2E+01
			Aroclor-1260	1.4E-03	NA	NA	1.4E-03	Cadmium	Proteinuria	2.2E+01	NA	NA	2.2E+01
			Dieldrin	9.9E-04	NA	NA	9.9E-04	Zinc	ESOD (Blood)	2.1E+01	NA	NA	2.1E+01
			Benzo(b)fluoranthene	8.1E-04	NA	NA	8.1E-04	Chromium	Fetus (Developmental) / GI Tract	2.1E+01	NA	NA	2.1E+01
			Benz(a)anthracene	7.7E-04	NA	NA	7.7E-04	Nickel	Decreased Body Weight/Organ Weight	8.5E+00	NA	NA	8.5E+00
			Indeno(1,2,3-cd)pyrene	4.7E-04	NA	NA	4.7E-04	Dieldrin	Liver	3.6E+00	NA	NA	3.6E+00
			Heptachlor Epoxide	6.7E-05	NA	NA	6.7E-05	Heptachlor Epoxide	Increased Liver Weight	1.7E+00	NA	NA	1.7E+00
			Benzo(k)fluoranthene	6.1E-05	NA	NA	6.1E-05	Selenium	Nails/Hair/Blood/Skin/CNS	1.1E+00	NA	NA	1.1E+00
			Alpha-Chlordane	5.7E-05	NA	NA	5.7E-05	Alpha-Chlordane	Liver	9.6E-01	NA	NA	9.6E-01
			4,4'-DDE	2.0E-05	NA	NA	2.0E-05	Silver	Skin	6.3E-01	NA	NA	6.3E-01
			Gamma-Chlordane	1.3E-05	NA	NA	1.3E-05	Gamma-Chlordane	Liver	2.1E-01	NA	NA	2.1E-01
			Heptachlor	1.0E-05	NA	NA	1.0E-05						
			Chrysene	9.1E-06	NA	NA	9.1E-06						
			Beta-BHC	6.3E-06	NA	NA	6.3E-06						
			4,4'-DDT	5.7E-06	NA	NA	5.7E-06						
			(Total ##)	1.7E-02	NA	NA	1.7E-02	(Total **)		1.6E+02	NA	NA	1.6E+02
						Total Risk ##	1.7E-02					Total Hazard Index Associated with Fish **	1.6E+02
						Total Adult Risk Associated with Fish ##	1.7E-02						
						Total Child Risk Associated with Fish ##	1.8E-02						
						Total Adult and Child Risk Associated with Fish ##	3.6E-02						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 15.3 Risk Assessment Summary
Child Recreational Fisher RME Lower Darby and Lower Cobbs Creeks
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Recreational Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Lower Darby and Lower Cobbs Creeks	Benzo(a)pyrene	1.0E-03	NA	NA	1.0E-03	Arsenic	Skin, Vascular	1.9E+01	NA	NA	1.9E+01
			Arsenic	7.3E-04	NA	NA	7.3E-04	Copper	GI Tract	1.6E+01	NA	NA	1.6E+01
			Dibenz(a,h)anthracene	2.5E-04	NA	NA	2.5E-04	Mercury	Developmental, neuropsychological impairment	1.4E+01	NA	NA	1.4E+01
			Aroclor-1260	2.1E-04	NA	NA	2.1E-04	Cadmium	Proteinuria	1.3E+01	NA	NA	1.3E+01
			Dieldrin	1.5E-04	NA	NA	1.5E-04	Zinc	ESOD (Blood)	1.3E+01	NA	NA	1.3E+01
			Benzo(b)fluoranthene	1.3E-04	NA	NA	1.3E-04	Chromium	Fetus (Developmental) / GI Tract	1.3E+01	NA	NA	1.3E+01
			Benz(a)anthracene	1.2E-04	NA	NA	1.2E-04	Nickel	Decreased Body Weight/Organ Weight	5.3E+00	NA	NA	5.3E+00
			Indeno(1,2,3-cd)pyrene	7.3E-05	NA	NA	7.3E-05	Dieldrin	Liver	2.2E+00	NA	NA	2.2E+00
			Heptachlor Epoxide	1.0E-05	NA	NA	1.0E-05	Heptachlor Epoxide	Increased Liver Weight	1.0E+00	NA	NA	1.0E+00
			Benzo(k)fluoranthene	9.5E-06	NA	NA	9.5E-06	Selenium	Nails/Hair/Blood/Skin/CNS	6.9E-01	NA	NA	6.9E-01
			Alpha-Chlordane	8.9E-06	NA	NA	8.9E-06	Alpha-Chlordane	Liver	5.9E-01	NA	NA	5.9E-01
			4,4'-DDE	3.0E-06	NA	NA	3.0E-06	Silver	Skin	3.9E-01	NA	NA	3.9E-01
			Gamma-Chlordane	2.0E-06	NA	NA	2.0E-06						
			Heptachlor	1.5E-06	NA	NA	1.5E-06						
			Chrysene	1.4E-06	NA	NA	1.4E-06						
			(Total ##)	2.7E-03	NA	NA	2.7E-03	(Total **)		9.8E+01	NA	NA	9.8E+01
						Total Risk ##	2.7E-03					Total Hazard Index Associated with Fish **	9.8E+01
						Total Child Risk Associated with Fish ##	2.7E-03						
						Total Adult Risk Associated with Fish ##	2.6E-03						
						Total Adult and Child Risk Associated with Fish ##	5.3E-03						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 15.4 Risk Assessment Summary
Adult Recreational Fisher RME Lower Darby and Lower Cobbs Creeks
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Recreational Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Lower Darby and Lower Cobbs Creeks	Benzo(a)pyrene	9.5E-04	NA	NA	9.5E-04	Arsenic	Skin, Vascular	4.5E+00	NA	NA	4.5E+00
			Arsenic	6.9E-04	NA	NA	6.9E-04	Copper	GI Tract	3.8E+00	NA	NA	3.8E+00
			Dibenz(a,h)anthracene	2.3E-04	NA	NA	2.3E-04	Mercury	Developmental, neuropsychological impairment	3.3E+00	NA	NA	3.3E+00
			Aroclor-1260	2.0E-04	NA	NA	2.0E-04	Cadmium	Proteinuria	3.2E+00	NA	NA	3.2E+00
			Dieldrin	1.5E-04	NA	NA	1.5E-04	Zinc	ESOD (Blood)	3.1E+00	NA	NA	3.1E+00
			Benzo(b)fluoranthene	1.2E-04	NA	NA	1.2E-04	Chromium	Fetus (Developmental) / GI Tract	3.1E+00	NA	NA	3.1E+00
			Benz(a)anthracene	1.1E-04	NA	NA	1.1E-04	Nickel	Decreased Body Weight/Organ Weight	1.3E+00	NA	NA	1.3E+00
			Indeno(1,2,3-cd)pyrene	6.9E-05	NA	NA	6.9E-05						
			Heptachlor Epoxide	9.9E-06	NA	NA	9.9E-06						
			Benzo(k)fluoranthene	9.0E-06	NA	NA	9.0E-06						
			Alpha-Chlordane	8.4E-06	NA	NA	8.4E-06						
			4,4'-DDE	2.9E-06	NA	NA	2.9E-06						
			Gamma-Chlordane	1.9E-06	NA	NA	1.9E-06						
			Heptachlor	1.5E-06	NA	NA	1.5E-06						
			Chrysene	1.3E-06	NA	NA	1.3E-06						
			(Total ##)	2.6E-03	NA	NA	2.6E-03	(Total **)		2.2E+01	NA	NA	2.2E+01
						Total Risk ##	2.6E-03					Total Hazard Index Associated with Fish **	2.2E+01
						Total Adult Risk Associated with Fish ##	2.6E-03						
						Total Child Risk Associated with Fish ##	2.7E-03						
						Total Adult and Child Risk Associated with Fish ##	5.3E-03						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 16.1 Risk Assessment Summary
Child Subsistence Fisher RME Tinicum Marsh
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Tinicum Marsh	Arsenic	1.2E-02	NA	NA	1.2E-02	Arsenic	Skin, Vascular	3.1E+02	NA	NA	3.1E+02
			Benzo(a)pyrene	3.7E-03	NA	NA	3.7E-03	Cadmium	Proteinuria	1.3E+02	NA	NA	1.3E+02
			Dibenz(a,h)anthracene	1.2E-03	NA	NA	1.2E-03	Copper	GI Tract	1.1E+02	NA	NA	1.1E+02
			Dieldrin	6.6E-04	NA	NA	6.6E-04	Chromium	Fetus (Developmental) / GI Tract	1.1E+02	NA	NA	1.1E+02
			Benzo(b)fluoranthene	4.8E-04	NA	NA	4.8E-04	Zinc	ESOD (Blood)	9.8E+01	NA	NA	9.8E+01
			Benz(a)anthracene	3.3E-04	NA	NA	3.3E-04	Mercury	Developmental, neuropsychological impairment	9.6E+01	NA	NA	9.6E+01
			Indeno(1,2,3-cd)pyrene	2.9E-04	NA	NA	2.9E-04	Nickel	Decreased Body Weight/Organ Weight	4.7E+01	NA	NA	4.7E+01
			4,4'-DDE	7.6E-05	NA	NA	7.6E-05	Dieldrin	Liver	9.6E+00	NA	NA	9.6E+00
			Alpha-Chlordane	7.0E-05	NA	NA	7.0E-05	Selenium	Nails/Hair/Blood/Skin/CNS	6.8E+00	NA	NA	6.8E+00
			Alpha-BHC	5.6E-05	NA	NA	5.6E-05	Heptachlor Epoxide	Increased Liver Weight	5.1E+00	NA	NA	5.1E+00
			Heptachlor Epoxide	5.2E-05	NA	NA	5.2E-05	Alpha-Chlordane	Liver	4.7E+00	NA	NA	4.7E+00
			Benzo(k)fluoranthene	3.7E-05	NA	NA	3.7E-05	Silver	Skin	2.9E+00	NA	NA	2.9E+00
			Gamma-Chlordane	1.1E-05	NA	NA	1.1E-05	Gamma-Chlordane	Liver	7.5E-01	NA	NA	7.5E-01
			4,4'-DDT	8.7E-06	NA	NA	8.7E-06	4,4'-DDT	Liver	6.0E-01	NA	NA	6.0E-01
			Chrysene	4.6E-06	NA	NA	4.6E-06						
			(Total ##)	1.9E-02	NA	NA	1.9E-02	(Total **)		9.3E+02	NA	NA	9.3E+02
						Total Risk ##	1.9E-02					Total Hazard Index Associated with Fish **	9.3E+02
						Total Child Risk Associated with Fish ##	1.9E-02						
						Total Adult Risk Associated with Fish ##	1.8E-02						
						Total Adult and Child Risk Associated with Fish ##	3.7E-02						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 16.2 Risk Assessment Summary
Adult Subsistence Fisher RME Tinicum Marsh
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Subsistence Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Tinicum Marsh	Arsenic	1.1E-02	NA	NA	1.1E-02	Arsenic	Skin, Vascular	7.3E+01	NA	NA	7.3E+01
			Benzo(a)pyrene	3.5E-03	NA	NA	3.5E-03	Cadmium	Proteinuria	3.1E+01	NA	NA	3.1E+01
			Dibenz(a,h)anthracene	1.2E-03	NA	NA	1.2E-03	Copper	GI Tract	2.7E+01	NA	NA	2.7E+01
			Dieldrin	6.2E-04	NA	NA	6.2E-04	Chromium	Fetus (Developmental) / GI Tract	2.6E+01	NA	NA	2.6E+01
			Benzo(b)fluoranthene	4.5E-04	NA	NA	4.5E-04	Zinc	ESOD (Blood)	2.3E+01	NA	NA	2.3E+01
			Benz(a)anthracene	3.1E-04	NA	NA	3.1E-04	Mercury	Developmental, neuropsychological impairment	2.3E+01	NA	NA	2.3E+01
			Indeno(1,2,3-cd)pyrene	2.8E-04	NA	NA	2.8E-04	Nickel	Decreased Body Weight/Organ Weight	1.1E+01	NA	NA	1.1E+01
			4,4'-DDE	7.2E-05	NA	NA	7.2E-05	Dieldrin	Liver	2.3E+00	NA	NA	2.3E+00
			Alpha-Chlordane	6.6E-05	NA	NA	6.6E-05	Selenium	Nails/Hair/Blood/Skin/CNS	1.6E+00	NA	NA	1.6E+00
			Alpha-BHC	5.3E-05	NA	NA	5.3E-05	Heptachlor Epoxide	Increased Liver Weight	1.2E+00	NA	NA	1.2E+00
			Heptachlor Epoxide	4.9E-05	NA	NA	4.9E-05	Alpha-Chlordane	Liver	1.1E+00	NA	NA	1.1E+00
			Benzo(k)fluoranthene	3.5E-05	NA	NA	3.5E-05	Silver	Skin	6.8E-01	NA	NA	6.8E-01
			Gamma-Chlordane	1.1E-05	NA	NA	1.1E-05						
			4,4'-DDT	8.2E-06	NA	NA	8.2E-06						
			Chrysene	4.4E-06	NA	NA	4.4E-06						
			(Total ##)	1.8E-02	NA	NA	1.8E-02	(Total **)		2.2E+02	NA	NA	2.2E+02
						Total Risk ##	1.8E-02					Total Hazard Index Associated with Fish **	2.2E+02
						Total Adult Risk Associated with Fish ##	1.8E-02						
						Total Child Risk Associated with Fish ##	1.9E-02						
						Total Adult and Child Risk Associated with Fish ##	3.7E-02						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 16.3 Risk Assessment Summary
Child Recreational Fisher RME Tinicum Marsh
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Recreational Fisher
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Tinicum Marsh	Arsenic	1.8E-03	NA	NA	1.8E-03	Arsenic	Skin, Vascular	4.5E+01	NA	NA	4.5E+01
			Benzo(a)pyrene	5.4E-04	NA	NA	5.4E-04	Cadmium	Proteinuria	1.9E+01	NA	NA	1.9E+01
			Dibenz(a,h)anthracene	1.8E-04	NA	NA	1.8E-04	Copper	GI Tract	1.7E+01	NA	NA	1.7E+01
			Dieldrin	9.7E-05	NA	NA	9.7E-05	Chromium	Fetus (Developmental) / GI Tract	1.6E+01	NA	NA	1.6E+01
			Benzo(b)fluoranthene	7.0E-05	NA	NA	7.0E-05	Zinc	ESOD (Blood)	1.4E+01	NA	NA	1.4E+01
			Benz(a)anthracene	4.8E-05	NA	NA	4.8E-05	Mercury	Developmental, neuropsychological impairment	1.4E+01	NA	NA	1.4E+01
			Indeno(1,2,3-cd)pyrene	4.3E-05	NA	NA	4.3E-05	Nickel	Decreased Body Weight/Organ Weight	6.9E+00	NA	NA	6.9E+00
			4,4'-DDE	1.1E-05	NA	NA	1.1E-05	Dieldrin	Liver	1.4E+00	NA	NA	1.4E+00
			Alpha-Chlordane	1.0E-05	NA	NA	1.0E-05	Selenium	Nails/Hair/Blood/Skin/CNS	9.9E-01	NA	NA	9.9E-01
			Alpha-BHC	8.2E-06	NA	NA	8.2E-06	Heptachlor Epoxide	Increased Liver Weight	7.6E-01	NA	NA	7.6E-01
			Heptachlor Epoxide	7.7E-06	NA	NA	7.7E-06	Alpha-Chlordane	Liver	6.9E-01	NA	NA	6.9E-01
			Benzo(k)fluoranthene	5.5E-06	NA	NA	5.5E-06	Silver	Skin	4.2E-01	NA	NA	4.2E-01
			Gamma-Chlordane	1.6E-06	NA	NA	1.6E-06						
			4,4'-DDT	1.3E-06	NA	NA	1.3E-06						
			(Total ##)	2.8E-03	NA	NA	2.8E-03	(Total **)		1.4E+02	NA	NA	1.4E+02
						Total Risk ##	2.8E-03					Total Hazard Index Associated with Fish **	1.4E+02
						Total Child Risk Associated with Fish ##	2.8E-03						
						Total Adult Risk Associated with Fish ##	2.6E-03						
						Total Adult and Child Risk Associated with Fish ##	5.4E-03						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

Table 16.4 Risk Assessment Summary
Adult Recreational Fisher RME Tinicum Marsh
Lower Darby Creek Area RI/FS

Scenario Timeframe: Current/Future
Receptor Population: Recreational Fisher
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical ##	Carcinogenic Risk				Chemical **	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total ##		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total**
Fish	Fish Tissue	Tinicum Marsh	Arsenic	1.7E-03	NA	NA	1.7E-03	Arsenic	Skin, Vascular	1.1E+01	NA	NA	1.1E+01
			Benzo(a)pyrene	5.1E-04	NA	NA	5.1E-04	Cadmium	Proteinuria	4.6E+00	NA	NA	4.6E+00
			Dibenz(a,h)anthracene	1.7E-04	NA	NA	1.7E-04	Copper	GI Tract	3.9E+00	NA	NA	3.9E+00
			Dieldrin	9.2E-05	NA	NA	9.2E-05	Chromium	Fetus (Developmental) / GI Tract	3.8E+00	NA	NA	3.8E+00
			Benzo(b)fluoranthene	6.6E-05	NA	NA	6.6E-05	Zinc	ESOD (Blood)	3.4E+00	NA	NA	3.4E+00
			Benz(a)anthracene	4.5E-05	NA	NA	4.5E-05	Mercury	Developmental, neuropsychological impairment	3.3E+00	NA	NA	3.3E+00
			Indeno(1,2,3-cd)pyrene	4.1E-05	NA	NA	4.1E-05	Nickel	Decreased Body Weight/Organ Weight	1.6E+00	NA	NA	1.6E+00
			4,4'-DDE	1.1E-05	NA	NA	1.1E-05	Selenium	Nails/Hair/Blood/Skin/CNS	2.4E-01	NA	NA	2.4E-01
			Alpha-Chlordane	9.8E-06	NA	NA	9.8E-06						
			Alpha-BHC	7.8E-06	NA	NA	7.8E-06						
			Heptachlor Epoxide	7.3E-06	NA	NA	7.3E-06						
			Benzo(k)fluoranthene	5.2E-06	NA	NA	5.2E-06						
			Gamma-Chlordane	1.6E-06	NA	NA	1.6E-06						
			4,4'-DDT	1.2E-06	NA	NA	1.2E-06						
			(Total ##)	2.6E-03	NA	NA	2.6E-03	(Total **)		3.2E+01	NA	NA	3.2E+01
						Total Risk ##	2.6E-03					Total Hazard Index Associated with Fish **	3.2E+01
						Total Adult Risk Associated with Fish ##	2.6E-03						
						Total Child Risk Associated with Fish ##	2.8E-03						
						Total Adult and Child Risk Associated with Fish ##	5.4E-03						

Notes:
NA = not available
YELLOW HIGHLIGHT indicates cancer risks greater than 1E-04 or noncancer HQ greater than 1.0.
All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

TABLE 17
SUMMARY OF CANCER RISKS AND NON-CANCER HAZARDS
FOR SOIL AREAS AND CUMULATIVE MULTI-MEDIA RISKS
Clearview Landfill

Receptor	Total Risks Excluding Soil Contact*** (GW, SW, Sed, Fish Tissue, Soil Gas)		Soil Risks - Zone 1		Soil Risks - Zone 2		Soil Risks - Zone 3		Total Risk Range (maximum soil risk + risk excluding soil)	
	Cancer*	Non-Cancer	Cancer*	Non-Cancer**	Cancer*	Non-Cancer**	Cancer*	Non-Cancer**	Cancer*	Non-Cancer**
Current Child Resident			4.8E-04 #	18 #	2.2E-04 #	2.5 #	1.6E-04 #	1.1 #	4.8E-04	18
Future Child Resident	3.1E-02	43	4.8E-04 @	18 @	1.9E-04 ##	1.2 ##	1.0E-04 ##	< 1 ##	3.2E-02	61
Current Adult Resident			1.8E-04 #	2.0 #	5.1E-05 #	< 1 #	2.9E-05 #	< 1 #	1.8E-04	2.0
Future Adult Resident	3.5E-02	31	1.8E-04 @	2.0 @	3.7E-05 ##	< 1 ##	1.8E-05 ##	< 1 ##	3.5E-02	33
Current Lifetime Resident			6.7E-04 #		2.8E-04 #		1.9E-04 #		6.7E-04	
Future Lifetime Resident	6.6E-02		6.7E-04 @		2.3E-04 ##		1.2E-04 ##		6.7E-02	
Current Child Recreational User	2.0E-05	< 1	8.9E-05 #	2.7 #	4.2E-05 #	< 1 #			1.1E-04	2.7
Future Child Recreation User	2.0E-05	< 1	8.9E-05 @	2.7 @	3.6E-05 ##	< 1 ##			1.1E-04	2.7
Current Adult Recreational User	9.9E-06	< 1	3.8E-05 #	< 1 #	1.2E-05 #	< 1 #			4.8E-05	< 1
Future Adult Recreational User	9.9E-06	< 1	3.8E-05 @	< 1 @	9.7E-06 ##	< 1 ##			4.8E-05	< 1
Current Lifetime Recreational User	3.0E-05		1.3E-04 #		5.5E-05 #				1.6E-04	
Future Lifetime Recreational User	3.0E-05		1.3E-04 @		4.6E-05 ##				1.6E-04	
Current/Future Child Subsistence Fisher	1.9E-02	319							1.9E-02	319
Current/Future Subsistence Adult Fisher	1.8E-02	76							1.8E-02	76
Current/Future Lifetime Subsistence Fisher	3.7E-02								3.7E-02	
Current/Future Child Recreational Fisher	2.8E-03	47							2.8E-03	47
Current/Future Adult Recreational Fisher	2.6E-03	11							2.6E-03	11
Current/Future Lifetime Recreational Fisher	5.4E-03								5.4E-03	
Current Industrial Worker	2.5E-04	< 1	3.9E-04 ##	1.1 ##	1.6E-05 ##	< 1 ##	1.1E-05 #	< 1 #	6.4E-04	1.1
Current Construction Worker	1.0E-05	< 1	5.2E-05 ##	4.7 ##	2.3E-06 ##	< 1 ##	1.2E-06 ##	< 1 ##	6.2E-05	4.7
Future Industrial Worker	2.5E-04	< 1	3.9E-04 ##	1.1 ##	1.6E-05 ##	< 1 ##	7.9E-06 ##	< 1 ##	6.4E-04	1.1
Future Construction Worker	1.0E-05	< 1	5.2E-05 ##	4.7 ##	2.3E-06 ##	< 1 ##	1.2E-06 ##	< 1 ##	6.2E-05	4.7

YELLOW HIGHLIGHT -- Cancer risk exceeds 1E-04 or noncancer hazard index exceeds 1.0.
GREY HIGHLIGHT -- Not applicable to this receptor.
* -- Cancer risks represent the cumulative risk from exposure to all chemicals of potential concern (COPCs).
** -- Non-cancer hazards represent the maximum hazard index (HI) for any target organ effect from all COPCs. This could be a different target organ for each media and pathway.
*** -- "Total risks excluding soil" is the sum of the highest risk combination of pathways including groundwater exposure, plus one soil gas zone, plus one surface water zone.
The soil gas risk pathway includes either Zone 1, 2, or 3, whichever has the highest risk, separately for non-cancer hazards and cancer risks. The surface water pathway includes either Tinicum Marsh or Lower Darby/Cobbs Creek, whichever has the highest total of risks from surface water contact, sediment contact, or fish consumption.
Total cancer risks less than 1E-04 were obtained from the Clearview LF RI RAGS D Table 9s, which contain risks for all COPCs selected in the human health risk assessment.
Total cancer risks greater than 1E-04 were obtained from Clearview LF RI RAGS D Table 10s using only risk drivers.
Non-cancer hazards greater than a HI of 1.0 for the target organ with the maximum HI were obtained from Clearview LF RI RAGS D Table 10s using only risk drivers.
-- It is assumed this receptor could be exposed to surface soil.
-- This receptor could be exposed to total soil, comprised of a mixture of surface soil and subsurface soil that has been disturbed and redistributed.
@ -- This receptor is only expected to be exposed to Zone 1 surface soil because subsurface soil in the landfill area would not be disturbed and left accessible at the surface.

Table 18. BERA Toxicity Reference Values
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Bird		Mammal	
	NOAEL	LOAEL	NOAEL	LOAEL
Inorganics				
ANTIMONY	NA	NA	0.062	0.62
ARSENIC	1.6	2.3	1.91	9.63
BERYLLIUM	NA	NA	0.62	NA
CADMIUM	0.85	3.4	0.23	2.3
CHROMIUM, HEXAVALENT	10.2	102.3	5.68	56.8
CHROMIUM, TOTAL	1	5	5.68	56.8
COPPER	26.9	33.2	24.3	35.4
LEAD	1.5	15	8	80
MANGANESE	977	NA	21	71
MERCURY	0.0051	0.051	0.032	0.16
NICKEL	57.2	79	0.13	1.33
SELENIUM	0.4	0.8	0.025	0.25
SILVER	3.97	39.7	0.27	2.7
THALLIUM	0.12	1.2	0.074	0.74
VANADIUM	0.82	2	0.5	5
ZINC	55.4	118.4	22.5	225
PCBs				
PCB-1242 (AROCHLOR 1242)	0.36	0.71	0.05	0.1
PCB-1254 (AROCHLOR 1254)	0.094	0.94	0.01	0.1
PCB-1260 (AROCHLOR 1260)	0.094	0.94	0.05	0.1
TOTAL PCBs	0.094	0.94	0.05	0.1
Pesticides				
ALDRIN	0.045	0.445	0.0081	0.015
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE	6.9	69	0.1	1
ALPHA ENDOSULFAN	116	125.5	10	15
BETA BHC (BETA HEXACHLOROCYCLOHEXANE	6.9	69	0.53	2.63
BETA ENDOSULFAN	116	125.5	10	15
DIELDRIN	0.045	0.445	0.0081	0.015
ENDOSULFAN SULFATE	116	125.5	10	15
ENDRIN	0.01	0.101	0.088	0.88
ENDRIN ALDEHYDE	0.01	0.101	0.088	0.88
ENDRIN KETONE	0.01	0.101	0.088	0.88
GAMMA-CHLORDANE	2.48	12.4	0.3	3
HEPTACHLOR	4.51	5.57	0.138	1.38
HEPTACHLOR EPOXIDE	4.51	5.57	0.138	1.38
METHOXYCHLOR	NA	NA	25	50
P,P-DDD	0.083	0.83	0.5	5
P,P-DDE	0.077	0.77	0.152	1.52
P,P-DDT	0.25	2.49	0.152	1.52
DDT, TOTAL	0.083	0.83	0.152	1.52
CHLORDANE, TOTAL	2.48	12.4	0.3	3
ENDOSULFAN, TOTAL	116	125.5	10	15
LINDANE (GAMMA BHC)	6.9	69	0.1	1
Semivolatile Organic Compounds				
2,6-DINITROTOLUENE	5	15	3.9	34
2-METHYLNAPHTHALENE	NA	NA	NA	NA
2-METHYLPHENOL (O-CRESOL)	NA	NA	NA	NA
2,4,5-TRICHLOROPHENOL	NA	NA	NA	NA
2,4-DIMETHYLPHENOL	NA	NA	NA	NA
4-METHYLPHENOL (P-CRESOL)	NA	NA	NA	NA
BENZYL BUTYL PHTHALATE	NA	NA	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	44.1	91.1
DIBENZOFURAN	0.0001	0.001	0.00015	0.0015
Semivolatile Polyaromatic Hydrocarbons				
HIGH MOLECULAR WEIGHT POLYAROMATIC HYDROCARBONS	2	20	1	10
low MOLECULAR WEIGHT POLYAROMATIC HYDROCARBONS	445	NA	30	300
Volatile OrganicCompounds				
ACETONE	6000	NA	NA	NA
ISOPROPYLBENZENE (CUMEME)	NA	NA	NA	NA
TOLUENE	NA	NA	NA	NA

All values in milligram per kilogram (mg/kg) dry weight
NA - not available

Table 19. BERA Sampling Locations by Area for Environmental Media
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Sampling Areas	Environmental Media	Sampling Designations	Map Designations
Reference Area: Upper Darby & Cobbs Creeks	Surface Water and Sediments	SW/SD01, SW/SD02, SW/SD03, SW/SD04, SW/SD05, SW/SD06, SW/SD07, SW/SD08, SW/SD11, SW/SD12, SW/SD13, SW/SD14, SW/SD15, SW/SD16, SW/SD17, SW/SD18	See Figure 2-4 (TetraTech 2006)
Lower Darby Creek	Surface Water and Sediments	SW/SD09, SW/SD10, SW/SD19, SW/SD20, SW/SD21, SW/SD22, SW/SD23, SW/SD24, SW/SD25, SW/SD26, SW/SD27, SW/SD28, SW/SD29	See Figure 2-4 (TetraTech 2006)
Tinicum Marsh: Tidal Marsh Habitat	Surface Water and Sediments	SW/SD30, SW/SD31, SW/SD34, SW/SD35, SW/SD37	See Figure 2-4 (TetraTech 2006)
Impoundment Area	Surface Water and Sediments	SW/SD32, SW/SD33, SW/SD36, SW/SD38	See Figure 2-4 (TetraTech 2006)
Clearview Landfill - Business Area	Surface Soil	LD-GP233, LD-GP234, LD-GP236, LD-GP238, LD-GP240, LD-GP242, LD-GP244, LD-GP245, LD-GP246, LD-GP248, LD-GP249, LD-GP250, LD-GP251, LD-GP253	See Figure 3-2 (TetraTech 2006)
Clearview Landfill - Wooded and Shrub Areas	Surface Soil	LD-GP034, LD-GP035, LD-GP036, LD-GP037, LD-GP039, LD-GP040, LD-GP067, LD-GP211, LD-GP214, LD-GP216, LD-GP217, LD-GP218, LD-GP219, LD-GP220, LD-GP221, LD-GP222, LD-GP224, LD-GP225, LD-GP226, LD-GP227, LD-GP228, LD-GP229, LD-GP230, LD-GP232, LD-GP235, LD-GP247	See Figure 3-2 (TetraTech 2006)
City Park	Surface Soil	GP018, GP019, GP020, GP021, GP022, GP023, GP024, GP025, GP026,GP027, GP028, GP029, GP030, GP031, GP032, GP033, GP041, GP038, GP081	See Figure 3-2 (TetraTech 2006)
Clearview Landfill Seeps/Leachate	Seep Water and Sediments	LD/LS01, LD/LS02, LD/LS03, LD/LS04, LD/LS05	See Figure 2-4 (TetraTech 2006)
Clearview Landfill	Groundwater	108 Locations	

Table 20. BERA COPCs Retained for Instream Sediments by Location
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Lower Darby Creek Stations Adjacent to Site			Tidal Marsh Open Water Area			Non-Tidal Marsh Impoundment Area			Reference Stations Upper Darby and Cobbs Creek		
COPCs	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples
Inorganics												
ARSENIC	7.5	20	0	**15.1**	5	0	13	5	0	8.1	18	0
BERYLLIUM	3.2	20	5	**4.1**	5	1	3.9	5	0	1.2	18	13
MERCURY	0.6	20	1	0.43	5	0	U (0.5)	5	5	**1.8**	18	6
SELENIUM	2.8	20	10	3.5	5	0	3.6	5	2	**6.8**	18	6
SILVER	1.4	20	11	1.9	5	0	U (16)	5	5	**2.2**	18	12
THALLIUM	3.6	20	7	3.2	5	1	2.6	5	2	**4.1**	18	6
PCBs												
PCB-1260 (AROCLOR 1260)	**0.39**	19	18	U (0.1179)	6	6	U (0.165)	5	5	0.15	18	17
Pesticides												
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	U (0.0059)	19	19	0.0034	6	5	U (0.0085)	5	5	**0.055**	18	17
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.0033	19	15	0.0092	6	5	U (0.0085)	5	5	**0.057**	18	13
DIELDRIN	0.055	19	2	0.067	6	1	U (0.0165)	5	5	**0.23**	18	
ENDOSULFAN SULFATE	**0.021**	19	16	U (0.0118)	6	6	U (0.0165)	5	5	0.0045	18	17
HEPTACHLOR	**0.0013**	19	18	U (0.0061)	6	6	U (0.0085)	5	5	U (0.0059)	18	18
HEPTACHLOR EPOXIDE	**0.0089**	19	3	0.0066	6	2	U (0.0085)	5	5	0.0056	18	8
P,P-DDD	**0.03**	19	13	0.033	6	2	0.022	5	1	0.02	18	11
P,P-DDE	0.013	19	8	0.02	6	0	**0.022**	5	0	0.015	18	5
P,P-DDT	**0.02**	19	11	0.0024	6	5	0.016	5	4	0.004	18	17
Semi-Volatile Organic Compounds												
2-METHYLPHENOL (O-CRESOL)	**0.045**	19	18	U (3.0)	6	6	0.15	5	5	U (3.413)	18	18
2,4-DIMETHYLPHENOL	**0.037**	19	18	U (3.0)	6	6	U (1.65)	5	4	U (3.413)	18	18
4-METHYLPHENOL (P-CRESOL)	4.2	19	7	**5.6**	6	1	0.15	5	0	3.8	18	
BIS(2-ETHYLHEXYL) PHTHALATE	6.4	19	0	9.9	6	0	1.4	5	0	**18**	18	
DIBENZOFURAN	**1.5**	19	3	0.15	6	1	0.029	5	3	0.5	18	
Volatile Organic Compounds												
ACETONE	0.077	14	4	0.14	5	1	0.047	5	0	**0.15**	18	12
TOLUENE	1.7	14	2	**6.1**	5	1	0.004	5	2	5.6	18	6

mg/kg - milligrams per kilogram dry weight
COPC - Contaminants of Potential Concern
U - Undetected at the Reporting Limit in parenthesis
(#) - number of undetected samples
Number in bolded font is maximum concentration determined for that COPC amongst all four sampling locations

Table 21. BERA COPCs Retained for Surface Water by Location
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Lower Darby Creek Stations Adjacent to Site			Tidal Marsh Open Water Area			Non-Tidal Marsh Impoundment Area			Reference Stations Upper Darby and Cobbs Creek		
COPCs	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples
Inorganics												
CADMIUM	0.022	14	11	U	5	5	U	5	5	U	18	18
ZINC	0.072	14	9	0.008	5	1	0.023	5	0	0.048	18	11

mg/L - milligrams per liter
COPC - Contaminants of Potential Concern
U - Undetected at the Reporting Limit in parenthesis
(#) - number of undetected samples

Table 22. BERA COPCs Retained for Soils by Location
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Clearview Landfill: Business Area			Clearview Landfill: Wooded and Shrub Area			City Park		
COPCs	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples
Inorganics									
ANTIMONY	968	16	10	10	28	21	5	22	12
BERYLLIUM	1.4	16	0	1.3	28	0	0.92	22	0
CADMIUM	95.2	16	1	12.1	28	5	2.7	22	14
CHROMIUM, TOTAL	90.1	16	0	353	28	0	67.7	22	0
COPPER	2620	16	0	366	28	0	282	22	0
LEAD	1060	16	0	681	28	0	8540	22	0
MANGANESE	828	16	0	638	28	0	668	22	0
MERCURY	0.68	16	4	2.7	28	2	3.2	22	0
NICKEL	226	16	0	85.8	28	0	41.4	22	0
SILVER	21.9	16	11	4.2	28	24	4	22	17
VANADIUM	50.1	16	1	76.9	28	0	57.6	22	0
ZINC	2510	16	0	3740	28	0	1110	22	0
PCBs									
PCB-1242 (AROCLOR 1242)	U	15	15	U	26	26	1.7	18	15
PCB-1254 (AROCLOR 1254)	U	15	15	6.1	26	21	0.14	18	16
PCB-1260 (AROCLOR 1260)	5.2	15	2	31	26	9	0.39	18	11
Pesticides									
ALDRIN	0.015	16	15	0.11	26	24	0.033	18	15
ALPHA ENDOSULFAN	0.014	16	12	0.0075	26	18	U	18	18
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.0047	16	13	0.015	26	18	0.016	18	16
BETA ENDOSULFAN	0.063	16	2	0.0072	26	14	U	18	18
ENDOSULFAN SULFATE	0.1	16	8	0.015	26	14	0.0069	18	17
ENDRIN ALDEHYDE	0.05	16	7	0.017	26	12	0.028	18	16
GAMMA-CHLORDANE	0.092	16	4	0.28	26	3	0.037	18	7
METHOXYCHLOR	0.03	16	5	0.46	26	11	0	18	18
P,P-DDD	0.13	16	2	0.68	26	6	0.035	18	13
P,P-DDE	0.21	16	5	0.14	26	7	0.018	18	11
P,P-DDT	0.45	16	0	0.61	26	1	0.02	18	12
Semi-Volatile Organic Compounds									
2,6-DINITROTOLUENE		16	16	6.8	26	25	U	18	18
BENZYL BUTYL PHTHALATE	1.9	16	12	2.5	26	21	0.075	18	17
BIS(2-ETHYLHEXYL) PHTHALATE	3.3	16	6	5.7	26	11	2.7	18	4
Semi-Volatile PAHs									
ACENAPHTHENE	0.46	16	9	3.5	26	12	1.2	18	11
ACENAPHTHYLENE	0.36	16	14	0.33	26	22	0.27	18	15
ANTHRACENE	1.7	16	7	7.5	26	5	1.7	18	6
BENZO(A)ANTHRACENE	3.6	16	2	14	26	1	5.7	18	3
BENZO(A)PYRENE	2.4	16	0	11	26	1	4	18	3
BENZO(B)FLUORANTHENE	3.7	16	0	13	26	1	3.3	18	3
BENZO(G,H,I)PERYLENE	1.5	16	2	5.4	26	3	2.9	18	3
BENZO(K)FLUORANTHENE	1.4	16	2	6.1	26	1	4	18	3
CHRYSENE	3.3	16	2	13	26	1	5.7	18	3
DIBENZ(A,H)ANTHRACENE	0	16	16	0.72	26	22	1.4	18	12
FLUORANTHENE	8.9	16	1	27	26	1	11	18	2
FLUORENE	1	16	9	4.3	26	11	0.67	18	12
INDENO(1,2,3-C,D)PYRENE	1.6	16	4	5.6	26	3	2.9	18	3
NAPHTHALENE	0	16	14	2.3	26	18	0.1	18	16
PHENANTHRENE	5.3	16	3	24	26	1	6.9	18	3
PYRENE	8.7	16	0	25	26	1	9.9	18	2

mg/kg - milligrams per kilogram dry weight
COPC - Contaminants of Potential Concern
(#) - number of undetected samples

Table 23. BERA COPCs Retained for the BERA for Seep Water and Sediments
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Seep Water	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples	Seep Sediments	Maximum Concentration (mg/kg)	# of Samples	# of Undetected Samples
Inorganics								
ANTIMONY	X	0.0037	12	8				
ARSENIC					X	9.2	11	0
BERYLLIUM	X	0.0151	12	6				
CADMIUM	X	0.0245	12	6	X	1.2	11	2
CHROMIUM, TOTAL					X	65.4	11	0
COPPER	X	3.04	12	1	X	153	11	0
LEAD	X	7.27	12	4	X	335	11	0
MERCURY	X	0.0544	12	1	X	1.5	11	0
NICKEL	X	0.249	12	1	X	27.7	11	0
SELENIUM	X	0.0074	12	6	X	3.4	11	4
ZINC	X	6.07	12	3	X	520	11	0
Pesticides								
DIELDRIN					X	0.06	11	2
ENDRIN					X	0.02	11	8
P,P-DDD					X	0.11	11	3
P,P-DDE					X	0.031	11	4
P,P-DDT					X	0.067	11	4
Semi-Volatile Organic Compounds								
BIS(2-ETHYLHEXYL) PHTHALATE					X	3	11	0
Semi-Volatile PAHs								
ACENAPHTHENE					X	0.43	11	4
ACENAPHTHYLENE					X	0.071	11	9
ANTHRACENE					X	0.87	11	3
BENZO(A)ANTHRACENE					X	3.7	11	0
BENZO(A)PYRENE					X	3.5	11	0
BENZO(B)FLUORANTHENE					X	3.8	11	0
BENZO(G,H,I)PERYLENE					X	2.4	11	0
BENZO(K)FLUORANTHENE					X	3.2	11	0
CHRYSENE					X	4.4	11	0
DIBENZ(A,H)ANTHRACENE					X	0.38	11	2
FLUORANTHENE					X	8.6	11	0
FLUORENE					X	0.24	11	5
INDENO(1,2,3-C,D)PYRENE					X	2.3	11	0
PHENANTHRENE					X	5.1	11	0
PYRENE					X	7.8	11	0
Volatile Organic Compounds								
ACETONE					X	0..03		2

X = COPC Retained
mg/kg - milligrams per kilogram dry weight
COPC - Contaminants of Potential Concern

(#) - number of undetected samples
mg/L - milligrams per Liter

Table 24. BERA COPCs Retained for Groundwater
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples
Inorganics			
ANTIMONY	0.271	105	77
CADMIUM	0.109	105	57
LEAD	26.5	105	32
MERCURY	0.0362	105	47
SELENIUM	0.0515	105	89
SILVER	0.13	105	70
ZINC	26.3	105	19
PCBs			
PCB-1260 (AROCLOR 1260)	0.012	75	70
Pesticides			
ENDRIN KETONE	0.0016	106	93
Semi-Volatile Organic Compounds			
2-METHYLNAPHTHALENE	0.027	120	93
DIBENZOFURAN	0.009	120	96
Semi-Volatile PAHs			
ACENAPHTHENE	0.014	120	79
BENZO(A)PYRENE	0.011	120	104
BENZO(B)FLUORANTHENE	0.015	120	102
BENZO(G,H,I)PERYLENE	0.0059	120	109
BENZO(K)FLUORANTHENE	0.016	120	105
CHRYSENE	0.012	120	103
DIBENZ(A,H)ANTHRACENE	0.0018	120	118
INDENO(1,2,3-C,D)PYRENE	0.0054	120	111
PYRENE	0.029	120	88
Volatile Organic Compounds			
ISOPROPYLBENZENE (CUMENE)	0.015	130	95

(#) - number of undetected samples mg/L - milligrams per Liter

Table 25. BERA *Lumbriculus variegatus* Bioaccumulation Tissue Data
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Sample Location	Background			SD19			SD22			SD24			SD25			SD28			SD30		
Sample Number	MC0039	MC0390	Mean	MC0041	MC0410	Mean	MC0042	MC0420	Mean	MC0043	MC0430	Mean	MC0044	MC0440	Mean	MC0045	MC0450	Mean	MC0038	MC0380	Mean
Metals																					
ALUMINUM	248	367	307.5	1010	905	957.5	1780	1420	1600	341	292	316.5	795	457	626	375	389	382	505	679	592
ANTIMONY	U	U	U	U	U	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
ARSENIC	U	8.5	8.5*	U	U	U	9.9	U	9.9*	4	3.2	3.6	10.6	11.8	11.2	U	U	U	12.6	9.6	11.1
BARIUM	301	351	326	374	337	355.5	334	335	334.5	421	327	374	409	374	391.5	327	278	302.5	300	269	284.5
BERYLLIUM	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CADMIUM	0.1	0.28	0.19	0.64	0.51	0.575	3	1.7	2.35	U	U	U	0.2	0.17	0.185	0.2	0.48	0.34	0.13	U	U
CALCIUM	1050	1210	1130	1920	1640	1780	2590	1540	2065	1320	1210	1265	1750	1390	1570	1120	1460	1290	1550	1540	1545
CHROMIUM	2.3	2.4	2.35	4.5	6.7	5.6	11.2	7.3	9.25	4.1	3.1	3.6	4.3	4	4.15	2.8	3.1	2.95	3.5	6.1	4.8
COBALT	0.86	1.4	1.13	2.8	2.1	2.45	3.9	2.1	3	2	1.6	1.8	2	2	2	1.4	2	1.7	2.1	1.8	1.95
COPPER	46.4	46.9	46.65	56.7	53.8	55.25	124	86	105	41	34.7	37.85	51.6	45	48.3	42.5	58.8	50.65	54.2	37.7	45.95
IRON	1920	2340	2130	3640	3440	3540	4090	3300	3695	2730	2320	2525	3390	2610	3000	2400	2380	2390	2530	2710	2620
LEAD	7.2	9.2	8.2	22.6	19.7	21.15	39.6	22.6	31.1	7.7	6.7	7.2	19.1	9.6	14.35	8.4	8.7	8.55	11.5	14.5	13
MAGNESIUM	899	1030	964.5	1300	1120	1210	1670	1230	1450	1040	1010	1025	1190	1100	1145	1040	1360	1200	1130	1040	1085
MANGANESE	18.6	22.8	20.7	66.7	58	62.35	80.4	55.3	67.85	25	25.6	25.3	49.9	32.4	41.15	24.2	25.5	24.85	52.2	56.1	54.15
MERCURY	U	U	U	U	U	U	0.6	0.55	0.575	U	U	U	U	U	U	U	U	U	U	U	U
NICKEL	2.2	2.3	2.25	4.1	4.7	4.4	6	3.3	4.65	3.5	2.7	3.1	3.8	3.6	3.7	2.3	3.7	3	3.6	3.9	3.75
POTASSIUM	8790	9150	8970	10100	8590	9345	14300	9260	11780	9800	9740	9770	10300	11000	10650	10200	14800	12500	11500	9200	10350
SELENIUM	4.9	3.6	4.25	6.7	6.6	6.65	7.8	4.2	6	6.5	8.4	7.45	5.2	6.5	5.85	4.2	6.9	5.55	5.7	5.8	5.75
SILVER	U	U	U	U	1	1*	1.6	0.88	1.24	0.72	U	0.72*	U	1.4	1.4*	U	U	U	0.79	1	0.895
SODIUM	3830	4090	3960	4830	4030	4430	6950	4430	5690	4250	4180	4215	5020	5090	5055	4390	6270	5330	5280	4460	4870
THALLIUM	U	U	U	U	U	U	U	U	U	U	U		U	U	U	U	U	U	U	U	U
VANADIUM	0.58	1.3	0.94	4.4	4	4.2	10.9	5.9	8.4	1.7	1.4	1.55	3.7	2.1	2.9	1.1	1.3	1.2	2.9	3.1	3
ZINC	167	190	178.5	223	199	211	228	183	205.5	213	177	195	238	210	224	197	207	202	190	165	177.5
Semi-Volatile Organic Compounds																					
BIS(2-ETHYLHEXYL)PHTHALATE	U	U	U	U	1.9	1.9*	U	U	U	U	U	U	2.2	U	2.2*	U	13	13*	U	2.3	2.3*
PCB Compounds																					
AROCLOR 1260	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.55	0.55*
Pesticides																					
ALDRIN	0.02	0.017	0.0185	0.027	U	0.027*	0.012	0.012	0.012	0.014	U	0.014*	U	0.01	0.01*	0.015	U	0.015*	U	0.011	0.011*
BETA-BHC	U	U	U	0.015	U	0.015*	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
GAMMA-BHC (LINDANE)	U	0.015	0.015*	U	0.016	0.016*	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
HEPTOCHLOR EPOXIDE	0.019	0.022	0.0205	0.049	0.018	0.0335	0.023	0.026	0.0245	0.034	0.3	0.167	0.032	0.028	0.03	U	0.017	0.017*	0.031	0.042	0.0365
DIELDRIN	0.1	U	0.1*	0.11	0.094	0.102	0.026	0.037	0.0315	0.18	0.2	0.19	0.2	0.21	0.205	0.071	U	0.071*	0.18	0.021	0.1005
DDE	0.035	0.031	0.033	0.041	0.03	0.0355	0.3	0.32	0.31	0.051	0.052	0.0515	0.056	U	0056*	0.033	0.042	0.0375	0.072	0.11	0.091
DDD	0.036	0.031	0.0335	0.038	0.038	0.038	0.16	0.15	0.155	0.039	0.041	0.04	0.039	0.042	0.0405	0.038	0.031	0.0345	0.048	0.068	0.058
DDT	U	U	U	U	U	U	0.28	0.32	0.3	U	U	U	U	U	U	U	U	U	U	U	U
ENDRIN	0.051	U	0.051*	0.088	U	0.088*	0.023	0.026	0.0245	0.059	0.044	0.0515	0.067	U	0.067*	0.041	U	0.041*	0.07	0.059	0.0645
ENDRIN ALDEHYDE	0.022	0.031	0.0265	0.022	U	0.022*	0.038	0.041	0.0395	0.019	0.023	0.021	0.023	0.019	0.021	0.025	U	0.025*	U	0.039	0.039*
ALPHA-CHLORDANE	0.074	0.076	0.075	0.078	0.045	0.0615	0.18	0.2	0.19	0.14	0.15	0.145	0.16	0.17	0.165	0.068	0.064	0.066	0.16	0.2	0.18
GAMMA-CHLORDANE	0.022	0.011	0.0165	0.027	0.051	0.039	0.046	0.012	0.029	0.034	0.1	0.067	0.05	0.052	0.051	0.069	0.021	0.045	0.1	0.08	0.09

mg/kg - milligram per kilogram dry weight
* maximum value - mean not calculated
U = undetected at Reporting Limit

Table 26. BERA Soil Invertebrates (Whole Body) Tissue Analyses
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Sample Location	BKG	GP021	GP031	GP032	GP081
Metals					
ALUMINUM	12600	8170	6680	5860	10400
ANTIMONY	1.4	1.4	0.92	1.5	1.5
ARSENIC	7.4	19.8	7.8	15.6	5
BARIUM	87.2	88.6	61.3	49.4	131
BERYLLIUM	U	0.17	0.16	0.25	0.17
CADMIUM	0.65	2.9	0.67	2.7	3.1
CALCIUM	2490	7910	3610	5020	3770
CHROMIUM	26.4	20	21.5	15.1	31.8
COBALT	10.2	8	6.2	5.3	9.2
COPPER	41.3	60.6	42	32.8	63.3
IRON	19000	14200	13100	11100	19800
LEAD	67.2	153	70.5	432	196
MAGNESIUM	4640	3260	3180	2140	2990
MANGANESE	240	384	293	171	378
MERCURY	0.14	0.56	0.18	0.43	0.23
NICKEL	17.5	14.4	13.5	11.1	17.3
POTASSIUM	11100	7450	6090	4290	3250
SELENIUM	U	4.2	U	2.2	1.2
SILVER	U	U	U	U	0.94
SODIUM	566	930	492	940	466
THALLIUM	U	U	U	U	U
VANADIUM	42.5	24.8	19.7	23.8	29.5
ZINC	183	339	152	238	348
Semi-Volatile Organic Compounds					
BENZALDEHYDE	U	U	0.54	U	U
PHENOL	U	U	0.73	U	U
4-METHYLPHENOL	U	U	1.8	U	U
PHENANTHRENE	U	0.38	0.71	U	0.37
FLUORANTHENE	U	0.69	0.9	U	0.82
PYRENE	U	0.65	1.6	U	0.9
BENZO(A)ANTHRACENE	U	0.31	0.59	U	0.37
CHRYSENE	U	0.3	0.69	U	0.39
BIS(2-ETHYLHEXYL)PHTHALATE	0.25	U	0.32	U	U
BENZO(b)FLUORANTHENE	U	0.19		U	0.27
BENZO(K)FLUORANTHENE	U	0.26		U	0.44
BENZO(A)PYRENE	U	0.24	0.7	U	0.34
BENZO(G,H,I)PERYLENE	U	U	0.2	U	U
PCB Compounds					
AROCLOR 1260	U	0.036	0.18	0.066	0.039
Pesticides					
ALDRIN	U	U	U	0.001	U
DELTA-BHC	0.003	U	0.081	U	U
HEPTOCHLOR EPOXIDE	U	U	0.0044	U	U
ENDOSULFAN I	0.0014	U	U	0.0092	0.003
ENDOSULFAN SULFATE	U	U	0.0057	U	U
METHOXYCHLOR	0.013	0.011	0.0094	U	U
DIELDRIN	U	0.0036	0.0027	U	0.0022
DDE	0.0072	0.0033	0.0023	U	U
DDT	U	0.0057	0.0092	U	0.0058
ENDRIN KETONE	0.012	0.0088	U	U	U
ALPHA-CHLORDANE	U	0.0016	U	U	U

All concentrations are in milligrams per kilogram (mg/kg) dry weight
U= Undetected
Analyses based on non-depurated invertebrates
Data derived from analytical report (Appendix G)

Table 27. BERA Earthworm 28-Day Bioaccumulation Tissue Analyses
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Sample Location	BKg			GP021			GP031			GP032			GP035			GP037			GP081		
Sample Number	MC0027	MC0270	Average	MC0030	MC0300	Average	MC031	MC0310	Average	MC032	MC0320	Average	MC033	MC0330	Average	MC0034	MC0340	Average	MC0035	MC0350	Average
Metals																					
ALUMINUM	1080	1550	1315	701	683	692	1040	1340	1190	388	424	406	546	286	416	466	363	414.5	555	512	533.5
ANTIMONY	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
ARSENIC	11.5	12.3	11.9	21.3	21.2	21.25	19.5	23.2	21.35	21.4	25.3	23.35	14.3	14.5	14.4	11.7	10.8	11.25	14.3	13.3	13.8
BARIUM	11.7	14.1	12.9	12.6	10.6	11.6	11.6	14.9	13.25	5.9	7.5	6.7	11.3	8.6	9.95	11.7	6.2	8.95	16.6	15.4	16
BERYLLIUM	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CADMIUM	3.5	3.5	3.5	7.7	7.2	7.45	4	4.6	4.3	1.7	2	1.85	1.8	1.8	1.8	2.8	2.6	2.7	3.9	4.1	4
CALCIUM	4100	3880	3990	4740	3790	4265	3580	4740	4160	3200	4350	3775	7740	6480	7110	6320	4900	5610	3950	4180	4065
CHROMIUM	3.4	4.1	3.75	2.8	2.8	2.8	3.8	4	3.9	3.1	3	3.05	3.3	2	2.65	2.9	2.2	2.55	3.9	3	3.45
COBALT	3.5	5.6	4.55	5.4	4.8	5.1	5.5	7.2	6.35	4.6	5.4	5	5.3	5.2	5.25	4.9	4.1	4.5	5.2	4.7	4.95
COPPER	15	16.2	15.6	20.6	19.9	20.25	16	18.5	17.25	15.2	19.2	17.2	29	24.9	26.95	26	21.1	23.55	22.8	23.9	23.35
IRON	2020	2750	2385	1560	1480	1520	2380	2960	2670	1090	1210	1150	1570	1010	1290	1670	1240	1455	1330	1170	1250
LEAD	10.1	10	10.05	19.8	16.5	18.15	12.2	14.6	13.4	106	134	120	9.4	7.7	8.55	12.3	9.5	10.9	20.2	16.9	18.55
MAGNESIUM	1240	1340	1290	1300	1080	1190	1160	1450	1305	971	1280	1125.5	2200	1550	1875	2570	2010	2290	1050	1090	1070
MANGANESE	29.7	36.8	33.25	36.2	30.9	33.55	53.4	64.8	59.1	19.4	24	21.7	38.6	31.1	34.85	31.4	22.6	27	32.6	29.6	31.1
MERCURY	U	U	U	0.56	0.46	0.51	0.27	0.29	0.28	U	0.28	0.28*	U	U	U	U	U	U	0.65	0.99	0.82
NICKEL	1.7	2.3	2	1.7	2	1.85	2.4	2.6	2.5	2.4	2.1	2.25	2.4	1.8	2.1	2.1	1.5	1.8	2	1.4	1.7
POTASSIUM	9710	10000	9855	9820	9180	9500	8830	10200	9515	8860	10200	9530	9460	9290	9375	8860	9150	9005	8950	9580	9265
SELENIUM	4.9	4.5	4.7	9.7	7.3	8.5	5.1	6.3	5.7	4.9	4.4	4.65	4.5	6	5.25	3.6	4.8	4.2	6.7	7.3	7
SILVER	0.69	0.44	0.565	0.66	0.71	0.685	U	U	U	0.6	0.71	0.655	0.69	0.84	0.765	0.91	U	0.91*	1.1	0.74	0.92
SODIUM	4890	5010	4950	5070	4980	5025	4730	5490	5110	4540	6290	5415	5980	4600	5290	5400	5170	5285	4710	5200	4955
THALLIUM	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
VANADIUM	3.8	5.2	4.5	2.3	2.4	2.35	3.1	3.9	3.5	3.1	3	3.05	2.5	1.6	2.05	2.7	1.9	2.3	2.1	1.5	1.8
ZINC	128	134	131	144	134	139	132	153	142.5	135	156	145.5	146	135	140.5	127	124	125.5	135	147	141
Semi-Volatile Organic Compounds																					
BENZALDEHYDE	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	12	U	U	13	13	13

All concentrations are in milligrams per kilogram (mg/kg) dry weight
U - Undetected at Reporting Limit
Tissue analyses based on depurated earthworms
Sampling locations designated GP021, GP031, GP032, and GP035 are located in City Park
Sampling locations designated GP035 and GP037are located in the Wooded and Shrub Areas of Clearview Landfill

Table 28. BERA *Hyalella Azteca* (42-Day) Chronic Sediment Toxicity Results
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Percent Survival			Growth Mean Dry Weight (mg)		Reproduction Mean # Young/ Female
Sample ID	28-day	35-day	42-day	28-day	42-day	35 and 42-day
Control	95	95	92.5	0.393	0.547	6.55
SD-Background	83.3	80	76.3	0.348	0.6	5.86
SD-19	90	88.8	83.8	0.286	0.502	5.62
SD-22	63.6*	66.3*	62.5*	NA	NA	NA
SD-24	80.8*	81.3	78.8	0.414	0.546	5.51
SD-25	90	77.5	75	0.354	0.547	5.32
SD-28	70.8*	68.8*	62.5*	NA	NA	NA
SD-30	85.8*	83.8*	81.3*	NA	NA	NA

* Significantly different when compared with control
NA - Not applicable due to reduced survival results

Table 29. BERA *Chironomus Tentans* (Life Cycle) Chronic Sediment Toxicity Results
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Percent Survival**	Growth Mean Dry Weight (mg) ***	Total Emergence of Adults	Reproduction Total # of Eggs / Female
Sample ID	Day 20	Day 20		
Control	81.3	1.41	67	965
SD-Background	58.3*	NA	NA	NA
SD-19	95.8	1.36	77	918
SD-22	91.7	1.54	76	945
SD-24	85.4	1.3	67	742*
SD-25	85.4	1.37	74	662*
SD-28	83.3	1.4	73	901
SD-30	89.6	1.86	76	1012

* Significantly different when compared with control
** Final Live Count includes larvae, pupae, and emerged adults
*** Only surviving larvae were used for dry weight data.

NA - not applicable due to reduced survival results
mg - milligrams

Table 30. BERA Earthworm (*Eisenia fetida*) 28-Day Soil Toxicity Results
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	28-Day Results	
Sample ID	Percent Survival	Total Depurated Weight (gm)[2]
Control	96.7	40.46
Soil-Background	90.6	43.03
GP021	95	43.58
GP031	96.2	44.63
GP032	81.7	36.55
GP035	96.2	42.17
GP037	90.8	39.51
GP081	96.1	42.54

2. Depurated Weight = Final weight of organisms after depurating over night in moist paper towels; total weight of ten replicates

Samples GP021, 031,032 and 081 are from City Park
Samples GP035 and 037 are from the Wooded and Shrub area

Table 31. BERA Fathead Minnow (*Pimephales promelas*) 96-Hour Static Renewal Toxicity Test Results
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Sampling Stations		
	LC02	LC05	SW22
Test Concentrations	96-Hour Percent Survival		
Control	90	90	90
25%	95	90	90
50%	85	90	95
100%	95	95	85
	96-Hour LC_{50}		
	>100%	>100%	>100%

96-Hour LC_{50} - Lethal Concentration Causing 50% Mortality

Table 32. BERA Summary of Hazard Quotients for Aquatic Plants
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

COPCs	Benchmark Value (mg/kg)	Source of Benchmark	Lower Darby Creek		Tinicum Marsh		Impoundment Area		Reference Area		Location with Highest HQ and/or Maximum Concentration
			Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	
Inorganics											
ARSENIC	10	Efroymoson *et.al.*	7.5	0.75	15.1	**1.51**	13	**1.3**	8.1	0.81	Tinicum Marsh
BERYLLIUM	10	Efroymoson *et.al.*	3.2	0.32	4.1	0.41	3.9	0.39	1.2	0.12	All HQs<1.0
MERCURY	0.3	Efroymoson *et.al.*	0.6	**2**	0.43	**1.43**	U (0.5)	NC	1.8	**6**	Reference Area
SELENIUM	1	Efroymoson *et.al.*	2.8	**2.8**	3.5	**3.5**	3.6	**3.6**	6.8	**6.8**	Reference Area
SILVER	2	Efroymoson *et.al.*	1.4	0.7	1.9	0.95	U (16)	NC	2.2	**1.1**	Reference Area
THALLIUM	1	Efroymoson *et.al.*	3.6	**3.6**	3.2	**3.2**	2.6	**2.6**	4.1	**4.1**	Reference Area
PCBs											
PCB-1260 (AROCLOR 1260)	40	Efroymoson *et.al.*	0.39	0.00975	U (0.1179)	NC	U (0.165)	NC	0.15	0.00375	All HQs<1.0
Pesticides											
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.0025	EPA Region 4	U (0.0059)	NC	0.0034	**1.36**	U (0.0085)	NC	0.055	**22**	Reference Area
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.00398	EPA Region 5 ESL	0.0033	0.83	0.0092	**2.31**	U (0.0085)	NC	0.057	**14.3**	Reference Area
DIELDRIN	0.1	EPA Region 3	0.067	0.67	0.067	0.67	U (0.0165)	NC	0.23	**2.3**	Reference Area
ENDOSULFAN SULFATE	nb	nb	0.021	nb	U (0.0118)	nb	U (0.0165)	nb	0.0045	nb	Lower Darby Creek
HEPTACHLOR	1	EPA 1999	0.0013	0.0013	U (0.0061)	NC	U (0.0085)	NC	U (0.0059)	NC	All HQs<1.0
HEPTACHLOR EPOXIDE	0.1	EPA Region 3	0.0089	0.089	0.0066	0.066	U (0.0085)	NC	0.0056	0.056	All HQs<1.0
P,P-DDD	0.1	EPA Region 3	0.033	0.33	0.033	0.33	0.022	0.22	0.02	0.2	All HQs<1.0
P,P-DDE	0.1	EPA Region 3	0.013	0.13	0.02	0.2	0.022	0.22	0.015	0.15	All HQs<1.0
P,P-DDT	0.1	EPA Region 3	0.02	0.2	0.0024	0.024	0.016	0.16	0.004	0.04	All HQs<1.0
Semi-Volatile Organic Compounds											
2-METHYLPHENOL (O-CRESOL)	100	EPA Region 8	0.045	0.00045	U (3.0)	NC	0.15	0.0015	U (3.413)	NC	All HQs<1.0
2,4-DIMETHYLPHENOL	100	EPA Region 8	0.037	0.00037	U (3.0)	NC	U (1.65)	NC	U (3.413)	NC	All HQs<1.0
4-METHYLPHENOL (P-CRESOL)	0.1	EPA Region 3	4.2	**42**	5.6	**56**	0.15	**1.5**	3.8	**38**	Tinicum Marsh
BIS(2-ETHYLHEXYL) PHTHALATE	nb	nb	6.4	nb	9.9	nb	1.4	nb	18	nb	Reference Area
DIBENZOFURAN	nb	nb	1.5	nb	0.15	nb	0.029	nb	0.5	nb	Lower Darby Creek
Volatile Organic Compounds											
ACETONE	nb	nb	0.077	nb	0.14	nb	0.047	nb	0.15	nb	Reference Area
TOLUENE	200	Efroymoson *et.al.*	1.7	0.0085	6.1	0.03	0.004	0.00002	5.6	0.028	All HQs<1.0

Efroymoson *et.al* . 1997. Toxiclological Benchmarks for Screening Contaminants of Concern for Effects on Terrestrial Plants. ES/ER/TM-85/R3. Oak Ridge National Laboratory.
EPA Region 3. 2005. BTAG Screening Levels. (Draft).
EPA Region 4. 2002. Ecological Risk Assessment Bulletin, 2/11/2002. Waste Management Division Freshwater Surface Water Screening Values for Hazardous Waste Sites.
EPA Region 5, RCRA. 2003. Ecological Screening Levels. July 17, 2003.
EPA Region 8. 2001. DRAFT. Region VIII Supplemental Guidance for Ecological Risk Assessment. November, 2001.
EPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume III: Appendix E. EPA 530-D-99-001C.

Bold - HQ greater than or equal to 1
nb - No benchmarks
COPC - Contaminant of Potential Concern
U - Undetected at the Reporting Limit in paraenthesis
NC - Not Calculated

mg/kg - milligram per kilogram dry weight
HQ - Hazard Quotient
PCB - Polychlorinated Biphenyl

Table 33. BERA Summary of Hazard Quotients (HQ) for COPCs Retained for Groundwater
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

	Maximum Concentration (mg/L)	# of Samples	# of Undetected Samples	Benchmark Values (mg/L)	HQ	Source of Benchmarks
Inorganics						
ANTIMONY	0.271	105	77	0.03	**9.0**	EPA Regions 1,3,6,9
CADMIUM	0.109	105	57	0.00025	**436.0**	EPA 2002
LEAD	26.5	105	32	0.0025	**10600.0**	EPA 2002
MERCURY	0.0362	105	47	0.00077	**47.0**	EPA 2002
SELENIUM	0.0515	105	89	0.005	**10.3**	EPA 2002
SILVER	0.13	105	70	0.00008	**1625.0**	EPA Region 6
ZINC	26.3	105	19	0.12	**219.2**	EPA 2002
PCBs						
PCB-1260 (AROCLOR 1260)	0.012	75	70	0.0013	**9.2**	R9 FW
Pesticides						
ENDRIN KETONE	0.0016	106	93	nb	nb	nb
Semi-Volatile Organic Compounds						
2-METHYLNAPHTHALENE	0.027	120	93	0.0047	**5.7**	NYDEC FW chronic
DIBENZOFURAN	0.009	120	96	0.0037	**2.4**	EPA R9 FW
Semi-Volatile PAHs						
ACENAPHTHENE	0.014	120	79	0.0053	**2.6**	NYDEC FW chronic
BENZO(A)PYRENE	0.011	120	104	0.000014	**785.7**	EPA R9 FW
BENZO(B)FLUORANTHENE	0.015	120	102	0.000027	**555.6**	EPA 1999
BENZO(G,H,I)PERYLENE	0.0059	120	109	0.00764	0.8	R5 FW ESLs
BENZO(K)FLUORANTHENE	0.016	120	105	0.000027	**592.6**	EPA 1999
CHRYSENE	0.012	120	103	0.000027	**444.4**	EPA 1999
DIBENZ(A,H)ANTHRACENE	0.0018	120	118	0.000027	**66.7**	EPA 1999
INDENO(1,2,3-C,D)PYRENE	0.0054	120	111	0.000027	**200.0**	EPA 1999
PYRENE	0.029	120	88	0.0046	**6.3**	NYDEC FW chronic
Volatile Organic Compounds						
ISOPROPYLBENZENE (CUMENE)	0.015	130	95	0.0026	**5.8**	NYDEC FW chronic

nb = no benchmark
COPC = Contaminant of Potential Concern
HQ - Hazard Quotient
mg/L - milligram per Liter

NY FW chronic: NY DEC (New York State Department of Environmental Conservation), Division of Water. 1998. Technical and Operational Guidance Series (1.1.1). Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.
EPA R1 FW: Hierarchy: chronic Ambient Water Quality Criteria > ORNL Tier II values > ORNL lowest of LOEC's for Daphnids and Fish
EPA R6: TX state values. TNRCC (Texas Natural Resource Conservation Commission), Toxicology and Risk Assessment Section. December 2001. Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas.
EPA R9 FW: Hierarchy: chronic Ambient Water Quality Criteria > lowest of ORNL FW values. Howerver, R9 considers any and all appropriate benchmarks.
EPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume III: Appendix E. EPA 530-D-99-001C.
EPA. 2002. National Recommended Water Quality Criteria. EPA 822-R-02-047.
EPA Region 5, RCRA. 2003. Ecological Screening Levels. July 17, 2003.

Table 34. BERA Risk Description of Aquatic Feeding Birds and Mammals (Assessment Endpoint #6)
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Exposure Scenario	Exposure Type	Predicted Risk	Lower Darby Creek	Landfill Seeps	Upstream Reference Area
Aquatic Feeding (Invertivore) Birds					
Conservative, Model 1	Abiotic	At Risk	Dibenzofuran		Dibenzofuran
		Possible Risk		Pb, Hg	Hg
Conservative, Model 2	Total	At Risk	Hg, Se, Dibenzofuran	Hg, Se	Hg, Se, Dibenzofuran
		Possible Risk		Cr, Pb	
Representative, Model 3	Total	At Risk	Dibenzofuran		
		Possible Risk	Hg, Se	Pb, Hg, Se	Hg, Se, Dibenzofuran
Aquatic Feeding (Invertivore) Mammals					
Conservative, Model 1	Abiotic	At Risk	Dibenzofuran		Dibenzofuran
		Possible Risk		Ni	Se
Conservative, Model 2	Total	At Risk	Se, Dibenzofuran	Se	Se, Dibenzofuran
		Possible Risk	Hg, Dieldrin	Hg, Ni, Dieldrin	Hg, Dieldrin
Representative, Model 3	Total	At Risk			
		Possible Risk	Se, Dibenzofuran	Ni, Se	Se, Dibenzofuran

Hg = Mercury
Pb = Lead
Cr = Chromium
Se = Selenium
Ni = Nickel

HQ = Hazard Quotient
COPC = Contaminant of Potential Concern

NOAEL - No Observable Adverse Effects Level
LOAEL - Lowest Observable Adverse Effects Level

Blank cell indicates that no model-calculated risk was identified.
COPCs identified "At Risk" were based on model-calculated risk in which the HQs exceeded 1.0 for both the NOAEL-based and the LOAEL-based HQs.
COPCs identified as "Possible Risk" indicates that it cannot be concluded there is no model-calculated risk in which the HQs exceeded 1.0 for the NOAEL-based HQ but not the LOAEL-based HQ.

Table 35. BERA Summary of Hazard Quotients for Terrestrial Plants
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

COPCs	Benchmark Value (mg/kg)	Source of Benchmark	Landfill Business Area		Landfill Wooded/Shrub Areas		City Park		Sample Location with Highest HQ
			Maximum Concentration	Hazard Quotient (HQ)	Maximum Concentration	Hazard Quotient (HQ)	Maximum Concentration	Hazard Quotient (HQ)	
Inorganics									
ANTIMONY	5	Efroymson *et.al.*	968	**193.6**	10	**2.0**	5	**1.0**	Landfill Business Area
BERYLLIUM	10	Efroymson *et.al.*	1.4	0.1	1.3	0.1	0.92	0.1	All HQs<1.0
CADMIUM	4	Efroymson *et.al.*	95.2	**23.8**	12.1	**3.0**	2.7	0.7	Landfill Business Area
CHROMIUM, TOTAL	1	Efroymson *et.al.*	90.1	**90.1**	353	**353.0**	67.7	**67.7**	Landfill Wooded/Shrub Areas
COPPER	100	Efroymson *et.al.*	2620	**26.2**	366	**3.7**	282	**2.8**	Landfill Business Area
LEAD	50	Efroymson *et.al.*	1060	**21.2**	681	**13.6**	8540	**170.8**	City Park
MANGANESE	500	Efroymson *et.al.*	828	**1.7**	638	**1.3**	668	**1.3**	Landfill Business Area
MERCURY	0.3	Efroymson *et.al.*	0.68	**2.3**	2.7	**9.0**	3.2	**10.7**	City Park
NICKEL	30	Efroymson *et.al.*	226	**7.5**	85.8	**2.9**	41.4	**1.4**	Landfill Business Area
SILVER	2	Efroymson *et.al.*	21.9	**11.0**	4.2	**2.1**	4	**2.0**	Landfill Business Area
VANADIUM	2	Efroymson *et.al.*	50.1	**25.1**	76.9	**38.5**	57.6	**28.8**	Landfill Wooded/Shrub Areas
ZINC	50	Efroymson *et.al.*	2510	**50.2**	3740	**74.8**	1110	**22.2**	Landfill Wooded/Shrub Areas
PCBs									
PCB-1242 (AROCLOR 1242)	40	Efroymson *et.al.*	U	NC	U	NC	1.7	0.0	All HQs<1.0
PCB-1254 (AROCLOR 1254)	40	Efroymson *et.al.*	U	NC	6.1	0.2	0.14	0.0	All HQs<1.0
PCB-1260 (AROCLOR 1260)	40	Efroymson *et.al.*	5.2	0.1	31	0.8	0.39	0.0	All HQs<1.0
Pesticides									
ALDRIN	0.00332	EPA Region 5 ESL	0.015	**4.5**	0.11	**33.1**	0.033	**9.9**	Landfill Wooded/Shrub Areas
ALPHA ENDOSULFAN	nb	nb	0.014	nb	0.0075	nb	U	nb	ND
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.00398	EPA Region 5 ESL	0.0047	**1.2**	0.015	**3.8**	0.016	**4.0**	City Park
BETA ENDOSULFAN	nb	nb	0.063	nb	0.0072	nb	U	nb	ND
ENDOSULFAN SULFATE	nb	nb	0.1	nb	0.015	nb	0.0069	nb	ND
ENDRIN ALDEHYDE	nb	nb	0.05	nb	0.017	nb	0.028	nb	ND
GAMMA-CHLORDANE[a]	0.224	EPA Region 5 ESL	0.092	0.4	0.28	**1.3**	0.037	0.2	Landfill Wooded/Shrub Areas
METHOXYCHLOR	0.1	EPA Region 3	0.03	0.3	0.46	**4.6**	0	0.0	Landfill Wooded/Shrub Areas
P,P-DDD	0.1	EPA Region 3	0.13	**1.3**	0.68	**6.8**	0.035	0.4	Landfill Wooded/Shrub Areas
P,P-DDE	0.1	EPA Region 3	0.21	**2.1**	0.14	**1.4**	0.018	0.2	Landfill Business Area
P,P-DDT	0.1	EPA Region 3	0.45	**4.5**	0.61	**6.1**	0.02	0.2	Landfill Wooded/Shrub Areas
Semi-Volatile Organic Compounds									
2,6-DINITROTOLUENE	nb	nb	U	NC	6.8	nb	U	nb	ND
BENZYL BUTYL PHTHALATE	nb	nb	1.9	nb	2.5	nb	0.075	nb	ND
BIS(2-ETHYLHEXYL) PHTHALATE	nb	nb	3.3	nb	5.7	nb	2.7	nb	ND
Semi-Volatile PAHs									
ACENAPHTHENE	20	Efroymson *et.al.*	0.46	0.0	3.5	0.2	1.2	0.1	All HQs<1.0
ACENAPHTHYLENE	0.1	EPA Region 3	0.36	**3.6**	0.33	**3.3**	0.27	**2.7**	Landfill Business Area
ANTHRACENE	0.1	EPA Region 3	1.7	**17.0**	7.5	**75.0**	1.7	**17.0**	Landfill Wooded/Shrub Areas
BENZO(A)ANTHRACENE	1.2	EPA 1999	3.6	**3.0**	14	**11.7**	5.7	**4.8**	Landfill Wooded/Shrub Areas
BENZO(A)PYRENE	1.2	EPA 1999	2.4	**2.0**	11	**9.2**	4	**3.3**	Landfill Wooded/Shrub Areas
BENZO(B)FLUORANTHENE	1.2	EPA 1999	3.7	**3.1**	13	**10.8**	3.3	**2.8**	Landfill Wooded/Shrub Areas
BENZO(G,H,I)PERYLENE	0.1	EPA Region 3	1.5	**15.0**	5.4	**54.0**	2.9	**29.0**	Landfill Wooded/Shrub Areas
BENZO(K)FLUORANTHENE	1.2	EPA 1999	1.4	**1.2**	6.1	**5.1**	4	**3.3**	Landfill Wooded/Shrub Areas
CHRYSENE	1.2	EPA 1999	3.3	**2.8**	13	**10.8**	5.7	**4.8**	Landfill Wooded/Shrub Areas
DIBENZ(A,H)ANTHRACENE	1.2	EPA 1999	0	0.0	0.72	0.6	1.4	**1.2**	City Park
FLUORANTHENE	0.1	EPA Region 3	8.9	**89.0**	27	**270.0**	11	**110.0**	Landfill Wooded/Shrub Areas
FLUORENE	0.1	EPA Region 3	1	**10.0**	4.3	**43.0**	0.67	**6.7**	Landfill Wooded/Shrub Areas
INDENO(1,2,3-C,D)PYRENE	1.2	EPA 1999	1.6	**1.3**	5.6	**4.7**	2.9	**2.4**	Landfill Wooded/Shrub Areas
NAPHTHALENE	100	EPA Region 8	0	0.0	2.3	0.0	0.1	0.0	All HQs<1.0
PHENANTHRENE	100	EPA Region 8	5.3	0.1	24	0.2	6.9	0.1	All HQs<1.0
PYRENE	100	EPA Region 8	8.7	0.1	25	0.3	9.9	0.1	All HQs<1.0

a = Screening value is for total chlordane

Efroymson *et.al* . 1997. Toxiclological Benchmarks for Screening Contaminants of Concern for Effects on Terrestrial Plants. ES/ER/TM-85/R3. Oak Ridge National Laboratory.
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EPA Region 5, RCRA. 2003. Ecological Screening Levels. July 17, 2003.
EPA Region 8. 2001. DRAFT. Region VIII Supplemental Guidance for Ecological Risk Assessment. November, 2001.
EPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume III: Appendix E. EPA 530-D-99-001C.

Bold - HQ greater than or equal to 1
nb - No benchmarks
COPC - Contaminant of Potential Concern
U - Undetected at the Reporting Limit in paraenthesis
NC - Not Calculated
ND - Not Determined

mg/kg - milligram per kilogram
HQ - Hazard Quotient
PCB - Polychlorinated Biphenyl
PAH - Polycylic Aromatic Hydrocarbons

Table 36. BERA Summary of Hazard Quotients for Terrestrial Invertebrates
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

COPCs	Earthworm / Invertebrate Benchmark Value (mg/kg)	Source of Benchmark	Landfill Business Area		Landfill Wooded/Shrub Areas		City Park		Sample Location with Highest HQ
			Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	Maximum Concentration (mg/kg)	Hazard Quotient (HQ)	
Inorganics									
ANTIMONY	78	EPA 2003	968	**12.4**	10	0.1	5	0.1	Landfill Business Area
BERYLLIUM	1.1	EPA Region 4	1.4	**1.3**	1.3	**1.2**	0.92	0.8	Landfill Business Area
CADMIUM	20	Efroymson *et.al.*	95.2	**4.8**	12.1	0.6	2.7	0.1	Landfill Business Area
CHROMIUM, TOTAL	0.4	Efroymson *et.al.*	90.1	**225.3**	353	**882.5**	67.7	**169.3**	Landfill Wooded/Shrub Areas
COPPER	60	Efroymson *et.al.*	2620	**43.7**	366	**6.1**	282	**4.7**	Landfill Business Area
LEAD	500	Efroymson *et.al.*	1060	**2.1**	681	**1.4**	8540	**17.1**	City Park
MANGANESE	330	EPA Region 3	828	**2.5**	638	**1.9**	668	**2.0**	Landfill Business Area
MERCURY	0.1	Efroymson *et.al.*	0.68	**6.8**	2.7	**27.0**	3.2	**32.0**	City Park
NICKEL	200	Efroymson *et.al.*	226	**1.1**	85.8	0.4	41.4	0.2	Landfill Business Area
SILVER[c]	50	Efroymson *et.al.*	21.9	0.4	4.2	0.1	4	0.1	All HQs<1.0
VANADIUM	58	EPA Region 3	50.1	0.9	76.9	**1.3**	57.6	**1.0**	Landfill Wooded/Shrub Areas
ZINC	100	Efroymson *et.al.*	2510	**25.1**	3740	**37.4**	1110	**11.1**	Landfill Wooded/Shrub Areas
PCBs									
PCB-1242 (AROCLOR 1242)	5	EPA Region 8	U	NC	U	NC	1.7	0.3	All HQs<1.0
PCB-1254 (AROCLOR 1254)	2.51	EPA 1999	U	NC	6.1	**2.4**	0.14	0.1	Landfill Wooded/Shrub Areas
PCB-1260 (AROCLOR 1260)	5	EPA Region 8	5.2	**1.0**	31	**6.2**	0.39	0.1	Landfill Wooded/Shrub Areas
Pesticides									
ALDRIN	0.1	EPA Region 3	0.015	0.2	0.11	**1.1**	0.033	0.3	Landfill Wooded/Shrub Areas
ALPHA ENDOSULFAN	nb	nb	0.014	nb	0.0075	nb	U	nb	ND
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)[a]	100	EPA Region 3	0.0047	0.0	0.015	0.0	0.016	0.0	All HQs<1.0
BETA ENDOSULFAN	nb	nb	0.063	nb	0.0072	nb	U	nb	ND
ENDOSULFAN SULFATE	nb	nb	0.1	nb	0.015	nb	0.0069	nb	ND
ENDRIN ALDEHYDE	nb	nb	0.05	nb	0.017	nb	0.028	nb	ND
GAMMA-CHLORDANE[b]	0.1	EPA Region 3	0.092	0.9	0.28	**2.8**	0.037	0.4	Landfill Wooded/Shrub Areas
METHOXYCHLOR	0.1	EPA Region 3	0.03	0.3	0.46	**4.6**	0	0.0	Landfill Wooded/Shrub Areas
P,P-DDD	1.5	EPA Region 8	0.13	0.1	0.68	0.5	0.035	0.0	All HQs<1.0
P,P-DDE	0.1	EPA Region 3	0.21	**2.1**	0.14	**1.4**	0.018	0.2	Landfill Business Area
P,P-DDT	0.1	EPA Region 3	0.45	**4.5**	0.61	**6.1**	0.02	0.2	Landfill Wooded/Shrub Areas
Semi-Volatile Organic Compounds									
2,6-DINITROTOLUENE	nb	nb	U	nb	6.8	nb	U	nb	ND
BENZYL BUTYL PHTHALATE	nb	nb	1.9	nb	2.5	nb	0.075	nb	ND
BIS(2-ETHYLHEXYL) PHTHALATE	nb	nb	3.3	nb	5.7	nb	2.7	nb	ND
Semi-Volatile PAHs									
ACENAPHTHENE	0.1	EPA Region 3	0.46	**4.6**	3.5	**35.0**	1.2	**12.0**	Landfill Wooded/Shrub Areas
ACENAPHTHYLENE	0.1	EPA Region 3	0.36	**3.6**	0.33	**3.3**	0.27	**2.7**	Landfill Business Area
ANTHRACENE	0.1	EPA Region 3	1.7	**17.0**	7.5	**75.0**	1.7	**17.0**	Landfill Wooded/Shrub Areas
BENZO(A)ANTHRACENE	25	EPA 1999	3.6	0.1	14	0.6	5.7	0.2	All HQs<1.0
BENZO(A)PYRENE	25	EPA 1999	2.4	0.1	11	0.4	4	0.2	All HQs<1.0
BENZO(B)FLUORANTHENE	25	EPA 1999	3.7	0.1	13	0.5	3.3	0.1	All HQs<1.0
BENZO(G,H,I)PERYLENE	0.1	EPA Region 3	1.5	**15.0**	5.4	**54.0**	2.9	**29.0**	Landfill Wooded/Shrub Areas
BENZO(K)FLUORANTHENE	25	EPA 1999	1.4	0.1	6.1	0.2	4	0.2	All HQs<1.0
CHRYSENE	25	EPA 1999	3.3	0.1	13	0.5	5.7	0.2	All HQs<1.0
DIBENZ(A,H)ANTHRACENE	25	EPA 1999	0	0.0	0.72	0.0	1.4	0.1	All HQs<1.0
FLUORANTHENE	0.1	EPA Region 3	8.9	**89.0**	27	**270.0**	11	**110.0**	Landfill Wooded/Shrub Areas
FLUORENE	30	TNRCC 2001	1	0.0	4.3	0.1	0.67	0.0	All HQs<1.0
INDENO(1,2,3-C,D)PYRENE	25	EPA 1999	1.6	0.1	5.6	0.2	2.9	0.1	All HQs<1.0
NAPHTHALENE	5	EPA Region 8	0	0.0	2.3	0.5	0.1	0.0	All HQs<1.0
PHENANTHRENE	5	EPA Region 8	5.3	**1.1**	24	**4.8**	6.9	**1.4**	Landfill Wooded/Shrub Areas
PYRENE	10	EPA Region 8	8.7	0.9	25	**2.5**	9.9	**1.0**	Landfill Wooded/Shrub Areas

a = value cited for total BHC
b = value cited for total chlordane
c= Value based on microbial benchmark

Efroymson *et.al* . 1997. Toxiclological Benchmarks for Screening Contaminants of Concern for Effects on Soil and Litter Invertebrates and Hetertophic Process. ES/ER/TM-126/R2. Oak Ridge National Laboratory.
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EPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Volume III: Appendix E. EPA 530-D-99-001C.
EPA 2003. Ecological Soil Screening Level for Antimony. Interim Final. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response.

Bold - HQ greater than or equal to 1
nb - No benchmarks
COPC - Contaminant of Potential Concern
U - Undetected at the Reporting Limit in paraenthesis
NC - Not Calculated
ND - Not Determined

mg/kg - milligram per kilogram dry weight
HQ - Hazard Quotient
PCB - Polychlorinated Biphenyl

Table 37: Risk Description of Terrestrial Feeding Birds and Mammals (Assessment Endpoint #7)
Clearview Landfill / Lower Darby Creek Site
Delaware County, PA

Exposure Scenario	Exposure Type	Predicted Risk	Clearview Landfill: Business Area	Clearview Landfill: Wooded and Shrub Areas	City Park
Terrestrial Feeding (Invertivore) Birds					
Conservative, Model 1	Abiotic	At Risk	Cu, Pb		Pb
		Possible Risk	Cd, Cr, Hg	Cr, Pb, Hg, V	Cr, Hg, V
Conservative, Model 2	Total	At Risk	Cu, Pb, Hg	Cr, Pb, Hg	Pb, Hg
		Possible Risk	Cd, Cr, V	Cd, V, Zn, Aroclor 1260	Cd, Cr, V
Representative, Model 3	Total	At Risk	Pb, Hg	Pb, Hg	Pb, Hg
			Cd, Cr, Cu, V	Cr, V, Aroclor 1260	Cr, V
Terrestrial Feeding (Invertivore) Mammals					
Conservative, Model 1	Abiotic	At Risk	Sb, Cd, Cu, Ni, Aroclor 1260	Hg, Ni, Aroclor 1254, Aroclor 1260	Pb, Hg, Ni
		Possible Risk	Pb, Mn, Hg, Ag, V, Zn	Sb, Cd, Cr, Pb, Mn, V, Zn, HMW PAHs	Sb, Mn, V, Zn, Aroclor 1242
Conservative, Model 2	Total	At Risk	Sb, Cd, Cu, Pb, Mn, Hg, Ni, V, Aroclor 1260	Cd, Cu, Pb, Mn, Hg, Ni, V, Zn, Aroclor 1254, Aroclor 1260	Cd, Pb, Mn, Hg, Ni, V, Aroclor 1260
		Possible Risk	Cr, Ag, Zn, HMW PAHs	Sb, Cr, Ag, HMW PAHs	Sb, Cr, Cu, Ag, Zn, Aroclor 1242, HMW PAHs
Representative, Model 3	Total	At Risk	Sb, Cd, Hg, Ni	Hg, Ni, Aroclor 1260	Pb, Hg
		Possible Risk	Cu, Pb, Mn, Ag, V, Zn, Aroclor 1260	Sb, Cd, Pb, Mn, V, Zn, Aroclor 254, HMW PAHs	Cd, Mn, Ni, V, Zn

Cr = Chromium
Cd = cadmium
Cu = copper
Hg = mercury
Pb = lead
V = vanadium
Zn = zinc
Sb = antimony
Mn = manganese
Ni = nickel
HMW PAHs = High Molecular Weight Polycyclicaromatic Hydrocarbons

HQ = Hazard Quotient
COPC = Contaminant of Potential Concern

Blank cell indicates that no model-calculated risk was identified.
COPCs identified "At Risk" were based on model-calculated risk in which the HQs exceeded 1.0 for both the NOAEL-based and the LOAEL-based HQs.
COPCs identified as "Possible Risk" indicates that it cannot be concluded that there is no model-calculated risk in which the HQs exceeded 1.0 for the NOAEL-based HQ but not the LOAEL-based HQ.

NOAEL - No Observable Adverse Effects Level
LOAEL - Lowest Observable Adverse Effects Level

TABLE 38
CITY PARK (ZONE 2) SOIL SAMPLES WITH PRG EXCEEDANCES
LOWER DARBY CREEK AREA SITE: OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

SAMPLE LOCATION NO.	SAMPLE LOCATION BENEATH ASPHALT OR IMPENETRABLE SURFACE?	SUBSTANCES AT LEVELS GREATER THAN CONTROLLING PRGs AND BASIS FOR PRG SELECTION
GP-10	Yes	Aroclor-1260 (for human health and ecological protection)
GP-18	No	Zinc, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene (for human health protection)
GP-21	No	Lead, Zinc, Copper, Cadmium, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)pyrene, Dibenz(a,h)anthracene, Benzo(a)anthracene (for human health protection)
GP-22	No	Total PAHs (for ecological protection); Benzo(a)pyrene (for human health protection)
GP-24	No	Lead, Zinc, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)pyrene, Dibenz(a,h)anthracene, Benzo(a)anthracene (for human health protection)
GP-29	No	Benzo(a)pyrene (for human health protection)
GP-31	No	Cadmium, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene (for human health protection)
GP-32	Yes (1)	Lead (for ecological protection)
GP-33	No	Zinc, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)pyrene (for human health protection)
GP-34	No	Aroclor-1254, Aroclor-1260, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Aroclor-1254, Arohlor-1260 (for human health protection)
GP-35	No	Lead, Zinc, Copper, Cadmium, Aroclor-1260, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Aroclor-1260 (for human health protection)
GP-36	No (3)	Benzo(a)pyrene (for human health protection); Aroclor-1260 (for ecological protection)
GP-37	No	Aroclor-1254 (for human health protection); Aroclor-1254, Cadmium (for ecological protection)
GP-49	No (3)	Benzo(a)pyrene (for human health protection)
GP-67	No	Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(a)pyrene (for human health protection)
GP-81	No	Cadmium, Lead, Zinc, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)pyrene, Dibenz(a,h)anthracene (for human health protection)
GP-91	Yes (2)	Benzo(a)pyrene, Dibenz(a,h)anthracene (for human health protection); Cadmium, Total PAHs (for ecological protection)

TABLE 38
CITY PARK (ZONE 2) SOIL SAMPLES WITH PRG EXCEEDANCES
LOWER DARBY CREEK AREA SITE: OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

SAMPLE LOCATION NO.	SAMPLE LOCATION BENEATH ASPHALT OR IMPENETRABLE SURFACE?	SUBSTANCES AT LEVELS GREATER THAN CONTROLLING PRGs AND BASIS FOR PRG SELECTION
GP-94	Yes (2) (3)	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene (for human health protection)
GP-96	Yes (2)	Benzo(a)pyrene, Dibenz(a,h)anthracene (for human health protection); Cadmium (for ecological protection)
GP-98	Yes (2)	Cadmium (for ecological protection)
GP-247	No	Zinc (for ecological protection); Benzo(a)pyrene, Dibenz(a,h)anthracene (for human health protection)

(1) The GP-32 location would be beneath the cover which is part of the OU-1 remedy.

(2) Sample locations beneath asphalt or impenetrable surfaces will be risk-managed (except GP-10).

(3) Substances were detected above the controlling PRGs in subsurface soil samples only.

TABLE 39
EASTWICK NEIGHBORHOOD (ZONE 3) SOIL SAMPLES WITH PRG EXCEEDANCES
LOWER DARBY CREEK AREA SITE: OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

SAMPLE LOCATION NO.	SAMPLE LOCATION BENEATH ASPHALT OR IMPENETRABLE SURFACE?	SUBSTANCES AT LEVELS GREATER THAN CONTROLLING PRGs AND BASIS FOR PRG SELECTION
GP-2	Yes (1) (2)	Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluorancene (for human health protection)
GP-7	Yes (1)	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Benzo(a)pyrene (for human health protection); Total PAHs, HMW PAHs (for ecological protection)
GP-101	Yes (1)	Cadmium (for ecological protection)
GP-102	Yes (1)	Cadmium (for ecological protection)
GP-106	Yes (1)	Cadmium, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene (for human health protection)
GP-107	Yes (1)	Cadmium (for ecological protection)
GP-108	No	Cadmium, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene (for human health protection)
GP-109	Yes (1)	Cadmium, Total PAHs, HMW PAHs (for ecological protection); Benzo(a)pyrene, Dibenz(a,h)anthracene, Benzo(b)fluoranthene (for human health protection)
GP-110	Yes (1)	Cadmium (for ecological protection)

(1) With the exception of sample location GP-108, these sample locations will be risk-managed.

(2) Substance was detected above the controlling PRG in subsurface soil sample only.

TABLE 40
COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
LOWER DARBY CREEK AREA SITE OU-1
PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTIONS	ALTERNATIVE 3: SINGLE BARRIER CAP WITH FML	ALTERNATIVE 4: SINGLE BARRIER CAP WITH FML AND PARTIAL ET COVER	ALTERNATIVE 6: SOIL CAP	ALTERNATIVE 7: ET COVER
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT						
Protection of Human Health and the Environment	· Does not meet any landfill RAOs. · Does not reduce or increase risks, and does not increase protectiveness to human health and the environment. · Does not minimize contaminant migration from the landfill to the environment.	· Does not meet most of the landfill RAOs. · Security fence will deter access to landfill and prevent unacceptable human exposure to landfill waste and contaminated materials, but would not minimize the exposure of ecological receptors to contaminated materials. · ICs would minimize exposure to contaminated groundwater and restrict its potable use in the future. · Deed restrictions would prohibit and/or regulate future on-site development. · Does not minimize contaminant migration from the landfill to the environment. · Demolition and removal of the existing building and debris within the SIA would mitigate physical hazards associated with them. · Provides minimal reductions in risks and protectiveness for human health and the environment.	· Meets all landfill RAOs · Fully protective of human health and the environment through containment and all limited actions employed in Alternative 2. · Reduces risks to human health and the environment by preventing direct exposure of human and ecological receptors to landfill contaminants and wastes. · Reduces risks to human health and the environment by significantly reducing infiltration, thereby reducing leachate production and migration of contaminants to groundwater and off-site. · Human health and ecological risks are significantly reduced by excavating contaminated soils and wastes associated with the landfill, and consolidating them within and under the landfill cap to the extent practicable. · Security fences will deter access to the landfill as necessary. · ICs/deed restrictions would prohibit and/or regulate future on-site development and protect integrity of the remedy.	· Same as Alternative 3. · A partial ET cover encircling the perimeter of the landfill would minimize potential slope instability and slippage, especially the steep landfill slopes adjacent to the creeks.	· Same as Alternative 3, except the degree of reducing infiltration. · Infiltration of precipitation into landfill waste materials and subsequent leachate production would not be as significant as other cover systems employed in Alternatives 3, 4, and 7. However, much of the leachate seeps would be collected and treated.	· Same as Alternative 3. · Meets all landfill RAOs. · ET cover would minimize potential slope instability and slippage, especially the steep landfill slopes adjacent to the creeks. · Due to natural E&S controls by established robust plant community and lack of geosynthetic materials, the potential for cover failure and the resulting risks to human health and the environment would be reduced. · Lower energy needs during construction due to lack of geosynthetic materials placement, reduced equipment operation time as no cover compaction is required, and likely local borrow sources would reduce the environmental footprint of construction activities. · Greater vegetation and biomass will have added benefit of acting as larger carbon sink, provide additional shade and habitat when compared with typical vegetation, e.g. grass, of a traditional cover.
COMPLIANCE WITH ARARs						
Chemical-Specific ARARs	· Not in compliance with State and Federal ARAR associated with contaminated media.	· Not in compliance with any potential State and Federal chemical-specific ARARs	· Pennsylvania Act 2 standards for direct exposure pathways addressed through capping. · Federal and State regulations pertaining to surface water quality criteria would be achieved through leachate collection and treatment.	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Location-Specific ARARs	· Does not comply with ARARs	· Not in compliance with any potential State and Federal location-specific ARARs	· All Federal and State location-specific ARARs, including those pertaining to surface water pollution, biologic preservation, floodplains, and stormwater management	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Action-Specific ARARs	- Not applicable.	· Not in compliance with State and Federal ARARs pertaining to closure and operation of municipal landfills. · State erosion and stormwater ARARs would be complied with as part of limited actions, e.g., building demolition.	· In compliance with State and Federal ARARs pertaining to closure and operation of municipal landfills, including final cover, leachate management, landfill gas management and monitoring, stormwater management, groundwater monitoring, and maintenance.	· Same as Alternative 3. · ET cover portion of remedy would meet all ARARs with exception of Federal RCRA Subtitle D final cover permeability requirements which would be waived under Equivalent Standard of Performance Waiver.	· Complies with Federal RCRA Subtitle D landfill and other ARARs	· ET cover would meet all ARARs with exception of Federal RCRA Subtitle D final cover permeability requirements which would be waived under Equivalent Standard of Performance Waiver. · All other ARARs same as Alternative 3.

TABLE 40
COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
LOWER DARBY CREEK AREA SITE OU-1
PHILADELPHIA AND DELAWARE COUNTIES, PENNSYLVANIA

CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTIONS	ALTERNATIVE 3: SINGLE BARRIER CAP WITH FML	ALTERNATIVE 4: SINGLE BARRIER CAP WITH FML AND PARTIAL ET COVER	ALTERNATIVE 6: SOIL CAP	ALTERNATIVE 7: ET COVER
			· Remedial action would trigger action-specific ARARs and TBCs pertaining to earth-moving, E&, stormwater runoff and particulate emissions.			
LONG-TERM EFFECTIVENESS AND PERMANENCE						
Magnitude of Residual Risk	· Is not effective and would not meet RAOs. · Potential future risks would remain long-term. Potential threat to human health and the environment would also remain.	· Is not effective and would not meet RAOs. · Existing risks would remain. · Fencing would reduce potential contact with contaminants in surface soil. Contaminants could be transported off-site via stormwater and erosion processes. · Landfill contents would continue to generate contaminated shallow groundwater and leachate seeps; exposure to seeps would not be prevented. · Implementation and enforcement of institutional controls would limit future use of the site and restrict potable use of groundwater near OU-1.	· Is very effective in the long-term and would meet all RAOs. · Capping would reduce the human health and ecological risks posed by direct exposure to contaminated soils and landfill materials to within EPA's acceptable risk range. · Capping with a single barrier FML cap would also significantly reduce infiltration, leachate generation and subsequent impacts to groundwater, thus reducing potential risks to downgradient human and ecological receptors. · Wetlands would treat all captured leachate and reduce future risk. · PCB principle threat wastes are addressed.	· Is very effective in the long-term and would meet all RAOs. · Hybrid FML cap/ET cover would prevent direct exposure and eliminate risks outside of EPA's acceptable range. · Infiltration would be significantly reduced and subsequent current and future risks substantially reduced to downgradient human and ecological receptors. · ET cover vegetation will require time to become established to achieve maximum infiltration reduction. · All other elements are same as Alternative 3.	· Is effective in the long-term and would meet all RAOs. · Reduction of infiltration into the waste and subsequent leachate production would not be as significant as Alternatives 3, 4, and 7. However, much of leachate seeps generated in the future would be collected and treated by on- and/or off-site treatment systems. · All other elements are same as Alternative 3.	· Is very effective in the long-term and would meet all RAOs. · Infiltration reduction through the ET cover is same as discussed under Alternative 3. More infiltration than Alternatives 3 and 4 may be allowed. · All other elements same as Alternative 3.
Adequacy and Reliability of Controls	· No new controls implemented.	· If implemented and enforced, some protection of human health would be provided by institutional controls, monitoring contaminant trends, and removing the physical hazards associated with the SIA buildings and debris. · Fencing will not likely eliminate trespassing. ICs will prevent future land use effectively. · ICs on groundwater will not prevent off-site migration and potential exposure. · No effective measures would be taken to reduce impacts on ecological receptors.	· Proper maintenance of cap will control contaminated soils, waste and quantity of leachate generation. · Cap slippage on slopes can be monitored and repaired, if necessary. · Stabilization and competency of cap along stream would require monitoring and periodic repair due to forces from stream flow. · Treatment wetlands should be largely self-sustaining but will require monitoring to ensure proper function. · Institutional controls and land use controls are reliable, once implemented. · Monitoring would be required to ensure long-term protectiveness for human health and the environment.	· Slippage of the ET cover on slope is unlikely. · Bank stabilization activities easily implemented due to lack of FML. · ET cover portion of the cover system likely requires little or no intrusive maintenance; eventually should be self-sustaining. · All other elements are same as Alternative 3.	· Soil cover may develop cracks over time due to freeze/thaw effects, which would increase precipitation infiltration and subsequent leachate generation until repaired. · All other elements are same as Alternative 3.	· Densely planted trees and vegetation would provide natural E&S controls for long-term. · Bank stabilization, cover maintenance are same as Alternative 4. · All other elements are same as Alternative 3.
Need for Five-Year Review	Yes	Yes	Yes	Yes	Yes	Yes
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT						
Reduction of Toxicity, Mobility, or Volume Through Treatment	· Does not reduce toxicity, mobility or volume through treatment.	· Same as Alternative 1.	· Treatment of collected leachate and shallow groundwater in would reduce the toxicity and volume of contaminants in leachate. · Treatment wetlands would also reduce mobility of contaminants sequestered in sediment. · Reductions in contaminant mobility	· Oxidation of landfill gas by microbial community within rhizosphere of partial ET cover would reduce toxicity and volume of contaminants in LFG. · All other elements are same as Alternative 3	· Same as Alternative 3.	· Same as Alternatives 3 and 4.

TABLE 40
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LOWER DARBY CREEK AREA SITE OU-1
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CRITERION:	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: LIMITED ACTIONS	ALTERNATIVE 3: SINGLE BARRIER CAP WITH FML	ALTERNATIVE 4: SINGLE BARRIER CAP WITH FML AND PARTIAL ET COVER	ALTERNATIVE 6: SOIL CAP	ALTERNATIVE 7: ET COVER
			by sorption in wetlands are potentially reversible. · PCBs shipped off-site will be treated prior to disposal if possible. Toxicity, mobility and volume will be permanently reduced.			
SHORT-TERM EFFECTIVENESS						
Community Protection	· Does not apply since no action is performed.	· No significant risk to community is anticipated. · Engineering controls would be used during construction of the perimeter fence. Short-term traffic and noise would be expected during demolition of the buildings within the SIA. · Green house gases and dust generation will be minimal.	· Short-term impact (e.g., noise, dust, and traffic) to community is expected during waste excavation and capping. Impacts would be minimized through engineering controls, use of experienced firms and personnel, and monitoring. · Excavation near residences will require additional planning and coordination.	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Worker Protection	· Does not apply since no action is performed.	· No significant risk to workers is anticipated. · Worker exposure to contaminants and other site hazards would be minimized by wearing PPE and following procedures of the HASP. · All workers would require training and medical monitoring in accordance with 29 CFR 1910.120.	Same as Alternative 2.	· Same as Alternative 2.	· Same as Alternative 2.	· Same as Alternative 2.
Environmental Impacts	· Does not apply since no action is performed.	· Engineering controls would minimize environmental impacts during SIA demolition activities.	· Engineering controls would minimize environmental impacts during demolition and cap placement activities. · Erosion control measures would be used to prevent damage to the environment from sediment runoff. · Contingencies for construction activities in a floodplain would be necessary.	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Time Until Action is Complete	Not Applicable	6 months	18-20 months	18-20 months	14-16 months	14-16 months
IMPLEMENTABILITY						
Ability to Construct and Operate	· Does not apply since no action is performed	· No major difficulties are anticipated. Demolition and fencing installation are readily implementable technologies.	· No major difficulties are anticipated. · Demolition, excavation, grading, capping, revegetation, bank stabilization, and fence installation are readily implementable technologies. · Excavating waste materials that may be encountered near the creek bank may pose some short-term challenge due steep slopes, unstable materials, and large volume of water requiring management. · Potential excavation near homes in City Park to remove contaminated soils and waste may pose some challenge.	· No major difficulties are anticipated. · Excavating near the creek bank during the construction of an ET cover may not be as challenging as Alternative 3 since there is no FML requiring substantial surface preparation and regrading. ·	· Same as Alternative 4. · Excavating near the creek bank during the construction of soil cover may not be as challenging as Alternative 3 since there is no FML requiring substantial surface preparation and regrading. .	· Same as Alternative 4.

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COMPARATIVE ANALYSIS OF REMEDIAL ACTION ALTERNATIVES
LOWER DARBY CREEK AREA SITE OU-1
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			· Excavations below water are possible and will require appropriate measures to manage.			
Ease of Doing More Action if Needed	· Does not apply since no action is performed	· Additional actions would be easily implemented if required.	· Capping area can be extended if required, but would require some modification of engineering design. · Additional soil borings within City Park and limited extent in Eastwick neighborhood during pre-design investigation would evaluate the extent of soil contamination and waste, and determine if additional actions would be required in these areas.	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Ability to Monitor Effectiveness	· Does not apply since no action is performed	· Monitoring can be easily implemented and would provide assessment of potential exposures, contaminant presence, and migration, or changes in site conditions.	· Same as Alternative 2.	· Same as Alternative 2.	· Same as Alternative 2.	· Same as Alternative 2.
Ability to Obtain Approvals and Coordinate with Other Agencies	· Does not apply since no action is performed	· Deed restriction and ordinances may or may not be difficult to implement and enforce, depending on the level of cooperation by site owners and municipal officials.	· Same as Alternative 2 for deed restriction and ordinances. · Permits may not be needed due to CERCLA; however, intent of regulations and permits need to be satisfied including erosion and sediment control, surface water discharge, construction permits and (potentially) wetland mitigation.	· Same as Alternative 2.	· Same as Alternative 2.	· Same as Alternative 2.
Availability of Treatment, Storage Capacities, and Disposal Services	· Does not apply since no action is performed	· Disposal services for demolition waste and debris are available.	· Same as Alternative 2.	· Same as Alternative 3.	· Same as Alternative 3.	· Same as Alternative 3.
Availability of Equipment, Specialists, and Materials	· Does not apply since no action is performed	· Ample availability of equipment and personnel to install fencing and perform long-term maintenance, monitoring, and five-year reviews.	· Ample availability of equipment and personnel to implement.	· Ample availability of equipment and personnel to implement. · The engineering associated with ET cover design and plant selection would require individuals with specialized knowledge.	· Ample availability of equipment and personnel to implement.	· Same as Alternative 4. · Requires the estimated large volume of off-site borrow materials.
Availability of Technology	· Does not apply since no action is performed	· Demolition and fencing are commonly used technologies.	· Capping with a single FML barrier cap is a common MSW landfill closure technology.	· Capping with a single FML barrier cap is a common MSW landfill closure technology. Capping with ET cover is considered an innovative technology, but has been installed on multiple landfills in various climates around the country.	· Capping with soil cover has been used as a remedy for many Superfund landfill sites. · Local borrow sources readily available for cover materials.	· Same as Alternative 4, with respect to ET cover.
COST						
Capital Cost	$0	$1,797,781	$35,980,451	$31,086,497	$27,262,480	$22,371,782
Annual O&M Cost	$0	$100,369	$255,945	$245,951	$238,301	$228,152
Five-Year Reviews	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Present Worth Cost*	$53,900	$2,708,143	$36,895,641	$32,072,090	$28,828,236	$23,955,276

* Present worth cost is based on discount rate of 7 percent for 30 years.

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
CHEMICAL-SPECIFIC				
FEDERAL				
Toxic Substances Control Act (TSCA)	40 CFR Part 761.61(c)	Relevant and Appropriate	Regulations for characterization, management, transport, and disposal of PCB remediation wastes.	The substantive requirements of 761.61(c) are relevant and appropriate to the PCBs wastes in the southern industrial area portion of the landfill which are to be excavated, shipped off-site for treatment (if practicable) and disposal.
Pennsylvania Hazardous Waste Program	25 PA Code Chapter 261a.1 (which incorporates the following by reference: 40 CFR Part 261.10; 261.20-24)	Relevant and Appropriate	Pertinent regulation defining solid waste and hazardous waste and establishes process for identifying characteristic wastes.	The contaminated soil associated with GP-108 is considered to be outside of the "area of contamination" (AOC) Soils excavated from this area and any other point determined by EPA to be outside the AOC will be evaluated to determine if the contaminated soils are characteristic wastes following the substantive requirements of 40 CFR 261.10, and .20-.24. Should any characteristics hazardous wastes be identified, they shall be managed following the substantive requirements regarding generators, transport, and land disposal restrictions.
	25 PA Code Chapter 262a.1 (which incorporates the following by reference: 40 CFR 262.10-.44)	Relevant and Appropriate	Establishes standards for generators of hazardous waste.	
	25 PA Code Chapter 268a.1 (which	Relevant and Appropriate	Provides Land Disposal Restrictions for hazardous	

TABLE 41

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ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
	incorporates the following by reference: 40 CFR 268.1-.4; 40 CFR 268.7-.12; 40 CFR 268.14; 40 CFR 268.4(e); 40 CFR 268.49)		wastes, including contaminated soil.	
	40 CFR 268.5-.6; 40CFR 268.13	Relevant and Appropriate	Provides Land Disposal Restrictions for hazardous wastes, including contaminated soil.	
EPA Region 3 Regional Screening Levels (RSLs)	EPA Regional Screening Levels http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm	TBC	Provides regularly updated tables of risk-based screening levels, calculated using the latest toxicity values, default exposure assumptions and physical and chemical properties, and a calculator where default parameters can be changed to reflect site-specific risks. Use for risk assessment and cleanup goal development.	These risk-based levels will be taken into account if any additional risk evaluation is conducted regarding dioxin soil results in the City Park.
STATE				
Pennsylvania Water Quality Standards	25 PA Code, Chapter 93.1-4; .6-.7; .8a-.8d;	Applicable	Sets forth criteria for pollutants that protect designated use of water bodies.	Stormwater discharges from the Site to surface waters and wetlands must not cause a violation of these substantive standards.

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
	93.9 and 93.9g			Darby and Cobbs Creeks are listed as impaired waters under the Total Maximum Daily Load (TMDL) program which is required by Section 303(d) of the Clean Water Act. TMDLs are intended to achieve state Water Quality Standards for waters that are impaired. However, no TMDLs have been established for Darby or Cobbs Creek at this time. If any TMDLs are established in the future for contaminants or pollutants of concern in Darby or Cobbs Creeks, they would need to be considered as part of the implementation of the OU1 remedy. A TMDL for PCBs has been established by EPA for the Delaware River Estuary. OU1 is situated within this estuary. This TMDL will be considered as part of the implementation of the OU1 remedy.
Fugitive Particulate Matter	25 PA Code Chapter 123.1 and 123.2	Applicable	Establishes particulate matter requirements.	Substantive applicable standards apply to remedial actions.
Ambient Air Quality Standards for Particulate Matter	25 PA Code 131.2 and 131.3	Applicable	Establishes standards for particulate matter.	Substantive applicable standards apply to remedial actions.

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Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
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ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
Air Quality Standards	25 PA Code Chapter 123.31	Applicable	Establishes requirements to limit odor emissions.	Substantive applicable standards apply during excavation and grading of landfill waste mass.
ACTION-SPECIFIC				
FEDERAL				
RCRA Final Cover Requirements for Municipal Solid Waste Landfills	40 CFR §258.60(a) 40 CFR §258.23(a)	Relevant and Appropriate	Established design criteria for final covers placed on municipal solid waste landfills. Establishes explosive gas controls for municipal solid waste landfills.	The substantive requirements of the specific subsections listed are relevant and appropriate to the design, construction or maintenance of the cover. Requirements in 40 CFR §258.60(a)(1) are being waived under CERCLA § 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D) and will be achieved via an Equivalent Standard of Performance.
Clean Water Act (CWA);National Pollutant Discharge Elimination System Requirements	40 CFR §122.1-.2; 122.4-.5; 122.21; 122.26; 122.29; 122.41; 122.43-.45; 122.47-.49 122.61-64 (All of these sections, except for 122.47, are incorporated by reference into Pennsylvania's regulation by 25 Pa. Code § 92a.3)	Applicable	Establishes processes for National Pollutant Discharge Elimination System and permitting process for establishing effluent limitations for discharges to waters of the United States.	Discharge of treated leachate on-site from the engineered treatment wetlands will comply with the substantive requirements of these provisions.

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
Clean Water Act (CWA): Wetlands Protection	40 CFR Part 230	Applicable	Consistent with Section 404(b)(1) of the CWA. Establishes guidelines for the discharge of dredged or fill material in wetlands.	Wetlands may be present on the landfill or along the creek banks adjacent to the landfill. Impacts to identified wetlands shall be dealt with in compliance with the substantive requirements of these provisions.
Discharge of Storm Water	40 CFR §122.26 40 CFR §122.44(h)(i)(4)	Applicable	Stormwater from the Site would fall within the definition of "storm water discharge associated with industrial activity" (40 CFR 122.26(b)(12)) so the substantive requirements of these sections must be met.	Stormwater runoff from the site may result in runoff to Darby or Cobbs Creek. Stormwater controls will be designed to comply with the substantive provisions of these requirements.
STATE				
Pennsylvania Construction/Demolition Waste Landfills	25 PA Code Chapter 277.233(a)(3)	Relevant and Appropriate	Establishes final cover and grading requirements for construction/demolition waste landfills	Although not a construction or demolition (C&D) waste landfill, the area outside of the landfill where C&D type materials have been discovered sporadically in the subsurface will be investigated. Any areas with C&D materials will be evaluated and addressed to ensure two feet of clean soil is present on the surface.
Clean Water Act (CWA);National Pollutant Discharge Elimination System Requirements	25 PA Code Chapters 92a.1-.7; 92a.12; 92a.41-.46; 92a.61;	Applicable	Establishes effluent limitations for discharges to waters of Pennsylvania and establishes specific requirements for waste treatment projects	Discharge of treated leachate on-site from the engineered treatment wetlands will comply with the substantive requirements of these provisions.

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
Erosion Control Regulations	25 PA Code, Chapter 102.4(b)(2)-(5), (7)-(9); 102.11; 122.14; 102.22	Applicable	Requires preparation of an erosion and sediment control plan for activities involving land clearing, grading and other earth disturbances and establishes erosion and sediment control criteria. No plan shall be submitted since this is a procedural requirement, but any applicable substantive standards shall be met.	Substantive, applicable requirements apply to construction and excavation activities at the ground surface, including clearing, grading, and excavation.
Water Well Drillers License Act	17 PA Code, Chapter 47	Applicable	Establishes requirements for the licensing of well drillers, prevention of pollution of underground waters, submittal of well construction records and well abandonment.	Only the substantive portions of these regulations apply to any monitoring, injection and/or recovery well installations.
LOCATION-SPECIFIC				
FEDERAL				
National Historic Preservation Act	18 CFR §380.14	Applicable	May be applicable if any prehistoric, historic, or archeological artifacts are encountered during site remediation.	Historic or cultural property or artifacts may be present in the area where the remedial action will be conducted. Evaluation of the potential for these items and their management, if necessary, will be conducted following the substantive portions of this regulation.
Federal Wetlands Requirements	40 CFR Part 6 Appendix A	Applicable	Sets forth federal requirements for carrying out provisions of	Wetlands may be present on the landfill or along the creek banks adjacent to

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
	Executive Order 11990		Executive Order 11990 (Protection of Wetlands) No activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be minimized and/or mitigated.	the landfill. Any potential impacts to identified wetlands shall be conducted in compliance with the substantive requirements of these provisions. .
Federal Floodplains Requirements	40 CFR Part 6 Appendix A Executive Order 11988	Applicable	Sets forth federal requirements for carrying out provisions of Executive Order 11988 (Protection of Floodplains). Reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial value of floodplains.	The landfill is situated within the floodplain. Work within the floodplain will comply with the substantive requirements of these provisions
Federal Emergency Management Agency Insurance and Hazard Mitigation	44 CFR §65.8	Applicable	Process for Conditional Letter of Map Revision (CLOMR) which is FEMA's comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective Base Flood Elevations	Impacts on the elevation of the land surface within the 100-year flood plain will be evaluated following the substantive requirements of these provisions.

TABLE 41

Applicable of Relevant and Appropriate Requirements (ARARs)
For the Selected Remedy for the
Lower Darby Creek Area Superfund Site: Clearview Landfill Soils and Waste (OU-1)

ARAR	LEGAL CITATION	CLASSIFICATION	Summary of Requirement	Further Detail Regarding ARAR in the context of the Remedial Action
			(BFEs), or the Special Flood Hazard Area (SFHA).	
STATE				
Pennsylvania Flood Plain Management Act Regulations	25 PA Code Chapters 106.31-.32	Relevant and Appropriate	Standards relating to construction, earthmoving, filling and excavation within 100-year floodplain, wetlands and regulated water.	Activities within the 100-year floodplain will be conducted in accordance with the substantive requirements of these provisions.

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	**$14,914,521.50**		$14,914,522	1.000	$14,914,522
1	**$7,457,260.75**	$228,152	$7,685,413.05	0.935	$7,185,861
2		$228,152	$228,152	0.873	$199,177
3		$228,152	$228,152	0.816	$186,172
4		$228,152	$228,152	0.763	$174,080
5		$196,114	$228,152	0.713	$162,673
6		$171,114	$196,114	0.666	$130,612
7		$171,114	$171,114	0.623	$106,604
8		$171,114	$171,114	0.582	$99,588
9		$171,114	$171,114	0.544	$93,086
10		$153,336	$171,114	0.508	$86,926
11		$128,336	$153,336	0.475	$72,834
12		$128,336	$128,336	0.444	$56,981
13		$128,336	$128,336	0.415	$53,259
14		$128,336	$128,336	0.388	$49,794
15		$121,252	$128,336	0.362	$46,458
16		$96,252	$121,252	0.339	$41,104
17		$96,252	$96,252	0.317	$30,512
18		$96,252	$96,252	0.296	$28,491
19		$96,252	$96,252	0.277	$26,662
20		$121,252	$96,252	0.258	$24,833
21		$96,252	$121,252	0.242	$29,343
22		$96,252	$96,252	0.226	$21,753
23		$96,252	$96,252	0.211	$20,309
24		$96,252	$96,252	0.197	$18,962
25		$121,252	$96,252	0.184	$17,710
26		$96,252	$121,252	0.172	$20,855
27		$96,252	$96,252	0.161	$15,497
28		$96,252	$96,252	0.150	$14,438
29		$96,252	$96,252	0.141	$13,571
30		$121,252	$96,252	0.131	$12,609
				TOTAL PRESENT WORTH	**$23,955,276**

Discount rate of 7% per OSWER Directive No. 9355.3-20, June 199
It was assumed that construction would be completed in 1.5 years (2/3 in Year 1 and 1/3 in Year
It was assumed that 25% reduction in O&M costs in every 5 years and no further O&M cost reduction after 20 yea

TABLE 42 - Detailed Cost Summary of Selected Remedy

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost
1 PROJECT DOCUMENTS/INSTITUTIONAL CONTROLS											
1.1 Prepare Documents, Plans, and Permits	1	ls	$25,000.00				$25,000	$0	$0	$0	$25,000
1.2 Prepare Deed Notifications/Restrictions	1	ls	$20,000.00				$20,000	$0	$0	$0	$20,000
1.3 Community Relations	500	hr			$38.00		$0	$0	$19,000	$0	$19,000
1.4 Contract Administration	500	hr			$38.00		$0	$0	$19,000	$0	$19,000
1.5 Post Construction Documents	300	hr			$38.00		$0	$0	$11,400	$0	$11,400
2 SITE PREPARATION AND FIELD SUPPORT											
2.1 Office Trailer	16	mo				$282.00	$0	$0	$0	$4,512	$4,512
2.2 Storage Trailer	16	mo				$97.50	$0	$0	$0	$1,560	$1,560
2.3 Field Office Support	16	mo		$150.00			$0	$2,400	$0	$0	$2,400
2.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,500.00				$1,500	$0	$0	$0	$1,500
2.5 Initial and Final Surveys	50	ac	$1,350.00				$67,500	$0	$0	$0	$67,500
2.6 Equipment Mobilization/Demobilization	10	ea			$158.00	$384.00	$0	$0	$1,580	$3,840	$5,420
2.7 Site Utilities	16	mo		$325.00			$0	$5,200	$0	$0	$5,200
2.8 Underground Utility Clearances	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
2.9 Professional Oversight (2 person)	32	mo			$8,708.48		$0	$0	$278,671	$0	$278,671
2.10 Site Health & Safety and QA/QC	3	mo			$8,708.48		$0	$0	$26,125	$0	$26,125
2.11 Materials Storage Pad, 25' X 25'	2	ls		$1,000.00	$250.00	$200.00	$0	$2,000	$500	$400	$2,900
2.12 Clear and Grub, light trees to 6" dia	52	ac			$1,550.00	$1,175.00	$0	$0	$80,600	$61,100	$141,700
2.13 Sediment and Erosion Controls	1	ls	$100,000.00				$100,000	$0	$0	$0	$100,000
2.14 Water Truck for Dust Control	14	mo				$4,000.00	$0	$0	$0	$56,000	$56,000
2.15 Water for Dust Suppression, 10,000 gal/month	140,000	gal		$0.02			$0	$2,800	$0		$2,800
3 DECONTAMINATION											
3.1 Equipment Decon Pad	1	ls		$5,800.00	$6,650.00	$700.00	$0	$5,800	$6,650	$700	$13,150
3.2 Decontamination Services	16	mo		$210.00	$1,800.00	$315.00	$0	$3,360	$28,800	$5,040	$37,200
3.3 Decon Water	16,000	gal		$0.02			$0	$320	$0	$0	$320
3.4 Decon Water Storage Tank, 5,000 gallon	1	ls		$4,000.00			$0	$4,000	$0	$0	$4,000
3.5 Clean Water Storage Tank, 2,000 gallon	1	ls		$1,200.00			$0	$1,200	$0	$0	$1,200
4 SIA DEMOLITION AND DISPOSAL											
4.1 Excavator- Mounted Breaker , 2 C. Y.	1	mo			$9,522.54	$11,799.76	$0	$0	$9,523	$11,800	$21,322
4.2 Dozer, 140 hp	2	wk			$2,199.20	$3,322.00	$0	$0	$4,398	$6,644	$11,042
4.3 Front End Loader, 2 C. Y. 130 hp	1	mo			$9,522.54	$11,128.68	$0	$0	$9,523	$11,129	$20,651
4.4 Concrete Removal and Crushed Concrete	494	cy	$50.00				$24,700	$0	$0	$0	$24,700
4.5 Building Demolition	15,016	sf	$6.00				$90,096	$0	$0	$0	$90,096
4.6 Junked Vehicles Removal	1	ls	$6,000.00				$6,000	$0	$0	$0	$6,000
4.7 Drums Removal	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
4.8 Metals Recycling	1	ls	$0.00				$0	$0	$0	$0	$0
4.9 Bulky Items, Tires, Cans and Trash Removal	1	ls	$6,000.00				$6,000	$0	$0	$0	$6,000
4.10 Waste Characterization Testing (TCLP)	5	ea	$820.00	$80.00			$4,100	$400	$0	$0	$4,500
4.11 Off Site Transportation & Disposal, Non-Hazardous	300	tons	$48.50				$14,550	$0	$0	$0	$14,550
4.12 Off Site Transportation & Disposal, Hazardous (PCBs > 50 ppm)	1,770	tons	$162.00				$286,740	$0	$0	$0	$286,740
4.13 Asbestos Abatement	.	ls	$25,000.00				$0	$0	$0	$0	$0
4.14 Relocation Fee (active businesses in SIA)	5	ls		$50,000.00				$250,000	$0	$0	$250,000
5 EXCAVATION AND BACKFILL CITY PARK AREA											
5.1 Excavators, 2 CY capacity	1	mo			$9,522.54	$11,799.76	$0	$0	$9,523	$11,800	$21,322
5.2 Front End Loader, 2 C. Y. 130 hp	1	mo			$9,522.54	$11,128.68	$0	$0	$9,523	$11,129	$20,651
5.3 Dozer, 140 hp	2	wk			$2,199.20	$3,322.00	$0	$0	$4,398	$6,644	$11,042
5.4 Off Site Transportation & Disposal, Non-Hazardous	0	tons	$75.00				$0	$0	$0	$0	$0
5.5 Off Site Transportation & Disposal, Hazardous	0	tons	$250.00				$0	$0	$0	$0	$0
5.6 Topsoil, Furnish and Place, 1' Thick (2.7 acres)	4,400	cy		$17.50			$0	$77,000	$0	$0	$77,000
5.7 Fine Grading, Soil Amendments, and Seeding (2.7 acres)	13,200	sy		$0.21	$1.53	$0.29	$0	$2,772	$20,196	$3,828	$26,796

TABLE 42 - Detailed Cost Summary of Selected Remedy

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Capital Cost

				Unit Cost				Total Cost			
	Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Total Direct Cost
6	**SITE REGRADING**											
6.1	Excavators, two, 2 CY capacity each	10	mo			$9,522.54	$11,799.76	$0	$0	$95,225	$117,998	$213,223
6.2	Dozer, 200 hp	10	mo			$9,522.54	$15,434.06	$0	$0	$95,225	$154,341	$249,566
6.3	Front End Loader, 2 C. Y. 130 hp	10	mo			$9,522.54	$11,128.68	$0	$0	$95,225	$111,287	$206,512
6.4	Landfill Compactor, 220 hp	2	mo			$9,522.54	$14,986.06	$0	$0	$19,045	$29,972	$49,017
7	**EVAPOTRANSPIRATION COVER**											
7.1	Spread Subgrade Sand and Clay Layer, 12" Thick on 50 acres	80,667	cy		$8.00			$0	$645,333	$0	$0	$645,333
7.2	Spread Fine-grained Soil Layer, 36" Thick on 50 acres	242,000	cy		$9.00			$0	$2,178,000	$0	$0	$2,178,000
7.3	Topsoil, Furnish and Place, 6" Thick on the areas where needed (assumed 5 acres)	4,000	cy		$17.50			$0	$70,000	$0	$0	$70,000
7.4	Fine Grading and Soil Amendments (with mushroom compost & other amendments for 37,500 trees in 50 acres)	242,000	sy		$0.21	$1.53	$0.29	$0	$50,820	$370,260	$70,180	$491,260
7.5	Trees (e.g., 750 hybrid poplar/acre, $7/tree) and Shrubs ($2,250/acre)	50	acre	$7,500.00				$375,000	$0	$0	$0	$375,000
8	**LANDFILL GAS MANAGEMENT**											
8.1	Gas Vent	50	ea	$300.00				$15,000	$0	$0	$0	$15,000
8.2	Gas Monitoring Well (with solar-powered turbine ventilator)	6	ea	$3,000.00				$18,000	$0	$0	$0	$18,000
9	**FENCING**											
9.1	4 strands of Barbed Wire Fence , Post @10', 4' High	6,000	lf	$10.00				$60,000	$0	$0	$0	$60,000
9.2	Galvanized 4 Rail Vehicle Gate,12' Opening	2	ls	$800.00				$1,600	$0	$0	$0	$1,600
9.3	Personnel Gates	2	ls	$400.00				$800	$0	$0	$0	$800
9.4	Signs	2	ls	$785.00				$1,570	$0	$0	$0	$1,570
9.5	Security Guard (24/7 during the RA)	17	mo	$9,000.00				$153,000	$0	$0	$0	$153,000
10	**DARBY CREEK EAST BANK EROSION CONTROLS**											
10.1	Excavators, two, 2 CY capacity each	3	mo			$9,522.54	$11,799.76	$0	$0	$28,568	$35,399	$63,967
10.2	Front End Loader, 2 C. Y. 130 hp	3	mo			$9,522.54	$11,128.68	$0	$0	$28,568	$33,386	$61,954
10.3	Site Labor, (2 laborers)	3	mo			$13,200.00		$0	$0	$39,600	$0	$39,600
10.4	8 oz/sy Separation Geotextile	5,953	sy		$1.78	$0.18		$0	$10,597	$1,072	$0	$11,669
10.5	Loose Rip-Rap	756	cy		$28.05	$9.30	$10.05	$0	$21,206	$7,031	$7,598	$35,834
10.6	Gabions, Galvanized Wire with PVC Coating, Filled with Rock (1/3 of 3,780-feet long bar	1,150	cy	$200.00				$230,000	$0	$0	$0	$230,000
10.7	Geocells Infilled with topsoil and Embankment Mix (2/3 of 3,780-feet long bank)	2,350	cy	$150.00				$352,500	$0	$0	$0	$352,500
10.8	Fine Grading and seeding, incl. lime, fert, and seed	14,520	sy		$0.21	$1.53	$0.29	$0	$3,049	$22,216	$4,211	$29,476
11	**STORMWATER MANAGEMENT AND LEACHATE SEEP TREATMENT**											
11.1	Storm Drainage Controls	1	ls	$80,000.00				$80,000	$0	$0	$0	$80,000
11.2	Engineered Wetlands/Detention Ponds (USEPA Wetlands Fact Sheet, 2000)	5	acre	$40,000.00				$200,000	$0	$0	$0	$200,000
11.3	Subsurface Drain, 2'x20'x1,800' (WxDxL), lined with geomembrane, backfilled with grave	75,680	sf	$35.00				$2,648,800	$0	$0	$0	$2,648,800
11.4	Leachate Pump Stations with Piping	2	ea	$120,000.00				$240,000	$0	$0	$0	$240,000
12	**GOUNDWATER MONITORING WELLS**											
12.1	Mobilization/Demobilization	1	ea	$20,000.00				$20,000	$0	$0	$0	$20,000
12.2	4 Deep Wells (6-inch air rotary drilling, 35 feet deep, 2-inch PVC casing/screen, stick-up finish)	4	ea	$2,125.00				$8,500	$0	$0	$0	$8,500
12.3	4 Shallow Wells (6-inch air rotary drilling, 20 feet deep, 2-inch PVC casing/screen, stick-up finish)	4	ea	$1,300.00				$5,200	$0	$0	$0	$5,200
12.4	Well Development	24	hour	$400.00				$9,600	$0	$0	$0	$9,600
12.5	Water Handling/Equipment	5	day	$550.00				$2,750	$0	$0	$0	$2,750
12.6	Geophysics/Packer Testing	8	ea	$1,000.00				$8,000	$0	$0	$0	$8,000
12.7	IDW Management/Disposal	1	ea	$5,000.00				$5,000	$0	$0	$0	$5,000
	Subtotal							$5,091,506	$3,336,257	$1,341,444	$760,496	$10,529,703

TABLE 42 - Detailed Cost Summary of Selected Remedy

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Total Cost Subcontract	Total Cost Material	Total Cost Labor	Total Cost Equipment	Total Direct Cost
Local Area Adjustments							100.0%	101.8%	100.0%	100.0%	
							$5,091,506	$3,396,310	$1,341,444	$760,496	$10,589,756
Overhead on Labor Cost @ 30%									$402,433		$402,433
G & A on Labor Cost @ 10%									$134,144		$134,144
G & A on Material Cost @ 10%								$339,631			$339,631
G & A on Subcontract Cost @ 10%							$509,151				$509,151
G & A on Equipment Cost @ 10%										$76,050	$76,050
Total Direct Cost							$5,600,657	$3,735,941	$1,878,022	$836,546	$12,051,165
Indirects on Total Direct Cost @ 30%											$3,615,349
Profit on Total Direct Cost @ 10%											$1,205,116
Subtotal											$16,871,631
Health & Safety Monitoring @ 2%											$337,433
Total Field Cost											$17,209,063
Contingency on Total Field Costs @ 20%											$3,441,813
Engineering on Total Field Cost @ 10%											$1,720,906
TOTAL COST											**$22,371,782**

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Annual O&M Cost

Item	Item Cost every year until Year 30	Item Cost per 5 years	Notes
Long-term Monitoring	$178,360		Collect groundwater samples from 12 existing and 8 new monitoring wells; 12 surface runoff and 12 leachate samples; and 2 surface water and 10 sediment samples per event semi-annually. Collect 2 wetland effluent samples per event quarterly. All samples are analyzed for VOCs, SVOCs, pesticides/PCBs and metals, except for wetland effluent samples for WQCs.
Land Use Controls Inspection and Report	$6,000		Visual inspection semi-annually
Fence/Sign Repair	$500		
Cap Maintenance	$18,798		0.5% of capital cost/year
East Bank Stabilization Controls O&M	$6,595		1% of capital cost/year
Wetland O&M and Leachate Treatment	$10,500		1% of capital cost/year for wetlands; $8,500/year for off-site leachate treatment ($22.14/1,000 ft3, assume 6,600 gal/day)
Leachate Pump Station	$2,400		1% of capital cost/year
Landfill Gas Monitoring	$5,000		Semi-annually ($2,500/event)
Site Review		$25,000	Review of site conditions by three engineers for Years 5, 10, 15, 20, 25, and 30
TOTALS	$228,152	$25,000	

TABLE 42 - Detailed Cost Summary of Selected Remedy

CLEARVIEW LANDFILL (OU 1)
PHILADELPHIA AND DELAWARE COUNTIES, PA
EVAPOTRANSPIRATION (ET) COVER
Annual Monitoring Cost

	Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal Direct Cost
1.01	Groundwater for VOCs - 20 samples/event, semiannual	40	samples	$100.00				$4,000	$0	$0	$0	$4,000
1.02	Groundwater for SVOCs, PCBs/pesticide, metals - 20 samples/event, semiannual	40	samples	$650.00				$26,000	$0	$0	$0	$26,000
1.03	Surface runoff and leachate for VOCs - 12 samples/event, semiannual	24	samples	$100.00				$2,400	$0	$0	$0	$2,400
1.04	Surface runoff and leachate for SVOCs, PCBs/pesticides, metals - 20 samples/event, semiannual	40	samples	$650.00				$26,000	$0	$0	$0	$26,000
1.05	Surface water for VOCs - 2 samples/ event, semiannual	4	samples	$100.00				$400	$0	$0	$0	$400
1.06	Surface water for SVOCs, PCBs/pesticides, metals - 2 samples/ event, semiannual	4	samples	$650.00				$2,600	$0	$0	$0	$2,600
1.07	Sediment for VOCs - 20 samples/event, semiannual	20	samples	$100.00				$2,000	$0	$0	$0	$2,000
1.08	Sediment for SVOCs, PCBs/pesticides, metals - 10 samples/event, semiannual	20	samples	$650.00				$13,000	$0	$0	$0	$13,000
1.09	Wetland Effluent for WQCs - 2 sample/event, quarterly	8	samples	$500.00				$4,000	$0	$0	$0	$4,000
1.10	Per Diem 10 day/person, 2 people	20	days	$150.00				$3,000	$0	$0	$0	$3,000
1.11	Vehicle	10	days	$90.00				$900	$0	$0	$0	$900
1.12	Field labor 10 days/person, 2 people	20	days		$20.00	$325.00		$0	$400	$6,500	$0	$6,900
1.13	Data Validation (QA/QC)	40	hours			$38.00		$0	$0	$1,520	$0	$1,520
1.14	Report	80	hours			$38.00		$0	$0	$3,040	$0	$3,040
1.15	Equipment Rental	2	events				$3,000.00	$0	$0	$0	$6,000	$6,000
1.16	Project Management	16	hrs			$50.00		$0	$0	$800	$0	$800
	Subtotal							$84,300	$400	$11,860	$6,000	$102,560
	Overhead on Labor Cost @ 75%									$8,895		$8,895
	G & A on Labor Cost @ 6%									$712		$712
	Sales Tax on Material: 6%								$24			$24
	G & A on Material Cost @ 5%								$21			$21
	G & A on Subcontract Cost @ 5%							$4,215				$4,215
	Total Direct Cost							$88,515	$445	$21,467	$6,000	$116,427
	Indirects on Total Direct Labor Cost @ 30%									$6,440		$6,440
	Profit on Total Direct Cost @ 10%											$11,643
	Subtotal											$134,509
	Health & Safety Monitoring @ 2%											$2,690.19
	Total Monitoring Cost											$137,200
	Contingency on Total Field Costs @ 30%											$41,160
	TOTAL COST											$178,360

TABLE 43

CONTROLLING PRELIMINARY REMEDIATION GOALS (PRGs) FOR OU-1 SOILS
LOWER DARBY CREEK AREA SITE: OU-1
DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

Chemical of Concern (COC)	BACKGROUND (Surface / Subsurface)		CONTROLLING PRGs					
			ZONE 1		ZONE 2		ZONE 3	
	Mean	95% UTL	Value	Basis (5)	Value	Basis (6)	Value	Basis (4)
INORGANICS	mg/kg	mg/kg	mg/kg		mg/kg		mg/kg	
Antimony	3.6 / ---	/ ---	430	HH Industrial Total Soil	--	--	--	--
Arsenic	4.55 / 4.33	8.25 / 10.3	25	HH Industrial Total Soil	--	--	--	--
Cadmium	0.403 /	1.8 /	--	--	2.2 (2)	Mammal	2.2	Mammal
Copper	25.6 / 24.9	82.8 / 69	--	--	166 (2)	Plants and Mammal; Surface Soil Only	--	--
Lead	54 / 54.5	148 / 182	957	HH Industrial Total Soil	380 (2)	Plants and Bird; Surface Soil Only	--	--
Zinc	80.6 / 92.5	154 / 272	--	--	308 (3)	Plants; Surface Soil Only	--	--
PAHs	µg/kg	µg/kg	µg/kg		µg/kg		µg/kg	
Benzo(a)anthracene	--	--	26000	HH Industrial Total Soil	1700	HH Residential Surface Soil	1700	HH Residential Surface Soil
Benzo(a)pyrene	--	--	2600	HH Industrial Total Soil	466 (1)	Maximum BTV Value for Surface Soil	466 (1)	Maximum BTV Value for Surface Soil
Benzo(b)fluoranthene	--	--	26000	HH Industrial Total Soil	1700	HH Residential Surface Soil	1700	HH Residential Surface Soil
Benzo(k)fluoranthene	--	--	--	--	17000	HH Residential Surface Soil	17000	HH Residential Surface Soil
Dibenzo(a,h)anthracene	--	--	2600	HH Industrial Total Soil	170	HH Residential Surface Soil	170	HH Residential Surface Soil
Indeno(1,2,3-cd)pyrene	--	--	26000	HH Industrial Total Soil	1700	HH Residential Surface Soil	1700	HH Residential Surface Soil
TOTAL PAHs	--	--	8754	Invertebrates; Surface Soil Only	8754	Invertebrates; Surface Soil Only	8754	Invertebrates; Surface Soil Only
HMW PAHs	--	--	8754	Mammal; Surface Soil Only	8754	Mammal; Surface Soil Only	8754	Mammal; Surface Soil Only
PESTICIDES / PCBs	µg/kg	µg/kg	µg/kg		µg/kg		µg/kg	
Dieldrin	--	--	1400	HH Industrial Total Soil	--	--	--	--
Heptachlor Epoxide	--	--	2500	HH Industrial Total Soil	--	--	--	--
Arochlor-1254	--	--	840	Mammal; Surface Soil Only	840	Mammal; Surface Soil Only	840	Mammal; Surface Soil Only
Arochlor-1260	--	--	840	Mammal; Surface Soil Only	840	Mammal; Surface Soil Only (7)	840	Mammal; Surface Soil Only
Arochlor-1268	--	--	9100	HH Industrial Total Soil	--	--	--	--
DIOXINS	µg/kg	µg/kg	µg/kg		µg/kg		µg/kg	
Total 2,3,4,8-TCDD TEQ			0.29	HH Industrial Total Soil	--	--	--	--

Notes:
(1) Calculated by taking the maximum of the BTV for surface soil (466 mg/kg) and subsurface soil (439 mg/kg).
(2) Calculated by doubling the maximum background surface soil concentration to account for natural background variability.
(3) Calculated by doubling the BTV value for zinc in surface soil.
(4) Controlling PRGs for Zone 3 soils were adopted from Zone 2 soils and apply only to sample location GP-108 as discussed in Section 2.4.3 of FS.
(5) HH residential surface soil PRGs were not considered as controlling PRGs for Zone 1 as it was assumed that the OU-1 remedy would involve containment (capping) and long-term exposure would likely be limited to industrial workers during remediation.
(6) HH residential surface soil PRGs encompassed all of the HH residential total soil COCs and were only slightly higher in concentration, so were selected as Zone 2 controlling PRGs.
(7) Zone 2 PRG for Arochlor-1260 (840 mg/kg) to protect ecological receptors would not apply to sample location GP-10 since the location is beneath asphalt. The human health PRG is 2,600 mg/kg.