FEASIBILITY STUDY

Revision 02

SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WEST VIRGINIA

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US Environmental Protection Agency
Region 3

BY
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ACRONYMS AND ABBREVIATIONS

AOC	area of concern
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BTV	background threshold value
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
CTE	central tendency exposure
CWA	Clean Water Act
ft	feet
FEMA	Federal Emergency Management Agency
FFS	Focused Feasibility Study
FS	Feasibility Study
GRA	General Response Action
HHRA	Human Health Risk Assessment
HI	Hazard Index
IC	institutional controls
LEDPA	Least Environmentally Damaging Practicable Alternative
LOAEL	Lowest Observed Adverse Effect Level
LTM	long-term monitoring
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/kg	nanogram per kilogram
NOAEL	No Observed Adverse Effect Level
Nobis	Nobis Engineering, Inc. (dba Nobis Group)
NPL	National Priorities List
NR&P	New River and Pocahontas Coal Company
O&M	operations and maintenance
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PDI	pre-design investigation
ppm	parts per million
PRG	Preliminary Remediation Goal
PSL	project screening level
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
ROD	Record of Decision
RME	reasonable maximum exposure
RSL	Regional Screening Level
SEC	Shaffer Equipment Company
SLERA	Screening Level Ecological Risk Assessment
SVOC	semivolatile organic compound
SWAC	Surface Weighted Average Concentration
TBC	To Be Considered

ACRONYMS AND ABBREVIATIONS

TCDD	tetrachlorodibenzo-p-dioxin
TEQ	toxicity equivalence
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources

1.0 INTRODUCTION

This Feasibility Study (FS) report for the Shaffer Equipment/Arbuckle Creek Area Superfund Site (Site) in Minden, Fayette County, West Virginia, was prepared by Nobis Engineering, Inc., (dba Nobis Group® [Nobis]) as part of the Remedial Investigation/Feasibility Study (RI/FS) for the Site under the U.S. Environmental Protection Agency (USEPA) Region 3 Contract No. 68HE0318D0013, Task Order No. 68HE0321F0039. This document presents a range of remedial options to address unacceptable risks to human health and the environment at the Site, risks associated with Site-related contamination were identified in the Remedial Investigation (RI) report (Nobis, 2025).

This FS report was prepared consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 Code of Federal Regulations (CFR) 300; and the *Interim-Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA RI/FS guidance document; USEPA, 1988).

1.1 Purpose of Report

The purpose of this FS report is to develop and evaluate a range of remedial alternatives that address Site-related contaminants in environmental media. The FS remedial options will be used by USEPA to formulate a preferred remedy to address unacceptable risk to human health and the environment. After a public comment period, the selected remedy will be documented in a USEPA Record of Decision (ROD).

Remedial alternatives for soil at one area of concern (AOC) at the Site, the former Shaffer Equipment Company (SEC) Property, were previously evaluated in the Focused Feasibility Study (FFS) for the Former SEC Property (Nobis, 2023a). The former SEC Property has the highest reported concentrations of polychlorinated biphenyls (PCBs) at the Site, is located within the 100-year floodplain, and is a potential source of contamination to the downstream wetlands and residential properties due to the repeated, and likely future, flooding of Arbuckle Creek. The purpose of the remedy for the former SEC Property is to address risks to human health and the environment from contaminated soil and mitigate the potential for future releases of contaminated soil via flooding events. The Proposed Plan for the former SEC Property soil, which is designated as Operable Unit 1 (OU-1), was released in March 2023 (USEPA, 2023). After a public comment period, the selected remedy for the former SEC Property soil was documented in the USEPA ROD for OU-1 (USEPA, 2024). The remedy consists of the following components:

- Removal of the impervious cap/barrier;
- Excavation of soil contaminated with PCBs above performance standards;
- Disposal of excavated PCB-contaminated soil and the impervious cap/barrier at an approved offsite disposal facility; and,
- Backfill with clean fill, as necessary.

The selected remedy includes short-term groundwater monitoring "to assess the effects of removal of the PCB remediation waste on groundwater quality." Therefore, Sections 3 through 6 of this FS report do not include remedial alternative evaluations for the former SEC Property soil and groundwater.

1.2 Site Background

The Site background information presented in this section is abbreviated; additional information is provided in the RI report (Nobis, 2025).

1.2.1 Site Description and History

The Site is located in Minden, Fayette County, West Virginia. From approximately 1970 until 1983 the SEC manufactured electrical substations for the coal mining industry on the former SEC Property. The substations incorporated various types of transformers, capacitors, switches, and related voltage regulation and distribution devices that utilized cooling oil that contained PCBs. Mismanagement of these electrical devices by the SEC resulted in the release of PCB-containing oils to the environment (Tetra Tech, 2020).

The Site includes the former SEC Property and surrounding areas along Arbuckle Creek where SEC-related contamination may be located. **Figure 1-1**, **Figure 1-2**, and **Figure 1-3** depict the Site location, including the former SEC Property and the additional AOCs.

The AOCs are described briefly below:

- Former SEC Property is a five-acre area located south of and adjacent to Arbuckle Creek in the western extent of Minden. This property is where manufacturing operations were conducted by the SEC. The former structures on this property have been removed.
- Possible Transformer Storage Area is a three-acre area on a plateau on the south side of Arbuckle Creek, immediately adjacent to and east of the former SEC Property. This area is approximately 30 feet (ft) higher in elevation than Arbuckle Creek. The SEC may have stored transformers in this area, and in 1993 a former SEC employee identified a pit in this area where PCB-contaminated oil was allegedly disposed (Tetra Tech, 2020).
- Britt Bath House is a three-acre area on the north side of Arbuckle Creek, immediately north of the former SEC Property. The former bath house building and a second smaller building were located on this property. These structures have been removed. The SEC used the former buildings to store miscellaneous equipment (Tetra Tech, 2020).
- Arbuckle Creek and Arbuckle Creek Wetlands are an approximate three mile stretch of Arbuckle Creek and associated wetlands adjacent to and downgradient of the former SEC Property. Arbuckle Creek flows east at this location and the primary portion of this AOC is the one-mile stretch of Arbuckle Creek and associated wetlands immediately downstream of the former SEC Property. The secondary portion of this AOC is the next two miles of the creek to its confluence with the New River.
- Residential Properties are comprised of 11 private properties located along Arbuckle Creek, downstream of the former SEC Property and within the floodplain, as shown on **Figure 1-4**. In 1984 sediment from the creek was allegedly placed on the properties in the form of berms for flood control and as backfill to restore yards to grade (NUS, 1991a).
- Rocklick Road is an approximately 1,000 square foot section of unpaved road located north of Arbuckle Creek in the northeast portion of Minden. Sediment was allegedly dredged from Arbuckle Creek and placed on the road, and there is anecdotal evidence that PCB-containing oil may have been sprayed on the unpaved portion of the road for dust control (NUS, 1991b; Tetra Tech, 2020).
- New River and Pocahantas (NR&P) Supply House (a.k.a. Powerhouse) is the former supply house located south of Arbuckle Creek in the eastern portion of Minden. The building was demolished, and six abandoned transformers were removed from the building basement (Tetra Tech, 2020).

- Berwind Green Hill Mine Dump (a.k.a. Needles Eye) is the former open coal mine dump operated by NR&P and located north of Minden and Arbuckle Creek. The area was abandoned, covered with soil, and revegetated. There is anecdotal evidence that sediment from Arbuckle Creek may have been placed on this area for flood control (NUS, 1990).
- New River is approximately three miles downstream of the former SEC Property at the confluence with Arbuckle Creek. At the junction of Arbuckle Creek and the New River, the New River flows to the north/northeast. This AOC is part of the New River Gorge National Park and Preserve.
- Former Mines, including several outfalls, are located within the Minden area and were historically operated from the late 1800s until the 1950s (Weston, 2018b).

1.2.2 Site Investigations and Removal Actions

In September of 1984 the West Virginia Division of Natural Resources (WVDNR), of which part is now incorporated within the West Virginia Department of Environmental Protection (WVDEP), inspected the former SEC Property. USEPA completed an initial Preliminary Assessment/Site Inspection in October of 1984 which identified 150 transformers, 60 capacitors, and 75 drums (USEPA, 1984). Several of the transformers and capacitors were broken with oil spillage evident on the ground surface. Sampling results indicated very high levels of PCBs were present, up to 260,000 milligrams per kilogram (mg/kg) in soil (International Consultants, 2003).

Between 1984 and 1993 additional sampling was conducted at the former SEC Property and in the surrounding areas (Tetra Tech, 2020). Based on sampling results, three separate Removal Actions were completed at the former SEC Property, as follows:

1. 1984 to 1987 Removal Action to remove and dispose of capacitors, transformers, drummed solids and liquids, and approximately 4,735 tons of PCB-contaminated soil (USEPA, 1987; Weston, 2018b);
2. 1990 to 1991 Removal Action to excavate six areas around the former SEC building (International Consultants, 2003); and
3. 2001 to 2002 Removal Action to install an approximately one-acre impervious cap/barrier over the PCB-contaminated soil and the foundation of the former SEC building and install

a sheet pile cutoff wall along Arbuckle Creek (Weston, 2020; International Consultants, 2003).

In 2016 and 2017, the Town of Minden experienced several large flooding events. Due to community concerns, additional sampling was conducted at the former SEC Property and in the surrounding areas (Weston, 2020).

In May 2019, the Site was listed on the National Priorities List (NPL) (USEPA, 2019).

Between 2019 and 2020, a fourth Removal Action was completed at the former SEC Property to excavate and dispose of approximately 1,126 tons of PCB-contaminated soil from south of the capped area and perform maintenance activities on the impervious cap/barrier and cutoff wall (Weston, 2020).

Between 2019 and 2022, as part of the RI, additional sampling was conducted at the Site (Nobis, 2025).

1.3 Physical Characteristics of the Site

The Site is situated in the Appalachian Plateaus Physiographic Province of West Virginia. Topographically, the Appalachian Plateaus Province is characterized by a series of uplifted, dissected plateaus. The major tributaries have eroded broad, deep, steep-sided valleys; local relief along the valleys may exceed 1,000 ft. The drainage pattern exhibited is dendritic (NUS, 1991a).

The area around Arbuckle Creek is mostly underlain by Dekalb and Gilpin, very stony soils (NUS, 1991a). Some areas of the Site are underlain by mine dump debris including the area at the NR&P Supply House and Berwind Green Hill Mine Dump (NUS, 1990a; NUS, 1990b). Bedrock consists of coal (where not mined), siltstone, claystone, sandstone, and shale (Nobis, 2025).

In the vicinity of Minden, there are several coal seams within the Kanawha Formation and the New River Formation that contained economically viable thickness of coal for mining. From the late 1800s to the late 1950s, most of the land surrounding Minden was mined, primarily by underground room and pillar mining or by stripping the land to access shallow coal seams (Tetra Tech, 2020).

Arbuckle Creek is a relatively small, shallow, low-gradient perennial creek through most of its length ranging from a few ft wide in the upstream portion to 20 to 30 ft wide further downstream of the New River Gorge National Park and Preserve boundary. The creek is generally less than one to two ft deep throughout much of its reach; however, there are some deeper pools in the further downstream portion. Large sections of the channel are relatively straight, but there are some bends in the channel throughout the creek where deposition can occur. Arbuckle Creek becomes a higher gradient stream downstream of New River Gorge National Park and Preserve boundary, where the banks become very steep upstream of where it enters the New River. There are few depositional areas between this point and where it subsequently discharges into the New River. Sediment from Arbuckle Creek will ultimately be transported to the New River, especially during heavy rain events (Tetra Tech, 2020; USGS, 2024).

The floodplain of Arbuckle Creek, is a Federal Emergency Management Agency (FEMA) designated Zone A Flood Hazard Area, indicating that the area is subject to inundation by the 1-percent-annual-chance flood event. Palustrine and riverine wetlands are located downgradient of the former SEC Property and are hydraulically connected to the creek and can be inundated during flooding of Arbuckle Creek (Tetra Tech, 2020). In July 2001, flood waters engulfed the town of Minden in several feet of water. Recent flooding events have occurred in Minden in June 2016, June 2017, June 2020, and July 2022 (Nobis, 2025).

Groundwater at the Site was encountered at depths generally between 4-12 ft below ground surface (bgs) in overburden at the former SEC Property and at depths generally between 5-46 ft bgs in bedrock at the former SEC Property, Britt Bath House, and the Possible Transformer Storage Area. Based on static water levels collected in 2021 and 2022, overburden groundwater at the former SEC Property generally flows to the northeast, in the same direction as Arbuckle Creek; however, in isolated areas of the former SEC Property, overburden groundwater flow is influenced by the presence of the sheet pile wall. At the former SEC Property, Britt Bath House, and Possible Transformer Storage Area, the bedrock groundwater flows to the east and southeast (Nobis, 2025).

1.4 Nature and Extent of Contamination

The nature and extent of contamination information presented in this section is abbreviated; additional information is provided in the RI report (Nobis, 2025).

During the RI, results from samples collected for various media (soil, overburden groundwater, bedrock groundwater, surface water, and sediment) were compared to project screening levels (PSLs) and Site-specific background threshold values (BTVs) to evaluate the nature and extent of contamination. PSLs are numerical screening values used to help determine if a contaminant is a potential concern to human health or the environment. The PSLs consisted of federal screening levels, federal standards, and West Virginia standards, as well as Site-specific ecological PSLs identified in the Screening Level Ecological Risk Assessment (SLERA) (Nobis, 2023b) which is Volume III of the RI report. Concentrations above PSLs do not necessarily indicate remedial action is required.

Below is a summary of the nature and extent of contamination in Site media.

1.4.1 Soil Contamination

Significant contaminant classes in soil include semivolatile organic compounds (SVOCs) (particularly polycyclic aromatic hydrocarbons [PAHs]), PCBs, dioxins/furans, metals, and cyanide. Volatile organic compounds (VOCs) and pesticides were infrequently detected in soils at concentrations above PSLs, and, therefore, do not represent significant contaminant classes for soil at the Site. The following briefly summarizes contaminants in Site soils.

Numerous SVOCs exceeded PSLs and, less frequently, BTVs, at all of the AOCs except the Berwind Green Hill Mine Dump. The PSL exceedances were primarily for PAHs, especially benzo(a)pyrene. There were also multiple PSL exceedances for bis(2-ethylhexyl)phthalate; however, a BTV is not established for this compound. The PSL and BTV exceedances are primarily located in surface and near surface soil near roads. Based on the distribution of exceedances in surface and near surface soil across all of the AOCs and the contaminants most frequently reported above PSLs, PAHs and bis(2-ethylhexyl)phthalate, which are both prevalent in urban environments and, in the case of PAHs, released from coal mining operations, it is likely that the elevated SVOC levels are due to sources other than the SEC activities.

Total PCBs exceeded PSLs and BTVs in one or more samples in all AOCs except Rocklick Road, the NR&P Supply House, and the Berwind Green Hill Mine Dump. The PCBs contributing to these exceedances were most commonly Aroclor 1260, Aroclor 1254, and PCB congeners (PCB-118, PCB-126, PCB-167, PCB-169, and PCB-77). The PSL and BTV exceedances are primarily located in surface and near surface soil. The highest total PCB results were reported at the former SEC Property and the majority of total PCB exceedances in Arbuckle Creek were reported at locations just downstream of the former SEC Property AOC. Based on this information, it is likely that the elevated PCB levels at the AOCs are due to SEC activities.

For dioxins/furans, the dioxin toxicity equivalence (TEQ) value for mammals exceeded PSLs and the BTV in one or more samples at all AOCs. These exceedances are primarily located in surface and near surface soil and distributed randomly across all of the AOCs. Based on the distribution of exceedances in surface and near surface soil across all AOCs, and combustion of PCBs, wood, coal, and other fossil fuels being a potential source of dioxins/furans, the elevated dioxin/furan levels at the AOCs may be due to SEC activities, as well as other sources. Specifically, other sources appear to have resulted in the elevated dioxins/furans detected in soil at the Rocklick Road, NR&P Supply House, and Berwind Green Hill Mine Dump AOCs due to the lack of elevated PCBs detected above PSLs and BTVs at these AOCs.

Numerous metals exceeded PSLs and BTVs at all AOCs. These exceedances are located in almost all surface soil, near surface soil, and subsurface soil samples with no clear spatial distribution. Based on this information, it is likely that the elevated metals levels are due to sources other than the SEC activities, such as the local coal mining operations which would have transported metal ores from the subsurface to the surface.

Cyanide exceeded PSLs in one or more samples at all AOCs except the Berwind Green Hill Mine Dump; however, a BTV is not established for this compound. The PSL exceedances are primarily located in surface and near surface soil. The highest cyanide results are in near surface and subsurface soil at two soil borings on the east side of the Possible Transformer Storage Area AOC. The material encountered in the two soil borings was reported as fill that included coal fragments/fines and mine spoil. Based on this information, it is likely that the elevated cyanide levels are due to sources other than the SEC activities, such as fill from unknown sources, the local coal mining industry, and/or naturally occurring background conditions.

1.4.2 Overburden Groundwater Contamination

Overburden groundwater was only investigated at the former SEC Property AOC. Contaminants reported in overburden groundwater above PSLs include VOCs, SVOC/PAHs, pesticides, PCBs, dioxins/furans, metals, and cyanide. The PSL exceedances for VOCs, SVOC/PAHs, pesticides, dioxins/furans, and cyanide were limited spatially to one or two wells and did not occur consistently during all four rounds of sampling; therefore, they are not considered significant contaminant classes in overburden groundwater.

Total PCB exceedances occurred in three wells over multiple sample rounds, GW-001, MW-403A, and MW-404A, which are located at the former SEC Property, at the upgradient end and side-gradient of the capped area. The exceedances are limited spatially and do not extend downstream or off the former SEC Property AOC. The exceedance at MW-403A extends to bedrock groundwater (MW-403B). Based on this information, it is likely that the elevated PCB levels in groundwater are due to SEC activities and the PCB-contaminated soil consolidated under the impervious barrier/cap.

Total and dissolved metals PSL exceedances occurred at all of the wells on the former SEC Property AOC. In particular, four total and dissolved metals including arsenic, cobalt, iron, and manganese, consistently exceeded PSLs during most sample events for most wells. Metals are frequently detected in groundwater due to naturally occurring conditions; however, because background samples were not collected for overburden groundwater, it cannot be determined which exceedances may be due to background conditions. Based on this information, the elevated metals levels in overburden groundwater are likely due to sources other than the SEC activities, such as naturally occurring background conditions and the local coal mining operations.

1.4.3 Bedrock Groundwater Contamination

Bedrock groundwater was investigated at the former SEC Property, Possible Transformer Storage Area, and the Britt Bath House AOCs. Contaminants reported in bedrock groundwater above PSLs include VOCs, SVOC/PAHs, PCBs, and metals. Three classes of contaminants, pesticides, dioxins/furans, and cyanide did not exceed PSLs, and the SVOC/PAH PSL exceedance was not above the BTV; therefore, they are not considered significant contaminant classes in bedrock groundwater.

VOC exceedances (chlorobenzene compounds) occurred over multiple sample rounds in one well, MW-403B, which is located at the former SEC Property, upgradient of the capped area. One chlorobenzene compound, 1,4-dichlorobenzene, was also reported above PSLs in the overburden groundwater at this location. The overburden and bedrock chlorobenzene compound exceedances are limited spatially to this well pair and do not extend downstream or off the former SEC Property AOC; chlorobenzenes were also not detected in the upgradient background wells. Chlorobenzenes were mixed with some commercial PCB mixtures. Based on this information, it is likely the elevated chlorobenzene compound levels in groundwater are due to SEC activities.

PCB exceedances occurred in one well over multiple sample rounds, MW-403B, which is located at the former SEC Property AOC, upgradient of the capped area. Total PCBs were also reported above PSLs in the overburden groundwater at this location. The exceedances are limited spatially and do not extend downstream or off the former SEC Property AOC. Based on this information, it is likely that the elevated PCB levels in groundwater are due to SEC activities and the PCB-contaminated soil consolidated under the impervious barrier/cap.

Total and dissolved metals PSL exceedances occurred at all of the wells in the three AOCs investigated (former SEC Property, Possible Transformer Storage Area, and Britt Bath House). Similar to overburden groundwater, four total and dissolved metals, arsenic, cobalt, iron, and manganese, consistently exceeded PSLs during most sample events for most wells. Some of these exceedances were also above BTVs. Based on this information, it is likely that the elevated metals levels in groundwater are due to sources other than the SEC activities, such as naturally occurring background conditions.

1.4.4 Surface Water Contamination

Surface water was investigated at the Britt Bath House, Arbuckle Creek, Arbuckle Creek Wetlands, Residential Properties, Rocklick Road, and NR&P Supply House AOCs. The primary contaminant class in surface water is metals. The other contaminant classes, VOCs, SVOCs, pesticides, PCBs, dioxins/furans, and cyanide do not represent significant contaminant classes for surface water at the Site.

Metals were consistently reported in surface water at all investigated AOCs at levels above PSLs; many of these PSL exceedances also exceeded BTVs. The primary metals reported above PSLs and BTVs include arsenic, cobalt, iron and manganese, similar to groundwater. As was noted for other Site media, it is also likely that the elevated metals levels in surface water are due to sources other than the SEC activities, such as naturally occurring background conditions and the local coal mining operations which would have transported metal ores from the subsurface to the surface.

1.4.5 Sediment Contamination

Sediment was investigated at the Britt Bath House, Arbuckle Creek, Arbuckle Creek Wetlands, Residential Properties, Rocklick Road, NR&P Supply House, and New River AOCs. Significant contaminant classes in sediment include SVOCs (particularly PAHs), PCBs, dioxins/furans and metals. VOCs, pesticides, and cyanide were infrequently detected in sediment at concentrations above PSLs and, therefore, do not represent significant contaminant classes for sediment at the Site. The following briefly summarizes contaminants in Site sediment.

Numerous SVOCs exceeded PSLs and, less frequently, BTVs, at all of the investigated AOCs. The PSL exceedances were primarily for PAHs, especially benzo(a)pyrene. There were also PSL exceedances for bis(2-ethylhexyl)phthalate at Rocklick Road AOC; however, a BTV is not established for this compound. The PAH PSL and BTV exceedances are primarily located in sediment near roads. For the Arbuckle Creek and Arbuckle Creek Wetlands AOCs, the PAH exceedances were located in sediment near roads and downstream of the Possible Transformer Storage Area. Similar to the PAH and bis(2-ethylhexyl)phthalate exceedances in soil, it is likely that the elevated SVOC levels in sediment are due to sources other than the SEC activities.

Total PCBs exceeded PSLs and BTVs in one sediment sample at the Britt Bath House and several samples at Arbuckle Creek and Arbuckle Creek Wetlands. The total PCB PSL and BTV exceedances in the creek and wetlands are at sample locations all along the creek from the former SEC Property AOC to the confluence with Rocklick Creek. The PCBs contributing to these exceedances were most commonly Aroclor 1260, Aroclor 1254, and PCB congener PCB-126. Based on this information, it is likely that the elevated PCB levels at the AOCs are due to SEC activities.

For dioxins/furans, the calculated dioxin TEQ for mammals exceeded PSLs and the BTV in one sediment sample from each of the following AOCs: Britt Bath House, Residential Property R6, and Rocklick Road; and in several samples at Arbuckle Creek and Arbuckle Creek Wetlands. The dioxin TEQ PSL and BTV exceedances in the creek are at sample locations near and downstream of the former SEC Property AOC and the Possible Transformer Storage Area AOC and in the wetlands all along the creek from the former SEC Property AOC to the confluence with Rocklick Creek. Except for Rocklick Road, these are similar to the areas with total PCB PSL and BTV exceedances. There is also a dioxin TEQ PSL and BTV exceedance at a sample located in the creek much farther downstream, prior to the confluence with the New River. Based on the distribution of exceedances and combustion of PCBs, wood, coal, and other fossil fuels being a potential source of dioxins/furans, the elevated dioxin/furan levels at the AOCs may be due to SEC activities, as well as other sources.

Numerous metals exceeded PSLs and BTVs at all of the investigated AOCs. These exceedances are located across the AOCs with no clear spatial distribution. The arsenic PSL and BTV exceedances in Arbuckle Creek and Arbuckle Creek Wetlands are at sample locations downstream of the Possible Transformer Storage Area AOC and all along the creek from the former SEC Property AOC to the confluence with New River. Based on this information, it is likely that the elevated metals levels are due to sources other than the SEC activities, such as the local coal mining operations which would have transported metal ores from the subsurface to the surface.

1.5 Risk Assessment Summary

The risk assessment summary information presented in this section is abbreviated; additional information is provided in the RI report (Nobis, 2025), the Human Health Risk Assessment (HHRA) (Nobis, 2022; Nobis, 2024) which is Volume II of the RI report, and the SLERA (Nobis, 2023b) which is Volume III of the RI report.

1.5.1 Human Health Risk Assessments Summary

Concurrent with development of the RI, Nobis and Bluestone Environmental Group, Inc., prepared two HHRAs, as follows:

- SEC Property HHRA to evaluate human health risks associated with surface and subsurface soil at the former SEC Property (Nobis, 2022); and
- Site-wide HHRA to evaluate human health risks associated with contamination in Site-wide groundwater and in soil, sediment, and surface water at all of the AOCs except the former SEC Property (Nobis, 2024).

The USEPA updated the lead policy on January 17, 2024, with Updated Residential Soil Lead Guidance for CERCLA and Resource Conservation and Recovery Act (RCRA) Corrective Action Facilities, which recommends using a residential soil lead Regional Screening Level (RSL) of 200 mg/kg when evaluating human health risks. Applying this policy to the HHRAs for the Site does not modify the Site-specific conclusions but will be considered throughout the CERCLA process.

Risks are based on an estimate of the Reasonable Maximum Exposure (RME) and the average Central Tendency Exposure (CTE) expected to occur at the Site. The four potential receptor populations identified for risk-based evaluation under the RME and CTE scenarios included:

- Adult and child recreators (current/future);
- Adult and child residents (current/future);
- Industrial workers (future); and
- Construction workers (future).

Chemicals of potential concern (COPCs) identified in the SEC Property HHRA include the following general classes of chemicals in soil (surface, near surface, and subsurface):

- SVOCs (1,2,4,5-tetrachlorobenzene and PAHs);
- Pesticides (dieldrin);
- PCBs (Aroclor 1254, Aroclor 1260, and dioxin-like PCB congeners TEQ)
- Dioxin TEQ; and,
- Metals (aluminum, antimony, arsenic, cadmium, chromium, cobalt, iron, manganese, and thallium).

COPCs identified in the Site-wide HHRA include the following general classes of chemicals in soil (surface, near surface, and subsurface), sediment, groundwater and surface water:

- VOCs (chlorinated) *groundwater only*;
- SVOCs (PAHs);
- Pesticides (4,4’-Dichlorodiphenyldichloroethane, dieldrin, heptachlor epoxide) *groundwater only*;
- PCBs (Aroclor 1260, dioxin-like PCB congeners TEQ, and total PCB homologs)
- Dioxin TEQ;

- Metals (aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, thallium, vanadium, and zinc); and,
- Cyanide.

As far as unacceptable risks to human health, in general, sediment, surface water and indoor air exposure are not a concern apart from chromium in sediment which is due to chromium being evaluated as hexavalent chromium, the more toxic form of chromium. With respect to current resident scenarios, exposure risks at R3, R5, R6, R8, and R10 are due to chromium (chromium being evaluated as hexavalent chromium), R7 and R8 have exposure risks due to dioxins/furans, and there is a potential concern for lead in surface soil at R3.

Groundwater contributes to unacceptable risk for future residential and industrial uses with overburden groundwater having significantly higher risk than bedrock groundwater. Potable use of overburden groundwater COPCs include arsenic, chromium (as hexavalent chromium), dioxins, cobalt, manganese, thallium, total PCB homologs (ingestion) and cyanide (inhalation while showering). Potable use of bedrock groundwater COPCs include arsenic and manganese. Currently, groundwater is not used for potable purposes at the Site as the residential community of Minden is supplied with public water via the West Virginia American Water Company.

Individual COPCs in Site media at each AOC are listed below by AOC:

- <u>Arbuckle Creek:</u> COPC is lead in surface soil.
- <u>Arbuckle Creek Wetlands:</u> COPC is lead in sediment.
- <u>Berwind Green Hill Mine Dump:</u> COPCs in total soil are arsenic and chromium.
- <u>Britt Bath House:</u> COPCs in total soil include: arsenic, chromium, cobalt, iron, manganese, thallium, benzo(a)pyrene, and dioxin-like PCB congener TEQ. COPCs in sediment include: arsenic, chromium, and manganese. COPCs in bedrock groundwater include: arsenic, chromium, cobalt, iron, manganese, thallium, cyanide, naphthalene, dioxin TEQ, and dioxin-like PCB congener TEQ.
- <u>Former SEC Property:</u> COPCs in surface soil include: cobalt, dioxin TEQ, and dioxin-like PCB congener TEQ. COPCs in total soil include: arsenic, chromium, benzo(a)pyrene, dioxin TEQ, dioxin-like PCB congener TEQ, and PCB Aroclor 1260. COPCs in groundwater were determined by applying the results from the Britt Bath House and

Possible Transformer Storage Area HHRA scenarios to the former SEC Property AOC. Based on this, COPCs in bedrock groundwater include: arsenic, chromium, cobalt, iron, manganese, thallium, cyanide, naphthalene, dioxin TEQ, and dioxin-like PCB congener TEQ. COPCs in overburden groundwater include: arsenic, chromium, cobalt, manganese, thallium, cyanide, dibenz(a,h)anthracene, 4,4'-dichlorodiphenyldichloroethane, dieldrin, dioxin TEQ, dioxin-like PCB congener TEQ, and total PCBs.

- NR&P Supply House: COPCs in total soil include: arsenic, chromium, and manganese. COPCs in sediment include: arsenic, chromium, manganese, and dioxin TEQ.
- Possible Transformer Storage Area: COPC in surface soil is manganese. COPCs in total soil include: arsenic, chromium, cobalt, iron, manganese, thallium, cyanide, and PCB Aroclor 1260. COPCs in bedrock groundwater include: arsenic, chromium, cobalt, iron, manganese, thallium, cyanide, naphthalene, dioxin TEQ, and dioxin-like PCB congener TEQ.
- Residential Properties: COPCs in surface soil and total soil include: arsenic, chromium, cobalt, lead, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, dioxin TEQ, dioxin-like PCB congener TEQ, and PCB Aroclor 1260. COPCs in sediment are arsenic, chromium, and dioxin TEQ. COPC in surface water is chromium.
- Rocklick Road: COPCs in surface soil, total soil, and sediment are arsenic and chromium. COPC in surface water is chromium.

1.5.2 Screening Level Risk Assessment Summary

Concurrent with development of the RI, Nobis and Jacobs Engineering prepared a SLERA to evaluate ecological risks to terrestrial and aquatic receptors from contamination in soil, sediment, and surface water at all AOCs. The spatial extent of the SLERA encompassed aquatic habitats at two AOCs (Arbuckle Creek and Arbuckle Creek Wetlands; and New River) and terrestrial habitat at all of the other AOCs. The SLERA was completed with RI data collected through 2019. Even though additional RI data were collected after 2019, the post-2019 data were consistent with the previous data and did not further inform the conclusions of the SLERA; therefore, additional ecological evaluations were not required (Nobis, 2025).

At the completion of the SLERA Step 2, several chemicals of potential ecological concern (COPECs) were identified in surface soil at the Site. Potential risks were indicated to aquatic and terrestrial receptors from direct exposure to a variety of chemicals in surface soils. Potential risks were also indicated through No Observable Adverse Effect Level (NOAEL)-based food web exposure to terrestrial and semiaquatic upper trophic-level receptors from exposure to several chemicals. Therefore, the screening and food chain modeling was reassessed using refined exposure assumptions (SLERA Step 3a).

The SLERA results indicated the presence of COPECs at the Site. Potential risks were indicated to aquatic and terrestrial receptors from direct exposure to a variety of chemicals in surface soils, including SVOCs, pesticides, PCBs, and inorganics. Potential risks were also indicated through NOAEL-based food web exposure to terrestrial and semiaquatic upper trophic-level receptors from exposure to PCBs, dioxins/furans, and metals. However, Site-wide Lowest Observed Adverse Effect Level (LOAEL)-based food web exposure for constituents across all aquatic habitats showed no risks for any of the COPECs. And Site-wide LOAEL-based food web exposure scenarios for constituents across all terrestrial habitats only showed risks to the short-tailed shrew (nickel).

1.6 Conceptual Site Model

A conceptual site model (CSM) is an iterative representation of a site that describes the known and suspected sources of contamination, types of contaminants, distribution and migration of contaminants for various media, as well as the site-specific conditions that affect the potential migration and fate of contaminants in the environment and known or potential human health and ecological receptors. Consistent with EPA's *Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model* (USEPA, 2011), a CSM has been developed and refined for the Site based on available information and data; the CSM is shown on **Figure 1-5**.

1.6.1 Contaminant Sources, Release Mechanisms, and Fate and Transport

As shown in the CSM (**Figure 1-5**), the primary source of contamination at the Site is from the historical manufacturing, disposal, and operation practices by the SEC that resulted in direct releases of PCB-containing oil and waste to the ground surface. Other sources of contamination at the Site include activities by the local coal mining industry, stormwater and treatment system discharges to Arbuckle Creek, and anthropogenic activities common to developed areas; these other sources have resulted in direct releases to the ground surface (soil) and Arbuckle Creek (surface water and sediment) and indirect releases to these media from the atmosphere.

Secondary release mechanisms for Site contaminants in surface soil consist of natural processes (seepage, infiltration, runoff, erosion, and airborne dust) which have previously and continue to transport contaminants from soil to groundwater, surface water, and sediment. Once contaminants are in surface water or are entrained in sediment, they become much more mobile than in terrestrial soil. Heavy rain and frequent flooding events have contributed to the transport of contaminants downstream in Arbuckle Creek. In addition, dredged sediment from Arbuckle Creek has reportedly been placed in upland areas along the creek which would also contribute to the transport of contamination from the former SEC Property. Contaminant migration via seepage and infiltration has transported soil contaminants into subsurface soil and the overburden and bedrock aquifers.

1.6.2 Site-Related Contamination

To assess whether contaminants detected at the Site are related to SEC activities or are from other anthropogenic sources or naturally occurring conditions, samples of soil, bedrock groundwater, surface water, and sediment were collected from background reference areas during the RI and historical Site activities were reviewed.

The results from the background reference samples were compared to PSLs, and the background data sets were used to calculate BTVs and perform BTV comparisons and statistical background evaluations. The BTVs were calculated and presented in the RI report (Nobis, 2025). For the PSL comparison, background sample results showed elevated concentrations above PSLs of SVOCs (particularly PAHs and bis[2-ethylhexyl]phthalate), dioxins/furans, and metals in soil, sediment, and surface water; and metals in bedrock groundwater. The BTV comparisons and statistical background evaluations were performed for COPCs and COPECs in the risk assessments, and results are presented in the RI report (Nobis, 2025).

The historical Site activities were reviewed to determine contaminants that may be present due to SEC activities. The primary Site contaminants from the SEC activities are PCBs associated with the dielectric oil used in the transformers. In addition to PCBs, PCB transformer oil often contains dioxins/furans, as well as VOCs and SVOCs such as phenols and chlorobenzenes.

Dioxins/furans are also produced from combustion of PCBs; the 1997 fire at the SEC Property building that reportedly contained materials with PCBs could have been a potential source for dioxins/furans.

Based on these known and suspected SEC activities, the following contaminants that were evaluated in the risk assessments are unlikely to be related to SEC activities, and are, therefore, eliminated as COPCs and COPECs for potential remedial action: SVOCs (PAHs and phthalates), pesticides, metals, and cyanide.

COPCs and COPECs above background that are likely due to or partially due to SEC activities and which will be evaluated for potential remedial action include:

- PCBs; and
- Dioxins/furans.

Specifically, this includes the following:

- Soil at: the Former SEC Property, Possible Transformer Storage Area, Britt Bath House, Residential Properties, Rocklick Road, NR&P Supply House, and Berwind Green Hill Mine Dump;
- Sediment at Residential Properties and New River;
- Sediment and surface water at Arbuckle Creek and Wetlands; and,
- Groundwater at the Former SEC Property.

2.0 REMEDIAL OBJECTIVES

This section presents the development of Remedial Action Objectives (RAOs) which are the goals used in developing General Response Actions (GRAs) and remedial alternatives.

2.1 Chemicals of Concern

The chemicals of concern (COCs) that will be addressed by the response action will be formally documented in the ROD. COCs are a subset of the COPCs and COPECs identified and evaluated in the risk assessments. The COCs identified in this FS are based on results of the risk assessments and the CSM, particularly the evaluation of Site-related contamination. The COCs include the following SEC-related contaminants: PCBs and dioxins/furans. Contaminants that were identified as COPCs and COPECs in the risk assessments but are unlikely to be related to SEC activities or are consistent with background levels are not included as COCs.

The calculated human health risks and ecological risks for the COCs in media at each AOC are summarized in **Table 2-1** and **Table 2-2**, respectively.

2.2 Applicable or Relevant and Appropriate Requirements and To Be Considered Information

2.2.1 General Overview

Applicable or Relevant and Appropriate Requirements (ARARs) are promulgated, enforceable, federal and state, substantive environmental protection requirements that are determined to be legally applicable or relevant and appropriate to hazardous substances, remedial actions, or other circumstances at a CERCLA site. The NCP Section 300.430 states that on-site remedial actions at CERCLA sites must meet ARARs unless there are grounds for invoking a waiver. The two classes of ARARs: "applicable" and "relevant and appropriate" requirements are defined below. Another category, To Be Considered (TBC) information, is also explained. Should ARARs change in the future, potential impacts to the effectiveness and protectiveness of the selected remedy will be evaluated during Five-Year Reviews.

Applicable Requirements – Section 300.5 of the NCP defines applicable requirements as “those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.” Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. For example, National Pollutant Discharge Elimination System regulations, which specify requirements for point source discharges to surface water, may be "applicable" to CERCLA remedial actions that include discharge of treated groundwater to a surface water body.

Relevant and Appropriate Requirements – Section 300.5 of the NCP defines relevant and appropriate requirements as “those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site." Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate. For example, Safe Drinking Water Act Maximum Contaminant Levels (MCLs), criteria that regulate the concentration of contaminants in public water supply systems, are often "relevant and appropriate" requirements at CERCLA sites. MCLs are "applicable" only to water in a public drinking water supply system; however, they may be "relevant and appropriate" requirements for groundwater at a CERCLA site if the aquifer could be used as a drinking water supply, or if MCLs are used to derive soil cleanup action levels.

TBC Information – TBC information includes non-promulgated criteria, advisories, and guidance issued by the federal or state governments. Along with ARARs, TBC information may be used to develop the interim action limits necessary to protect human health and the environment. For example, USEPA Health Advisories and Reference Doses are non-promulgated criteria that are used in assessing health risks from contaminants present on CERCLA sites.

ARARs and TBCs are divided into three categories: chemical-specific, location-specific, and action-specific. These are briefly described in the following paragraphs.

Chemical-specific ARARs and TBCs – Chemical-specific ARARs are cited if they include promulgated health- or risk-based numerical values that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Chemical-specific TBCs consist of guidance that describe methodologies used in the calculation of risk-based numerical values that establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Typically, chemical-specific requirements are set for a single chemical or a closely related group of chemicals.

Location-specific ARARs and TBCs – Location-specific ARARs are typically restrictions placed on the conduct of activities solely because they are in specific areas. Typically, the location-specific ARARs are pertinent to wetlands, floodplains, the presence of endangered species, or historical, archaeological, or cultural resources at sites where remedial actions may occur. In general, the location-specific regulations require a determination of whether adverse effects will result from actions to be taken; unavoidable impacts require appropriate mitigation and/or compensation measures.

Action-specific ARARs and TBCs – Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to the proposed remediation methods. These requirements are generally focused on actions taken to remediate, handle, treat, transport, or dispose of waste materials. They also include regulations for control of noise, fugitive dust, and invasive species during construction activities. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved.

2.2.2 Site-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Information

Potential chemical-specific, location-specific, and action-specific ARARs and TBCs are presented in **Appendix A**, as **Tables A-1**, **A-2**, and **A-3**, respectively.

2.3 Basis for Action

2.3.1 General Overview

To determine whether a response action is warranted at a Superfund site, risk management decisions need to assess whether there is a basis for action. If one or more conditions identified below are met, then a basis for action will have been established to support a response action under CERCLA (USEPA, 1997):

- Releases specified in CERCLA Part 104(a)(1).
- Presence of significant human health risk, defined as follows:
    - The cumulative excess carcinogenic risk to an individual exceeds 1E-04 (using RME assumptions for either the current or reasonably anticipated future land use);
    - The non-carcinogenic hazard index (HI) is greater than 1 (using RME assumptions for either the current or reasonably anticipated future land use).
- Exceedances of chemical-specific standards or other measures that define acceptable risk levels.
- COCs that cause adverse environmental impacts.

2.3.2 Site-Specific Basis for Action

Table 2-3 summarizes the basis for action at each AOC and media for the COCs, if a basis for action was established. This information is also discussed below.

The HHRAs identified unacceptable human health risks establishing a basis of action for the COCs as follows:

- Carcinogenic risks greater than 1E-04 and/or non-carcinogenic risks greater than 1, partially due to COCs in soil, at the following AOCs:
    - Former SEC Property
    - Possible Transformer Storage Area
    - Britt Bath House
    - Residential Properties (R3, R4, R5, R6, R7, R8, R9, R10, and R11)
- Carcinogenic risks greater than 1E-04 and non-carcinogenic risks greater than 1, partially due to COCs in groundwater at the Former SEC Property.

The SLERA identified a potential for unacceptable ecological risks establishing a basis for action for the COCs as follows:

- Ecological risks greater than LOAELs based on food-web modeling due to COCs in soil at the Former SEC Property and the NR&P Supply House.

As presented in Section 2.2 and **Appendix A Table A-1** (Chemical-Specific ARARs and TBCs), the *USEPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (USEPA, 1990) developed risk-based (for human health ingestion, inhalation, and dermal contact) PCB soil action levels and analytical starting points over which some action should be considered at a Superfund Site once it has been determined that action is necessary to provide protection of human health and the environment. For residential land use, this guidance recommends a PCB action level of 1 mg/kg in soil. Based on this chemical-specific policy a basis for action is established for the following:

- PCB concentrations greater than 1 mg/kg in soil and/or sediment at Former SEC Property; Possible Transformer Storage Area; Britt Bath House; Residential Properties R5, R6, R7, and R9, and Arbuckle Creek and Wetlands.

For this Site, this chemical-specific policy is applied to both soil and sediment due to the proximity and mixing of soil and sediment at the AOCs from flooding events and human activity.

2.4 Remedial Action Objectives

RAOs consist of media-specific goals for protecting human health and the environment. The RAOs specify the media and COCs, potential exposure routes and receptors, and remediation goals for each exposure route. By specifying what the cleanup will accomplish, the RAOs permit the development of a range of alternatives that may achieve protection by reducing exposure to contaminated media or reducing contaminant concentrations through treatment or removal.

RAOs have been developed for each environmental medium for which there is a basis for action under CERCLA and include the following:

- Prevent direct human exposure (via inhalation, dermal contact, and/or ingestion) to COCs in soil and sediment in excess of risk-based Preliminary Remedial Goals (PRGs).
- Prevent exposure of ecological receptors to COCs in soil and sediment that present an unacceptable ecological risk.
- Prevent migration of contaminants from soil source materials at the Former SEC Property to groundwater and surface water/sediments within Arbuckle Creek and downstream wetlands. (This RAO applies to soil at the Former SEC Property AOC which is evaluated in the FFS for the Former SEC Property [Nobis, 2023a] and will be addressed by the Early Action for OU-1 [USEPA, 2024]).
    - Groundwater monitoring will be performed following source removal as part of the Early Action for OU-1 (USEPA, 2024). Based on the results of monitoring, if further action is required to address groundwater contamination, it will be evaluated and addressed as a separate Operable Unit.

2.5 Preliminary Remediation Goals

2.5.1 General Overview

PRGs are risk-based concentrations derived from standardized equations, combining exposure assumptions and toxicity data, to determine an acceptable level or range of levels for each exposure route or are based on more stringent promulgated standards within chemical-specific

ARARs. PRGs for each COC are assembled based on readily available information (e.g., chemical-specific ARARs and risk information) and adjusted based on Site-specific information. PRGs are selected herein for use in the FS to determine the areas and volumes of contaminated media that will need to be addressed during the remedial action.

Although starting cleanup levels at the more protective end of the risk range is preferred, PRGs can be revised to a different risk level within the acceptable range in cases when appropriate site-specific factors support the revision. Such factors include:

- Exposure factors such as potential human exposure through various pathways and potential impacts to ecological receptors;
- Uncertainty factors such as analytical detection limits that may represent the lower bounds that chemicals can be reliably detected by commercial laboratories using standardized methods; and
- Technical factors such background levels of contamination and the ability to control the movement of contaminants.

The hierarchy used in the selection of PRGs is as follows:

1. If Site-specific background standards are greater than the PRG, the background value is the PRG.
2. If a promulgated ARAR standard is available, greater than background levels, and the most protective standard, that standard is selected as the PRG unless it is waived based on CERCLA standards for waiving ARAR requirements.
3. If a human health or ecological risk-based concentration is greater than background levels and the most protective standard, that concentration is selected as the PRG.
4. Finally, no risk-based PRG may be lower than the laboratory-determined reporting limit (RL) which is the detection level that a commercial analytical laboratory can be reasonably expected to achieve. If a risk-based PRG is lower than the RL, the RL is selected as the PRG.

2.5.2 Site-Specific Preliminary Remediation Goals

The selection of PRGs for Site media is summarized in **Table 2-4** and described below. The PRGs were selected based on human health and ecological ARARs or risk-based concentrations relative to site-specific BTVs.

2.5.2.1 Preliminary Remediation Goals for Soil and Sediment

PRGs developed for this FS include total PCBs (total PCB Aroclors or total PCB congeners) and dioxins/furans as measured by a dioxin TEQ for mammals. The PRGs for total PCBs will be protective for the risk posed by total PCBs, PCB Aroclor 1260, and dioxin-like PCB congeners TEQ exposures.

<u>Total PCBs</u>

Due to the historical and current PCB concentrations in soil at the former SEC Property source area, the *USEPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination* (USEPA, 1990) will be used to determine the PRG for PCBs in soil at the Site. This guidance document sets a PRG of 1 mg/kg for total PCBs in residential soil and a PRG of 10 mg/kg to 25 mg/kg for total PCBs in non-residential soil. This guidance further states that a PRG of 1 mg/kg to 2 mg/kg for PCBs is generally protective of wildlife.

Because the Site AOCs are in-use residential properties or are in areas of Minden currently zoned as Medium Density Residential District or Land Conservation District (City of Oak Hill, 2024), the PRG for PCBs in soil will be set at 1 mg/kg for total PCBs (Aroclors or congeners) to protect human health. A concentration of 1 mg/kg for PCBs equates to a cancer risk of 4.4E-06, which falls below the unacceptable risk level of 1E-04.

The PRG of 1 mg/kg for total PCBs will also apply to Site sediment due to proximity and mixing of soil and sediment at the AOCs from flooding events and human activity.

The PRG of 1 mg/kg for total PCBs is below the BTVs for near surface soil and subsurface soil, as shown in **Table 2-4**. PRGs cannot be set below background levels; however, the total PCB BTVs for near surface soil, subsurface soil, and sediment are based on non-detect results which are elevated due to the reporting limits for the individual PCB Aroclors. Therefore, the PRG of 1 mg/kg for total PCBs is reasonable and not below detectable background levels.

Dioxins

In 2012 USEPA released an oral non-cancer reference dose (RfD) for 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD) in the USEPA Integrated Risk Information System (USEPA, 2012). The 2012 RfD for TCDD is used to develop site-specific risk-based cleanup levels at Superfund sites. Therefore, the USEPA is no longer using the PRGs for dioxin in soil recommended in the USEPA 1998 *Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites* or the proposed interim PRGs provided in the USEPA December 2009 *Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites* (USEPA, 2025).

The USEPA resident risk-based RSLs for 2,3,7,8-TCDD in soil for the carcinogenic target risk of 1E-05 is 48 nanograms per kilogram (ng/kg) (equivalent to 4.8E-05 mg/kg) and for the non-cancer HI of 1 is 51 ng/kg, as shown in **Table 2-4**. Therefore, the PRG for protection of human health for dioxins/furans is 48 ng/kg. The PRG of 48 ng/kg for dioxin TEQ will apply to surface soil, near surface soil, and subsurface soil; it will also apply to Site sediment due to proximity and mixing of soil and sediment at the AOCs from flooding events and human activity. Based on the RI, the only portions of the Site with a basis for action and dioxin TEQ exceedances greater than 48 ng/kg are residential properties R7 and R8 being addressed in this FS, and one location at the former SEC Property AOC being addressed via cleanup of OU1.

Even though there is no actionable risk for dioxins/furans in Site soil and sediment based on SLERA food-web modeling LOAEL exceedances, the SLERA conservatively identified the potential for adverse risk based on NOAEL exceedances at the Britt Bath House AOC and the Site as a whole. Therefore, an analysis was performed to evaluate the adequacy of the PCB PRG of 1 mg/kg to also be ecologically protective for dioxins/furans due to COC co-location. This analysis is summarized in the Technical Memorandum for Surface Weighted Average Concentration Evaluation (SWAC) for Dioxin and Dioxin-like Compounds TEQ (Nobis, 2026). The analysis considered both pre- and post-remedial scenarios for dioxin TEQ SWACs for soil and sediment between 0-2 ft bgs in the Arbuckle Creek and Wetlands AOC. A similar SWAC evaluation was previously documented for the former SEC Property AOC and is not necessary nor relevant to the Residential Properties AOC because there are no ecological receptors or the Possible Transformer Storage Area or Britt Bath House AOCs because TEQ is already below the BTV of 14 ng/kg. The evaluation concluded that if soil/sediment with PCBs greater than 1 mg/kg are addressed throughout the Arbuckle Creek and Wetlands AOC, the resulting SWAC for TEQ would be less than the site-specific BTV (14 ng/kg) indicating the PRG for PCBs is adequately protective of ecological risk concerns from dioxins/furans.

2.6 Areal Extent and Volume of Contaminated Media

The distribution of total PCBs and/or dioxin TEQ above PRGs at the AOCs where there is a basis of action for these COCs is presented on **Figure 2-1** through **Figure 2-9** and discussed below by AOC. These figures also present the areal extents of the soil and sediment remedial response areas at each AOC. The estimated volume of soil and sediment to be remediated at each AOC is summarized in **Table 2-5**.

For each AOC where there is a basis of action for a COC, the areal extents assume samples that exceed the COC PRGs will be addressed. The areal extents conservatively encompass areas between exceedances. The volume estimates assume the depth of contaminated soil and sediment is the maximum depth of the sample exceedances and includes all material above the exceedances. This soil and sediment depth range is based on the CSM which attributes the PCB and dioxin contamination to surface deposits or surface releases.

The areal extent and volume of contaminated soil at the former SEC Property is not included in this FS; it was evaluated as part of the FFS (Nobis, 2023a). The areal extent and volume of contaminated groundwater at the former SEC Property is not included in this FS. Groundwater monitoring will be performed following source removal as part of the remedy for OU-1 (USEPA, 2024). Based on the results of groundwater monitoring, if further action is required to address groundwater contamination, it will be evaluated and addressed as a separate Operable Unit.

2.6.1 Possible Transformer Storage Area PCBs in Soil

At the Possible Transformer Storage Area, there is a basis for action for PCBs in soil.

The distribution of total PCBs in soil at the Possible Transformer Storage Area, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-1**. Total PCB Aroclors in one soil sample (SB333 [6-10 ft bgs] at 6.69 mg/kg) exceed the PRG of 1 mg/kg. This exceedance was due to the presence of Aroclor 1260. Four soil borings (SB-370 through SB-373) were added in all directions around SB-333 for purposes of delineating the 6.69 mg/kg concentration observed at this location. Results from all depth intervals from these borings were non-detect for total PCB

Aroclors, with the exception of SB-370 between 6-8 ft bgs, which detected Aroclor 1260 at a concentration of 0.116 mg/kg. This indicates that the single total PCB exceedance is localized.

The single remedial response area at SB333 for total PCBs in soil is shown on **Figure 2-1**.

2.6.2 Britt Bath House PCBs in Soil

At the Britt Bath House, there is a basis for action for PCBs in soil.

The distribution of total PCBs in soil and sediment at the Britt Bath House, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-2**. Total PCB congeners in one soil sample (SB344 [0-0.5 ft bgs] at 1.3 mg/kg) exceed the PRG of 1 mg/kg.

The single remedial response area at SB344 for total PCBs in soil is shown on **Figure 2-2**.

2.6.3 NR&P Supply House PCBs in Soil

At the NR&P Supply House, there is a basis for action for PCBs in soil.

A total of 14 soil samples were collected from various depths in 5 soil borings advanced at the AOC and 1 surficial grab location. None of the results exceed the PCB PRG of 1 mg/kg. Therefore, there is no remedial response area at the NR&P Supply House for PCBs in soil.

2.6.4 Arbuckle Creek and Wetlands PCBs in Soil and Sediment

At the Arbuckle Creek and Wetlands AOC, there is a basis for action for PCBs in soil and sediment.

The distribution of total PCBs in soil and sediment at the Arbuckle Creek and Wetlands AOC, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-3**.

For soil, total PCB congeners in six samples exceed the PRG of 1 mg/kg, as follows:

- SB409 (0-0.5 ft bgs) at 1.6 mg/kg;
- SB415 (0.5-2 ft bgs) at 1.2 mg/kg;
- SB416 (0.5-2 ft bgs) at 1.7 mg/kg;

- SB421 (0.5-2 ft bgs) at 1.3 mg/kg;
- SB424 (0-0.5 ft bgs) at 1.2 mg/kg; and
- SB428 (2-4 ft bgs) at 55 mg/kg.

For sediment, total PCB Aroclors in one sample exceed the PRG of 1 mg/kg (SW/SD311 [0.5-2 ft bgs] at 1.3 mg/kg) and total PCB congeners in nine samples exceed the PRG of 1 mg/kg, as follows:

- SW/SD305 (0-0.5 ft bgs) at 4.3 mg/kg;
- SW/SD306 (0-0.5 ft bgs) at 1.2 mg/kg;
- SW/SD308 (0-0.5 ft bgs) at 1.6 mg/kg;
- SW/SD310 (0.5-2 ft bgs) at 2.6 mg/kg;
- SW/SD311 (0-0.5 ft bgs) at 1.5 mg/kg;
- SW/SD318 (0-0.5 ft bgs) at 5.2 mg/kg;
- SD402 (0-0.5 ft bgs) at 2.2 mg/kg and (0.5-1 ft bgs) at 1.6 mg/kg; and
- SD405 (0-0.5 ft bgs) at 17 mg/kg.

The six remedial response areas at the Arbuckle Creek and Wetlands AOC for total PCBs in soil and sediment (AC1, AC2, AC2A, AC3, AC4, and AC5) are shown on **Figure 2-3A** and **Figure 2-3B**.

2.6.5 Residential Property R3 Dioxins in Soil

At Residential Property R3, there is a basis for action for dioxins in soil.

A total of three composite soil samples were collected from random locations across R3 (one each at the following depths: 0-0.5 ft bgs, 0.5-2 ft bgs, and 2-4 ft bgs). None of the results exceed the dioxin PRG of 48 ng/kg for dioxin TEQ. Therefore, there is no remedial response area at Residential Property R3 for dioxins in soil.

2.6.6 Residential Property R4 Dioxins in Soil

At Residential Property R4, there is a basis for action for dioxins in soil.

Only composite soil samples were collected from random locations across R4. None of the results exceed the dioxin PRG of 48 ng/kg. Therefore, there is no remedial response area at Residential Property R4 for dioxins in soil.

2.6.7 Residential Property R5 PCBs and Dioxins in Soil

At Residential Property R5, there is a basis for action for PCBs and dioxins in soil.

<u>Total PCBs</u>

The distribution of total PCBs in soil at Residential Property R5, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-4**. Total PCB congeners in five soil samples exceed the PRG of 1 mg/kg, as follows:

- R5-S03 (0-0.5 ft bgs) at 1.1 mg/kg;
- R5-S03 (0.5-2 ft bgs) at 1.1 mg/kg;
- R5-S04 (0-0.5 ft bgs) at 1.3 mg/kg;
- R5-S04 (0.5-2 ft bgs) at 2.3 mg/kg; and
- R5-S05 (0.5-2 ft bgs) at 3.9 mg/kg.

Total PCB Aroclors in one soil sample collected prior to the RI exceeded the PRG of 1 mg/kg (SS-43 [0-0.5 ft bgs] at 1.3 mg/kg). Also, total PCB Aroclors in one composite soil sample collected from random locations across R5 exceeds the PRG of 1 mg/kg (R05-S [0-0.5 ft bgs] at 1.29 mg/kg).

The remedial response area at Residential Property R5 for total PCBs in soil is shown on **Figure 2-4**.

<u>Dioxins</u>

None of the results exceed the dioxin PRG of 48 ng/kg. Therefore, there is no remedial response area at Residential Property R5 for dioxins in soil.

2.6.8 Residential Property R6 PCBs and Dioxins in Soil and Dioxins in Sediment

At Residential Property R6, there is a basis for action for PCBs and dioxins in soil and a basis for action for dioxins in sediment.

Total PCBs in Soil

The distribution of total PCBs in soil at Residential Property R6, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-5**. Total PCBs in three soil samples exceed the PRG of 1 mg/kg, as follows:

- R6-S05 (0.5-2 ft bgs) at 1.7 mg/kg (total PCB congeners);
- SS407 (0-0.5 ft bgs) at 2.4 mg/kg (total PCB congeners); and
- R06-C-D (0.5-2 ft bgs) at 1.67 mg/kg (total PCB Aroclors).

The remedial response area at Residential Property R6 for total PCBs in soil is shown on **Figure 2-5**.

Dioxins in Soil and Sediment

None of the soil results or sediment results exceeded the dioxin PRG of 48 ng/kg for dioxin TEQ. Therefore, there are no remedial response areas at Residential Property R6 for dioxins in soil or sediment.

2.6.9 Residential Property R7 PCBs and Dioxins in Soil

At Residential Property R7, there is a basis for action for PCBs and dioxins in soil.

Total PCBs

The distribution of total PCBs in soil at Residential Property R7, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-6**. Total PCB congeners in two soil samples collected from R7-S05 exceed the PRG of 1 mg/kg, as follows:

- R7-S05 (0-0.5 ft bgs) at 1.7 mg/kg; and
- R7-S05 (0.5-2 ft bgs) at 3.0 mg/kg.

The remedial response area at Residential Property R7 for total PCBs in soil is shown on **Figure 2-6**.

Dioxins

The distribution of total dioxins in soil at Residential Property R7 using the dioxin TEQ is shown on **Figure 2-7**. A total of two soil samples exceed the PRG of 48 ng/kg.

- R7-S04 (0-0.5 ft bgs) at 580 ng/kg; and
- R7-S05 (0.5-2 ft bgs) at 62 ng/kg.

The remedial response area at Residential Property R7 for dioxins in soil is shown on **Figure 2-7.**

2.6.10 Residential Property R8 PCBs and Dioxins in Soil

At Residential Property R8, there is a basis for action for PCBs and dioxins in soil.

Total PCBs

The distribution of total PCBs in soil at Residential Property R8, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-8**. Only composite soil samples were collected from random locations across R8 and none of the results exceed the PRG of 1 mg/kg. Therefore, there is no remedial response area at Residential Property R8 for total PCBs in soil.

Dioxins

The distribution of dioxin TEQ in soil at Residential Property R8 is also shown on **Figure 2-8**. Only composite soil samples were collected from random locations across R8. Results for the following composite samples exceed the PRG of 48 ng/kg:

- R8-S01 (0-0.5 ft bgs) at 88 ng/kg;
- R8-S02 (0.5-2 ft bgs) at 62 ng/kg.

The remedial response area at Residential Property R8 for dioxins in soil is shown on **Figure 2-8**. Because the exceedances are based on a composite sample collected across the property, an assumed remedial response area of a portion of the property is identified in the figure; however, the extents of this remedial response area will be refined by collecting discrete soil samples during future pre-design investigation (PDI) sampling. It should be noted that although PCBs have not been detected above the PRG of 1 mg/kg at this property, any co-located PCBs in soil will be addressed through a remedial action based on dioxin TEQ and will consequently result in an overall reduction of risk. PDI and any confirmation samples that may be collected can be used to confirm that PCBs do not require further action for this property.

2.6.11 Residential Property R9 PCBs and Dioxins in Soil

At Residential Property R9, there is a basis for action for PCBs and dioxins in soil.

Total PCBs

The distribution of total PCBs in soil at Residential Property R9, using the higher of total PCB Aroclors and total PCB congeners, is shown on **Figure 2-9**. Total PCB congeners exceed the PRG of 1 mg/kg in one soil sample, R9-S04 (0.5-2 ft bgs) at a concentration of 1.2 mg/kg.

The remedial response area at Residential Property R9 for total PCBs in soil is shown on **Figure 2-9**.

Dioxins

None of the results exceed the dioxin PRG of 48 ng/kg. Therefore, there is no remedial response area at Residential Property R9 for dioxins in soil.

2.6.12 Residential Property R10 Dioxins in Soil

At Residential Property R10, there is a basis for action for dioxins in soil.

Only composite soil samples were collected from random locations across R10. None of the results exceed the dioxin PRG of 48 ng/kg. Therefore, there is no remedial response area at Residential Property R10 for dioxins in soil.

2.6.13 Residential Property R11 PCBs and Dioxins in Soil

At Residential Property R11, there is a basis for action for PCBs and dioxins in soil.

Total PCBs

A total of three composite soil samples were collected from random locations across R11 (one each at the following depths: 0-0.5 ft bgs, 0.5-2 ft bgs, and 2-4 ft bgs). None of the results exceed the total PCB PRG of 1 mg/kg. Therefore, there is no remedial response area at Residential Property R11 for total PCBs in soil.

Dioxins

Only composite soil samples were collected from random locations across R11. None of the results exceed the dioxin PRG of 48 ng/kg. Therefore, there is no remedial response area at Residential Property R11 for dioxins in soil.

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section presents the identification and screening of technologies that have the potential to be included in a remedial action alternative for soil and sediment that, when assembled, will meet the RAOs. Section 3.1 presents GRAs, general technologies and process options to be considered to achieve the RAOs for the area and volume of soil and sediment to be remediated. The resulting identification and preliminary screening of technologies to determine viability for remediation of soil and sediment at the Site is presented in Section 3.2.

3.1 Development of General Response Actions

GRAs are media-specific measures that may be taken to satisfy the RAOs established for a site. GRAs may include treatment, containment, removal, disposal, and institutional actions, or a combination of these measures. Several GRAs were identified to provide a wide range of possible options for satisfying the RAOs for soil and sediment at the Site. The potential GRAs identified are: no action, institutional actions, natural attenuation/recovery, containment, removal, disposal, and treatment. **Table 3-1** presents the various GRAs, remedial technologies, and process options identified to address contaminated soil and sediment.

3.2 Identification and Screening of Technologies and Process Options

The identification, evaluation, and preliminary screening of technologies and process options for remediation of soil and sediment at the Site are presented in this section. Technologies refer to general categories of technologies. Process options are specific processes within each technology family.

Technologies and process options identified and evaluated for Site soil and sediment are presented in **Table 3-2**. **Table 3-3** presents the preliminary screening of technologies and process options for remediation of soil and sediment.

Potential remedial technologies and process options were identified and evaluated according to their overall applicability to address contaminated soil and sediment given the Site-specific conditions. The purpose of this evaluation is to investigate available technologies and process options and to eliminate those that are not applicable/viable, based on the established RAOs and GRAs. Additionally, the evaluation step is conducted to refine the alternatives development process. In this step, process options are evaluated with respect to other processes in the same technology category. One representative process option is selected, if possible, for each technology type, to simplify the subsequent development and screening of alternatives without limiting flexibility during alternative selection or remedial design.

The preliminary screening of technologies and process options utilizes three criteria: effectiveness, implementability and relative cost. The USEPA RI/FS guidance document suggests that this evaluation focuses on the effectiveness criterion, with less emphasis directed at the implementability and relative cost criteria (USEPA, 1988). A brief description of the process option is provided, and a determination is made to either retain or eliminate it based on its technical implementability, effectiveness, and relative cost. A description of the rationale that was used to eliminate technologies is also provided. The remedial technologies/ process options retained from the preliminary screening to remediate contaminated soil and sediment are summarized below:

- No action;
- Institutional controls;
- Access restrictions;
- Low permeability cap;
- Bulk mechanical excavation;
- Off-site disposal;
- On-Site consolidation; and
- In-situ solidification/stabilization.

Permanent relocation was not included as a potential response action for the residential areas under consideration. According to the USEPA's relocation policy, it is the Agency's preferred approach to remediate contamination in place whenever feasible, allowing residents to safely remain in their homes following cleanup activities (USEPA, 1999). This policy prioritizes on-site remedial measures over relocation, which is generally reserved for situations where contamination poses an immediate and unavoidable threat to human health and where no reasonable engineering solutions exist.

In the case of the residential response areas evaluated in this study, the identified remedial technologies and process options are considered technically and logistically implementable within the constraints of the community setting. These remedies are designed to address the contamination effectively without necessitating the demolition or removal of existing residential structures. Therefore, consistent with USEPA policy and based on technical feasibility, permanent relocation was not deemed appropriate as part of the remedial action strategy.

4.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

This section presents the development, assembly, and screening of remedial alternatives for contaminated soil and sediment. Section 4.1 presents the rationale for development of remedial action alternatives for soil and sediment. Section 4.2 describes the alternatives assembled for each area. Section 4.3 presents the screening of alternatives.

4.1 Rationale for Development of Remedial Action Alternatives

The alternatives were developed in accordance with the NCP (40 CFR 300.430) and the USEPA RI/FS guidance document (USEPA, 1988). The NCP encourages developing alternatives that favor treatment technologies to address principal threats and alternatives that employ engineering controls to address relatively low long-term threats. Additionally, the NCP suggests developing a range of treatment alternatives, including one or more engineering control alternatives (such as containment), one or more innovative treatment alternatives, and the baseline no action alternative. The USEPA RI/FS guidance document provides detailed guidance on formulating, screening, and selecting remedial alternatives for more detailed evaluations.

The following subsections summarize the significant considerations for developing the remedial action alternatives.

4.1.1 Land Use and Redevelopment Considerations

In selecting and implementing remedial actions that protect human health and the environment at Superfund sites, the USEPA typically considers the reasonably anticipated future land use of the site.

The Site AOCs are either in-use residential properties or are located in areas of Minden currently zoned as Medium Density Residential District or Land Conservation District (City of Oak Hill, 2024).

At the Possible Transformer Storage Area and Britt Bath House AOCs, the land is openly accessible to the public and is not currently used for any specific purpose. Access to these AOCs is not restricted and the public uses these areas for driving recreational all-terrain vehicles. No industrial or commercial activities are currently conducted in these AOCs.

At the Residential Properties AOC, the parcels contain occupied dwellings and the land is used for residential purposes. These residential properties are located near or adjacent to Arbuckle Creek.

At the Arbuckle Creek and Wetland AOC, the land consists of the creek and adjacent wetlands. These areas are mostly used for passive recreation, such as wildlife viewing and walking along wetland borders, and some active recreation, such as collecting fish bait.

Future land use is expected to remain the same as current land use. However, potential future use at the Possible Transformer Storage Area and Britt Bath House AOCs could also include residential and/or commercial/industrial use if the properties are developed.

4.1.2 Hazardous Waste Classification

Contaminated media that is determined to contain hazardous waste is subject to regulation under RCRA, including handling of hazardous waste as part of CERCLA response actions. USEPA considers contaminated media to contain hazardous waste when it meets the RCRA hazardous waste definition for characteristic hazardous waste and/or contains a listed hazardous waste.

Based on historical information and RI activities, the contaminated media at the Site does not contain a listed hazardous waste. Based on RI activities and prior removal actions that generated investigation-derived waste at the Site, it is anticipated that Site soil and sediment that requires remedial action will not exhibit characteristics of a hazardous waste and can be classified as non-hazardous under RCRA, and if it requires off-site disposal, it will be disposed of as such. None of the Toxicity Characteristic Leaching Procedure extracts for investigation-derived waste exceeded the 40 CFR 261.24 limits, indicating the soil samples were not characteristically hazardous.

4.1.3 TSCA-Regulated PCB Wastes

PCB-contaminated soil and sediment are regulated for cleanup and disposal under 40 CFR Part 761 of the Toxic Substances Control Act (TSCA) based on the source of contamination and concentrations being remediated. TSCA applies to “as-found” concentrations as determined by laboratory analysis of discrete samples collected in-situ. USEPA may authorize disposal of PCBs in a manner not otherwise specified provided it determines that the disposal will not pose an unreasonable risk of injury to health or the environment.

At the AOCs being evaluated for remedial action in this FS, only one soil/sediment sample reported PCB concentrations ≥ 50 mg/kg, soil sample SB428 (2-4 ft bgs) at a concentration of 55 mg/kg total PCB congeners in the Arbuckle Creek/Wetlands AOC.

4.1.4 Floodplain and Wetland Considerations

Significant portions of the AOCs being evaluated for remedial action in this FS are in a FEMA designated Zone A Flood Hazard Area (the 100-year flood zone) and the Arbuckle Creek and Wetlands AOC includes delineated wetlands.

Floodplain-related ARARs require that federal agencies seek practicable alternatives to actions that involve occupancy and modifications to floodplains, and if no practicable alternative exists, efforts must be made to reduce the risk of flood loss and minimize the impact of floods on human safety, health, and welfare.

With respect to federal and state jurisdictional wetlands, to the extent any of the remedial alternatives will result in the dredging or filling of these wetlands or aquatic habitats, USEPA is required to determine which alternative is the Least Environmentally Damaging Practicable Alternative (LEDPA) under Section 404 of the Clean Water Act (CWA). Any area of altered regulated wetlands or aquatic habitats will be restored in-place or addressed by other mitigation measures, and USEPA will solicit public comment in the Proposed Plan as to its draft determination of the LEDPA.

Therefore, development and evaluation of remedial action alternatives for the Site will consider potential impacts due to construction in a floodplain and wetland resource areas, will consider impacts to flood storage capacity, and will assess measures that may be needed to restore, mitigate, or compensate for the loss of flood storage and natural resources.

4.2 Assembly of Alternatives

Based on the technology screening performed in Section 3.0 and the considerations described in Section 4.1, remedial action alternatives were developed for soil and sediment. CERCLA has a statutory preference for a range of alternatives that employ treatment to reduce the toxicity, mobility, or volume of hazardous substances to the maximum extent feasible, thereby eliminating or minimizing, to the degree possible, the need for long-term management. Consistent with the NCP and the USEPA RI/FS guidance document, alternatives were assembled that represent a range of actions to encompass: no action, institutional controls (ICs), engineering controls, removal, and treatment. Notably, under 40 CFR Part 300.430(a)(1)(iii)(C), the NCP states that most sites will likely use a combination of actions to achieve the mandates under CERCLA.

Four alternatives were developed for addressing soil and sediment, as follows:

- No action;
- Low permeability cap;
- Removal with off-site disposal; and
- In-situ treatment.

These alternatives are described below and the major elements of each of the alternatives are identified in **Table 4-1**.

4.2.1 Alternative 1 – No Action

Under this alternative, no actions would be taken at the AOCs to address contaminated soil and sediment, or to monitor and manage risk. This alternative is required to be considered by the NCP and is the baseline for comparison to all other active remedial alternatives.

4.2.2 Alternative 2 – Low Permeability Cap

This alternative includes installation of a low permeability cap at each AOC to contain PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. Alternatively, a single consolidation area may be used to contain all waste removed from the AOCs under one cap located outside of the floodplain.

This alternative is different from the impervious cap/barrier remedy that was installed at the Former SEC Property between 2001-2002 which was the subject of the Former SEC Property FFS (Nobis, 2023a), in that, this alternative includes capping soil/sediment with total PCB concentrations less than 100 parts per million (ppm) which would be in compliance with TSCA.

4.2.3 Alternative 3 – Removal with Off-Site Disposal

This alternative would include removal of PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. The removed material would be transported offsite for disposal at an approved, licensed facility, and the excavation areas would be backfilled with clean material, as necessary, followed by restoration activities.

4.2.4 Alternative 4 – In-Situ Treatment

This alternative includes in-situ treatment via solidification/stabilization to treat PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. In-situ treatment would be used to immobilize the contaminants in the soil and sediment. The treated soil would be covered with a warning layer and clean soil; the treated sediment would be covered with a clean habitat layer.

4.3 Screening of Remedial Alternatives

The assembled alternatives presented in Section 4.2 were screened for effectiveness, implementability, and cost which are described below.

- Effectiveness – Refers to a process option's ability to: meet the RAOs within a reasonable timeframe, address the areas or volume of each contaminated media, avoid the creation of adverse effects to human health and the environment during implementation, and be reliable with respect to contaminants and conditions at the Site.
- Implementability – Includes both technical and administrative feasibility in implementing the process option.
- Relative Cost – Costs are generally evaluated as high, medium, or low, relative to the cost of other process options. Costs play a limited role at the screening stage.

The results of the screening of the remedial alternatives for soil and sediment are presented in **Table 4-2**. After screening, all four remedial alternatives for soil and sediment were retained for the detailed analysis provided in Section 5.0 and the comparative analysis provided in Section 6.0.

5.0 DETAILED DESCRIPTIONS AND ANALYSIS OF ALTERNATIVES

The remedial alternatives for soil and sediment retained from Section 4.0 are analyzed in detail in this section. Section 5.1 provides a detailed description of the alternatives. Section 5.2 presents the detailed analysis of the alternatives.

5.1 Detailed Descriptions of Alternatives

The detailed descriptions of the four remedial alternatives for soil and sediment are presented below. Further details and a revised cost estimate for the preferred alternative will be determined during the remedial design process. **Figure 5-1** presents the general topography of the remedial response areas. **Figure 5-2** presents the conceptual construction layout for the alternatives.

5.1.1 Alternative 1 – No Action

Under this alternative, no actions would be taken at the AOCs to address contaminated soil and sediment, or to monitor and manage risk. This alternative is required to be considered by the NCP and is the baseline for comparison to all other active remedial alternatives.

5.1.2 Alternative 2 – Low Permeability Cap

This alternative includes installation of a low permeability cap to contain PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. The cap construction would encompass approximately three acres for the delineated response areas at all AOCs. Low-permeability caps could be constructed over in-place contaminated soil/sediment. Alternatively, a single consolidation area may be used to contain all contaminated material removed from the AOCs under one cap located outside of the floodplain. Since substantial parts of the AOCs with contamination are situated within the 100-year floodplain, Alternative 2 proposes consolidating the contaminated soil and sediment at a single location outside the floodplain, specifically at the Possible Transformer Storage Area. This consolidation would support compliance with ARARs as any excavated areas within the floodplain would be restored to pre-existing elevations and flood storage capacity would remain unaltered.

Waste would remain on-site. For caps over soil, proper construction and maintenance of the cap would prevent erosion and surface water infiltration and the potential for direct contact with subsurface soil.

This alternative would include a soil and sediment sampling PDI to refine the extent of COC concentrations greater than the PRGs at the remedial response areas where the extents are not currently bound by samples with concentrations at or below the PRGs.

The design of the cap to prevent direct contact with contaminated material and control erosion and infiltration depends on Site conditions. The thickness of the cap would be designed to sufficiently account for the various processes that could adversely affect performance and cap integrity. A low permeability cap generally includes a barrier layer of low permeable soil (i.e., clay) or a geosynthetic clay liner, drainage layer (e.g., sand/gravel, geomembrane liner), and a layer of topsoil. The placement of a cap will result in elevation increases of ground surface. The cap will also reduce the permeability of the capped area, significantly impacting hydrology. Remedial areas would be restored to pre-remedial conditions and revegetated with native vegetation. Vegetation clearing to construct the cap would be conducted, as needed. Surface water and erosion controls would be installed, as needed. An operations and maintenance (O&M) plan would be required to maintain the integrity of the cap. Monitoring wells would be installed to monitor the groundwater under the contamination. A long-term monitoring (LTM) plan would be required for the groundwater monitoring and to verify the cap is functioning as designed.

Contaminated material removed from the AOCs and consolidated under one cap located outside of the floodplain would require dewatering during excavation activities in Arbuckle Creek and Wetlands. Based on recent RI activities and prior removal actions that generated investigation derived waste within the former SEC Property, it is anticipated that water generated during excavation and consolidation would be non-hazardous/non-TSCA waste, which would be transported offsite for disposal. Alternatively, water generated during excavation and consolidation could be treated on-site prior to discharge to the Oak Hill Wastewater Treatment Plant if the wastewater treatment influent requirements are met or could be treated on-site prior to discharge to Arbuckle Creek if the substantive requirements of the CWA are met for effluent standards and the prevention of degradation of surface water.

Impacts to the creek, riparian corridor and all associated wetlands that may be adversely impacted by this alternative must be considered and controlled/mitigated during and after implementation of the alternative.

During material handling activities, fugitive dust emissions would be monitored and managed. Erosion and sedimentation controls would be put in-place during the construction phase and turbidity within the water body would be monitored and managed as needed. Due to the risk of flooding within the AOCs, during cap construction and/or potential repairs, precautions would need to be taken to mitigate the risk that contaminated soil or sediment could be released and potentially transported downstream within the creek and adjacent floodplains.

Access restrictions and ICs would be required because contamination would be left in-place above levels that do not allow for unlimited use and unrestricted exposure. Access restrictions would include fencing with signage to restrict access to the capped area. ICs would include establishing land use restrictions prohibiting disturbance of the capped area. Periodic evaluation would be required during LTM to assess the effectiveness of the access restrictions and ICs and identify if any O&M activities are needed (i.e., fence repairs or signage replacement).

An O&M plan would be required. Cap O&M activities would consist of annual inspections, with more frequent inspections when a significant storm event occurs, and mowing. Repairs would be performed as needed based on inspection results.

The inspection and LTM activities would be documented in annual reports, and the ICs would be reviewed annually. LTM is presumed to be conducted annually for the first five years and a minimum of every five years after that, while cap O&M would be performed annually or more frequently as needed based on storm events. In addition, due to hazardous substances remaining onsite above levels that do not allow for unlimited use and unrestricted exposure, Five-Year Reviews would be required to determine whether the remedy at the Site is protective of human health and the environment. Typically, 30 years of these post-implementation activities are assumed for costing purposes, however, with waste left in place under a cap, LTM, O&M, and Five-Year Reviews would continue into perpetuity.

5.1.3 Alternative 3 – Removal with Off-Site Disposal

This alternative would include removal of PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. The removed material would be replaced with clean backfill, as necessary, followed by restoration activities. Based on historical sample results, the depth of soil and sediment excavations from all AOCs ranges from approximately 1 to 10 ft bgs (refer to **Table 2-5**). The Possible Storage Transformer Area would require the deepest excavation depth of approximately 10 ft. Confirmation sampling would be required to verify that remaining concentrations are at or below PRGs. Excavated material would be transported offsite for disposal at an approved, licensed facility. Sediment from Arbuckle Creek and Arbuckle Creek Wetlands would require dewatering prior to disposal.

This alternative would include a soil and sediment sampling PDI to refine the extent of COC concentrations greater than the PRGs at the remedial response areas where the extents are not currently bound by samples with concentrations at or below the PRGs.

It is estimated that approximately 8,287 cubic yards of contaminated material would require removal (refer to **Table 2-5**); this volume estimate includes a 10% contingency. Both TSCA waste and non-TSCA waste are expected to be generated and require offsite disposal. The TSCA waste, excavated soil and sediment with total PCB concentrations ≥ 50 mg/kg, would be required to be disposed of at a TSCA-approved landfill, TSCA-approved incinerator, or a RCRA Subtitle C landfill permitted to accept PCB waste with concentrations ≥ 50 mg/kg. The non-TSCA waste, excavated soil and sediment with total PCB concentrations greater than 1 mg/kg and less than 50 mg/kg, would be required to be disposed of in a RCRA Subtitle D landfill. Note that only one soil sample from the Arbuckle Creek/Wetlands AOC was detected with concentrations of PCBs greater than 50 mg/kg. Therefore, it is assumed that six cubic yards of soil with PCB concentrations ≥ 50 mg/kg from Arbuckle Creek Remedial Response Area AC2A would require off-site disposal as TSCA waste.

Dewatering would be required during excavation activities in Arbuckle Creek and Wetlands. Based on recent RI activities and prior removal actions that generated investigation derived waste within the former SEC Property, it is anticipated that water generated during excavation and stockpile dewatering would be non-hazardous/non-TSCA waste, which would be transported offsite for disposal. Alternatively, water generated through excavation and stockpile dewatering could be treated on-site prior to discharge to the Oak Hill Wastewater Treatment Plant if the wastewater treatment influent requirements are met or could be treated on-site prior to discharge to Arbuckle Creek if the substantive requirements of the CWA are met for effluent standards and the prevention of degradation of surface water.

Impacts to the creek, riparian corridor and associated wetlands that may be adversely impacted by this alternative must be considered and controlled/mitigated during and after implementation of the alternative. Remedial areas would be restored to pre-remedial conditions and revegetated with native vegetation.

During excavation and material handling activities, fugitive dust emissions would be monitored and managed. Erosion and sedimentation controls would be put in-place during implementation and turbidity within the water body would be monitored and managed. Due to the risk of flooding within the AOCs, during excavation activities, precautions would need to be taken to mitigate the risk that contaminated soil or sediment could be released and potentially transported downstream within the creek and adjacent floodplains.

Because the excavated material would be permanently removed from the AOCs, no access restrictions or ICs would be required, and no periodic evaluations or O&M would be required. Five-Year Reviews would also not be required.

5.1.4 Alternative 4 – In-Situ Treatment

This alternative includes in-situ treatment via solidification/stabilization to treat PCB- and dioxin-contaminated soil and sediment with concentrations greater than the PRGs in the AOCs with unacceptable risks. In-situ treatment would be used to immobilize the contaminants in the soil and sediment; no materials would be removed from the AOCs. Solidification/stabilization treated soil and sediment are vulnerable to weathering processes, therefore dermal exposure pathways are not necessarily broken by solidification/stabilization. For this reason, the in-situ treatment of soil includes the placement of a warning layer and clean soil over the treated soil. Treatment of sediment includes placement of a clean habitat layer of 2 to 3 inches of soil or sand over the treated sediment.

This alternative would include a soil and sediment sampling PDI to refine the lateral extents of COC concentrations greater than the PRGs at the remedial response areas where the extents are not currently bound by samples with concentrations at or below the PRGs.

Solidification/stabilization involves injecting or mixing (passively or mechanically) reagents into contaminated media to decrease the mobility of contaminants physically and/or chemically. Solidification uses a reagent to bind and encapsulate the contaminated media, decreasing permeability and increasing compressive strength. Stabilization involves processes that cause a chemical reaction to reduce leachability/mobility and toxicity of contaminants. Solidification/stabilization reagents include cement, pozzolanic material, thermoplastics, polymers, asphalt, activated carbon and clays. The performance of solidification/stabilization is dependent on the type of reagent used to immobilize the contaminants. It is likely that treatment would increase the in-place volume of soil/sediment. The increase in treated soil/sediment volume and the placement of clean soil/habitat layers will result in elevation increases of Site ground surface and treatment will also reduce the permeability of the treated soil/sediment, significantly impacting hydrology.

A treatment PDI would be required to determine the appropriate reagent to use for soil and sediment. In-situ treatment of sediments would likely use an activated carbon reagent (e.g., SediMite™ or other proprietary reagent/amendments). Delivery methods for treatment agents are minimally intrusive. PCBs and dioxins would be effectively removed from the bioavailable fraction of sediment, reducing the toxicity, bioaccumulation, and associated ecological risk. Activated carbon, typically pelletized in nature, naturally mixes into the upper bioactive zone and regeneration of a clean habitat layer would occur over time with natural re-sedimentation processes or can be expedited via construction of a clean habitat layer after applying activated carbon. Note that storm events and flooding may hinder the re-sedimentation process due to scour. An O&M plan would be required to maintain the integrity of the treatment area. A LTM plan would be required to evaluate that the treatment is functioning as designed.

Any loss of wetlands or floodplain storage capacity based on the treatment must be mitigated. Impacts to the creek, riparian corridor and all associated wetlands that may be adversely impacted by this alternative must be considered and controlled/mitigated during and after implementation of the alternative.

During treatment and material handling activities, fugitive dust emissions would be monitored and managed. Erosion and sedimentation controls would be put in-place during implementation and turbidity within the water body would be monitored and managed. Due to the risk of flooding within the AOCs, during treatment, precautions would need to be taken to mitigate the risk that contaminated soil or sediment would be released and potentially transported downstream within the creek and adjacent floodplains.

Access restrictions and ICs would be required because contamination would be left in-place above levels that do not allow for unlimited use and unrestricted exposure. Access restrictions would include fencing with signage to restrict access to treated areas. ICs would include establishing land use restrictions prohibiting disturbance of the treated areas. Periodic evaluation would be required to assess the effectiveness of the access restrictions and ICs, and identify any needed repairs (i.e., fencing repair, signage replacement, revegetation/repair of restored wetlands/habitat layer).

After implementation, periodic evaluations and repair of the fencing and signage, if needed, would be conducted. LTM would include evaluation of surface water and sediment quality, the condition of the treatment area and associated controls, and whether biota has re-established on and around the treatment area in Arbuckle Creek and Arbuckle Wetlands. Treatment area O&M activities would consist of annual inspections with more frequent inspections when a significant storm event occurs. Repairs would be performed as needed based on inspection results.

The inspection and LTM activities would be documented in annual reports, and the ICs would be reviewed annually. LTM is presumed to be conducted annually for the first five years and a minimum of every five years after that. In addition, Five-Year Reviews would be required to determine whether the remedy at the Site is protective of human health and the environment, and to evaluate the implementation and performance of the selected remedy. Typically, 30 years of these post-implementation activities are assumed for costing purposes; however, with waste left in place, LTM, O&M, and Five-Year Reviews may continue into perpetuity.

5.2 Detailed Analysis of Alternatives

In accordance with the NCP, the remedial alternatives are to be evaluated per the nine criteria presented below. As part of this FS, the seven criteria identified as Threshold Criteria and Primary Balancing Criteria are used to evaluate the remedial alternatives and facilitate the selection of a preferred alternative. The two Modifying Criteria, State Acceptance and Community Acceptance, will be addressed following the public comment period for the Proposed Plan.

- **Threshold Criteria:**
  - Overall Protection of Human Health and the Environment – Overall assessment as to whether the alternative provides adequate protection of human health and the environment.
  - Compliance with ARARs – Evaluation criterion used to determine whether each alternative meets federal and state ARARs.
- **Primary Balancing Criteria:**
  - Long-Term Effectiveness and Permanence – Evaluates risk remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

- Reduction of Toxicity, Mobility, or Volume through Treatment – This evaluation criterion addresses the statutory preference for selecting remedial alternatives that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances.
- Short-Term Effectiveness – Evaluates the effects of the alternative during the construction and implementation phase until remedial response objectives are met (e.g., cleanup goals are met). Under this criterion, alternatives are evaluated with respect to their effects on human health and the environment during implementation of the remedial action.
- Implementability – Evaluates the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during implementation.
- Cost – A detailed cost analysis is performed for each alternative to assess the net present worth cost to implement each alternative, including capital costs and annual O&M costs. Costs are determined based upon the data available at the time of FS development and are intended to represent an approximation of the actual alternative cost.

- **Modifying Criteria:**
  - State Acceptance – To the extent possible, the remedial alternatives have been assembled to comply with State ARARs. State agency concerns communicated during the public comment period for the Proposed Plan will be taken into account in the ROD establishing the selected remedy.
  - Community Acceptance – To the extent possible, the remedial alternatives have been assembled taking into account protection of the community and anticipation of community concerns. Community concerns communicated during the public comment period for the Proposed Plan will be taken into account in the ROD establishing the selected remedy.

Table 5-1 presents the detailed analysis of the remedial alternatives for soil and sediment using the Threshold Criteria and Primary Balancing Criteria. The table includes a summary of estimated capital costs, O&M costs, and the overall present value cost. Detailed cost estimates are included in **Appendix B**.

6.0 COMPARATIVE ANALYSIS

This section presents a comparative analysis of the results of the remedial alternatives evaluation performed in Section 5.0. The comparative analysis evaluates the relative performance of each of the alternatives using the Threshold Criteria and Primary Balancing Criteria. This comparison assists in the selection of a preferred alternative by identifying the advantages and disadvantages of each alternative and considers the major tradeoffs among the evaluation criteria. For the comparative analysis the AOCs that have a basis for action are considered together for each alternative.

The results of the comparative analysis are discussed below and summarized in **Table 6-1**. The remedial alternatives for soil and sediment that were compared through this analysis include the following:

- Alternative 1 – No Action
- Alternative 2 – Low Permeability Cap
- Alternative 3 – Removal with Off-Site Disposal
- Alternative 4 – In-Situ Treatment

6.1 Overall Protection of Human Health and the Environment

The Overall Protection of Human Health and the Environment 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, or ICs. This is a Threshold Criteria that must be met for an alternative to be eligible for selection in the ROD.

Alternative 1 does not meet this Threshold Criteria and would not provide any protection of human health and the environment because no actions would be taken to address the contaminated soil and sediment. The contaminated soil and sediment would remain onsite continuing to pose adverse human health and ecological risks, and the contaminants would likely migrate beyond current remedial action areas through natural physical processes (e.g., erosion and migration during flooding events).

Alternatives 2, 3, and 4 meet this Threshold Criteria and would provide protection of human health and the environment. Alternative 3 is considered the most protective because the soil and sediment with COCs above PRGs would be permanently removed from the Site and no access restrictions, ICs, periodic evaluations, or LTM would be required in the future. For Alternatives 2 and 4, contaminated soil and sediment would remain on-site. Alternative 4 is more protective than Alternative 2 because, after treatment, the adsorbed/stabilized contaminants would no longer be bioavailable (reduced toxicity) and would be less mobile. Both Alternatives 2 and 4 would require access restrictions, ICs, periodic O&M, and LTM to verify the integrity and effectiveness of the remedial areas.

6.2 Compliance with ARARs

The compliance with ARARs criterion addresses whether or not a remedial alternative would meet all of the substantive requirements of federal and state environmental laws and/or provide grounds for invoking a waiver. This is a Threshold Criteria that must be met for an alternative to be eligible for selection in the ROD.

Alternative 1 does not meet this Threshold Criteria and would not comply with chemical-specific or location-specific ARARs because no response action would be taken to address PCB- and dioxin-contaminated soil and sediment above PRGs and PCB concentrations ≥ 50 mg/kg from Arbuckle Creek Remedial Response Area AC2A would not be protected by deed restrictions as required under the state regulatory requirement for waste management. Action-specific ARARs are not applicable to Alternative 1 because no response action will be taken.

Alternatives 2, 3, and 4 meet this Threshold Criteria and would comply with chemical-specific, location-specific, and action-specific ARARs. As part of these alternatives, the PCB- and dioxin-contaminated soil and sediment above PRGs will be either capped, removed, or treated and covered, meeting chemical-specific ARARs. All three of these alternatives would temporarily impact the wetlands and floodplains during implementation, but through detailed assessments during remedial design, it is expected that work could be performed without permanent impairment to these resources as long as proper engineering controls are implemented and sufficient wetlands restoration/mitigation is performed to meet location-specific ARARs. To meet action-specific ARARs, these three alternatives would employ monitoring and best management practices to avoid introduction of invasive species; manage noise, odor, and stormwater; and implement erosion and sedimentation controls. Wastes (soil, sediment, and water) generated would be properly treated, stored, and/or disposed.

6.3 Long-Term Effectiveness and Permanence

The Long-Term Effectiveness and Permanence criterion addresses the magnitude of the residual risks at the Site after remedy implementation, and the adequacy and reliability of the controls required to manage these residual risks.

Alternative 1 is not effective in the long term and does not provide permanent protection from contaminants.

Alternatives 2, 3, and 4 can be effective in the long term. Alternative 3 provides the most long-term effectiveness and permanence of all the alternatives because the soil and sediment with COCs above PRGs would be permanently removed from the Site. In Alternatives 2 and 4, contaminated soil and sediment would remain on-site which would require access restrictions, ICs, periodic evaluations, and LTM to verify the integrity and effectiveness of the covers and the remedial areas. Capping and in-situ treatment which are part of Alternatives 2 and 4, respectively, are both reliable technologies if the remedial areas are maintained through proper O&M; evaluated through Five-Year Reviews, periodic evaluations, and LTM; and if the ICs and access restrictions are property enforced and maintained.

6.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the degree to which alternatives employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of the hazardous substances.

Alternatives 1 and 2 do not include treatment processes and do not satisfy this criterion.

Alternative 4 is the only alternative that satisfies this criterion and satisfies the statutory preference for treatment. This alternative includes in-situ treatment of the soil and sediment with an appropriate reagent to physically bind or adsorb the contaminants.

Alternative 3 would only satisfy this criterion and include treatment of contaminated soil and sediment if the off-site disposal facility treats the material.

6.5 Short-Term Effectiveness

The Short-Term Effectiveness criterion addresses the magnitude of any adverse impacts on human health and the environment during implementation of the remedial action and the length of time needed to complete the remedial action objectives.

Alternative 1 poses no short-term risks because no remedial actions would be taken.

Alternatives 2, 3, and 4 pose similar short-term adverse impacts to the environment associated with disturbing wetlands; some of the temporary impacts, such as erosion and sedimentation, can be minimized with engineering controls. These three alternatives also pose similar short-term impacts to human health, although Alternative 4 would be slightly less than Alternative 2 or Alternative 3 as no contaminated material handling would occur via in situ treatment. The risks to workers can be minimized or eliminated through engineering controls. The adverse impacts to the community are mostly associated with increased vehicular traffic and noise during construction activities; some of the temporary impacts, such as fugitive dust emissions and surface water turbidity, can be minimized with engineering controls.

RAOs will not be achieved with Alternative 1. It will take approximately two to three years for Alternatives 2, 3, and 4 to achieve RAOs. For Alternatives 2 and 4, permanent achievement of the RAOs would require maintenance into perpetuity.

6.6 Implementability

The Implementability criterion addresses the technical and administrative feasibility of implementing the remedy, including the availability of the materials and services required.

Alternative 1 is the easiest to implement, as no actions would be taken and no materials or services are required.

Alternatives 2 and 3 are constructable and would employ reliable technologies that could be implemented with materials and services that are readily available through general construction contractors and specialty contractors for the hazardous materials handling components. Alternative 4 is constructable and would employ a technology that could be implemented with materials and services that are readily available through specialty contractors. The reliability of

Alternative 2 and Alternative 4 would be dependent on the ICs and access controls remaining in-place and enforced to ensure the integrity of the cap and/or treatment area. Alternative 4 reliable would further depend on the results of treatability studies which would be used to determine the appropriate reagent and application method for Site conditions.

6.7 Cost

The estimated capital costs, O&M costs, and the overall present value cost for each alternative are included in **Table 5-1** and **Table 6-1**. Detailed cost estimates are included in **Appendix B**.

Alternative 1 costs nothing because no actions would be taken. The estimated overall present value costs to implement Alternatives 2, 3, and 4 are of similar magnitude. Alternative 3 does not include O&M costs because the soil and sediment with COCs above PRGs would be permanently removed from the Site. Alternatives 2 and 4 include O&M costs because contaminated soil and sediment would remain on-site which would require access restrictions, ICs, periodic evaluations, and LTM to verify the integrity and effectiveness of the cap and treated remedial areas.

7.0 REFERENCES

International Consultants, 2003. Final Removal Action Report, Installation of Impervious Cap/Barrier, Shaffer Equipment Company, Fayette County, West Virginia. Prepared for U.S. Army Corps of Engineers. December.

Nobis Engineering, Inc. (Nobis), 2022. Final Human Health Risk Assessment for the Former Shaffer Equipment Company Property, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Fayette County, Minden, West Virginia. August 8.

Nobis, 2023a. Final Focused Feasibility Study for the Former Shaffer Equipment Company Property, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Fayette County, Minden, West Virginia. January 24.

Nobis, 2023b. Final Screening Level Ecological Risk Assessment, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Minden, Fayette County, West Virginia. July 18.

Nobis, 2024. Final Human Health Risk Assessment, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Minden, Fayette County, West Virginia. February 23.

Nobis, 2025. Final Remedial Investigation Report, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Minden, Fayette County, West Virginia. December 26.

Nobis, 2026. Technical Memorandum for Surface Weighted Average Concentration (SWAC) Evaluation for Dioxin and Dioxin-like Compounds Toxicity Equivalency (TEQ) at the Shaffer Equipment/Arbuckle Creek Area Superfund Site. April 17.

NUS, 1990a. Preliminary Assessment of Berwind Green Hill/Reclaimed Mine Dump. Prepared for Hazardous Site Control Division, U.S. Environmental Protection Agency. R-585-7-0-52. October 19.

NUS, 1990b. Preliminary Assessment of NR&P Supply House (Abandoned Substation). Prepared for Hazardous Site Control Division, U.S. Environmental Protection Agency. R-585-7-0-54. October 11.

NUS, 1991a. Site Inspection of Arbuckle Creek Area. Prepared for Hazardous Site Control Division, U.S. Environmental Protection Agency. R-585-8-0-45. March 14.

NUS, 1991b. Site Inspection of Rocklick Road. Prepared for Hazardous Site Control Division, U.S. Environmental Protection Agency. R-585-8-0-42. March 7.

Tetra Tech, 2020. Phase 1 Remedial Activities Data Summary Technical Memorandum for Shaffer Equipment/Arbuckle Creek Area Site, Minden, West Virginia. December 2020.

United States Environmental Protection Agency (USEPA), 1984. Potential Hazardous Waste Site, Preliminary Assessment, Shaffer Equipment Company.

USEPA, 1987. Federal On-Scene Coordinator's Report for the Shaffer Equipment Site. CERCLA Removal Action. December 28, 1984, through December 20, 1987. Minden, Fayette County, West Virginia.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01; EPA/540/G-89/004. October.

USEPA, 1990. Guidance on Remedial Actions for Superfund Sites with PCB Contamination. OSWER Directive 9355.4-01; EPA/540/G-90/007. August.

USEPA, 1997. United States Environmental Protection Agency (EPA), 1997. Rules of Thumb for Superfund Remedy Selection. OSWER 9355.0-69, EPA 540-R-97-013. August.

USEPA, 1999. Interim Policy on the Use of Permanent Relocation as Part of Superfund Remedial Actions. OSWER Directive 9355.0-71P. June.

USEPA, 2011. Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model, Office of Solid Waste and Emergency Response, EPA 542-F-11-011. July 2011.

USEPA, 2012. EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments, Volume 1, CAS No. 1746-01-6, In Support of Summary Information on the Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/038F. February.

USEPA, 2019. National Priorities List, Site Listing, Shaffer Equipment/Arbuckle Creek Area, Minden, West Virginia. May.

USEPA, 2023. Proposed Plan, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Operable Unit 1, Minden, West Virginia. March.

USEPA, 2024. Record of Decision, Operable Unit 1, Shaffer Equipment Company Property Soil, Shaffer Equipment/Arbuckle Creek Area Superfund Site, Minden, Fayette County, West Virginia. July.

USEPA, 2025. USEPA Risk Assessment for Dioxin at Superfund Sites. Risk Assessment for Dioxin at Superfund Sites | US EPA. Accessed January 6, 2025.

United States Geological Survey (USGS), 2024. National Water Information System: Web Interface, Water Data for the Nation. https://waterdata.usgs.gov/nwis. Updated 07/11/2024. Accessed 07/11/2024.

Weston Solutions (Weston), 2018a. Wetland Delineation Report, Shaffer Equipment-Minden, Fayette County, West Virginia. June 13.

Weston, 2018b. Final Expanded Site Inspection Report, Shaffer Equipment/Arbuckle Creek Area Site, Minden, Fayette County, West Virginia. October.

Weston, 2020. Removal Summary Report, Shaffer Equipment Company Site, Minden, Fayette County, West Virginia. June.

TABLES

Table 2-1
Human Health Risk Summary for Chemicals of Concern
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

AOC [1]	Media	Scenario/ Receptor	Cancer Risk			Non-Cancer Risk		
			Scenario/Receptor Total Cancer Risk	Media Total Cancer Risk	COCs that are Contributors to Total Cancer Risk [2]	Scenario/Receptor Total Non-Cancer Hazard Index	Media Total Non-Cancer Hazard Index	COCs that are Contributors to Non-Cancer Hazard Index [2]
Former SEC Property	Surface Soil	SEC RME (Site-Wide) Future On-Site Resident (Child) - Surface Soil (0-0.5 ft)	--	--	--	2	2	Dioxin-like PCB congeners TEQ HQ = 0.6 2,3,7,8-TCDD TEQ HQ = 0.4
	Total Soil	SEC RME (Site-Wide with Hotspot) Future On-Site Resident (Lifetime) - Total Soil (0-8.8 ft)	2E-04	2E-04	**Total Soil** PCB Aroclor 1260 1E-04 Dioxin-like PCB congeners TEQ 4E-06 2,3,7,8-TCDD TEQ 2E-06 **Outdoor Air - Vapors Above Site** PCB Aroclor 1260 1E-05	--	--	--
	Overburden Groundwater [3]	BBH/PTSA RME Future On-Site Construction Worker - Total Soil (0-10 ft BBH; 0-12 ft PTSA), Groundwater (Trench), Trench Air	--	--	--	66 (BBH) 67 (PTSA)	66	**Trench (Vapors)** Dioxin-like PCB congeners TEQ HQ = 0.6 2,3,7,8-TCDD TEQ HQ - 0.8
		BBH/PTSA RME Residential Scenario A Future On-Site Resident (Adult) - Total Soil (0-10 ft BBH; 0-12 ft PTSA), Groundwater - Overburden (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water	Lifetime 5E-04 (BBH) 4E-04 (PTSA)	Lifetime 2E-04	Total PCB congeners 6E-06 Dioxin-like PCB congeners TEQ 6E-06 2,3,7,8-TCDD TEQ 4E-05	15	14	Dioxin-like PCB congeners TEQ HQ = 0.2 2,3,7,8-TCDD TEQ HQ = 1
		BBH/PTSA RME Residential Scenario A Future On-Site Resident (Child) - Total Soil (0-10 ft BBH; 0-12 ft PTSA), Groundwater - Overburden (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water				26 (BBH) 25 (PTSA)	23	Dioxin-like PCB congeners TEQ HQ = 0.3 2,3,7,8-TCDD TEQ = HQ = 2
	Bedrock Groundwater [3]	BBH RME Residential Scenario B Future On-Site Resident (Adult) - Total Soil (0-10 ft), Groundwater - Bedrock (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water	Lifetime 4E-04 (BBH) 2E-04 (PTSA)	Lifetime 1E-04	2,3,7,8-TCDD TEQ 4E-05	7 (BBH)	7 (BBH)	Dioxin-like PCB congeners TEQ HQ = 0.02 2,3,7,8-TCDD TEQ HQ = 1
		BBH/PTSA RME Residential Scenario B Future On-Site Resident (Child) - Total Soil (0-10 ft BBH; 0-12 ft PTSA), Groundwater - Bedrock (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water				16 (BBH) 15 (PTSA)	13	Dioxin-like PCB congeners TEQ HQ = 0.04 2,3,7,8-TCDD TEQ HQ = 2
Possible Transformer Storage Area	Total Soil	PTSA RME Residential Scenario A Future On-Site Resident (Lifetime) - Total Soil (0-12 ft), Groundwater - Overburden (Potable Use), Groundwater (Vapor Intrusion)	4E-04	1E-04	PCB Aroclor 1260 2E-06	--	--	--
		PTSA RME Residential Scenario B Future On-Site Resident (Lifetime) - Total Soil (0-12 ft), Groundwater - Bedrock (Potable Use), Groundwater (Vapor Intrusion)	2E-04	1E-04	PCB Aroclor 1260 2E-06	--	--	--
Britt Bath House	Total Soil	BBH RME Residential Scenario A Future On-Site Resident (Child) - Total Soil (0-10 ft), Groundwater - Overburden (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water	--	--	--	26	2	Dioxin-like PCB congeners TEQ HQ = 0.2
		BBH RME Residential Scenario B Future On-Site Resident (Child) - Total Soil (0-10 ft), Groundwater - Bedrock (Potable Use), Groundwater (Vapor Intrusion), Sediment, Surface Water	--	--	--	16	3	Dioxin-like PCB congeners TEQ HQ = 0.2
Residential Property R3	Surface Soil	R3 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	2E-04	2E-04	2,3,7,8-TCDD TEQ 2E-06	--	--	--
	Total Soil	R3 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft)	2E-04	2E-04	2,3,7,8-TCDD TEQ 2E-06	--	--	--
Residential Property R4	Surface Soil	R4 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	2E-04	2E-04	2,3,7,8-TCDD TEQ 3E-06	--	--	--
	Total Soil	R4 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft)	2E-04	2E-04	2,3,7,8-TCDD TEQ 3E-06	--	--	--

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AOC [1]	Media	Scenario/ Receptor	Cancer Risk			Non-Cancer Risk		
			Scenario/Receptor Total Cancer Risk	Media Total Cancer Risk	COCs that are Contributors to Total Cancer Risk [2]	Scenario/Receptor Total Non-Cancer Hazard Index	Media Total Non-Cancer Hazard Index	COCs that are Contributors to Non-Cancer Hazard Index [2]
Residential Property R5	Surface Soil	R5 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	2E-04	2E-04	PCB Aroclor 1260 4E-06 Dioxin-like PCB congeners TEQ 2E-06 2,3,7,8-TCDD TEQ 6E-06	--	--	--
	Total Soil	R5 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft)	2E-04	2E-04	PCB Aroclor 1260 4E-06 2,3,7,8-TCDD TEQ 3E-06	--	--	--
Residential Property R6	Surface Soil	R6 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft), Sediment, Surface Water	3E-04	2E-04	PCB Aroclor 1260 2E-06 2,3,7,8-TCDD TEQ 3E-06	--	--	--
	Total Soil	R6 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft), Sediment, Surface Water	3E-04	1E-04	PCB Aroclor 1260 7E-06 2,3,7,8-TCDD TEQ 2E-06	--	--	--
	Sediment	R6 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft), Sediment, Surface Water	3E-04	2E-04	2,3,7,8-TCDD TEQ 2E-06	--	--	--
		R6 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft), Sediment, Surface Water	3E-04	2E-04	2,3,7,8-TCDD TEQ 2E-06	--	--	--
Residential Property R7	Surface Soil	R7 RME Current On-Site Resident (Child) - Surface Soil (0-0.5 ft)	Lifetime 3E-04	Lifetime 3E-04	**Surface Soil** Dioxin-like PCB congeners TEQ 1E-05 2,3,7,8-TCDD TEQ 1E-04 **Outdoor Air - Vapors Above Site** 2,3,7,8-TCDD TEQ 4E-06	13	13	Dioxin-like PCB congeners TEQ HQ = 1 2,3,7,8-TCDD TEQ HQ = 11
	Total Soil	R7 RME Future On-Site Resident (Child) - Total Soil (0-4 ft)	--	--	--	3	3	Dioxin-like PCB congeners TEQ HQ = 0.3 2,3,7,8-TCDD TEQ HQ = 2
Residential Property R8	Surface Soil	R8 RME Current On-Site Resident (Child) - Surface Soil (0-0.5 ft), Household Dust	Lifetime 2E-04	Lifetime 2E-04 (Surface Soil) 2E-06 (Household Dust)	**Surface Soil** Dioxin-like PCB congeners TEQ 2E-06 2,3,7,8-TCDD TEQ 2E-05 **Household Dust** Dioxin-like PCB congeners TEQ 2E-06	3	3 (Surface Soil) 0.3 (Household Dust)	**Surface Soil** Dioxin-like PCB congeners TEQ HQ = 0.2 2,3,7,8-TCDD TEQ HQ = 2 **Household Dust** Dioxin-like PCB congeners TEQ HQ = 0.3
	Total Soil	R8 RME Future On-Site Resident (Child) - Total Soil (0-4 ft), Household Dust	Lifetime 2E-04	Lifetime 2E-04 (Total Soil) 2E-06 (Household Dust)	**Total Soil** Dioxin-like PCB congeners TEQ 2E-06 2,3,7,8-TCDD TEQ 2E-05 **Household Dust** Dioxin-like PCB congeners TEQ 2E-06	3	3 (Total Soil) 0.3 (Household Dust)	**Total Soil** Dioxin-like PCB congeners TEQ HQ = 0.2 2,3,7,8-TCDD TEQ HQ = 2 **Household Dust** Dioxin-like PCB congeners TEQ HQ = 0.3
Residential Property R9	Surface Soil	R9 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	3E-04	3E-04	2,3,7,8-TCDD TEQ 7E-06	--	--	--
Residential Property R10	Surface Soil	R10 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	2E-04	2E-04	2,3,7,8-TCDD TEQ 4E-06	--	--	--
	Total Soil	R10 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft)	5E-04	5E-04	2,3,7,8-TCDD TEQ 4E-06	--	--	--
Residential Property R11	Surface Soil	R11 RME Current On-Site Resident (Lifetime) - Surface Soil (0-0.5 ft)	2E-04	2E-04	Dioxin-like PCB congeners TEQ 3E-06 2,3,7,8-TCDD TEQ 3E-06	--	--	--
	Total Soil	R11 RME Future On-Site Resident (Lifetime) - Total Soil (0-4 ft)	2E-04	2E-04	Dioxin-like PCB congeners TEQ 3E-06 2,3,7,8-TCDD TEQ 3E-06	--	--	--

Notes:

AOC = Area of Concern
BBH = Britt Bath House
COC = chemical of concern
ft = feet
HHRA = Human Health Risk Assessme
HQ = hazard quotient
PCB = Polychlorinated Biphenyl
RME = reasonable maximum exposure
SEC = Shaffer Equipment Company
SRI = Supplemental Remedial Investigation
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxic Equivalence Value

Blue text = Indicates that after the risk assessments were completed, COC concentrations were determined to be consistent with background per the RI report.

[1] Human health risks for the Former SEC Property soil from the Final HHRA Shaffer Equipment Company Property (Nobis, 2022); human health risks for all other AOCs and media from the Final HHRA Shaffer Equipment/Arbuckle Creek Area Superfund Site (Nobis, 2024b). Cancer risks below 1E-04 and/or non-cancer HQs below 1 were calculated for AOCs and residential properties not shown in the table.

[2] COCs include PCBs and dioxins/furans.

[3] Groundwater was evaluated as part of the Britt Bath House and Possible Transformer Storage Area HHRA scenarios, and the results were applied to the former SEC Property.

Table 2-2
Ecological Risk Summary for Chemicals of Concern
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

AOC [1]	Direct Contact Screening			Food Web Modeling	
	Media	**Scenario/ Receptor**	**COC Risk [2,3]**	**Scenario/ Receptor**	**COC Risk [2,4]**
Former SEC Property	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 150 2,3,7,8-TCDD TEQ mammal HQ = 44	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (meadow vole) NOAEL HQ = 1.42 Total PCBs (red fox) NOAEL HQ = 4.66 Total PCBs (red fox) MATC HQ = 2.08 Total PCBs (short-tailed shrew) NOAEL HQ = 54.0 Total PCBs (short-tailed shrew) MATC HQ = 17.1 **Total PCBs (short-tailed shrew) LOAEL HQ = 5.40** Total PCBs (white-footed mouse) NOAEL HQ = 8.44 Total PCBs (white-footed mouse) MATC HQ = 2.67 Total PCBs (American robin) NOAEL HQ = 3.90 Total PCBs (American robin) MATC HQ = 1.23 Total PCBs (red-tailed hawk) NOAEL HQ = 1.74 2,3,7,8-TCDD TEQ mammal (short-tailed shrew) NOAEL HQ = 4.22 2,3,7,8-TCDD TEQ mammal (short-tailed shrew) MATC HQ = 1.33
Possible Transformer Storage Area	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 36 2,3,7,8-TCDD TEQ mammal HQ = 4.7	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (short-tailed shrew) NOAEL HQ = 7.60 Total PCBs (short-tailed shrew) MATC HQ = 2.40 Total PCBs (white-footed mouse) NOAEL HQ = 1.19
Britt Bath House	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 42 2,3,7,8-TCDD TEQ mammal HQ = 15	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (short-tailed shrew) NOAEL HQ = 3.03 2,3,7,8-TCDD TEQ mammal (short-tailed shrew) NOAEL HQ = 1.22
Rocklick Road	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 38 2,3,7,8-TCDD TEQ mammal HQ = 12	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (short-tailed shrew) NOAEL HQ = 8.23 Total PCBs (short-tailed shrew) MATC HQ = 2.60 Total PCBs (white-footed mouse) NOAEL HQ = 1.29
NR&P Supply House	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 36 2,3,7,8-TCDD TEQ mammal HQ = 40	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (red fox) NOAEL HQ = 1.03 Total PCBs (short-tailed shrew) NOAEL HQ = 12.3 Total PCBs (short-tailed shrew) MATC HQ = 3.88 **Total PCBs (short-tailed shrew) LOAEL HQ = 1.23** Total PCBs (white-footed mouse) NOAEL HQ = 2.58
Berwind Green Hill Mine Dump	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 36 2,3,7,8-TCDD TEQ mammal HQ = 5.4	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (short-tailed shrew) NOAEL HQ = 7.76 Total PCBs (short-tailed shrew) MATC HQ = 2.45 Total PCBs (white-footed mouse) NOAEL HQ = 1.21
Arbuckle Creek	Sediment	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 4.6 2,3,7,8-TCDD TEQ mammal HQ = 6.5	Food Web Model using 95% UCL - Aquatic receptors	Total PCBs (mink) NOAEL HQ = 1.04
	Surface Water	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 60919 2,3,7,8-TCDD TEQ mammal HQ = 9.3		
Arbuckle Creek Wetlands	Sediment	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 7.5 2,3,7,8-TCDD TEQ mammal HQ = 12	Food Web Model using 95% UCL - Aquatic receptors	Total PCBs (mink) NOAEL HQ = 3.96 Total PCBs (mink) MATC HQ = 1.77 Total PCBs (Indiana bat) NOAEL HQ = 1.44
	Surface Water	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 60973 2,3,7,8-TCDD TEQ mammal HQ = 1042		
Rocklick Creek	--	--	--	Food Web Model using 95% UCL - Aquatic receptors	Total PCBs (mink) NOAEL HQ = 2.05
New River	Sediment	Direct screening evaluation using 95% UCL	2,3,7,8-TCDD TEQ mammal HQ = 1.8	--	--

Table 2-2
Ecological Risk Summary for Chemicals of Concern
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

AOC [1]	Direct Contact Screening			Food Web Modeling	
	Media	**Scenario/ Receptor**	**COC Risk [2,3]**	**Scenario/ Receptor**	**COC Risk [2,4]**
Whole Site	Sediment	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 5.8 2,3,7,8-TCDD TEQ mammal HQ = 10	Food Web Model using 95% UCL - Terrestrial receptors	Total PCBs (short-tailed shrew) NOAEL HQ = 8.76 Total PCBs (short-tailed shrew) MATC HQ = 2.77 Total PCBs (white-footed mouse) NOAEL HQ = 1.37 2,3,7,8-TCDD TEQ mammal (short-tailed shrew) NOAEL HQ = 2.25
	Surface Water	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 60743 2,3,7,8-TCDD TEQ mammal HQ = 515		
	Surface Soil	Direct screening evaluation using 95% UCL	Total PCB Aroclors HALFND HQ = 56 2,3,7,8-TCDD TEQ mammal HQ = 26		

Notes:
AOC = Area of Concern
COC = chemical of concern
ft = feet
HALFND = for non-detect results, half of the reporting limit was used in the calculation
HQ = hazard quotient
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration
NOAEL = No Observed Adverse Effect Level
PCB = Polychlorinated Biphenyl
SEC = Shaffer Equipment Company
SRI = Supplemental Remedial Investigation
SLERA = Screening Level Ecological Risk Assessment
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxic Equivalence Value
UCL = upper confidence limit

Blue text = Indicates that after the risk assessment was completed, COC concentrations were determined to be consistent with background per the RI report.
[1] Ecological risks from the Final SLERA Shaffer Equipment/Arbuckle Creek Area Superfund Site (Nobis, 2023b).
[2] COCs include PCBs and dioxins/furans.
[3] Direct contact screening risks reported in the SLERA include HQs for multiple PCBs and dioxins. This table only includes direct contact screening HQs for Total PCBs (Aroclors and congeners) and 2,3,7,8-TCDD TEQ mammal which were the PCBs and dioxins evaluated for food web modeling.
[4] Bolded COCs exceed LOAEL HQ of 1.

Table 2-3
Basis for Remedial Action Evaluation
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

AOC	Media	To be Evaluated for Remedial Action	Basis for Action for the COCs [3,4,5]
Former SEC Property	Soil	Yes Previously evaluated in Former SEC Property Focused Feasibility Study; therefore, it will not be evaluated as part of this Feasibility Study. [1]	Actionable Risk based on HHRA for the following COCs: -- PCB Aroclor 1260 -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ Actionable Risk based on SLERA for the following COCs: -- Total PCBs Total PCBs >1 mg/kg per USEPA Guidance
	Groundwater [2]	No To be reassessed following the completion of the cleanup at Operable Unit 1. [1]	Actionable Risk based on HHRA for the following COCs: -- Total PCB congeners -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ
Possible Transformer Storage Area	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- PCB Aroclor 1260 Total PCBs >1 mg/kg per USEPA Guidance
Britt Bath House	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- Dioxin-like PCB congeners TEQ Total PCBs >1 mg/kg per USEPA Guidance
NR&P Supply House	Soil	Yes	Actionable Risk based on SLERA for the following COCs: -- Total PCBs
Arbuckle Creek and Wetlands	Soil	Yes	Total PCBs >1 mg/kg per USEPA Guidance
	Sediment	Yes	Total PCBs >1 mg/kg per USEPA Guidance
Residential Property R3	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- 2,3,7,8-TCDD TEQ
Residential Property R4	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- 2,3,7,8-TCDD TEQ
Residential Property R5	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- PCB Aroclor 1260 -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ Total PCBs >1 mg/kg per USEPA Guidance
Residential Property R6	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- PCB Aroclor 1260 -- 2,3,7,8-TCDD TEQ Total PCBs >1 mg/kg per USEPA Guidance
	Sediment	Yes	Actionable Risk based on HHRA for the following COCs: -- 2,3,7,8-TCDD TEQ
Residential Property R7	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ Total PCBs >1 mg/kg per USEPA Guidance
Residential Property R8	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ
Residential Property R9	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- 2,3,7,8-TCDD TEQ Total PCBs >1 mg/kg per USEPA Guidance
Residential Property R10	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- 2,3,7,8-TCDD TEQ
Residential Property R11	Soil	Yes	Actionable Risk based on HHRA for the following COCs: -- Dioxin-like PCB congeners TEQ -- 2,3,7,8-TCDD TEQ

Notes:

AOC = Area of Concern
COC = chemical of concern
HHRA = Human Health Risk Assessment
PCB = Polychlorinated Biphenyl
SEC = Shaffer Equipment Company
SLERA = Screening Level Ecological Risk Assessment
SRI = Supplemental Remedial Investigation
TCDD = Tetrachlorodibenzo-p-dioxin
TEQ = Toxic Equivalence Value
USEPA = U.S. Environmental Protection Agency

[1] Soil at the Former SEC Property is being addressed separately via an Early Action per the USEPA Record of Decision for Operable Unit 1 (USEPA, 2024).

[2] Groundwater was evaluated as part of the Britt Bath House and Possible Transformer Storage Area HHRA scenarios, and the results were applied to the Former SEC Property.

[3] Human health risks for the Former SEC Property soil are from the Final HHRA Shaffer Equipment Company Property (Nobis, 2022); human health risks for all other AOCs and media are from the Final HHRA Shaffer Equipment/Arbuckle Creek Area Superfund Site (Nobis, 2024b). Actionable risk based on human health risk is defined as: 1) cumulative excess carcinogenic risk to an individual greater than 1E-04 and/or 2) non-carcinogenic hazard index greater than 1 (both using reasonable maximum exposure assumptions for either the current or reasonably anticipated future

[4] Ecological risks are from the Final SLERA Shaffer Equipment/Arbuckle Creek Area Superfund Site (Nobis, 2023b). Actionable risk based on ecological risk is defined as: the presence of contaminants that exceed ecological lowest observed adverse effect levels (LOAELs) using food-web modeling.

[5] Basis for action for total PCBs greater than 1 mg/kg per USEPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination (USEPA, 1990) which is an Applicable or Relevant and Appropriate Requirement (ARAR).

Table 2-4
Selection of Preliminary Remediation Goals
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

COC	Site Media [2]	Cancer or Non-Cancer Risk Contributor [3]	Units	BTV [8]	Minimum Reporting Limit [9]	Risk-Based USEPA Resident RSLs [10] Carcinogenic Target Risk 1E-05	Risk-Based USEPA Resident RSLs [10] Non-Cancer Child Hazard Index HI=1	Value from USEPA Guidance [11]	PRG Determination: PRG [12,13,14,15]	PRG Determination: Basis
Soil/Sediment										
Total PCBs [1]	Surface Soil/Sediment	Primarily Cancer [4,5]	mg/kg	0.24	NA	2.3	NA	1	1	USEPA Guidance (for soil)
	Near Surface Soil/Sediment	Primarily Cancer [5]	mg/kg	1.6	NA					
	Subsurface Soil		mg/kg	1.6	NA					
Dioxin TEQ	Surface Soil/Sediment	Cancer and Non-Cancer [6,7]	ng/kg	14	NA	48	51	NA	48	USEPA Residential RSL (1E-05)
	Near Surface Soil/Sediment	Cancer and Non-Cancer [7]	ng/kg	5.5	NA					
	Subsurface Soil		ng/kg	2.5	NA					

Notes:

AOC = Area of Concern
bgs = below ground surface
BTV = background threshold value
COC = chemical of concern
ft = feet
HHRA = Human Health Risk Assessment
HI = hazard index
HQ = hazard quotient
mg/kg = milligrams per kilogram
ng/kg = nanograms per kilogram
NA = not applicable
PCB = Polychlorinated Biphenyl
RME = reasonable maximum exposure
RSL = Regional Screening Level
SEC = Shaffer Equipment Company
SRI = Supplemental Remedial Investigation
TEQ = Toxicity Equivalence

[1] Either total PCB Aroclors or total PCB congeners.

[2] Surface soil/sediment depth 0-0.5 ft bgs, near surface soil/sediment depth 0.5-2 ft bgs, and subsurface soil depth >2 ft bgs. Soil and sediment between 0-2 ft bgs are evaluated together due to proximity and mixing due to flooding and human activity.

[3] Human health risks for the Former SEC Property soil from the Final HHRA Shaffer Equipment Company Property (Nobis, 2022); human health risks for all other AOCs and media from the Final HHRA Shaffer Equipment/Arbuckle Creek Area Superfund Site (Nobis, 2024b).

[4] PCB Aroclor 1260 and/or Dioxin-like PCB congeners TEQ are contributors to unacceptable total cancer risk from surface soil at Residential Properties R5, R6, and R11; Dioxin-like PCB congeners TEQ is a contributor to unacceptable total non-cancer hazard index from surface soil at the Former SEC Property.

[5] PCB Aroclor 1260 and/or Dioxin-like PCB congeners TEQ are contributors to unacceptable total cancer risk from total soil at the Former SEC Property and Residential Properties R5, R6, R8, and R11; Dioxin-like PCB congeners TEQ is also a contributor to unacceptable total non-cancer hazard index from total soil at Residential Properties R7 and R8.

[6] Dioxin TEQ is a contributor to unacceptable total cancer risk from surface soil at Residential Properties R5, R6, R7, R8, R9 and R11; Dioxin TEQ is a contributor to unacceptable total non-cancer hazard index from surface soil at the Former SEC Property and Residential Properties R7 and R8.

[7] Dioxin TEQ is a contributor to unacceptable total cancer risk from total soil at the Former SEC Property and Residential Properties R5, R6, R8, and R11; Dioxin TEQ is a contributor to unacceptable total non-cancer hazard index from total soil at Residential Properties R7 and R8.

[8] The BTVs are for soil. BTVs for total PCBs are the calculated sum of the Aroclors using half of the reporting limit if an individual Aroclor was not detected. The BTVs for dioxin TEQ are the calculated dioxin TEQ for mammals using half of the reporting limit if an individual dioxin compound was not detected.

[9] No minimum laboratory reporting limit for total PCBs and dioxin TEQ because these are calculated values.

[10] USEPA Resident Risk-Based Regional Screening Levels for soil (November 2024) for target cancer risk or target hazard index for Total PCBs (high risk) and 2,3,7,8-tetrachlorodibenzo-p-dioxin for dioxin TEQ.

[11] Total PCB value is residential value for soil from USEPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination, OSWER Directive 9355.4-01; EPA/540/G-90/007, August 1990.

[12] PRG for total PCBs in soil applies to the following AOCs where there is a Basis for Action for PCBs in soil: Former SEC Property, Possible Transformer Storage Area, Britt Bath House, NR&P Supply House, Arbuckle Creek and Wetlands, Residential Properties R5, R6, R7, R8, R9, and R11; however, there are no exceedances of the PRG for total PCBs in soil at the NR&P Supply House or Residential Properties R8 and R11.

[13] PRG for dioxin TEQ in soil applies to the following AOCs where there is a Basis for Action for dioxins in soil: former SEC Property and Residential Properties R3, R4, R5, R6, R7, R8, R9, R10, and R11; however, the only exceedances of the PRG for dioxins in soil are at Residential Properties R7 and R8 and the former SEC Property.

[14] PRG for total PCBs in soil was also selected as the PRG for total PCBs in sediment due to the proximity and mixing of soil and sediment at the AOCs from flooding events and human activity. This PRG applies to the following AOC where there is a Basis for Action for PCBs in sediment: Arbuckle Creek and Wetlands.

[15] PRG for dioxin TEQ in soil was also selected as the PRG for dioxin TEQ in sediment due to the proximity and mixing of soil and sediment at the AOCs from flooding events and human activity. This PRG applies to the following AOC where there is a Basis for Action for dioxins in sediment: Residential Property R6; however there are no exceedances of the PRG for dioxins in sediment at Residential Property R6.

Table 2-5
Estimated Volume of Soil and Sediment in Remedial Response Areas
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Area of Concern Remedial Response Area	Media	COC(s)	Perimeter (feet)	Area (square feet)	Depth (feet)	Volume (cubic feet)	Volume (cubic yards)	Volume (cubic yards) With 10% Contingency
Possible Transformer Storage Area	Soil	Total PCBs	30	400	10	4,000	148	163
Britt Bath House	Soil	Total PCBs	80	400	1	400	15	16
Arbuckle Creek/Wetlands - AC1	Soil, Sediment	Total PCBs	1,434	59,800	2	119,600	4,430	4,873
Arbuckle Creek - AC2	Soil, Sediment	Total PCBs	1,217	26,000	1	26,000	963	1,059
Arbuckle Creek - AC2A[1]	Soil	Total PCBs	30	50	3	150	6	6
Arbuckle Creek/Wetlands - AC3	Sediment	Total PCBs	360	7,200	1	7,200	267	293
Arbuckle Creek/Wetlands - AC4	Sediment	Total PCBs	421	9,000	1	9,000	333	367
Arbuckle Creek/Wetlands - AC5	Sediment	Total PCBs	440	11,200	2	22,400	830	913
Residential Property R5	Soil	Total PCBs	255	3,000	2	6,000	222	244
Residential Property R6	Soil	Total PCBs	30	50	2	100	4	4
Residential Property R7	Soil	Total PCBs, Dioxin TEQ	200	1,875	2	3,750	139	153
Residential Property R8	Soil	Dioxin TEQ	225	2,000	2	4,000	148	163
Residential Property R9	Soil	Total PCBs	80	400	2	800	30	33
						Total Cubic Yards =	7,533	8,287

Notes:

COC = chemical of concern

PCB = polychlorinated biphenyl

TEQ = Toxic Equivalence Value

[1] At remedial response area AC2A, the top 1 foot of soil/sediment would be addressed as part of AC2.

Table 3-1
Remedial Action Objectives, General Response Actions, Technology Types, and Process Options for Remediation of Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Environmental Medium	Remedial Action Objective	General Response Action	Remedial Technology	Process Options
Soil and Sediment	<u>Protection of Human Health</u> Prevent direct human exposure (via inhalation, dermal contact, and/or ingestion) to COCs in soil and sediment in excess of risk-based PRGs. <u>Protection of the Environment</u> Prevent exposure of ecological receptors to COCs in soil and sediment that present an unacceptable ecological risk.	No Action	No Action	- Not applicable
		Institutional Actions	Institutional Controls	- Deed restrictions - Local ordinances - Periodic evaluations
			Access Restrictions	- Fencing/signage
		Natural Attenuation/Recovery	Monitored Natural Attenuation (soil)	- Natural biotic/abiotic attenuation processes - Long-term monitoring
			Monitored Natural Recovery (sediment)	- Natural biotic/abiotic attenuation processes - Re-sedimentation of exposed sediments. - Long-term monitoring
		Containment	Horizontal Barriers	- Low permeability cap - Permeable cap or cover
		Removal	Excavation	- Bulk mechanical excavation
			Dredging	- Hydraulic dredging - Mechanical dredging
		Disposal	Disposal	- Off-site disposal to appropriate facility - On-site consolidation under protective cover
		Treatment	Immobilization	- Solidification/stabilization - Microencapsulation
			Thermal Treatment	- Incineration - Pyrolysis - Thermal desorption - Supercritical water oxidation - Vitrification
			Physical Treatment	- Soil flushing - Soil washing - Liquefied gas solvent extraction - Soil vapor extraction - Electrokinetic separation

Table 3-1
Remedial Action Objectives, General Response Actions, Technology Types, and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Environmental Medium	Remedial Action Objective	General Response Action	Remedial Technology	Process Options
Soil and Sediment (continued)	Protection of Human Health (continued) Protection of the Environment (continued)	Treatment (continued)	Chemical Treatment	- Dehalogenation - Chemical oxidation - Solvent extraction
			Biological Treatment	- Aerobic biodegradation - Anaerobic biodegradation - Biopiles - Bioventing - Phytoremediation

Notes:
COC = chemical of concern
PRG = Preliminary Remediation Goal

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options for Remediation of Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
No Action	No Action	Not Applicable	No activities conducted to address soil/sediment contamination.	Retained. Used as baseline for comparison with other options as required by the National Oil and Hazardous Substances Pollution Contingency Plan.
Institutional Actions	Institutional Controls	Deed Restrictions, Local Ordinances, Periodic Evaluations	Administrative action used to restrict future site activities on individual properties. Restrictions would manage, limit, or prevent activities such as excavation or residential development. Periodic evaluations will be required to ensure institutional controls are implemented and are effective.	Retained. Potentially applicable paired with other actions.
	Access Restrictions	Fencing/Signage	Barrier erected to restrict access to contaminated properties with "No Trespassing" or hazard warning signs posted. Periodic evaluations will be required to assess the effectiveness of access restrictions and identify if maintenance activities are needed.	Retained. Potentially applicable paired with other actions.
Natural Attenuation	Natural Attenuation	Monitored Natural Attenuation (soil)	Contaminated soils are left in place and naturally occurring biotic and abiotic processes may degrade or attenuate organics. Periodic monitoring events are conducted to evaluate contaminant reductions over time.	Retained. Potentially applicable paired with other actions.
		Monitored Natural Recovery (sediment)	Contaminated sediments are left in place and naturally occurring biotic and abiotic processes may degrade or attenuate organics. Re-sedimentation may occur as natural water flow deposits new sediment on top of the existing contaminated sediments. Periodic monitoring events are conducted to evaluate changes in sediment quality over time.	Retained. Potentially applicable paired with other actions.
Containment	Horizontal Barriers	Low Permeability Cap	Various materials (specified below) are used for soil/sediment caps to prevent direct contact with contaminated material, control erosion and control infiltration to minimize leaching of contaminants to groundwater. The sediment cap limits interactions with contaminants between biota in upper habitat layer as well. Upland soil caps include asphalt, concrete, geosynthetics, or multimedia materials to form an impermeable barrier. Sediment caps include a combination of clay, granular and geotextile for physical isolation and erosion protection with an upper habitat layer for biota, which re-populates over time. Cap will increase the elevation of the impacted area.	Retained. Potentially applicable.

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
Containment (continued)	Horizontal Barriers (continued)	Permeable Cap or Cover	Various materials (specified below) are used to prevent direct contact with contaminated soil/ sediments and minimize erosion and surface migration of contaminated soils/sediments. Upland soil covers include crushed stone, geosynthetics, and a vegetative cover. Sediment covers may include a single layer granular cover consisting of clean sediment, sand or gravel or a multiple layer cover to contain the contamination in place and include an upper habitat layer for biota. Cap or cover will increase the elevation of the impacted area.	Retained. Potentially applicable.
Removal	Excavation	Bulk Mechanical Excavation	Use of common construction equipment to remove contaminated soil/sediments. Excavation would be a prerequisite to any other process option that is performed ex-situ. Sediments would require dewatering prior to ex-situ processes/disposal.	Retained. Potentially applicable paired with other actions.
	Dredging	Hydraulic dredging	Use of common construction equipment to remove contaminated sediment. Dredging would be a prerequisite to any other process option that is performed ex-situ. Sediments would require dewatering prior to ex-situ processes/disposal.	Eliminated. Not applicable because the stream and wetlands do not exhibit open water conditions.
		Mechanical dredging	Use of common construction equipment to remove contaminated sediment. Dredging would be a prerequisite to any other process option that is performed ex-situ. Sediments would require dewatering prior to ex-situ processes/disposal.	Eliminated. Not applicable because the stream and wetlands do not exhibit open water conditions.
Disposal	Disposal	Off-site Disposal	Transportation and disposal of treated or untreated soil/sediment to an approved, licensed, out-of-town disposal location. Would be used in conjunction with removal. Dewatering would be required for sediment excavation. Could also be used as an ultimate disposal location after an ex-situ treatment process.	Retained. Potentially applicable paired with removal.
		On-site Consolidation	Assumes consolidation of soil/sediment posing unacceptable risk under a protective cover.	Retained. Potentially applicable paired with removal.

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
Treatment	Immobilization	Solidification/ Stabilization	Solidification/stabilization is designed to immobilize contaminants within the media matrix. Equipment is used to inject or mix (passively or mechanically) reagents into contaminated media to physically and/or chemically decrease the mobility of contaminants. Solidification uses a reagent to bind and encapsulate the contaminated media, decreasing permeability and increasing compressive strength. Stabilization involves processes that cause a chemical reaction to reduce leachability/mobility and toxicity of contaminants. Reagents include cement, pozzolanic material, thermoplastics, polymers, asphalt, activated carbon and clays. Treatment may be performed in-situ or ex-situ. As the treated soils would remain in place indefinitely and may undergo weathering, a warning layer and soil cover will be installed, and the area will be revegetated to avoid direct contact for human and environmental receptors. Treatment may increase the volume of treated media, and the soil cover will increase the elevation of the impacted area.	Retained. Potentially applicable.
		Micro-encapsulation	Contaminants adsorbed to soil/sediment particles are desorbed and then encapsulated by an inert, silica-based solution that will minimize leaching. Treatment would be performed ex-situ.	Eliminated. Not feasible in cases involving large quantities of contaminated, heterogeneous material.

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
Treatment (continued)	Thermal Treatment	Incineration	Destruction of organic contaminants by subjecting them to high temperatures under controlled conditions in a combustion chamber. Treatment would be performed ex-situ.	Retained. Potentially applicable paired with removal to treat organic contaminants.
		Pyrolysis	Chemical decomposition of organic contaminants by heating the material in the absence of oxygen. Treatment would be performed ex-situ.	Eliminated. Not effective for PCBs or dioxins.
		Thermal Desorption	Air, heat, and mechanical agitation are used to volatilize organic contaminants from soil into a vapor stream. Vapor is usually further treated. Treatment would be done ex-situ.	Eliminated. Not likely effective for PCBs or dioxins.
		Supercritical Water Oxidation	Contaminated media is exposed to water in a high temperature, high pressure environment. Under such conditions, organic substances are oxidized. Treatment would be done ex-situ.	Eliminated. Not effective for PCBs or dioxins.
		Vitrification	Melting of contaminated material to volatilize or pyrolyze organics and entrain inorganics in a stable vitreous residual. Treatment may be done in-situ or ex-situ.	Eliminated due to technical implementability issues based on the variability and distribution of contaminants at the Site.
	Physical Treatment	Soil Flushing	Contaminants sorbed to soil/sediment are mobilized or dissolved in an aqueous flushing solution in-situ. The flushing solution is then extracted from the subsurface and treated. Flushing solution may be augmented by chemicals that increase the mobilization or dissolution of organics and some heavy metals from the soil. Treatment would be performed in-situ.	Eliminated. Difficult to ensure capture of flushing solution due to shallow water table. Not a reliable method in cases involving multiple types of contaminants.
		Soil Washing	Process reduces the amount of contaminated material by two means. Finer particles, which contain the bulk of contaminants, are separated from more coarse material. Contaminants sorbed to soil/sediment are dissolved in an aqueous washing solution. The wash water may be augmented by chemicals which increase the leaching of organics and some heavy metals. Treatment would be performed ex-situ.	Eliminated due to technical implementability issues related to the feasibility of washing the anticipated volume of contaminated soil.
		Liquefied Gas Solvent Extraction	Liquefied gas solvents, such as propane, are used to extract organics from soil/sediment. Treatment would be performed ex-situ.	Retained. Potentially applicable paired with removal to treat organic contaminants.

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options
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Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
Treatment (continued)	Physical Treatment (continued)	Soil Vapor Extraction	In-situ technology in which vacuum blowers and extraction wells are used to strip volatile organic compounds from unsaturated soil. Treatment would be performed in-situ.	Eliminated. Not effective for PCBs or dioxins.
		Electrokinetic Separation	A low-intensity direct current is applied to contaminated soil between electrodes, causing ions to move towards the positive or negative electrode. Once contaminants have been separated from soil particles in this manner, they may be recovered and treated either ex-situ or in-situ.	Eliminated. Materials to be treated are too heterogeneous. Technical implementability low.
	Chemical Treatment	Dehalogenation	Contaminated soil/dewatered sediments are screened, processed with a crusher and pug mill, and mixed with reagents. The mixture is heated in a reactor. Dehalogenation occurs through either replacement of the halogen molecules or the decomposition and partial volatilization of contaminants. Treatment would be performed ex-situ.	Eliminated. Materials to be treated are too heterogeneous.
		Chemical Oxidation	Oxidants are injected or mixed into the subsurface where they react with contaminants to form less toxic or harmless end products. Treatment would be performed in-situ.	Eliminated. Generally, more effective for treatment of aqueous wastes.
		Solvent Extraction	Chemical desorption and dissolution of organic and some inorganic contaminants by washing soil with a solvent solution. Treatment would be performed ex-situ.	Retained. Potentially applicable paired with removal. However, multiple solvent formulations will be required.
	Biological Treatment	Aerobic Biodegradation	Microorganisms degrade organic contaminants to carbon dioxide and water. Oxygen is used as an electron acceptor in the degradation process. Treatment may be performed in-situ or ex-situ.	Eliminated. Not likely effective for PCBs or dioxins.
		Anaerobic Biodegradation	An electron acceptor other than oxygen is used in the process in which microorganisms degrade organic contaminants. Treatment may be performed in-situ or ex-situ.	Eliminated. Not likely effective for PCBs or dioxins.
		Biopiles	Excavated soils/dewatered sediments are mixed with amendments and placed on a treatment area that includes leachate collection systems and some form of aeration. Moisture, heat, nutrients, and oxygen levels are controlled to enhance the biodegradation of contaminants. Treatment would be performed ex-situ.	Eliminated. Not implementable at this Site.

Table 3-2
Identification and Evaluation of Remedial Technologies and Process Options
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Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Description	Evaluation Comments
Treatment (continued)	Biological Treatment (continued)	Bioventing	Oxygen is directly injected into unsaturated subsurface soils via a network of air injection wells at air flow rates adequate to sustain microbial activity. Volatile contaminants are desorbed from soil and biodegraded as vapors move through the biologically active soil. Treatment would be performed in-situ.	Eliminated. Not likely effective for PCBs or dioxins.
		Phytoremediation	Plants are used to naturally remediate contaminants via three mechanisms: direct uptake and accumulation of contaminants in plant tissue, release of enzymes that stimulate microbial activity and biochemical transformation, and enhancement of mineralization in plants' roots. Treatment would be performed in-situ.	Eliminated. Effectiveness is limited to soil within the reach of plant root systems. Plants would require harvesting, proper disposal, and replanting. Reliable cost information not available.

Notes:
1. General response actions, remedial technologies, and process options for soil/sediment were adapted from Table 3-1.
2. Process options were retained or eliminated based on an evaluation of their technical implementability given the contaminant types and concentrations in soil/sediment, and other relevant Site characteristics such as the location and distribution of contaminated soil/sediment.

(shaded) Eliminated process option (see screening comment).

Table 3-3
Preliminary Screening of Remediation Technologies and Process Options for Remediation of Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Effectiveness[1]	Implementability[2]	Cost[3]	Conclusion and Comments
No Action	No Action	Not Applicable	Would not achieve remedial action objective.	No permits required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain. Used as baseline.
Institutional Actions	Institutional Controls	Deed Restrictions Local Ordinances, Periodic Evaluations	Would not achieve remedial action objectives without other actions. No human health or environmental impacts from implementation. Reliable to the extent that restrictions can be enforced.	Institutional controls would require legal and/or political actions from others. No treatment, storage, or disposal involved. Services readily available to implement institutional controls.	Capital: Low O&M: Low	Retain. Potentially applicable paired with other actions.
	Access Restrictions	Fencing/Signage	Would not achieve remedial action objectives without other actions. No human health or environmental impacts from implementation. Reliable to the extent that barriers are maintained, and warnings are heeded.	No treatment, storage, or disposal involved. Conventional construction, readily available skilled labor and services from several sources.	Capital: Low O&M: Low	Retain. Potentially applicable paired with other actions.
Natural Attenuation	Natural Attenuation	Monitored Natural Attenuation (soil)	Would not achieve remedial action objectives without other actions. PCBs and dioxins are hydrophobic and chemically stable, which makes the natural breakdown process require an extensive amount of time. Precipitation infiltration would unlikely be effective. Erosion processes (i.e., wind, floods, precipitation) may spread impacted soil beyond current remedial action areas. Very low potential for impacts to human health and environment during implementation. Monitoring is a reliable process for the evaluation of potential contaminant reduction trends and to monitor the progress of remediation.	No permits required for implementation. No treatment involved. Minimal storage and disposal needs to handle investigation derived waste from sampling activities. Labor and services readily available from several sources.	Capital: None O&M: Medium	Eliminate. Would not achieve remedial action objectives and not likely to be paired with other actions.
		Monitored Natural Recovery (sediment)	Would not achieve remedial action objectives without other actions. PCBs and dioxins are hydrophobic and chemically stable, which makes the natural breakdown process require an extensive amount of time. Natural water movement of Arbuckle Creek may result in natural burial of contaminated sediment, but this would likely take an extended period of time. Storm events and flooding may hinder the re-sedimentation process due to scour. Very low potential for impacts to human health and environment during implementation. Monitoring is a reliable process for the evaluation of contaminant migration trends and to monitor the progress of remediation.	No permits required for implementation. No treatment involved. Minimal storage and disposal needs to handle investigation derived waste from sampling activities. Labor and services readily available from several sources.	Capital: None O&M: Medium	Eliminate. Would not achieve remedial action objectives and not likely to be paired with other actions.
Containment	Horizontal Barriers	Low Permeability Cap	Would achieve remedial action objectives by preventing direct contact with contaminated soil/sediment. It is also well-suited to control infiltration and erosion. Some potential adverse impacts are possible during construction or implementation beyond typical earth-moving construction activities because of contaminated soil/sediment presence, which can be mitigated through engineering and air pollution controls, proper decontamination, and H&S measures. Reliable technology when properly designed, constructed, and maintained. Cap materials with a low-permeability layer, if inundated, could be disturbed or damaged during flood events. Stormwater runoff would need to be managed.	Would need to comply with substantive requirements of Applicable or Relevant and Appropriate Requirements (ARARs) for on-site activities. Potential adverse impacts to wetlands and the 100-year floodplain would need to be evaluated and mitigated. Regular maintenance would be required to ensure protectiveness. No treatment, storage, or disposal involved. Materials, labor, and services for implementation readily available from several sources.	Capital: Medium O&M: Medium	Retain. Potentially applicable.
		Permeable Cap or Cover	Would achieve remedial action objectives by preventing direct contact with contaminated soils/sediments. However, due to the location of contaminated soil/sediment within the 100-year floodplain and increasing frequency of flooding events, a permeable cover would be subject to erosion and would not likely to be effective over the long-term or permanent. Some potential adverse impacts are possible during construction or implementation beyond typical earth-moving construction activities because of contaminated soil/sediment presence, which can be mitigated through engineering and air pollution controls, proper decontamination and H&S measures. Reliable technology when properly designed, constructed, and maintained. Cap materials with a permeable cover, if inundated, may be less likely disturbed or damaged during flood events due to increased permeability. However, strong flows during flood events could still result in damage.	Would need to comply with substantive requirements of ARARs for on-site activities. Potential adverse impacts to wetlands and the 100-year floodplain would need to be evaluated and mitigated. Regular maintenance would be required to ensure protectiveness. No treatment, storage, or disposal involved. Materials, labor, and services for implementation readily available from several sources.	Capital: Medium O&M: Medium	Eliminate. Not as effective or permanent over the long-term as Low Permeability Cap.

Table 3-3
Preliminary Screening of Remediation Technologies and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
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General Response Action	Remedial Technology	Process Option	Effectiveness[1]	Implementability[2]	Cost[3]	Conclusion and Comments
Removal	Excavation	Bulk Mechanical Excavation	Would be required to consolidate and grade contaminated soil/sediment. This process is typically used in conjunction with other remediation options (i.e., disposal). Would achieve remedial action objectives by removing all soil/sediment with concentrations exceeding remedial goals (for off-site disposal). Some potential adverse impacts during construction or implementation beyond typical earth-moving construction activities because of contaminated soil/sediment presence, which can be mitigated through engineering and air pollution controls, and proper decontamination, and H&S procedures to prevent the spread of contamination during excavation. Very reliable process for the removal of contaminated soil/sediment.	Would need to comply with substantive requirements of ARARs for on-site activities. Adequate on-site capacity must be available for temporary storage of excavated material prior to disposal. This includes sediment dewatering. Location to be determined. No treatment involved. Construction activities would require the potential for active dewatering to support excavation and restoration below the water table and within water bodies. Water would require collection, treatment and disposal to an approved location. Sufficient space required for dewatering and water treatment. Conventional construction process that is easily implemented with equipment and services that are readily available from several sources. Potential adverse impacts to the 100-year floodplain would need to be evaluated and mitigated if necessary.	Capital: Medium O&M: None Note: Includes cost of excavating only. Transport, treatment, or disposal of soil/sediment not included.	Retain. Potentially applicable paired with other actions.
Disposal	Disposal	Off-Site Disposal	May be difficult to accommodate anticipated volume of contaminated soil/sediment during temporary storage prior to off-site disposal. Remedial action objectives would be achieved since all contamination would be removed from site. Some potential adverse impacts may occur during implementation beyond typical earth-moving construction activities because of contaminated soil/sediment presence, which can be mitigated through engineering and air pollution controls, proper decontamination and H&S procedures to prevent the spread of contamination during excavation and loading. There would be the potential for release of contaminants during transport due to accidents. Proven and reliable for site contaminants.	Permits for off-site landfill disposal could be obtained. Off-site disposal capacity for the anticipated volume of contaminated soil should be available. Would require transport, as disposal facilities are located > 500 miles away. Materials and services required to implement technology readily available.	Capital: High O&M: None	Retain. Potentially applicable paired with other actions.
		On-Site Consolidation	Remedial action objective would be achieved for contaminated soil/sediment that is consolidated and isolated beneath low permeability cap to eliminate direct contact risks by isolating wastes from human and environmental contact. This process would be used in conjunction with excavation and containment; it could also be used in conjunction with treatment. Potential impacts to human health and the environment from excavation, placement, grading, and transportation of contaminated material to consolidation areas could be mitigated using engineering and air pollution controls, proper decontamination and H&S procedures. Proven and reliable for site contaminants.	Disposal capacity for the anticipated volume of contaminated soil/sediment would not be available without raising the elevation of the disposal area or excavating material to create a subsurface cell and disposing of the clean excavated material. Materials and services required to implement technology readily available. Potential adverse impacts to the 100-year floodplain would need to be evaluated and mitigated if necessary.	Capital: Medium O&M: Medium	Retain. Potentially applicable paired with other actions.
Treatment	Immobilization	Solidification/ Stabilization	Would achieve human health remedial action objective for contaminated soil/sediment, as long as additional protections were in place (e.g., institutional controls, warning layer with clean soil cover) to ensure prevention of direct contact of treated soils with human and environmental receptors. Environmental remedial action object would be achieved for sediments by binding with and reducing bioavailability of PCBs and dioxins in sediments. Potential impacts to human health and the environment from the implementation of solidification/stabilization processes can be mitigated using engineering and air pollution controls, and proper decontamination and H&S procedures. Additional steps for ex-situ treatment include excavation, constructing upland treatment area, and pouring/backfilling treated materials into excavated areas. Treated materials that cannot be returned to the excavation area may need to be disposed of. Higher cost with ex-situ, but no more protective than in-situ treatment. Treatment with a binding agent (e.g., cement, lime, natural pozzolans, fly ash) is a proven process for the treatment of soil contaminated with PCBs and dioxins. However, high concentrations may impede the setting and long-term durability of the stabilization agent. Weathering over time may occur. Stabilization with activated carbon containing proprietary amendments have been proven to treat PCBs and dioxins in solid matrices.	Adequate on-site capacity must be available for temporary storage of excavated soil/sediment if undergoing ex-situ treatment. Treatment may increase the volume of treated soils resulting in issues with capacity for replacement on site and potential elevation increase of site ground surface, in addition to the treatment agency affect hydrology (i.e., decreased infiltration capacity). Materials, equipment and services required to implement technology are readily available. Permits or approvals possibly required for injection of reagents into the subsurface are likely obtainable. Treatability study would be required to evaluate the effectiveness of potential amendments. Long-term monitoring/maintenance required. Potential adverse impacts to wetlands and the 100-year floodplain would need to be evaluated and mitigated.	Capital: Medium (cost increase with ex-situ treatment) O&M: Low	Retain In-Situ Solidification/ Stabilization. Potentially applicable. Eliminate Ex-Situ Solidification/ Stabilization. Equally effective as in-situ treatment, but with higher cost.

Table 3-3
Preliminary Screening of Remediation Technologies and Process Options
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Effectiveness[1]	Implementability[2]	Cost[3]	Conclusion and Comments
Treatment (continued)	Thermal Treatment	Incineration	Would achieve remedial action objective for the organic contaminants but would be ineffective for treating soil contaminated with inorganics. Potential impacts to human health and the environment from excavation, temporary stockpiling, loading, transport, and on-site incineration of contaminated soil/sediment. Effects could be mitigated using engineering and air pollution controls, proper decontamination and H&S procedures to prevent the spread of contamination during implementation. Incineration would be performed at an off-site location. Very reliable process for the treatment of soil contaminated with organic contaminants.	Permits or approvals required to incinerate site soil/sediment off-site should be obtainable. Temporary storage and loading capacity available on site. Equipment/facilities required for treatment are available. Distance to incineration facility greater than 500 miles from site.	Capital: High O&M: None	Eliminate. Higher cost than other treatment options.
	Physical Treatment	Liquefied Gas Solvent Extraction	Would not achieve remedial action objective for PCBs and dioxins. Process not effective for treating soil contaminated with inorganic contaminants. Potential impacts to human health and the environment from excavation, temporary stockpiling, loading, and transport of contaminated soil/sediment. Effects could be mitigated using engineering and air pollution controls, proper decontamination, and H&S procedures. Treatment would be performed at an off-site location. Technology still emerging. Not yet proven to be reliable for treatment of heterogeneous waste.	Permits or approvals required to treat site soil/sediment off-site should be obtainable. Equipment/facilities required for treatment are limited. May be difficult to implement due to heterogeneous nature of waste materials.	Capital: High O&M: None	Eliminate. Higher cost and reliability is more uncertain than other treatment options.
	Chemical Treatment	Solvent Extraction[4]	Multiple solvents are required to address organic and inorganic contaminants. Additional processing may be required to remove residual solvents from treated soils. Potential impacts to human health and the environment from excavation, temporary stockpiling, loading, and transport of contaminated soil/sediment. Effects could be mitigated using proper engineering controls, proper decontamination and H&S procedures. Treatment would be performed at an off-site location. Technology still emerging. Not yet proven to be reliable for treatment at full scale, and site-specific soil treatment using this method was determined to be ineffective during prior remedial activities.	Permits or approvals required to treat site soil/sediment off-site should be obtainable. Equipment/facilities required for treatment are limited. May be difficult to implement due to heterogeneous nature of waste materials.	Capital: High O&M: None	Eliminate. Higher cost than other treatment options and determined to be ineffective during prior remedial activities at the Site.

Notes:
1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated soil/sediment and meeting the preliminary remediation goals.
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the Site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for offsite actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical implementability concerns.
3. Cost plays a limited role in the screening of process options. Relative capital and operations and maintenance (O&M) costs are used at this stage rather than detailed cost estimates. Cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, medium, or low relative to other process options in the same technology type.
4. Between 1985 and 1986, USEPA began pilot testing on-site treatment of PCB contaminated soil/sediment using a solvent (methanol) extraction process, however, the process was deemed too costly and ineffective (USEPA, 1987).

(shaded) Eliminated process option.

Table 4-1
Summary of Major Elements of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

General Response Action	Remedial Technology	Process Option	Alt. 1 No Action	Alt. 2 Low Permeability Cap	Alt. 3 Removal with Off-Site Disposal	Alt. 4 In-Situ Treatment
No Action	No Action	Not Applicable	✶			
Institutional Actions	Institutional Controls	Deed Restrictions Local Ordinances Periodic Evaluations		✶		✶
	Access Restrictions	Fencing/Signage		✶		✶
Containment	Horizontal Barriers	Low Permeability Cap		✶		
Removal	Excavation	Bulk Mechanical Excavation		Possible[1]	✶	
Disposal	Disposal	Off-Site Disposal			✶	
		On-Site Consolidation		Possible[1]		
Treatment	Immobilization	Solidification/ Stabilization (In-Situ)				✶

Notes:
✶ - Process option is a component of this alternative
1. Removal and on-Site consolidation are possible components of this alternative if a single consolidation area is used to contain the waste under one cap located outside of the floodplain.

Table 4-2
Screening of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Alternative	Description	Screening Criteria			Comments
		Effectiveness[1]	Implementability[2]	Cost	
Alternative 1 No Action	Implementation Period None – no action Post-Implementation Period None – no action	Would not achieve remedial action objective. Any reduction in toxicity or volume would be the result of natural attenuation or degradation processes. However, PCBs and dioxins will only attenuate very gradually, and monitoring will not be conducted to evaluate future attenuation or protectiveness. Erosion processes (i.e., wind, floods, precipitation) and human activity may spread impacted soil/sediment beyond current AOCs. Current and future human health risks would remain as quantified in the baseline risk assessment.	No permits required; no treatment, storage, or disposal involved; no equipment or services required.	Capital: None O&M: None	Retain (as baseline)

Table 4-2
Screening of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Alternative	Description	Screening Criteria			Comments
		Effectiveness[1]	**Implementability[2]**	**Cost**	
Alternative 2 Low Permeability Cap	Implementation Period • Low permeability cap installation • Interim monitoring during construction • Institutional controls • Access restrictions (fencing/signage) • Development of a Cap Operations and Maintenance Plan • Development of a Periodic Evaluation and Long-term Monitoring Plan Post-Implementation Period • Cap maintenance/inspections • Periodic evaluation of institutional controls and access restrictions • Long-term monitoring of soil, sediment, and surface water • Five-Year Reviews	Containment achieves remedial action objectives by preventing direct contact with contaminated soils/sediment with concentrations greater than the PRGs. For caps over soils, proper construction and maintenance would prevent soil erosion, surface water infiltration, and direct contact with contaminated soil. For caps over sediment, proper construction and maintenance would prevent sediment erosion and physically isolate the contamination from the upper habitat layer. Waste could remain in-place with the proper design measures for both soil and sediment caps. Alternatively, a single consolidation area could be used to contain the waste under one cap located outside of the floodplain. Cap materials, if inundated, could be disturbed or damaged during flood events. Stormwater runoff would need to be managed. Prevention of migration of waste during severe flooding events may not be able to be achieved though standard engineering practices. Any reduction in toxicity, mobility, or volume would be the result of natural attenuation processes and not treatment. Potential adverse impacts may occur during implementation beyond typical cap construction activities because of contaminated soil/sediment presence. This can be mitigated through engineering and air pollution controls, proper decontamination, and H&S procedures to prevent the spread of contamination during construction. Institutional controls would limit access to the land-capped areas and waterway capped areas to protect the cap, to the extent that restrictions can be enforced. A cap is reliable when containment is properly designed, constructed, and maintained; institutional controls and an operation and maintenance plan are integral parts of the alternative, including inspections and potential repairs. Long-term monitoring and Five-Year Reviews would be needed to evaluate the protectiveness of the remedy over time.	No treatment, storage, or disposal involved. Would need to comply with substantive requirements of ARARs for on-site activities. Adequate on-site storage capacity required for materials staging and adequate space required for cap construction. On-site capacity is available for a consolidation laydown area to contain the waste under one cap located outside of the floodplain and in a low occupancy area (e.g., Possible Transformer Storage Area). Conventional construction processes utilize equipment and services that are readily available from several sources. During design, evaluation of impacts to wetlands and the 100-year floodplain would be required and any adverse impacts would be required to be mitigated. Avoidance of adverse impacts could be achieved during design by including limited excavation and consolidation under a cap in a single or multiple areas outside of wetlands and floodplains. Community impacts from construction activities are mainly short-term including large numbers of construction vehicles moving clean cap materials. Fugitive dust emissions will be monitored and managed. Turbidity within the water body will be monitored and managed. Operation and maintenance of the capped areas and inspections would be required. These services are widely available. Periodic evaluation of the institutional controls and access restrictions would consist of annual inspections, reports, and maintenance, if needed. These services are widely available. Long-term monitoring would consist of groundwater monitoring to evaluate that the cap is functioning as designed. The frequency of sampling may be annually for the first five years and a minimum of every five years after that. Services to perform long-term monitoring are widely available. Services to implement institutional controls and access restrictions (i.e., signs, fencing) are widely available. Five-Year Reviews would be required.	Capital: Moderate to High O&M: Moderate to High	Retain

Table 4-2
Screening of Remedial Alternatives for Soil and Sediment
Feasibility Study
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Minden, West Virginia

Alternative	Description	Screening Criteria			Comments
		Effectiveness[1]	Implementability[2]	Cost	
Alternative 3 Removal with Off-site Disposal	Implementation Period • Excavation of contaminated materials • Interim monitoring during construction • Dewatering of excavated sediments and dewatering of excavations when depths extend below the water table • Off-Site disposal of excavated PCB-contaminated soil/sediments at an approved off-site disposal facility • Backfill with clean fill and restoration Post-Implementation Period • None	Remedial action objectives preventing direct contact would be achieved since all material with concentrations greater than the PRGs would be removed from the site. Removal would eliminate the threat of release/migration to Arbuckle Creek and associated wetlands. No reduction of toxicity, mobility, or volume through treatment is anticipated except to the limited extent any saturated soils need to be dewatered and the water treated before discharge or disposal. Extensive materials handling would be required during excavation, temporary storage, and loading of vehicles. Potential adverse impacts may occur during implementation beyond typical earth-moving construction activities because of contaminated soil/sediment presence, which could be mitigated through engineering and air pollution controls, proper decontamination and H&S procedures to prevent the spread of contamination during excavation and loading. Proven and reliable for site contaminants. No institutional controls or O&M would be included in this alternative since all soil/sediments posing risk will be removed from the site.	Off-site disposal capacity for the anticipated volume of contaminated soil/sediment is likely available. Would need to comply with substantive requirements of ARARs for on-site activities. On-site capacity for the dewatering of removed sediments is likely available. Excavated materials would require transport as disposal facilities are located > 500 miles away. Conventional construction processes utilize equipment and services that are readily available from several sources. During design, evaluation of short-term impacts to wetlands and the 100-year floodplain would be required and any adverse impacts would be minimized. No permanent impacts to wetlands or floodplains are anticipated as the excavated areas would be restored to pre-existing elevations with native vegetation. Dewatering while excavating/backfilling below the water table would be required; generated water would either be transported and disposed of off-site or treated on-site then discharged to the Oak Hill Wastewater Treatment Plant. Note that groundwater was encountered at depths between 4 to 12 feet in overburden. Soil/sediment excavations at all remedial response areas in Arbuckle Creek/Wetlands are likely in water. Community impacts from construction activities are mainly short-term including large numbers of construction vehicles moving clean and contaminated materials. The movement of excavated soils will need to be closely managed both on- and off-site to minimize impacts to the community. Fugitive dust emissions will be monitored and managed. Turbidity within the water body will be monitored and managed. Waste characterization sampling of on-site materials needed prior to off-site disposal. Utilities (sewer and gas) known to be present at the AOCs may complicate the excavation process as the precise locations are not known. Long-term monitoring and Five-Year Reviews are not anticipated to be needed following removal to achieve PRGs. Proven and reliable for site contaminants.	Capital: High O&M: None	Retain

Table 4-2
Screening of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Alternative	Description	Screening Criteria			Comments
		Effectiveness[1]	Implementability[2]	Cost	
Alternative 4 In-Situ Treatment	Implementation Period • Treatability study • Installation of sediment physical adsorption layer • Treatment of impacted soils • Placement of soil/sediment cover • Interim monitoring during construction • Institutional controls • Access restrictions (fencing/signage) • Development of a Treatment Area Operations and Maintenance Plan • Development of a Periodic Evaluation and Long-term Monitoring Plan Post-Implementation Period • Treatment area inspections/maintenance • Periodic evaluation of institutional controls and access restrictions • Long-term monitoring of soil, sediment, and surface water • Five-Year Reviews	This alternative achieves remedial action objectives as physical adsorption with suitable reagents will bind with and reduce the mobility and toxicity of PCBs and dioxins in soil/sediment, and the clean soil/sediment cover will prevent direct contact with treated soil/sediment. Stabilization of soils with a binding agent (e.g., cement, lime, natural pozzolans, fly ash) is a proven process for in-situ treatment of soils contaminated with PCBs and dioxins to convert contaminants to less soluble, mobile or toxic form. However, high concentrations of contaminants may impede the setting and long-term durability of the stabilization agent. A warning layer covered with clean soil will be placed over the stabilized soil to prevent direct human contact with treated soil. Stabilization of sediment with a reagent containing activated carbon will bind with and reduce the bioavailability of PCBs and dioxins. A layered application will provide protection of the stabilized sediments from potential erosion. A clean habitat layer (3 to 4 inches of topsoil and/or sand) will be placed over the stabilized sediments to create a clean benthic habitat. Due to the location of contaminated soil/sediment within the 100-year floodplain and increasing frequency of flooding events, the clean habitat layer could be subject to erosion. Institutional controls and an operation and maintenance plan are integral parts of the alternative, including inspections and potential cover repairs. No reduction of volume through treatment is anticipated. However, mobility and thus toxicity of contaminated soil/sediment would be decreased. Potential short-term adverse impacts to human health and the environment from the implementation of treatment processes can be mitigated using engineering and air pollution controls, proper decontamination, and H&S procedures to prevent the spread of contamination during construction. No long-term impacts to human health or the environment are anticipated. A treatability study is needed prior to implementing this alternative to ensure efficacy of chosen reagents. Institutional controls would limit access to the treated areas, to the extent that restrictions can be enforced. Long-term monitoring and Five-Year Reviews would be needed to evaluate the protectiveness of the remedy over time.	Materials, equipment and services required to implement a treatability study and implement the treatment technology are readily available. Permits or approvals that may be required for mixing/injection of reagents into the subsurface are likely obtainable. Nearby storage is anticipated to be available for stockpiling/staging of materials and for construction equipment. Treatment may increase the volume of treated soil/sediment resulting in potential elevation increases of site ground surface and/or requiring off-site disposal of excess material. Community impacts from construction activities are minimal and mainly short-term during installation activities. Fugitive dust emissions from materials handling and the soil treatment will be monitored and managed. Turbidity within the water body will be monitored and managed. During the design phase, evaluation of impacts to wetlands and the 100-year floodplain would be required and any adverse impacts would be required to be mitigated. Avoidance of adverse impacts could be achieved during design by including limited excavation and consolidation onsite for treatment in a single or multiple areas outside of wetlands and floodplains. Utilities (sewer and gas) known to be present at the AOCs may complicate the treatment process as the precise locations are not known. Complications for this technology could be encountered if mixing of reagent in soils occurs within the saturated zone. Operation and maintenance of the treated and covered areas and inspections would be required. These services are widely available. Periodic evaluation of the institutional controls would consist of annual inspections and reports. These services are widely available. Long-term monitoring may require initial conditions sampling to determine soil/sediment physical characteristics, soil/sediment geochemistry, and waterway flow/scour conditions. Long-term monitoring would also consist of sampling sediment and surface water to monitor the effectiveness of the remedy. The frequency of sampling may be annually for the first five years and a minimum of every five years after that. Groundwater monitoring would not be required (see Note 3). Services to perform long-term monitoring are widely available. Services to implement institutional controls and access restrictions (i.e., signs, fencing) are widely available. Five-Year Reviews would be required.	Capital: Moderate O&M: Low	Retain

Table 4-2
Screening of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Notes:
AOC = Area of Concern
ARAR = Applicable or Relevant and Appropriate Requirements
H&S = health and safety
O&M = operation and maintenance
PCB = polychlorinated biphenyl
PRG = Preliminary Remediation Goal
FYR = Five-year review

1. Effectiveness is evaluated relative to other processes within the same technology type using the following criteria:
   A. Potential effectiveness of process option in handling the estimated volume of contaminated soil and meeting the preliminary remediation goals.
   B. Potential impacts to human health and the environment during the construction and implementation phase.
   C. Reliability of the process with respect to the contaminants and conditions at the site.
2. Implementability is evaluated relative to other processes within the same technology type using the following criteria:
   A. Ability to obtain necessary permits for offsite actions.
   B. Availability of treatment, storage, and disposal services (including capacity).
   C. Availability of necessary equipment and skilled workers to implement the technology.
   D. Potential technical implementability concerns.
3. Historical groundwater investigations have indicated minimal to no PCB leaching is occurring.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Overall Protection of Human Health and the Environment				
Overall assessment of long-term and short-term protectiveness for human health and the environment	▪ Developed as a baseline per NCP for comparison purposes. No actions would be taken to address contamination. ▪ Would not be protective of human health or the environment. ▪ PCBs and dioxins in soil/sediment would continue to pose unacceptable health risks through direct human exposure (dermal, ingestion, inhalation) and ecological exposure. ▪ Contaminants could spread beyond current remedial action areas through erosion processes.	▪ Offers protection to human health and the environment by preventing direct human exposure (dermal contact, incidental ingestion, and inhalation) and ecological exposure to soil/sediment. Prevents surface water infiltration of contaminated soil. ▪ Offers protection to human health and the environment by preventing exposure to contaminated sediments via physical isolation and erosion prevention. ▪ Cap design would include surface water diversion features to mitigate the risk of infiltration and divert run-on from contacting contaminated soil. Cap design could include multiple or a single consolidation area located outside of the floodplain. ▪ Institutional controls, if enforced, would limit potential damage of cap system. ▪ Periodic maintenance would sustain effectiveness of the cap. ▪ Long-term monitoring would indicate possible changes in surface water or sediment quality or characteristics of capped materials.	▪ Offers protection of human health and the environment by preventing direct exposure (dermal contact, incidental ingestion, and inhalation) of soil/sediment through permanent removal of contaminated soil. ▪ Offers protection of environmental receptors by preventing direct contact via permanent PCB and dioxin removal in sediments. ▪ Restoration would return the ground surface to natural contours within the 100-year floodplain, which would be protective of the environment. ▪ Permanent removal of PCBs and dioxins in soil/sediments would be protective of the overburden aquifer.	▪ Offers protection of human health receptors by strongly binding/sorbing PCBs and dioxins to soil/sediment. This immobilization reduces PCB and dioxin migration potential via erosion processes to the surrounding environment. Clean soil/sediment cover will prevent direct contact with treated soil/sediment. Natural weathering of treated soil over time has been observed in case studies. ▪ Institutional controls, if enforced, would limit potential damage of cover. ▪ Due to the location of contaminated soil/sediment within the 100-year floodplain, the clean soil/sediment would be subject to erosion, but this could be mitigated through institutional controls and implementation of an O&M plan which includes inspections. ▪ Offers protection to environmental receptors as stabilization of sediments via activated carbon (e.g., Sedimite™) would bind with and reduce the bioavailability of PCBs and dioxins. Regeneration of a clean habitat layer would occur over time. ▪ Long-term monitoring and Five-Year Reviews would be required to evaluate the protectiveness of the remedy because PCBs and dioxins would remain on-site.
Compliance with ARARs				
Compliance with chemical-specific ARARs	▪ Would not comply with chemical-specific ARARs because no response action would be taken to address PCB- and dioxin-contaminated soil/sediment above PRGs.	▪ Would comply with chemical-specific ARARs because PCB- and dioxin-contaminated soil/sediment above PRGs would be capped.	▪ Would comply with chemical-specific ARARs because PCB- and dioxin-contaminated soil/sediment above PRGs would be removed.	▪ Would comply with chemical-specific ARARs because PCB- and dioxin-contaminated soil/sediment above PRGs would be treated and covered.
Compliance with location-specific ARARs	▪ Would not comply with location-specific ARARs because 1) no action would be taken to be protective of endangered species and 2) deed restrictions would not be implemented as required under the state regulatory requirement for Waste Management (33 CSR 20-12) due to hazardous waste presence (i.e., PCBs > 50 ppb).	▪ Would comply with location specific ARARs. Proper design considerations and implementation would be conducted to avoid or mitigate adverse impacts to wetlands and floodplains from site modifications.	▪ Would comply with location specific ARARs. Proper design considerations and implementation would be conducted to avoid adverse impacts to wetlands floodplains from site modifications.	▪ Would comply with location specific ARARs. Proper design considerations and implementation would be conducted to avoid or mitigate adverse impacts to wetlands and floodplains from site modifications.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Compliance with action-specific ARARs	▪ Not applicable to action-specific ARARs because no response action would be taken.	▪ This alternative would comply with the action-specific ARARs during the capping of PCB- and dioxin-contaminated soil/sediment above PRGs. Modifications to floodplain storage would require evaluation.	▪ This alternative would comply with the action-specific ARARs during the excavation and off-site disposal of PCB- and dioxin-contaminated soil/sediment above PRGs. Modifications to floodplain storage would require evaluation.	▪ This alternative would comply with the action-specific ARARs during the in-situ treatment of PCB- and dioxin-contaminated soil above PRGs. Modifications to floodplain storage would require evaluation.
Long-Term Effectiveness and Permanence				
Magnitude of residual risks	▪ Contaminated soil/sediment totaling approximately 8,287 cubic yards would remain unaddressed. ▪ Potential risks related to soil/sediments to human health and the environment would remain present on the site. ▪ Erosion processes and human activity may spread impacted soil/sediment beyond current AOCs.	▪ Contaminated soil/sediment totaling approximately 8,287 cubic yards would remain onsite but would be controlled and contained. ▪ Potential risks to human health would not occur because direct exposure to PCBs and dioxins would be prevented by the cap and institutional controls. ▪ Potential risks to the environment would not occur because direct exposure to PCBs and dioxins would be prevented by the cap. ▪ Cap operation and maintenance activities, institutional controls, and access restrictions, if enforced, would maintain the integrity of the cap which controls the potential risks.	▪ Contaminated soil/sediment totaling approximately 8,287 cubic yards would be removed from the site. ▪ Potential risks to human health and the environment would not occur because the contaminants would be removed.	▪ Contaminated soil/sediment totaling approximately 8,287 cubic yards would be treated in-situ to immobilize the PCBs and dioxins. ▪ Potential risks to human health would not occur because direct exposure to PCBs and dioxins would be prevented by the treatment and cover. ▪ Potential risks to the environment would not occur because direct exposure to PCBs and dioxins would be prevented by the treatment and cover. ▪ Treatment area operation and maintenance activities, institutional controls, and access restrictions, if enforced, would maintain the integrity of the treatment area which controls the potential risks.
Adequacy and reliability of controls	▪ No controls are used. Therefore, no protection for human health or the environment from potential exposure to contaminants would be achieved and the alternative would be ineffective.	▪ Capping is reliable and permanent if the cap system is maintained through proper O&M. ▪ Adequacy of this alternative would be confirmed through Five-Year Review and long-term monitoring. ▪ The institutional controls and access restrictions implemented to protect the cap would be reliable if properly enforced and if maintained through periodic evaluations.	▪ Removal is reliable and permanent. ▪ Adequacy of impacted material removal would be verified via confirmation sampling.	▪ In-situ treatment with a clean cover is reliable if the treatment area is maintained through proper O&M. ▪ The appropriate treatment reagent would be determined through treatability studies. ▪ Adequacy of this alternative would be determined through Five-Year Reviews and long-term monitoring. ▪ The institutional controls and access restrictions implemented to protect the treatment area would be reliable if properly enforced and if maintained through periodic evaluations.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Reduction of Toxicity, Mobility, or Volume Through Treatment				
Treatment process used	▪ No treatment used.	▪ No treatment used.	▪ No on-site treatment used for soil/sediment. ▪ Treatment of dewatered groundwater from excavations that extend below the water table and from sediment dewatering may be required for disposal/discharge to an approved location.	▪ Soil would undergo in-situ treatment by mixing an appropriate binding reagent with soils to convert contaminants to a less mobile and toxic form. ▪ Sediment would undergo in-situ treatment by applying an appropriate reagent to sediment (e.g., SediMite™) resulting in physical adsorption of PCBs and dioxins and reduction of bioavailability.
Reduction in toxicity, mobility, or volume	▪ No reduction of toxicity, mobility, or volume through treatment.	▪ No reduction of toxicity, mobility, or volume through treatment.	▪ No reduction of toxicity, mobility, or volume through treatment.	▪ Contaminated soil/sediment would remain within the soil/sediment via physical adsorption of PCBs and dioxins.
Type and quantity of treatment residuals	▪ No treatment, therefore, no residuals.	▪ No treatment, therefore, no residuals.	▪ Treating water generated from dewatering may result in treatment residuals which would be disposed off-site.	▪ In-situ treatment of soils/sediments would not result in residuals. The reagents would be directly combined with the soils and sediments and remain on the site.
Satisfies statutory preference for treatment	▪ Would not satisfy statutory preference for treatment.	▪ Would not satisfy statutory preference for treatment.	▪ Would not satisfy statutory preference for treatment unless off-site disposal facility treats the removed material. ▪ The treatment of dewatering water generated as a by-product of remedial activities would not satisfy the statutory preference for treatment.	▪ In-situ treatment satisfies the statutory preference for treatment.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Short-Term Effectiveness				
Risks to community during implementation of remedial action	▪ No additional risks to community as no actions would be taken.	▪ Limited impacts to the community are anticipated. Increased truck and vehicular traffic would occur during site preparation and capping construction activities. ▪ Increased vehicular traffic on public roads would need to be coordinated and scheduled to minimize impacts to the local community. ▪ Fugitive dust emissions from cap system construction could be minimized or eliminated by applying proper engineering controls and monitoring. ▪ Turbidity within the water body could be minimized by applying proper engineering controls and monitoring. ▪ Noise could be controlled through engineering controls. ▪ Special considerations to minimize risks would need to be taken for the Residential Properties. ▪ Long-term monitoring events, inspections, and maintenance would result in minimal risks.	▪ Moderate to high impacts to community are anticipated. Increased truck and vehicular traffic would occur during site preparation, soil/sediment excavation, dewatering, offsite transportation and disposal, backfilling, and restoration activities. ▪ Significantly increased vehicular traffic on public roads would need to be coordinated and scheduled to minimize impacts to the local community. ▪ Risks of release would be high during implementation due to potential flooding risks associated with Arbuckle Creek. Risk could be minimized through proper planning and engineering controls. ▪ Risks from temporary storage of contaminated materials could be minimized by applying proper engineering controls. ▪ Fugitive dust emissions from excavation, backfilling, and restoration activities could be minimized or eliminated by applying proper engineering controls and monitoring. ▪ Turbidity within the water body could be minimized by applying proper engineering controls and monitoring. ▪ Noise could be controlled through engineering controls. ▪ Special considerations to minimize risks would need to be taken for the Residential Properties.	▪ Minimal impacts to the community are anticipated. Increased truck and vehicular traffic would occur during site preparation and treatment activities. ▪ Increased vehicular traffic on public roads would need to be coordinated and scheduled to minimize impacts to the local community. ▪ Risks of release would be moderate during implementation due to potential flooding risks associated with Arbuckle Creek. Risk could be minimized through proper planning and engineering controls. ▪ Fugitive dust emissions from materials handling and treatment would be minimized or eliminated by applying proper engineering controls and monitoring. ▪ Turbidity within the water body could be minimized by applying proper engineering controls and monitoring. ▪ Noise would be controlled through engineering controls. ▪ Special considerations to minimize risks would need to be taken for the Residential Properties. ▪ Long-term monitoring events, inspections, and maintenance would result in minimal risks.
Risks to workers during implementation of remedial action	▪ No additional risks to workers as no actions would be taken.	▪ Risks to workers during the remedial action can be minimized or eliminated through the use of proper personal protective equipment to prevent exposures to contaminant-laden dusts. ▪ Minimal risks to workers during long-term monitoring.	▪ Risks to workers during the remedial action can be minimized or eliminated through the use of proper personal protective equipment to prevent exposures to contaminant-laden dusts.	▪ Risks to workers during the remedial action can be minimized or eliminated through the use of proper personal protective equipment to prevent exposures to reagents and/or contaminant-laden dusts. ▪ Minimal risks to workers during long-term monitoring.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Environmental impacts	▪ No additional risks to environment as no actions would be taken.	▪ Risks to the environment remain until RAOs are achieved. ▪ Potential adverse impacts to the environment by performing remediation in wetlands or reducing the storage capacity of the floodplain due to cap materials. Potential reduction of infiltration capacity. Adverse impact would require mitigation. ▪ Disturbance of wetland areas. ▪ Potential impacts due to erosion or sedimentation in the water body could be minimized by applying proper engineering controls. ▪ Minimal risks to the environment during long-term monitoring events.	▪ Risks to the environment remain until RAOs are achieved. ▪ No permanent adverse impacts to the environment are anticipated as the result of the remedial action. Ground surface would be returned to original elevation. ▪ Disturbance of wetland areas. ▪ Environmental impacts due to erosion or sedimentation in the water body could be minimized by applying proper engineering controls.	▪ Risks to the environment remain until RAOs are achieved. ▪ Minimal adverse impacts are expected from placement of in-situ treatment reagent. ▪ Potential adverse impacts to the environment by performing remediation in wetlands or reducing the storage capacity of the floodplain due to increased volume of treated materials. Potential decrease in the permeability of treated soil/sediment. Adverse impact would require mitigation. ▪ Potential impacts due to erosion or sedimentation or resuspension of sediment in the water body could be minimized by applying proper engineering controls. ▪ Minimal risks to the environment during long-term monitoring events.
Time until remedial action objectives (RAOs) are achieved	▪ RAOs would not be achieved.	▪ Approximately 2-3 years required to achieve the RAOs, including pre-design, design and construction activities. However, permanent achievement of the RAOs would require maintenance into perpetuity.	▪ Approximately 2-3 years required to achieve the RAOs, including pre-design, design, and construction activities.	▪ Approximately 2-3 years required to achieve the RAOs, including pre-design, design, and construction activities. However, permanent achievement of the RAOs would require maintenance into perpetuity.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Implementability				
Constructable	▪ Easy to construct as no actions would be taken.	▪ Precautions due to potential flooding would need to be taken during cap system construction. ▪ Construction would require identification and assessment of permanent impacts to wetlands and the 100-year floodplain during design, which would require mitigation measures to avoid loss, destruction or degradation of the floodplain. ▪ Handling of hazardous materials would require specially trained workers and supervisors. ▪ Access restrictions are easily constructed. ▪ Institutional controls can be prepared to restrict land use but would require coordination with the property owners. ▪ The presence of known utilities (sewer, gas) would result in challenges during implementation. ▪ The small, localized areas of impacted soil/sediment in each AOC are not as optimal for cap construction (higher cost, continuous maintenance) than other less intrusive technologies.	▪ Precautions due to potential flooding would need to be taken during excavation, off-site transportation and disposal, backfilling, and restoration activities. ▪ All of the AOCs lie within the 100-year floodplain. Unavoidable impacts to the floodplain would result because contaminated floodplain soil/sediment needs to be excavated. However, because finish grades would be returned to natural contours, impacts to the floodplain would be temporary. ▪ Handling of hazardous materials would require specially trained workers and supervisors. ▪ The presence of known utilities (sewer, gas) would result in challenges during implementation. ▪ Implementation on the residential properties may be challenging to maintain pre-excavation conditions.	▪ Precautions due to potential flooding would need to be taken during treatment. ▪ The reagents for soil and sediment are mixed/applied using conventional equipment. ▪ Evaluation of potential impacts to wetlands and the 100-year floodplain would be required during the design to avoid loss, destruction or degradation of the floodplain. ▪ Handling of hazardous materials would require specially trained workers and supervisors. ▪ Access restrictions are easily constructed. ▪ Institutional controls can be prepared to restrict land use but would require coordination with the property owners. ▪ The presence of known utilities (sewer, gas) would result in challenges during and post implementation. A plan on how to access utilities post-treatment would be needed. ▪ Implementation on the residential properties may be challenging to maintain pre-implementation conditions.
Technology reliability	▪ Not applicable as no technology would be used.	▪ Capping is a reliable technology, if properly maintained. ▪ Access restrictions and institutional controls are reliable technologies, if enforced and properly maintained. ▪ Long-term monitoring is reliable for evaluation of site conditions.	▪ Very reliable as standard construction equipment would be used, and contaminated soil/sediment would be permanently removed.	▪ In-situ solidification/stabilization paired with clean cover is a reliable technology if the cover is properly maintained. ▪ Treatability studies for soil and sediments would be needed to determine the appropriate reagents for site conditions. ▪ Access restrictions and institutional controls are reliable technologies, if enforced and properly maintained. ▪ Long-term monitoring is reliable for evaluation of site conditions.
Ease of implementing additional actions, if necessary	▪ Easily implemented.	▪ Additional actions can be implemented by partial or full removal of the cap. ▪ Additional actions which require the cap to remain in-place afterward must include cap repair/replacement. ▪ The future use of all the AOCs would be limited by the presence of a cap.	▪ Additional actions can be easily implemented. However, the necessity for additional action is very unlikely.	▪ Additional actions, such as removal, can be implemented. Additional treatment actions would be limited by the characteristics and composition of the treated soil/sediment. ▪ The presence of stabilized soil/sediment may hinder certain activities and may limit re-development options.
Monitoring effectiveness	▪ Not applicable as monitoring would not be included.	▪ Annual inspections are effective in monitoring the integrity of the cap. ▪ Interim construction monitoring (dust, surface water, stormwater) is effective in evaluating short-term human and environmental impacts. ▪ Periodic evaluations are effective in monitoring institutional controls and access restrictions. ▪ Long-term monitoring and Five-Year Reviews are effective in evaluating the protectiveness of the remedy over time.	▪ Interim construction monitoring (dust, surface water, stormwater) is effective in evaluating short-term human and environmental impacts.	▪ Annual inspections are effective in monitoring the integrity of the treatment and cover. ▪ Interim construction monitoring (dust, surface water, stormwater) is effective in evaluating short-term human and environmental impacts. ▪ Periodic evaluations are effective in monitoring institutional controls and access restrictions. ▪ Long-term monitoring and Five-Year Reviews are effective in evaluating the protectiveness of the remedy over time.
Coordination with other agencies	▪ Not applicable as no actions would be taken.	▪ Coordination with other agencies can be readily implemented.	▪ Coordination with other agencies can be readily implemented.	▪ Coordination with other agencies can be readily implemented.

Table 5-1
Detailed Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria[1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Availability of treatment, storage, and disposal services	▪ Not applicable as no treatment, storage, or disposal services would be performed.	▪ If treatment, storage, or disposal services are required, facilities are readily available.	▪ Appropriate treatment, storage and disposal facilities are readily available, including Subtitle C and Subtitle D disposal facilities which are anticipated to be needed for this alternative.	▪ If treatment, storage, or disposal services are required, facilities are readily available.
Availability of equipment and specialists	▪ Not applicable as no actions would be taken.	▪ Equipment and materials required for this alternative are readily available. This includes standard construction equipment for access controls and material handling and specialty equipment for cap construction. ▪ Lead time would be required to obtain the cap materials. ▪ Specialists required to complete the monitoring and construction activities include OSHA HAZWOPER certified workers which are readily available through many specialty contractors. ▪ Specialists that prepare institutional controls are readily available.	▪ Equipment and materials required for this alternative are readily available. This includes standard construction equipment for access controls, excavation, material handling, and restoration. ▪ Lead time would be required to identify facilities and obtain approvals for off-site transportation and disposal and to obtain materials for backfilling and restoration. ▪ Specialists required to complete the monitoring and construction activities include OSHA HAZWOPER certified workers which are readily available through many contractors.	▪ Equipment and materials required for this alternative are generally available. Standard construction equipment for access controls and material handling are readily available. Specialty equipment and materials for in-situ treatment are generally available. ▪ Lead time would be required to obtain the treatment materials. ▪ Specialists required to perform in-situ treatment are generally available. ▪ Specialists required to complete the monitoring and construction activities include OSHA HAZWOPER certified workers which are readily available through many contractors. ▪ Specialists that prepare institutional controls are readily available.
Availability of prospective technologies	▪ Not applicable as no technologies would be used.	▪ Cap construction, inspection, and maintenance is a readily available technology through many specialty contractors. ▪ Access restrictions and institutional controls are readily available technologies. ▪ Long-term monitoring is a readily available technology.	▪ Excavation, material handling, and restoration are readily available technologies through many contractors.	▪ In-situ treatment and cover construction, inspection, and maintenance are generally available technologies through specialty contractors. ▪ Access restrictions and institutional controls are readily available technologies. ▪ Long-term monitoring is a readily available technology.
Costs				
Capital Costs	$0	$3,847,000	$4,449,000	$4,244,000
O&M Costs (Present Value)[2]	$0	$625,000	$0	$710,000
Total Costs (Present Value)[2]	$0	$4,472,000	$4,449,000	$4,954,000

Notes:
AOC = Area of Concern
ARAR = Applicable or Relevant and Appropriate Requirements
HAZWOPER = Hazardous Waste Operations and Emergency Response
NCP = National Oil and Hazardous Substances Pollution Contingency Plan
O&M = operations and maintenance
OSHA = Occupational Safety and Health Administration
PCB = polychlorinated biphenyl
PRG = Preliminary Remediation Goal
RAO = Remedial Action Objective

1. Evaluation criteria from *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988.
2. Present Value calculated based on 7% discount rate per *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 540-R-00-002, OSWER 9355.0-75, July 2000

Table 6-1
Comparative Analysis of Remedial Alternatives for Soil and Sediment
Feasibility Study
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia

Evaluation Criteria [1]	Alternative 1 No Action	Alternative 2 Low Permeability Cap	Alternative 3 Removal with Off-Site Disposal	Alternative 4 In-Situ Treatment
Threshold Criteria [2]				
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes
Compliance with ARARs	No	Yes	Yes	Yes
Primary Balancing Criteria [3]				
Long-Term Effectiveness and Permanence	⊖	○✓	●✔	○✓
Reduction of Toxicity, Mobility, or Volume Through Treatment	⊖	⊖	○✓ [5]	●✔
Short-Term Effectiveness	○✓	○✓	○✓	○✓
Implementability	●✔	○✓	○✓	○✓
Capital Costs	$0	$3,847,000	$4,449,000	$4,244,000
O&M Costs (Present Value)	$0	$625,000	$0	$710,000
Total Costs (Present Value)	$0	$4,472,000	$4,449,000	$4,954,000
Modifying Criteria [4]				
State Acceptance	To be determined	To be determined	To be determined	To be determined
Community Acceptance	To be determined	To be determined	To be determined	To be determined

Notes:
ARAR = Applicable or Relevant and Appropriate Requirements
O&M = operations and maintenance

[1] Evaluation criteria from *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988.
[2] For threshold criteria, remedial alternative must meet (i.e., yes) these criteria for selection.
[3] For primary balancing criteria, alternatives are evaluated on the degree that they satisfy each criterion as follows:

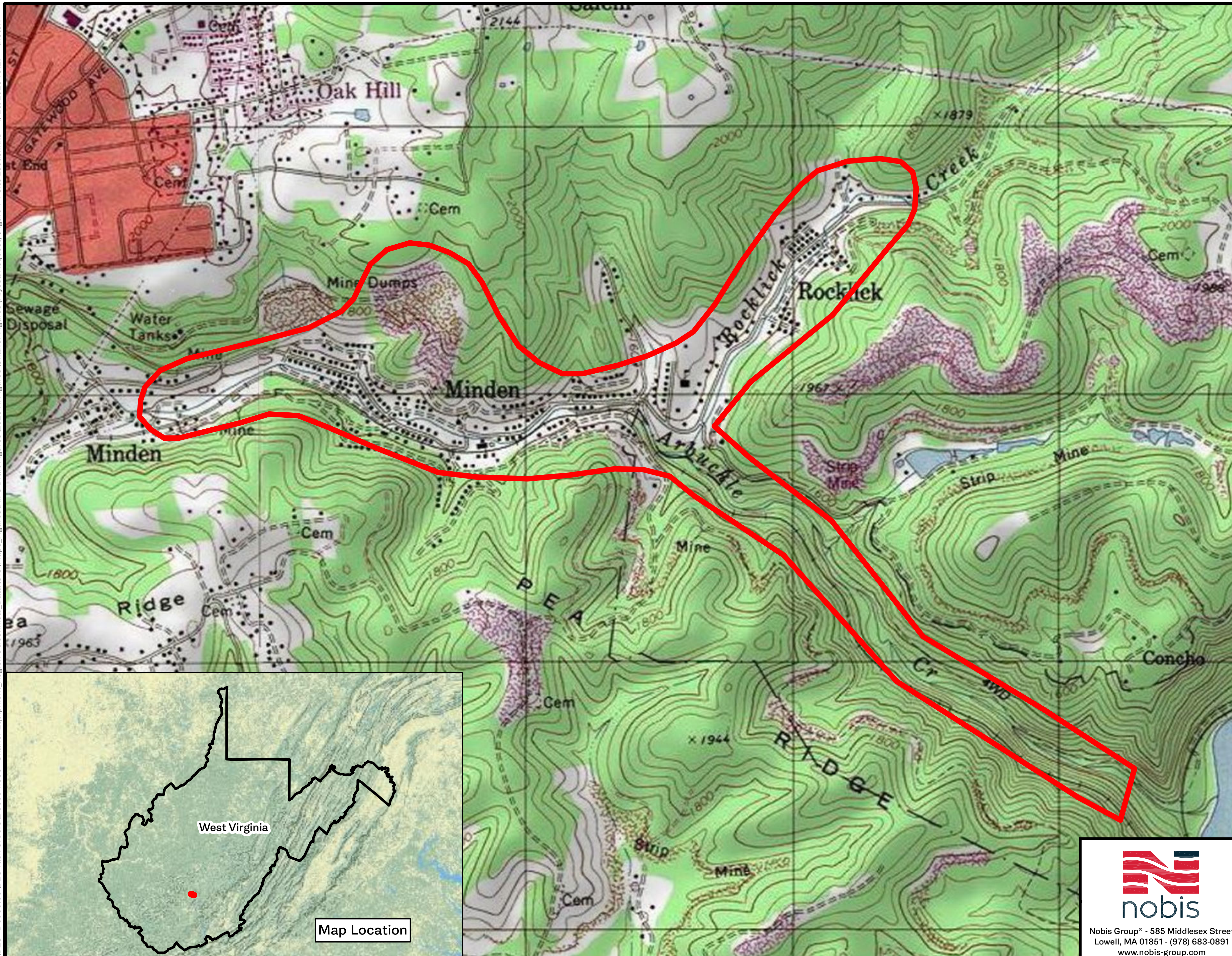
●✔ = Best satisfies criterion

○✓ = Somewhat satisfies criterion

⊖ = Does not satisfy criterion

[4] Modifying criteria will be evaluated following the public comment period for the Proposed Plan.
[5] This alternative would only satisfy this criterion if the off-site disposal facility treats the contaminated soil and sediment.

FIGURES



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

2. US Topographic Map courtesy of ESRI's ArcGIS Online map service (© 2013 National Geographic Society, i-cubed)

Legend

Project Location

0 750 1,500 3,000 Feet

N

1 inch = 1,500 feet

nobis

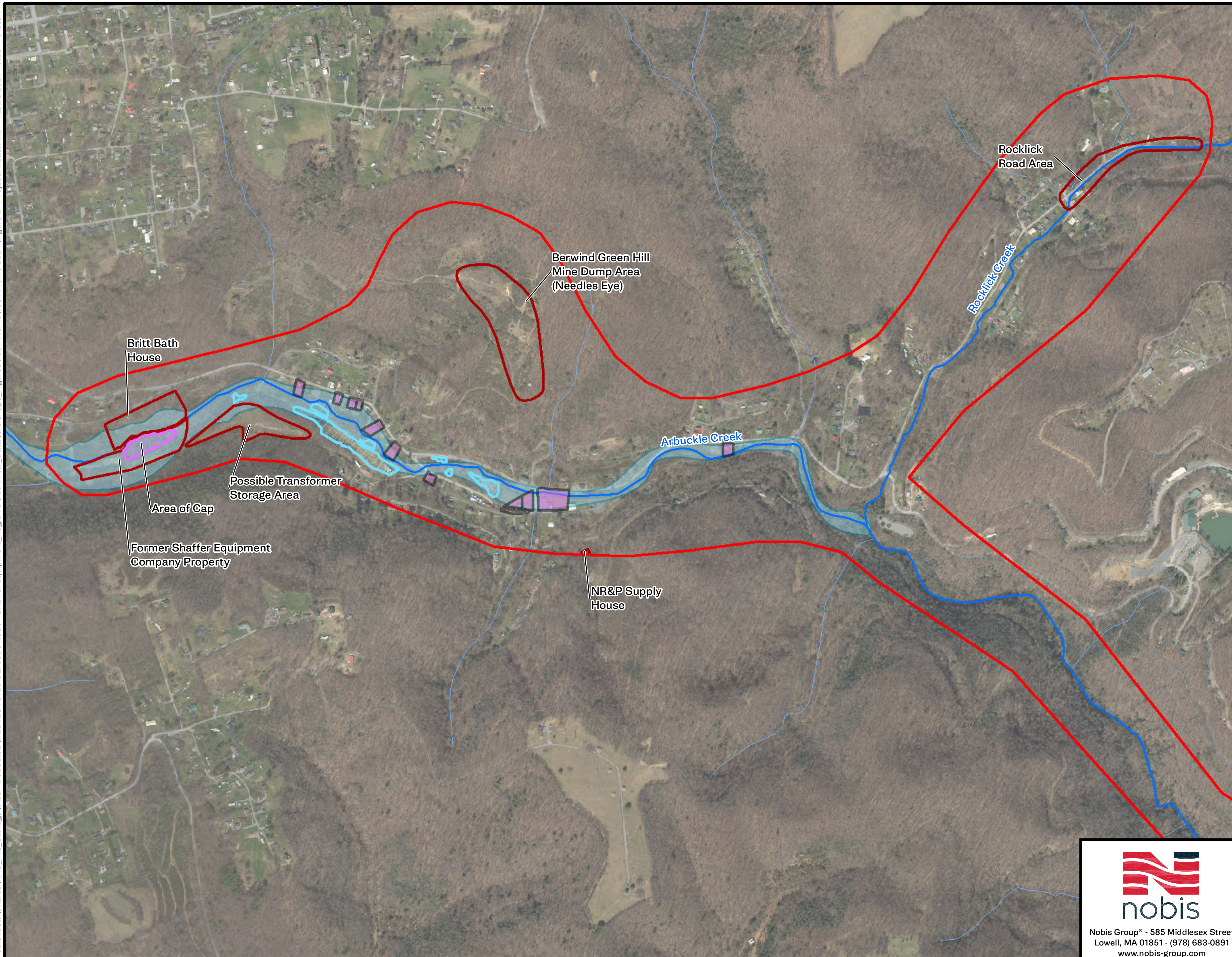
Nobis Group® - 585 Middlesex Street
Lowell, MA 01851 - (978) 683-0891
www.nobis-group.com

FIGURE 1-1

SITE LOCATION
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA
SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: ANE
PROJECT NO. D00004	DATE: JULY 2023

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\2023 RI Figures\Shaffer Figures (Alyssa Request)\Figure 1-1 Site Locus.mxd 7/25/2023 13:27 tfistori



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

2. Aerial image courtesy of ESRI.

3. Roads courtesy of West Virginia GIS Technical Center.

4. Wetland boundaries were obtained from the June 13, 2018 Weston Solutions, Inc. Wetland Delineation Report.

Legend

- Residential Properties
- Project Location
- Areas of Concern
- Area of Cap
- Arbuckle Creek
- Unnamed Tributary
- Wetland Boundary
- FEMA Zone A Flood Hazard

0 500 1,000 2,000 Feet

1 inch = 1,000 feet

N

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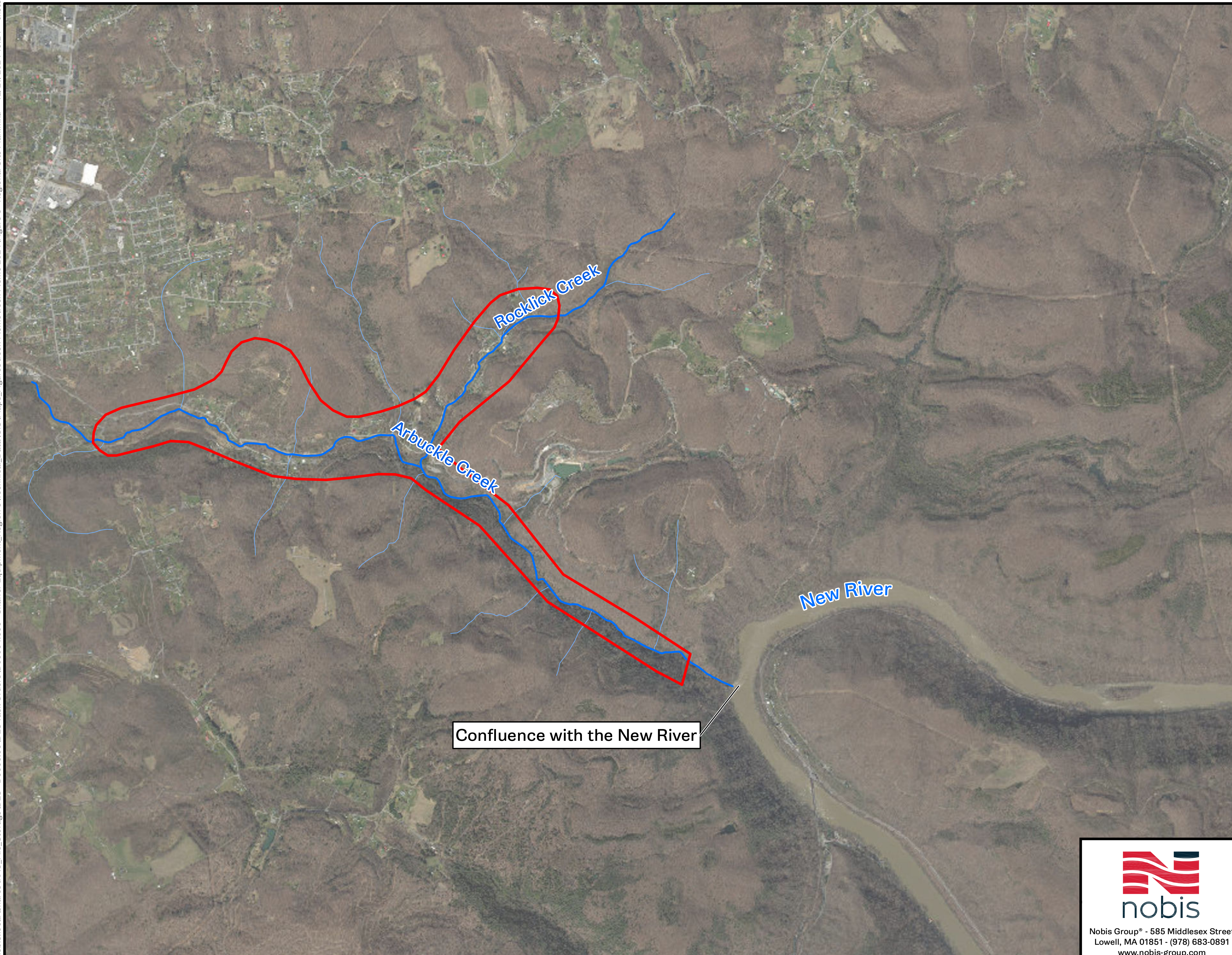
FIGURE 1-2

PROJECT AREAS
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA
SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: DECEMBER 2024

\\nobis.local\shares\RAC_File_Storage\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\Tech Memo\Tech Memo 2024\Figure 2 - Project Areas.mxd 12/27/2024 10:25 tfistori



Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

2. Aerial image courtesy of ESRI.

Legend

Project Location

Arbuckle Creek

Unnamed Tributary

0 1,250 2,500 5,000 Feet

1 inch = 2,500 feet

N

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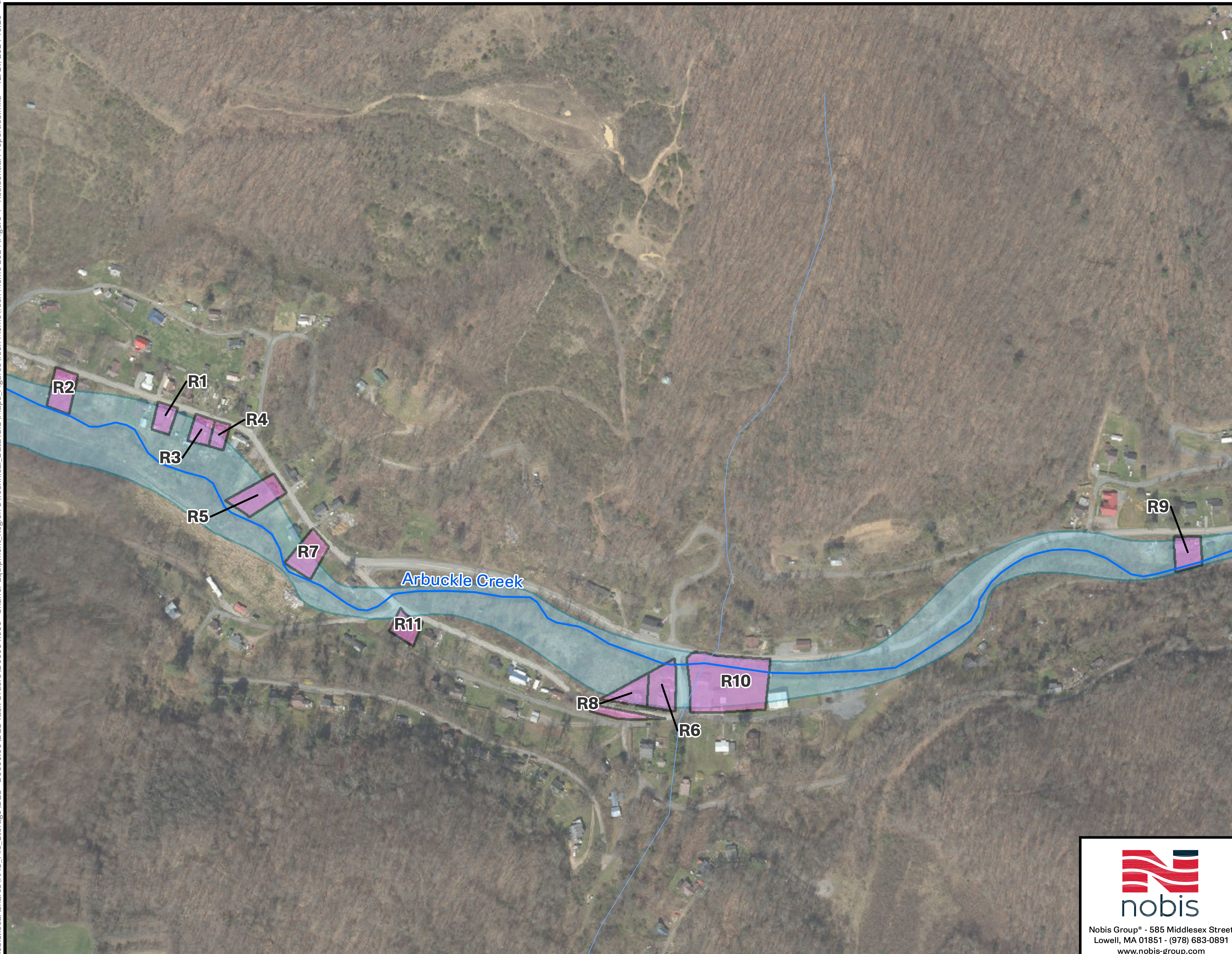
FIGURE 1-3

REGIONAL SITE PLAN
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA
SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: DECEMBER 2024



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

Legend

- Residential Parcels
- FEMA Zone A Flood Hazard
- Arbuckle Creek
- Unnamed Tributary

0 150 300 600

Feet

1 inch = 300 feet

N

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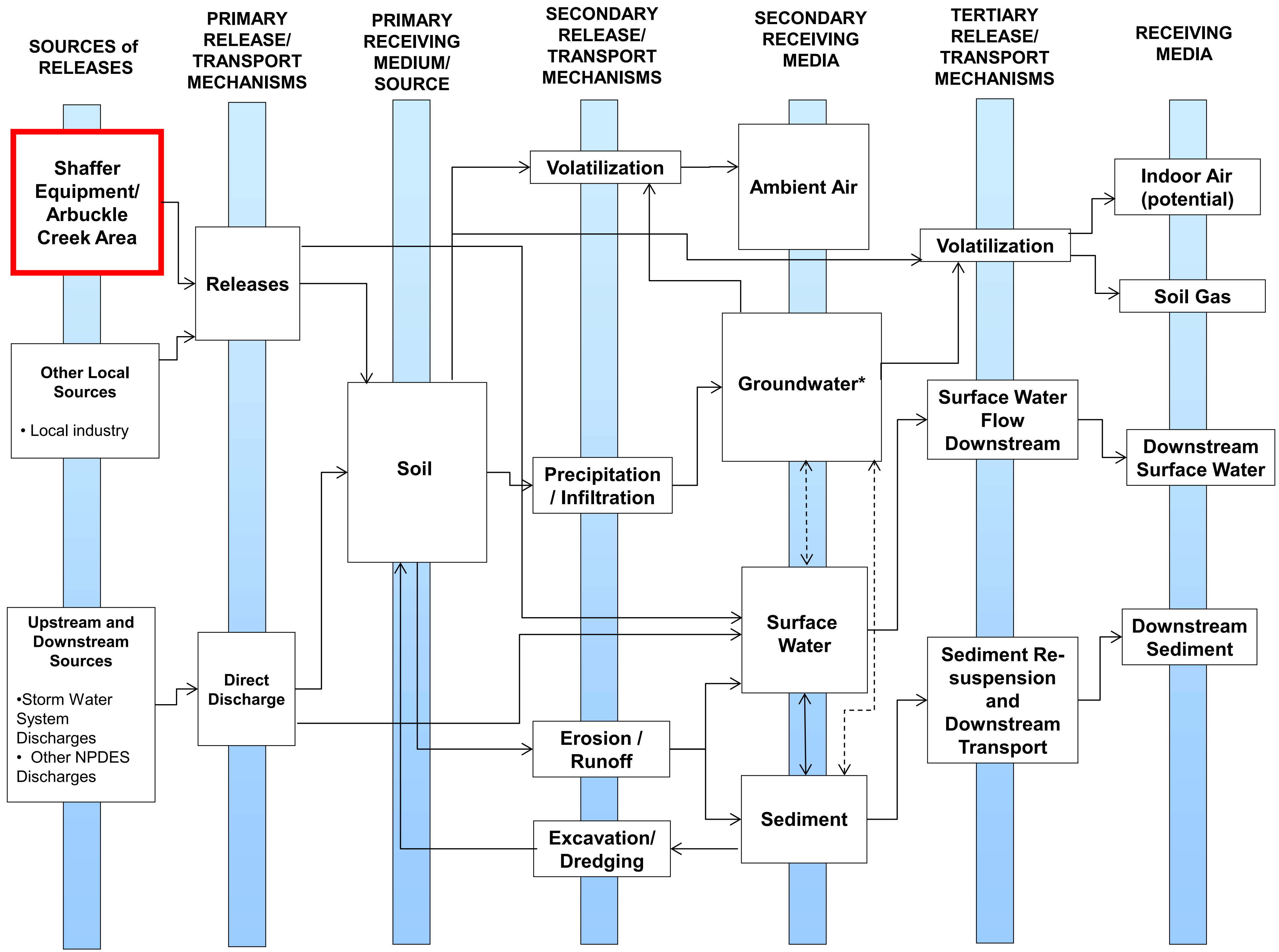
FIGURE 1-4

RESIDENTIAL PROPERTIES
SHAFFER EQUIPMENT /
ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: DECEMBER 2024

\\nobis.local\shares\RAC_File_Storage\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\Tech Memo\Tech Memo 2024\Figure 4 - Residential Properties.mxd 12/27/2024 10:26 tfistori

Figure 1-5
Conceptual Site Model – Exposure Pathways
Shaffer Equipment/Arbuckle Creek Area Superfund Site
Minden, West Virginia



FATE AND TRANSPORT SCREENING SUMMARY

	Soil	Groundwater	Air	Surface Water	Sediment
VOCs	✓	✓	✓		
SVOCs	✓	✓		✓	✓
PESTICIDES	✓	✓			✓
PCBs	✓	✓	✓	✓	✓
Dioxins and Furans	✓	✓		✓	✓
Metals and Cyanide	✓	✓	✓	✓	✓

Note:
✓ Indicates a transport pathway of interest due to analytical detections above Project Screening Levels and known chemical properties dictating fate and transport.

Legend:

* Based on the limited overburden monitoring wells available at the Site, a hydraulic connection between groundwater and Arbuckle Creek has not been established.

Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. PCBs = polychlorinated biphenyls
5. sq ft = square feet
6. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
7. PCB results shown are the higher value of total PCB Aroclors and total PCB congeners.
8. The following sediment samples were collected from and will be addressed as part of Arbuckle Creek and Arbuckle Creek Wetlands areas of concern: SW/SD305, SW/SD306, SW/SD308, SD401, SD402, SD403, and SD404.
9. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG
- Arbuckle Creek
- FEMA Zone A Flood Hazard
- Possible Transformer Storage Area
- Pit Area
- Remedial Response Area

N

0 37.5 75 150

Feet

1 inch = 75 feet

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FIGURE 2-1

TOTAL PCBS IN SOIL
POSSIBLE TRANSFORMER STORAGE AREA
SHAFFER EQUIPMENT /
ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: CO
PROJECT NO. D00004.004	DATE: FEBRUARY 2025

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures\Figure 2-1 - Total PCB in Soil - PTSA.mxd 2/13/2025 14:30 tfistori

Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. PCBs = polychlorinated biphenyls
5. sq ft = square feet
6. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
7. PCB results shown are the higher value of total Aroclors and total PCB congeners.
8. The following sediment samples were collected from Arbuckle Creek area of concern: SD411, SW/SD303, and SW/SD304.

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG
- Arbuckle Creek
- FEMA Zone A Flood Hazard
- Britt Bath House
- Remedial Response Area

0 37.5 75 150
Feet
1 inch = 75 feet
N

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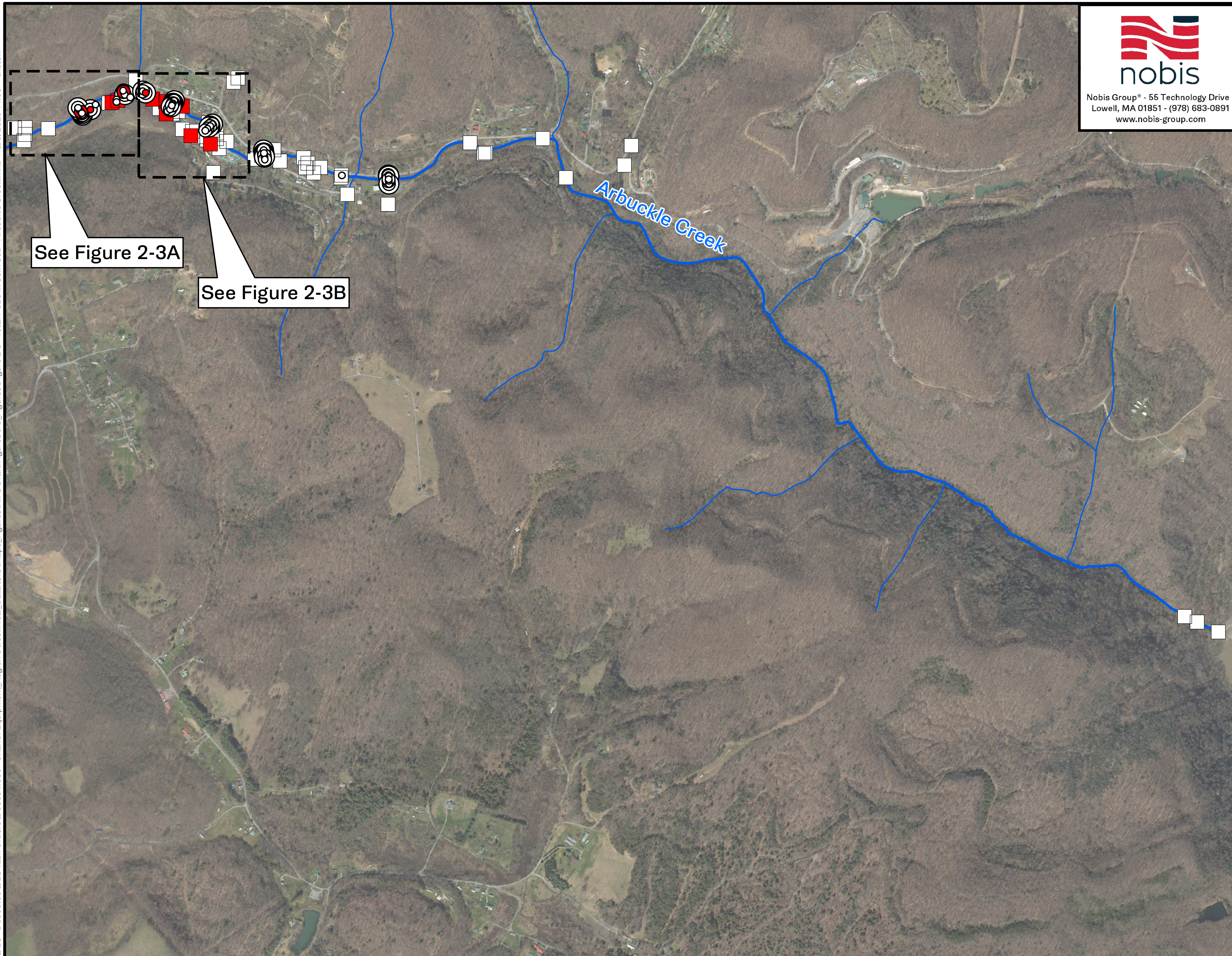
FIGURE 2-2

TOTAL PCBS IN SOIL AND SEDIMENT
BRITT BATH HOUSE
SHAFFER EQUIPMENT/ARBUCKLE
CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: OCTOBER 2025

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures_2025\Figure 2-2 - Total PCB in Soil - Britt Bath House.mxd 10/7/2025 11:36 tfistori



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Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
4. PCB results shown are the higher value of total Aroclors and total PCB congeners.
5. Wetland boundaries were obtained from the June 13, 2018 Weston Solutions, Inc. Wetland Delineation Report.

Legend

Total PCB Concentration in Soil (mg/kg)

- ○ ≤ 1 PRG
- ● > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- □ ≤ 1 PRG
- ■ > 1 PRG
- Arbuckle Creek
- Unnamed Tributary
- Wetland Boundary

0 500 1,000 2,000
Feet
1 inch = 1,000 feet

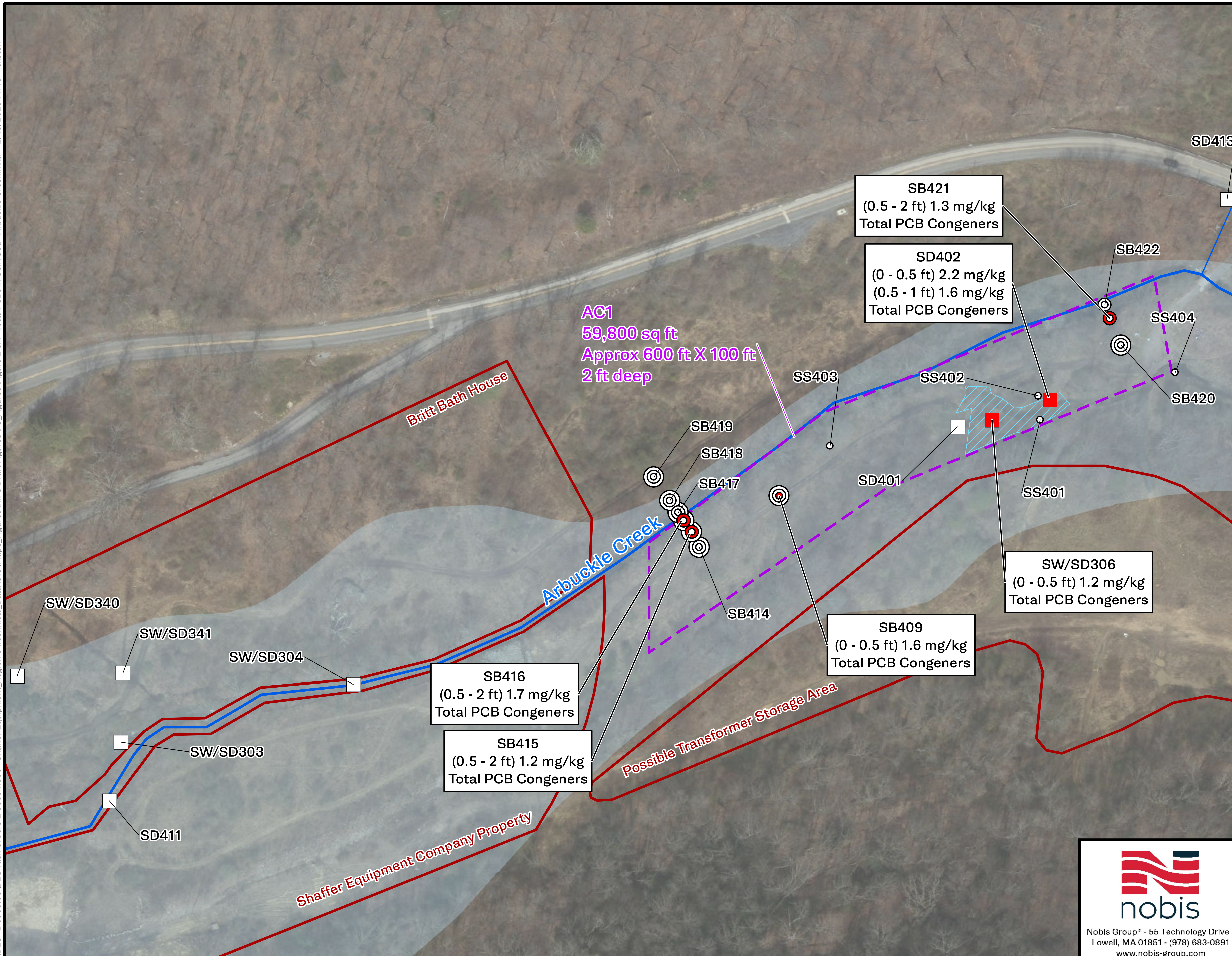
N

FIGURE 2-3

TOTAL PCBS IN SOIL AND SEDIMENT
ARBUCKLE CREEK / WETLANDS
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: MARCH 2025

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures\Figure 2-3 - Total PCBs in Soil+Sed - Arbuckle Creek.mxd 3/5/2025 14:39 tfistori



Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. PCBs = polychlorinated biphenyls
5. sq ft = square feet
6. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
7. PCB results shown are the higher value of total Aroclors and total PCB congeners.
8. Wetland boundaries were obtained from the June 13, 2018 Weston Solutions, Inc. Wetland Delineation Report.

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG

- Arbuckle Creek
- Unnamed Tributary
- Wetland Boundary
- FEMA Zone A Flood Hazard
- Remedial Response Area

N

0 50 100 200

Feet

1 inch = 100 feet

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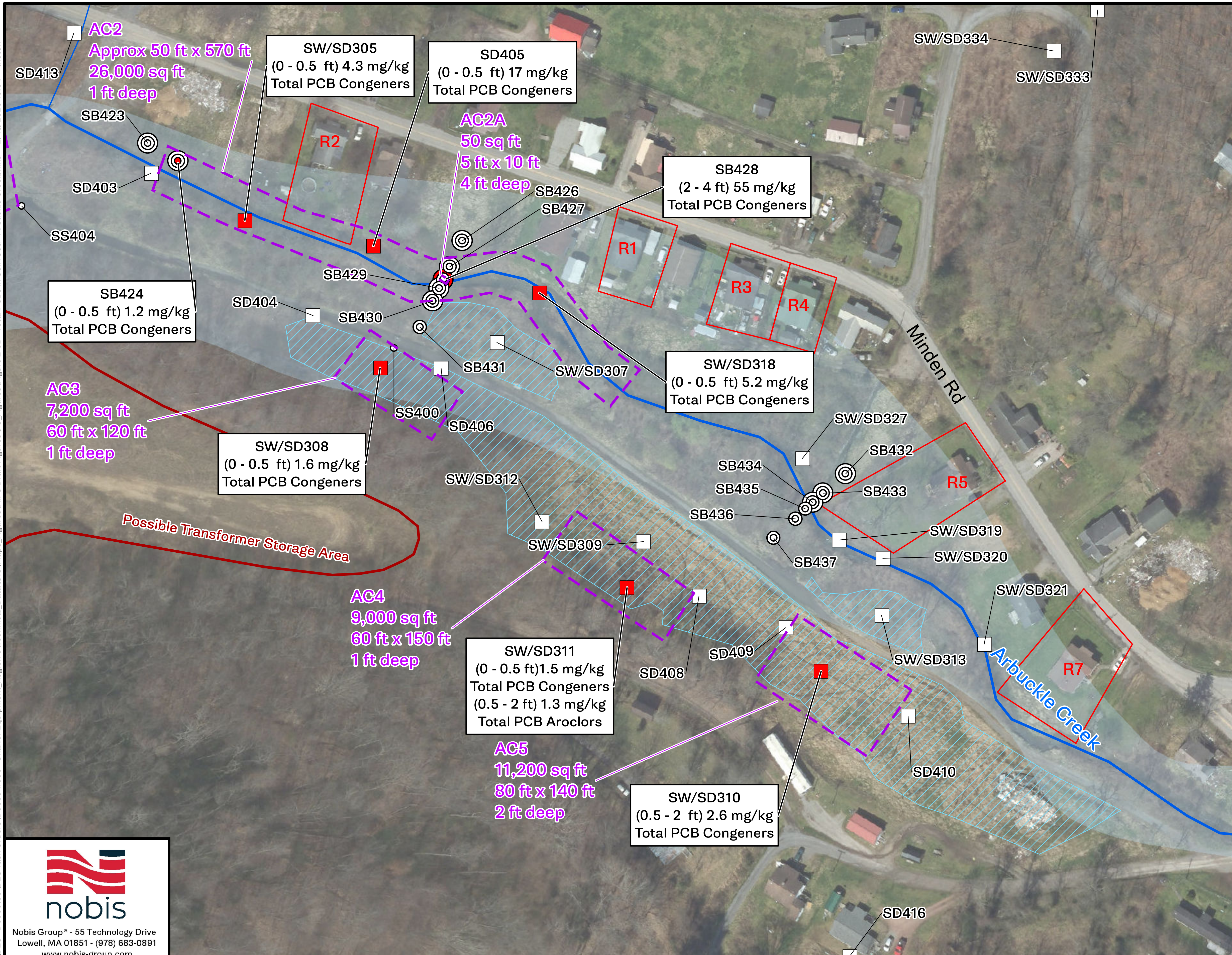
FIGURE 2-3A

TOTAL PCBS IN SOIL AND SEDIMENT
ARBUCKLE CREEK / WETLANDS
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: CO
PROJECT NO. D00004.004	DATE: FEBRUARY 2025



Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. PCBs = polychlorinated biphenyls
5. sq ft = square feet
6. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
7. PCB results shown are the higher value of total Aroclors and total PCB congeners.
8. Wetland boundaries were obtained from the June 13, 2018 Weston Solutions, Inc. Wetland Delineation Report.

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG
- Arbuckle Creek
- Unnamed Tributary
- Wetland Boundary
- FEMA Zone A Flood Hazard
- Remedial Response Area
- Residential Properties

N

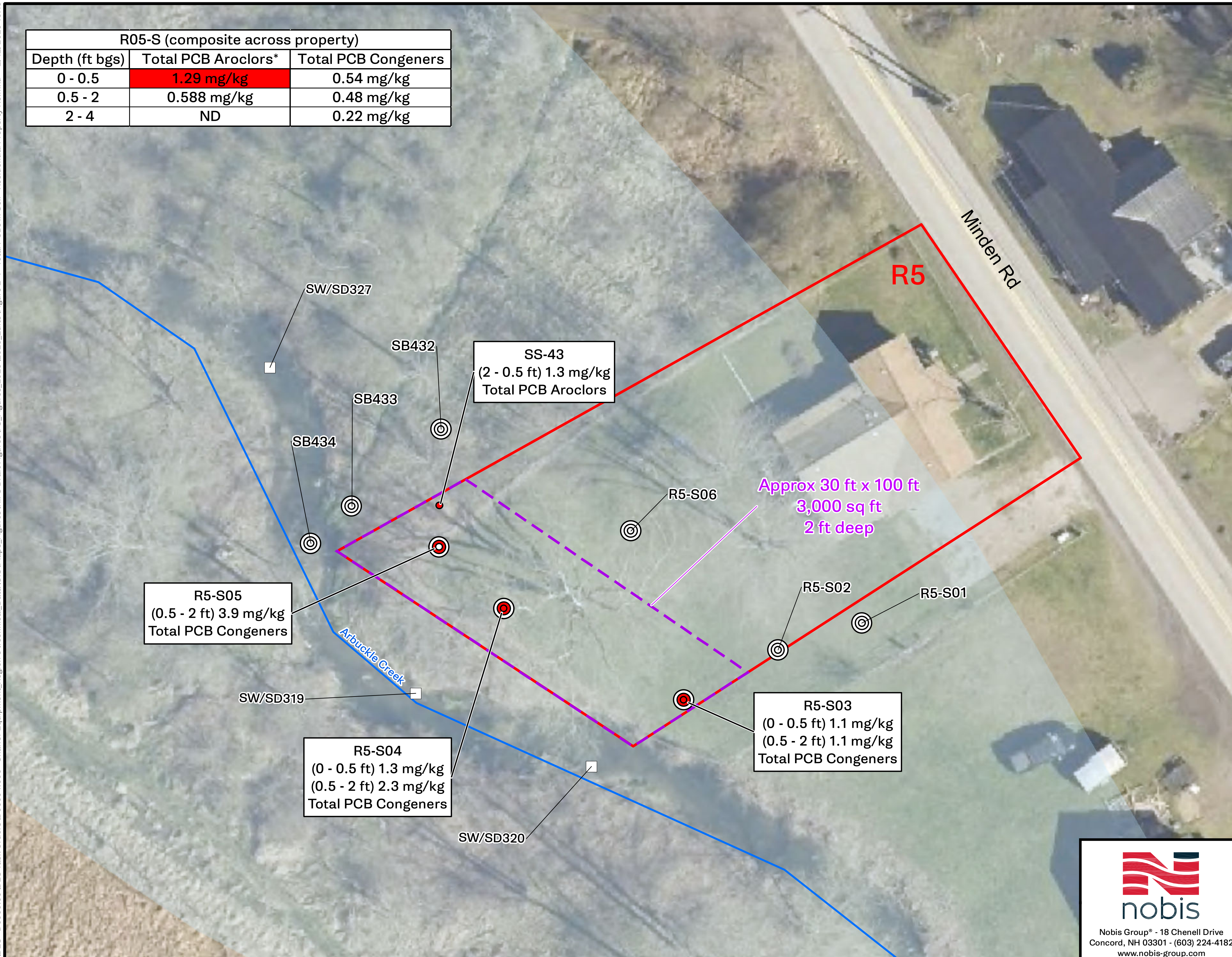
0 50 100 200
Feet
1 inch = 100 feet

FIGURE 2-3B

TOTAL PCBS IN SOIL AND SEDIMENT
ARBUCKLE CREEK / WETLANDS
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: CO
PROJECT NO. D00004.004	DATE: FEBRUARY 2025

F:\DES - D00000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures\Figure 2-3B - Total PCBs in Soil+Sed - Arbuckle Creek.mxd 2/13/2025 15:34 tfistori



R05-S (composite across property)		
Depth (ft bgs)	Total PCB Aroclors*	Total PCB Congeners
0 - 0.5	1.29 mg/kg	0.54 mg/kg
0.5 - 2	0.588 mg/kg	0.48 mg/kg
2 - 4	ND	0.22 mg/kg

Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. ft bgs = feet below ground surface
5. sq ft = square feet
6. PCBs = polychlorinated biphenyls
7. ND = non-detect
8. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
9. PCB results shown are the higher value of total Aroclors and total PCB congeners.
10. Location of sample SS-43 is approximate and was collected in 2017 prior to RI.
11. The following soil and sediment samples were collected from Arbuckle Creek area of concern: SB434, SB433, SB432, SW/SD327, SW/SD319, and SW/SD320.
12. Samples R5-S01 through R5-S05 collected in 2021; composite sample R05-S collected in 2019.
13. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).
14. Red highlighted results indicate values that exceed the Total PCB PRG of 1 mg/kg in composite soil samples.

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG
- Arbuckle Creek
- FEMA Zone A Flood Hazard
- Remedial Response Area
- Residential Parcel

0 12.5 25 50
Feet
1 inch = 25 feet
N

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FIGURE 2-4

TOTAL PCBS IN SOIL
RESIDENTIAL PROPERTY R5
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

R06-S (composite across property)		
Depth (ft bgs)	Total PCB Aroclors*	Total PCB Congeners
0 - 0.5	0.332 mg/kg	0.36 mg/kg
0.5 - 2	0.338 mg/kg	0.19 mg/kg
2 - 4	ND	0.015 mg/kg

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Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. ND = non-detect
4. mg/kg = milligrams per kilogram
5. ft bgs = feet below ground surface
6. sq ft = square feet
7. PCBs = polychlorinated biphenyls
8. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
9. PCB results shown are the higher value of total Aroclors and total PCB congeners.
10. Samples SS406 and SS407 collected in 2022; sediment sample SD415 and samples R6-S01 through R6-S07 collected in 2021; sample R06-C-D and composite sample R06-S collected in 2019.
11. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).
12. The following sediment samples were collected from Arbuckle Creek area of concern: SW/SD355 and SS405.

Total PCB Concentration in Soil

Total PCB Concentration in Sediment

FEMA Zone A Flood Hazard

0 10 20 40
Feet
1 inch = 20 feet

N

FIGURE 2-5

TOTAL PCBS IN SOIL AND SEDIMENT
RESIDENTIAL PROPERTY R6
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: MSL
PROJECT NO. D00004.004	DATE: APRIL 2026

R07-S (composite across property)		
Depth (ft bgs)	Total PCB Aroclors*	Total PCB Congeners
0 - 0.5	ND	0.47 mg/kg
0.5 - 2	0.525 mg/kg	0.48 mg/kg
2 - 4	ND	0.012 mg/kg

Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. mg/kg = milligrams per kilogram
4. ft bgs = feet below ground surface
5. sq ft = square feet
6. PCBs = polychlorinated biphenyls
7. ND = non-detect
8. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
9. PCB results shown are the higher value of total Aroclors and total PCB congeners.
10. The following sediment sample was collected from Arbuckle Creek area of concern: SW/SD321.
11. Samples R7-S01 through R7-S06 collected in 2021; composite sample R07-S collected in 2019.
12. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).

Legend

Total PCB Concentration in Soil (mg/kg)

○ ≤ 1 PRG

● > 1 PRG

Total PCB Concentration in Sediment (mg/kg)

□ ≤ 1 PRG

■ > 1 PRG

Arbuckle Creek

FEMA Zone A Flood Hazard

Remedial Response Area

Residential Parcel

N

0 12.5 25 50

Feet

1 inch = 25 feet

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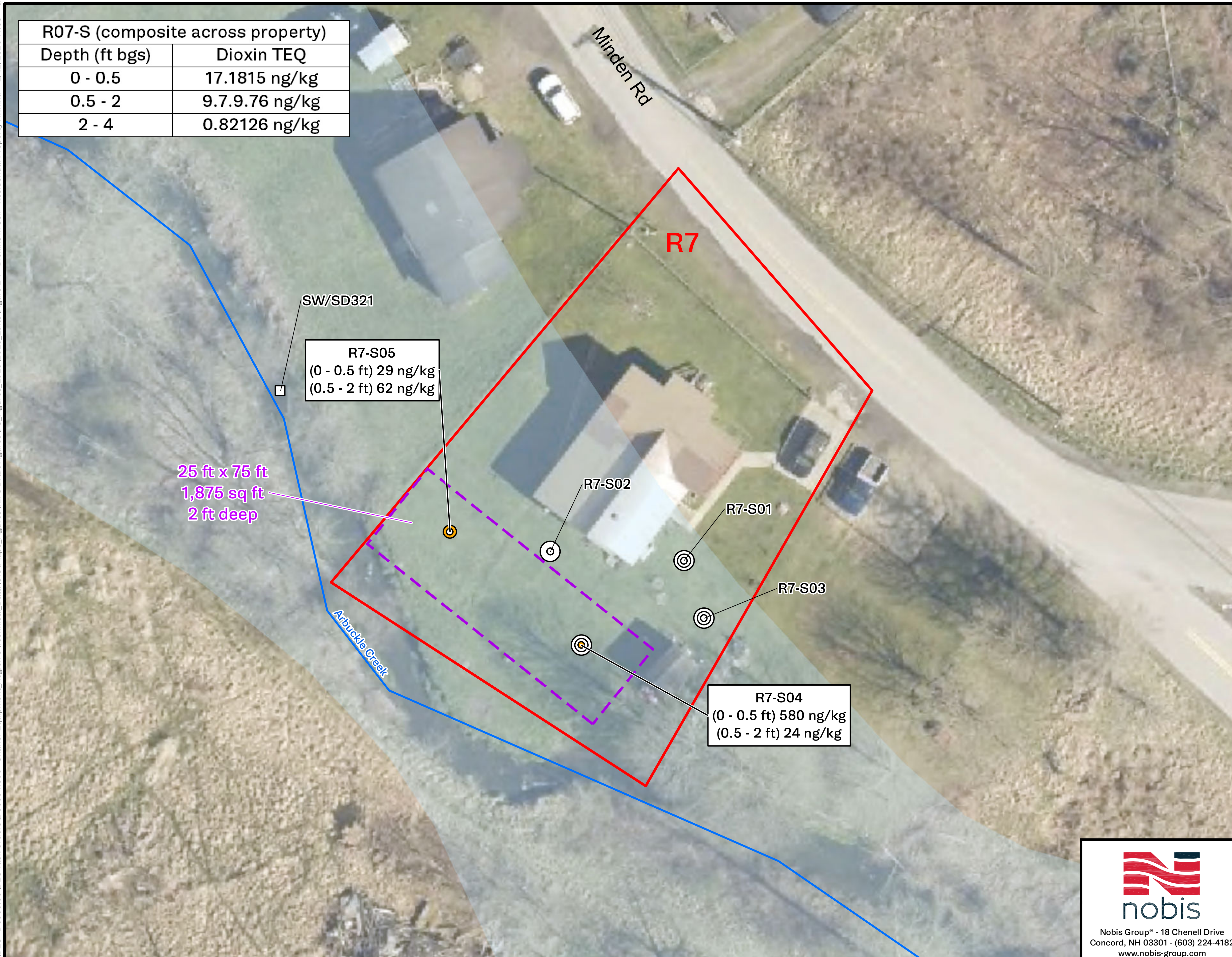
FIGURE 2-6

TOTAL PCBS IN SOIL
RESIDENTIAL PROPERTY R7
SHAFFER EQUIPMENT/ARBUCKLE CREEK
AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures_2025\2026_Edits\Figure 2-7 - Dioxins in Soil - Residential Property R7.mxd 2/12/2026 11:53 tfistori

R07-S (composite across property)	
Depth (ft bgs)	Dioxin TEQ
0 - 0.5	17.1815 ng/kg
0.5 - 2	9.7.9.76 ng/kg
2 - 4	0.82126 ng/kg



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. ng/kg = nanograms per kilogram
4. ft bgs = feet below ground surface
5. sq ft = square feet
6. Dioxin TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalence value for mammal
7. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
8. The following sediment sample was collected from Arbuckle Creek area of concern: SW/SD321.
9. R7-S02 (0.5-2 ft) was not analyzed for dioxins.
10. The following sediment sample was collected from Arbuckle Creek area of concern: SW/SD321.
10. Samples R7-S01 through R7-S06 collected in 2021; composite sample R07-S collected in 2019.

Legend

Dioxin TEQ Concentration in Soil (ng/kg)

- ≤ 48 PRG
- > 48 PRG

Dioxin TEQ Concentration in Sediment (ng/kg)

- ≤ 48 PRG
- > 48 PRG
- Arbuckle Creek
- FEMA Zone A Flood Hazard
- Remedial Response Area
- Residential Parcel

N

0 12.5 25 50
Feet
1 inch = 25 feet

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FIGURE 2-7

DIOXINS IN SOIL
RESIDENTIAL PROPERTY R7
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

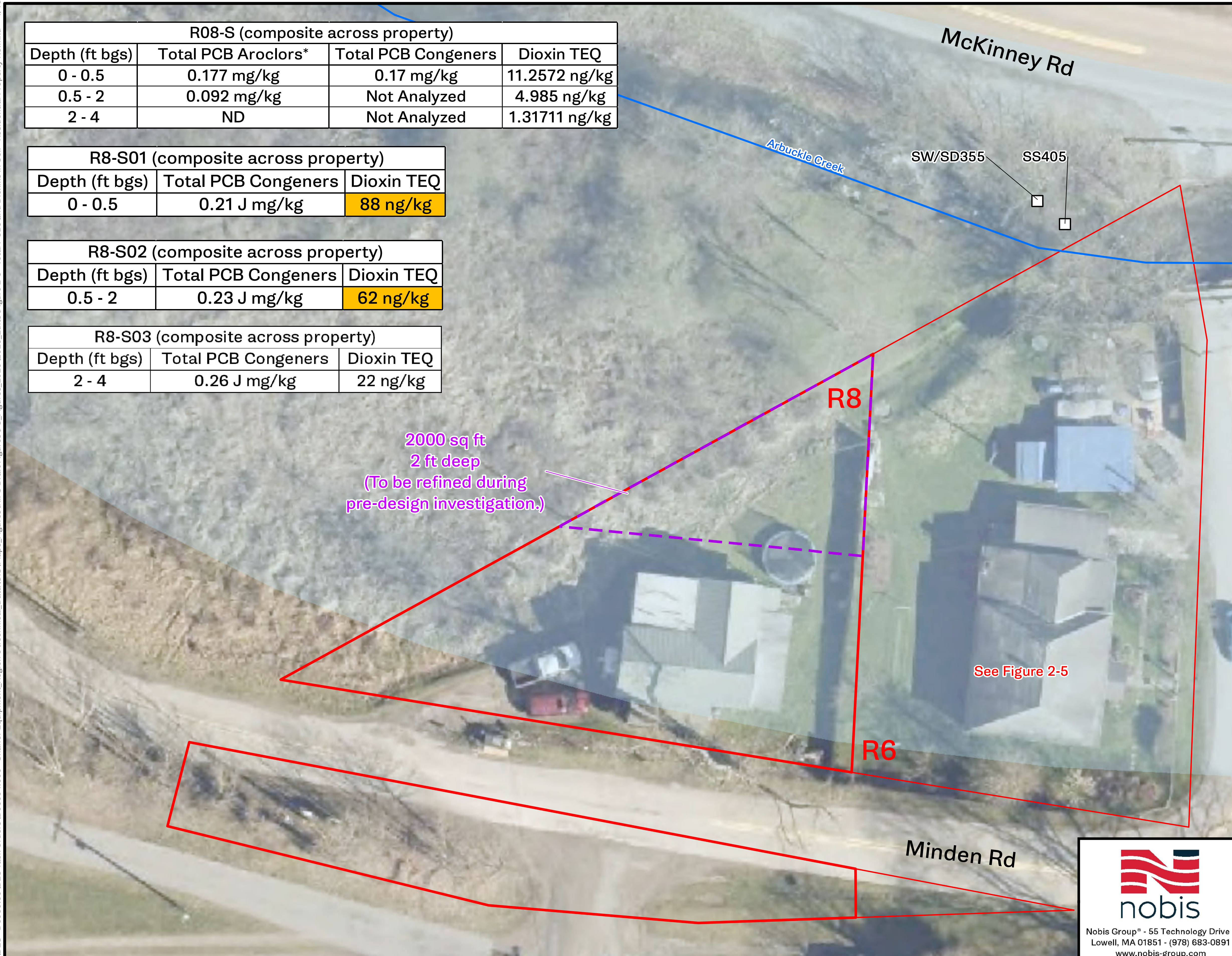
PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

R08-S (composite across property)			
Depth (ft bgs)	Total PCB Aroclors*	Total PCB Congeners	Dioxin TEQ
0 - 0.5	0.177 mg/kg	0.17 mg/kg	11.2572 ng/kg
0.5 - 2	0.092 mg/kg	Not Analyzed	4.985 ng/kg
2 - 4	ND	Not Analyzed	1.31711 ng/kg

R8-S01 (composite across property)		
Depth (ft bgs)	Total PCB Congeners	Dioxin TEQ
0 - 0.5	0.21 J mg/kg	88 ng/kg

R8-S02 (composite across property)		
Depth (ft bgs)	Total PCB Congeners	Dioxin TEQ
0.5 - 2	0.23 J mg/kg	62 ng/kg

R8-S03 (composite across property)		
Depth (ft bgs)	Total PCB Congeners	Dioxin TEQ
2 - 4	0.26 J mg/kg	22 ng/kg



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. Dioxin TEQ = 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxic equivalence value for mammal
3. PCBs = polychlorinated biphenyls
4. mg/kg = milligrams per kilogram
5. ng/kg = nanograms per kilogram
6. ft bgs = feet below ground surface
7. sq ft = square feet
8. ND = non-detect
9. The following sediment samples were collected from Arbuckle Creek area of concern: SW/SD355 and SS405.
10. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).
11. Orange highlighted results indicate values that exceed the total dioxin PRG of 48 ng/kg in composite soil samples.

Legend

Total PCB Concentration in Sediment (mg/kg)

- ≤ 1 PRG
- > 1 PRG

Dioxin TEQ Concentration in Sediment (ng/kg)

- ≤ 48 PRG
- > 48 PRG

Arbuckle Creek

Residential Parcels

Remedial Response Area

0 12.5 25 50
Feet
1 inch = 25 feet

N

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FIGURE 2-8

TOTAL PCBS AND DIOXIN TEQ IN SOIL
RESIDENTIAL PROPERTY R8
SHAFFER EQUIPMENT /
ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: MSL
PROJECT NO. D00004.004	DATE: APRIL 2026

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures_2025\2026_Edits\Figure 2-8 - Total PCBs and Dioxins in Soil - Residential Property R8.mxd 4/16/2026 15:5

R09-S (composite across property)		
Depth (ft bgs)	Total PCB Aroclors*	Total PCB Congeners
0 - 0.5	0.341 mg/kg	0.3 mg/kg
0.5 - 2	ND	0.099 mg/kg
2 - 4	ND	0.022 mg/kg

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Notes:
1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.
2. PRG = Preliminary Remediation Goal
3. ND = non-detect
4. ft bgs = feet below ground surface
5. sq ft = square feet
7. PCBs = polychlorinated biphenyls
8. mg/kg = milligrams per kilogram
9. Different sized rings indicate sample depth: inner ring 0-0.5 ft bgs, middle ring 0.5-2 ft bgs, and outer ring greater than 2 ft bgs.
9. PCB results shown are the higher value of total Aroclors and total PCB congeners.
10. Samples R9-S01 through R9-S04 collected in 2021; composite sample R09-S collected in 2019.
11. An asterisk (*) indicates that the total PCB Aroclor data is from the U. S. Environmental Protection Agency (USEPA) Environmental Response Team (ERT) mobile laboratory using a gas chromatograph (GC) and electron capture detector (ECD).

Legend

Total PCB Concentration in Soil (mg/kg)

- ≤ 1 PRG
- > 1 PRG
- Arbuckle Creek
- FEMA Zone A Flood Hazard
- Residential Parcel
- Remedial Response Area

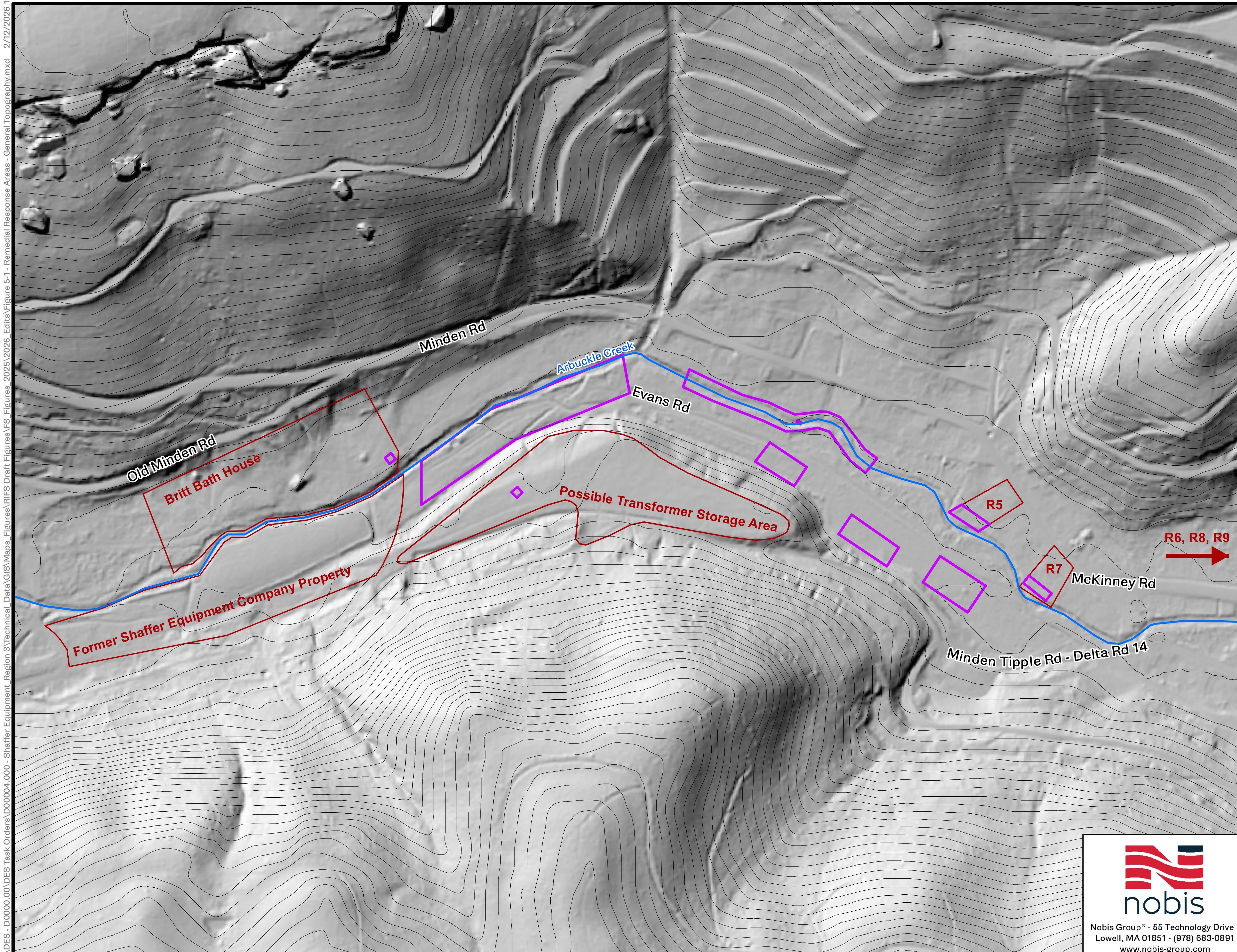
0 10 20 40
Feet
1 inch = 20 feet
N

FIGURE 2-9

TOTAL PCBS IN SOIL
RESIDENTIAL PROPERTY R9
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREASUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

F:\DES - D0000.00\DES Task Orders\D000004.000 - Shaffer Equipment_Region 3\Technical_Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures_2025\2026_Edits\Figure 2-9 - Total PCBs in Soil - Residential Property R9.mxd 2/12/2026 13:09 tfistori



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

Legend

- 10 foot Elevation Contours
- Arbuckle Creek
- Remedial Response Area
- Areas of Concern

0 125 250 500

Feet

1 inch = 250 feet

N

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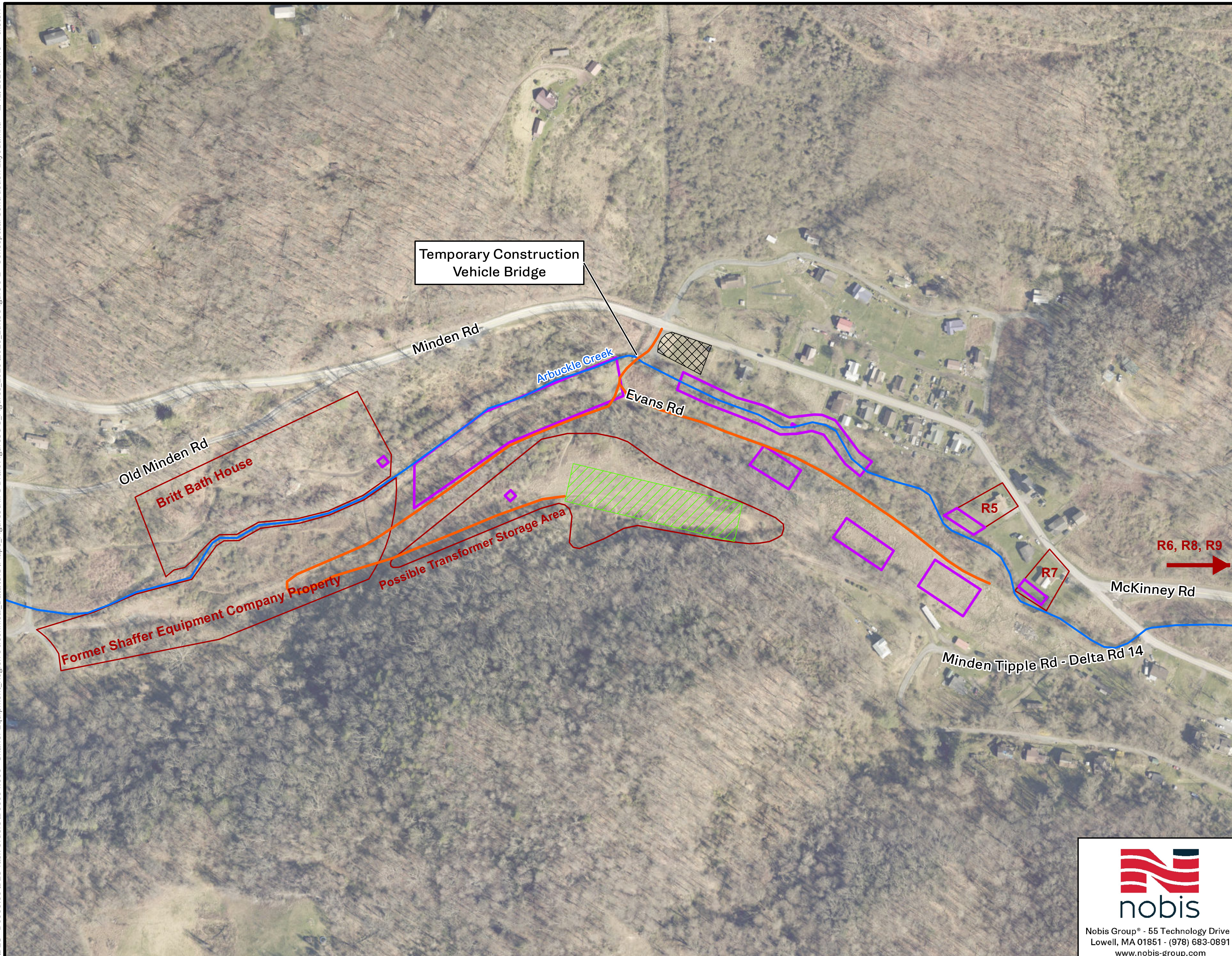
FIGURE 5-1

REMEDIAL RESPONSE AREAS
GENERAL TOPOGRAPHY
SHAFFER EQUIPMENT /
ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

F:\DES - D0000.00\DES Task Orders\D00004.000 - Shaffer Equipment_Region 3\Technical Data\GIS\Maps_Figures\RIFS Draft Figures\FS_Figures_2025\2026 Edits\Figure 5-1 - Remedial Response Areas - General Topography.mxd 2/12/2026 14:12 tfisto



Notes:

1. Locations of site features depicted hereon are approximate and given for illustrative purposes only.

Legend

- Arbuckle Creek
- Proposed Temporary Haul Road
- Soil Stockpile Area (Alt. 3) / Consolidated Cap Area (Alt. 2)
- Equipment Staging Area
- Remedial Response Area
- Areas of Concern

0 125 250 500

Feet

1 inch = 250 feet

N

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FIGURE 5-2

CONCEPTUAL CONSTRUCTION LAYOUT
SHAFFER EQUIPMENT /
ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, FAYETTE COUNTY, WV

PREPARED BY: TF	CHECKED BY: DVR
PROJECT NO. D00004.004	DATE: FEBRUARY 2026

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APPENDICES

APPENDIX A

TABLE A-1
POTENTIAL CHEMICAL-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
Federal Criteria, Advisories, and Guidance	United Stated Environmental Protection Agency (EPA) Guidance of Remedial Actions for Superfund Sites with Polychlorinated Biphenyl (PCB) Contamination, EPA-540-G-90-007 (August 1990)	EPA Guidance for developing risk-based remediation standards forrisks posed by PCBs at Superfund Sites.	To Be Considered	This guidance document sets a PRG of 1 milligram per kilogram (mg/kg) for PCBs in residential soils and a PRG of 10 mg/kg to 25 mg/kg for PCBs in non-residential soils. The Site Areas of Concern (AOCs) are currently zoned as Medium Density Residential District or Land Conservation District or are current residences.
Federal Regulatory Requirement	Toxic Substances Control Act (TSCA) - Sampling PCB Remediation Waste Destined for Off-Site Disposal [40 CFR § 761.61(a)-(c)]	Guidance describing methods to sample and dispose of PCB remediation waste to analyze the waste to determine PCB concentration or leaching characteristics for storage or disposal.	Applicable	Will be used to evaluate sampling and analysis of PCBs in soil and to determine the PCB concentrations or leaching characteristics for storage or disposal.
State Regulatory Requirement	WV Requirements Governing (Surface) Water Quality Standards [47 C.S.R. §§ 2-3.2(a)-(f), 3.2(i), and 4-5]	Regulates the discharge of wastes (sewage, industrial, other, etc.) into standing or flowing surface water of the State and establishes water quality criteria.	Relevant and Appropriate	These regulations will be followed during remedial activities to make sure no waste causes distinctly visible solids, tastes or odors that would adversely affect the designated uses of the affected waters, or concentrations which are harmful, hazardous, or toxic to man, animal, and aquatic life. Surface water standards to be used during interim monitoring activities for active remedial alternatives.

TABLE A-2
POTENTIAL LOCATION-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
Federal Regulatory Requirement	Clean Water Act, Section 404; Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 33 U.S.C. § 1344's implementing regulations at 40 C.F.R. Part 230, Subpart B-H	Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. Sets standards for restoration and mitigation required as a result of unavoidable impacts to aquatic resources. The United States Environmental Protection Agency (EPA) must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources. Under Section 10, the obstruction or alteration (including dredging) of any navigable water of the United States is prohibited except as authorized after a finding that the activity in not contrary to the public interest and otherwise complies with applicable federal laws, pursuant to 33 C.F.R. Part 320.	Applicable	Remedial actions required within or along the bank of Arbuckle Creek and all associated wetlands will comply with this requirement. If the selected alternative is the LEDPA, mitigation and restoration measures will be included to restore the disturbed areas damaged by the remedial action.
Federal Regulatory Requirement	Endangered Species Act of 1973, 16 U.S.C. § 1531 et seq.'s implementing regulations at 50 CFR § 402	Establishes requirements to protect species threatened by extinction and habitats critical to their survival.	Applicable	Multiple species of clams, plants, and mammals that are listed threatened or endangered species are known to exist in the area. Consultation with other Federal agencies will occur and mitigation measures, as necessary, will be implemented. Should additional endangered species or critical habitats be identified during the remedial design, consultation will occur, and measures will be developed to protect the identified species or habitats critical to their survival, as necessary.
Federal Regulatory Requirement	Migratory Bird Treaty Act, 16 U.S.C. § 703	Prohibits the unlawful taking, possession or sale of any migratory bird, including any part, nest, or egg of any such bird, native to the U.S. or its territories.	Applicable	Remediation activities might be performed while migratory birds are present. Appropriate actions will be taken during the remedial action to ensure that no on-Site migratory birds, listed at 50 C.F.R. § 10.13, or their nests are adversely affected.
Federal Criteria, Advisories, and Guidance	Presidential Memorandum – Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators (June 20, 2014)	Describes the policy for maintaining habitat for honey bees and other pollinators.	To Be Considered	Disruption to habitat (such as wetlands) may occur during the implementation of any remedial alternative. Actions will be needed to provide suitable habitat during site restoration activities.
Federal Criteria, Advisories, and Guidance	Presidential Memorandum – Incorporating Natural Infrastructure and Ecosystem Services in Federal Decision-Making (October 7, 2015)	Provides guidance for integrating benefits and tradeoffs among ecosystem services associated with potential Federal actions, including benefits and costs that may not be recognized in private markets because of the public-good nature of some ecosystem services.	To Be Considered	Applies to projects where ecosystems (such as wetlands) are disrupted and restored.
Federal Regulatory Requirement	Floodplains Management and Protection of Wetlands: FEMA Regulations (44 C.F.R Part 9, §9.9 and 9.11)	Regulations that set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988 (Floodplain Management). Requires the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain.	Applicable	Impacts within the 500-year floodplain will be assessed during the alternative development. Floodplain habitat will be restored/replaced, as required.

TABLE A-2
POTENTIAL LOCATION-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
Federal Criteria, Advisories, and Guidance	USEPA "Policy on Floodplains and Wetland Assessments for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Actions" Office of Solid Waste and Emergency Response (OSWER) Dir. 9280.0 (August 6, 1985)	This guidance details situations that require preparation of floodplains or wetlands assessments and the factors that should be considered in preparing an assessment for actions taken under Section 104 or 106 of CERCLA, including avoiding adverse impacts to wetlands and floodplains unless there is no practicable alternative, and the proposed action includes all practicable measures to minimize harm that may result from such actions.	To Be Considered	This guidance will be considered when planning and implementing actions within protected resources.
Federal Regulatory Requirement	Toxic Substances Control Act for PCB Remediation Waste 40 CFR § 761.61(a) through (c)	This section applies to cleanup and disposal options for polychlorinated biphenyl (PCB) remediation waste. Disposal and managed of PCBs is based on concentrations at which PCBs are found. PCB remediation waste may be left in-place or consolidated with compliant means of control via fencing and signage and/or containment below a cap meeting all of the requirements specified in paragraphs (a)(4), (a)(7), and (a)(8) of this section, unless a waiver from these requirements is obtained pursuant to paragraph (c)(2) of this section. In addition, cleanup and disposal shall meet any other requirements that may be prescribed pursuant to paragraph (c)(1) of this section.	Applicable.	These regulations apply to future remedial actions that leave PCB-contaminated soil on-site. §761.61(a)(4)(i)(B)(2) allows for up to 50 parts per million (ppm) PCBs to be left on-site and controlled via fencing and compliant signage. §761.61(a)(4)(i)(B)(3) allows for up to 100 ppm PCBs to be left on-site under a cap compliant with §761.61(a)(7) and (8).
Federal Regulatory Requirement	Toxic Substances Control Act for Chemical Waste Landfills 40 CFR § 761.75(a) through (c)	This section applies to facilities used to dispose of polychlorinated biphenyls (PCBs). A chemical waste landfill used for the disposal of PCBs and PCB Items shall be approved by the Agency Regional Administrator pursuant to paragraph (c) of this section. The landfill shall meet all of the requirements specified in paragraph (b) of this section, unless a waiver from these requirements is obtained pursuant to paragraph (c)(4) of this section. In addition, the landfill shall meet any other requirements that may be prescribed pursuant to paragraph (c)(3) of this section.	Applicable.	These regulations apply to future remedial actions that leave PCB-contaminated soil capped. §761.61(a)(4)(i)(B)(3) allows for up to 100 ppm PCBs to be left on-site under a cap. The location of the site with regards to the floodplain is not a limitation until you cap over 100 ppm on-site. However, capping greater than 100 ppm on-site can only be approved under 761.61(c) and requires that EPA make a determination of no unreasonable risk to human health and the environment as well as demonstrating that the on-site capped area meets the technical requirements of 761.75(b) since it would be considered an on-site chemical waste landfill. 761.75(b)(4) states that for sites located below the 100-year floodwater elevation they are required to have diversion dikes around the perimeter of the capped area of the site with a minimum height equal to two feet above the 100-year floodwater elevation. Even if the capped area currently meets the diversion dike requirement, EPA still has to make a no unreasonable risk determination that leaving greater than 100 ppm on-site will not pose an unreasonable risk.
Federal Regulatory Requirement	Protection of Historic Properties (36 CFR § 800.4(b-c),)	Requires consideration of effects on properties included on or eligible for the National Register of Historic Places.	Relevant and Appropriate	Coordination with the State Historic Preservation Office (SHPO) will be conducted as needed to ensure no eligible locations have been identified during remedial design that would impact performance of the remedy.
State Regulatory Requirement	West Virginia Uniform Environmental Covenants Act (W. Va. Code § 22-22B)	Procedures for implementing environmentally based Institutional Controls.	Relevant and Appropriate	Land use restrictions will be implemented if the alternative does not permit unlimited use and unrestricted exposure.

TABLE A-2
POTENTIAL LOCATION-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
State Regulatory Requirement	West Virginia Division of Culture and History – State Historic Preservation Office/Historic Preservation and Related Requirements [W. Va. Code § 29-1-8(a-b)]	Rules for protection of human remains, artifacts, historic and prehistoric sites, and other locations/structures protected due to historic and/or cultural significance. A reasonable and good faith effort should be exhausted to carry out appropriate identification efforts.	To Be Considered	Should any historic or culturally significant artifacts or structures be identified at the site based on coordination with the SHPO.
State Regulatory Requirement	Waste Management – Deed and Lease Disclosure; Notice in Deed to Property (33 C.S.R § 20-12)	Requires the owner to record on the property deed that the property has been used to manage hazardous waste and that the land use is restricted.	Relevant and Appropriate	This requirement invokes deed restriction requirements under 40 CFR 264.117(c).
State Criteria, Advisories, and Guidance	2015 West Virginia State Wildlife Action Plan, West Virginia Division of Natural Resources (WVDNR), 9.1.2015	This plan identifies over 600 animal and 400 plants "Species of Greatest Conservation Need" in the state with the goal of halting the decline of at-risk species to avoid listing as threatened or endangered, assisting with the recovery of federally listed species, keeping common species common and conserving the full array of habitat types and biological diversity of the state.	To Be Considered	Consultation with WVDNR will determine if any of the Species of Greatest Conservation Need are identified that may be impacted by site-related activities. If any Species of Greatest Conservation Need are identified the development of protective measures may be needed that meet the goals of the State Wildlife Action Plan.

TABLE A-3
POTENTIAL ACTION-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
Federal Regulatory Requirement	Toxic Substances Control Act (TSCA), 15 U.S.C. § 2601 *et seq.*'s implementing regulations at PCB Remediation Waste 40 C.F.R. § 761.61(b) and (c)	These regulations establish requirements for the management and disposal of polychlorinated biphenyl (PCB) remediation waste.	Applicable	The storage and response to PCB remediation waste will be conducted with approval by the Regional Administrator pursuant to TSCA's risk-based approval provisions or in accordance with other provisions of 40 C.F.R. § 761.61.
Federal Regulatory Requirement	TSCA - Decontamination Standards and Procedures (40 C.F.R. § 761.79)	These regulations establish decontamination standards and procedures for removing PCBs for disposal. Provides numeric standards for allowable PCB concentrations in various building materials and in liquids.	Applicable	Equipment and materials contaminated with PCBs during the remedial action will be decontaminated in accordance with these regulations. Wastes from decontamination will need to be disposed of appropriately.
Federal Regulatory Requirement	Toxic Substances Control Act (TSCA), 40 C.F.R. § 761.65(a), 40 C.F.R. § 761.65(b), 40 C.F.R. § 761.65(c)(6) and (9)	Establishes requirements for temporary storage of PCB remediation waste. Section (a) identifies limitation on the storage of waste, Section (c)(6) identifies the requirements for the storage containers, and Section (c)(9) identifies the requirements for soils stockpiles.	Applicable	Stockpiles and storage containers used to store PCB remediation waste will comply with this regulation. Time frames for storage of PCB remediation waste will be adhered to. This regulation is only applicable to PCB remediation waste concentrations greater than 50 milligram per kilogram (mg/kg) total PCBs and is not required for soils with PCB concentrations less than 50 mg/kg.
Federal Regulatory Requirement	40 C.F.R. Noise Abatement Programs Parts 204 and 205 Part B	National Noise Abatement Programs for construction equipment and transportation equipment and the Noise Control Act. Regulates noise pollution with the intent of protecting human health and minimizing annoyance of noise to the general public.	Applicable	Construction and trucking equipment may be utilized for the chosen remedial alternatives for soil thus these regulations would apply.
Federal Regulatory Requirement	Clean Water Act NPDES Regulations (Stormwater Discharges) (40 C.F.R. § 122.26(c)(ii)(C))	Discharges of stormwater associated with construction activities are required to implement measures, including best management practices, to control pollutants in stormwater discharges during and after construction activities.	Applicable	Alternatives involving remedial construction will be designed and implemented to comply with the substantive provisions, including use of best management practices and other measures to control pollutants in stormwater discharges.
Federal Regulatory Requirement	Clean Water Act, NPDES's implementing regulations at 40 C.F.R. §.122.44-45	These standards govern discharge of water into surface waters.	Applicable	Alternatives that include discharge of water into surface water (from dewatering activities, collection of stormwater, decontamination water) shall meet the substantive standards of this regulations including meeting effluent standards and preventing degradation of surface water.
State Regulatory Requirement	West Virginia Department of Environmental Protection (WVDEP) Division of Air Quality – Control of Air Pollution from Hazardous Waste TSD Facilities (45 C.S.R. § 25-4.3)	These standards state that facilities shall minimize unplanned releases of hazardous constituents into the air.	Relevant and Appropriate	Remedial alternatives that include excavation, thermal or chemical oxidation, capping, or other activities will have control measures implemented to prevent unplanned releases of hazardous constituents into the air.
State Regulatory Requirement	WVDEP Erosion and Sediment Control Best Management Practice Manual (47 C.S.R. 2Appendix E, Table 1, line 8.53)	The Manual addresses erosion and sediment control for earth disturbing activities by assisting in identifying and implementing the most appropriate best management practices. This eliminates the requirement for in-stream turbidity monitoring as an alternative to 47 C.S.R. § 2-8.33.	Relevant and Appropriate	Alternatives involving earth moving will follow standardized and comprehensive erosion and sediment control management practices to reduce the water quality impacts. The turbidity monitoring requirement does not apply where Best Management Practices in accordance with the State Water Quality Management Plan are being utilized.

TABLE A-3
POTENTIAL ACTION-SPECIFIC ARARS AND TBC INFORMATION
FEASIBILITY STUDY
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Authority	Requirement	Requirement Synopsis	Status	Consideration
State Regulatory Requirement	WVDEP Division of Water and Waste Management (DWWM) – Groundwater/Underground Injection Control (UIC) Program - Groundwater Protection Regulations (47 C.S.R. §.58-7.1)	Certain practices must be followed for the protection of the State's groundwater.	Relevant and Appropriate	Site cleanup/construction activities will be conducted in a manner that prevents release of hazardous substances to the groundwater.
State Regulatory Requirement	WVDEP DWWM – Groundwater/UIC Program - Monitoring Well Regulations and Monitoring Well Design Standards (47 C.S.R. §§.59-4 and 60-5 to 60-21)	Requirements for certification of monitoring well drillers and for the construction/abandonment of monitoring wells.	Relevant and Appropriate	Any alternative that includes the installation or abandonment of temporary or permanent monitoring wells, recovery wells, piezometers, and boreholes shall be subject to these regulations.

APPENDIX B

APPENDIX B-1
SUMMARY OF COSTS
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

ALTERNATIVE 1 - No Action	
Capital Costs	$ -
O&M Costs (Present Value)	$ -
Total Costs (Present Value)	$ -

ALTERNATIVE 2 - Low Permeability Cap	
Capital Costs	$ 3,847,000
O&M Costs (Present Value)	$ 625,000
Total Costs (Present Value)	$ 4,472,000

ALTERNATIVE 3 - Removal with Off-Site Disposal	
Capital Costs	$ 4,449,000
O&M Costs (Present Value)	$ -
Total Costs (Present Value)	$ 4,449,000

ALTERNATIVE 4 - In-Situ Treatment	
Capital Costs	$ 4,244,000
O&M Costs (Present Value)	$ 710,000
Total Costs (Present Value)	$ 4,954,000

APPENDIX B-2
SOIL AND SEDIMENT SAMPLING PRE-DESIGN INVESTIGATION COST ESTIMATE
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		QUANTITY	UNIT	UNIT COST	TOTAL COST	ASSUMPTIONS and SOURCE
1.0 SOIL AND SEDIMENT SAMPLING PRE-DESIGN INVESTIGATION						
1.1 Pre-Design Investigation - Field Preparation						
1.1.1	Contracted Utility Survey	2.65	Acres	$8,240	$21,801	Extrapolated from the private utility markout from RI.
1.1.2	Utility Survey Oversight, Demarkate Boring Locations and DigSafe	10	Hr	$110	$1,100	Engineer estimate, Project Sci/Geo III
1.1.3	Project Management/Coordination for Field Investigation	25	Hr	$180	$4,500	Engineer estimate, Sr. PM
	Subtotal				**$27,401**	
1.2 Pre-Design Investigation - Environmental Investigation						
1.2.1	**Labor**					
1.2.1i	Sampling Labor - FOL (Mid Scientist)	70	Hr	$140	$9,800	Assumes 5x 10-hr day for sampling plus round trip travel plus preparation time
1.2.1ii	Sampling Labor - Sampler (Jr Scientist)	50	Hr	$130	$6,500	Assumes:5x 10-hr day for sampling plus round trip travel
1.2.1iii	Sampling Labor - Sampler (Jr Scientist)	50	Hr	$130	$6,500	Assumes:5x 10-hr day for sampling plus round trip travel
1.2.1iv	Sampling Labor - Sampler (Jr Scientist)	50	Hr	$130	$6,500	Assumes:5x 10-hr day for sampling plus round trip travel
1.2.1v	Sampling - PM Oversight	10	Hr	$180	$1,800	Engineer estimate, Sr. PM (includes half day trip)
1.2.2	**Field Equipment**					
1.2.2i	Trimble GPS unit	10	Day	$120	$1,200	US Env. 2025 MOA. Assumes 2 field teams using 1 Trimble each
1.2.2ii	Hand Auger	20	Day	$14.40	$288	US Env. 2025 MOA. Assumes 4 hand augers for 5 days.
1.2.2iii	Generator	5	Day	$36.00	$180	US Env. 2025 MOA
1.2.2iv	Consumables and PPE	1	Ea	$300.00	$300	Engineer estimate
1.2.3	Travel	11	Day	$77	$844	Enterprise Rental (standard SUV) for 5 days of work with 2 vehicles and 1 vehicle day for the PM
1.2.4	24ct 8oz amber glass jars	4	box	$61	$242	QEC Order 2023
1.2.5	**Soil Sample Analytical Costs**					15 locations in Arbuckle Creek, 2 samples per location (0-0.5 feet, and 0.5-2 feet), 15 locations at Residential Properties, 3 samples per location (0-0.5 feet, and 0.5-2 feet, 2-4 feet). All sampled for PCBs and Dioxins. QC includes 1 FD, 1 MS, 1 MSD per 20 field samples. No IDW will be generated. Total of 75 samples, plus 12 additional QC samples per analysis.
1.2.5i	PCB Aroclors	87	Ea	$72	$6,264	Pace MOA 2025
1.2.5ii	Dioxins	87	Ea	$595	$51,765	Pace Quote 2025
1.2.5iii	Sample Shipping	10	Cooler	$250	$2,500	FedEx, assumes shipping to 2 labs per day total of 10 coolers
	Subtotal				**$94,683**	
1.5 Pre-Design Investigation Reporting						
1.5.1	Data Validation - Mid Chemist	70	Ea	$155	$10,850	Assumes 0.5 hour per sample (including QA/QC)
1.5.2	Data Review/Analysis - Mid Engineer	30	Hr	$185	$5,550	Engineer estimate
1.5.3	Data Review/Analysis - CAD/GIS Specialist	12	Hr	$115	$1,380	Engineer estimate
1.5.4	Report Preparation - Sr Engineer	8	Hr	$230	$1,840	Engineer estimate
1.5.5	Report Preparation - Jr Engineer	30	Hr	$130	$3,900	Engineer estimate
1.5.6	Meetings/Reviews	8	Hr	$185	$1,480	Engineer estimate
	Subtotal				**$25,000**	
TOTAL DIRECT COSTS					**$147,084**	

APPENDIX B-3
IMPACTED SOIL AND SEDIMENT VOLUME ESTIMATES
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Area of Concern	Possible Transformer Storage Area	Britt Bath House	Arbuckle Creek Total	Residential Properties Total	**Totals**	Units
Perimeter (LF)	30	80	3,902	790	**4,802**	LF
Surface Area (SF)	400	400	113,250	7,325	**121,375**	SF
Surface Area (Acre)	0.009	0.009	2.60	0.17	**2.8**	Acre
Clear and Grub Zone (Acre)	-	-	2.60	0.07	**2.7**	Acre
Removal Area (SF)	400	400	113,250	7,325	**121,375**	SF
Removal Depth (FT)	10	1				FT
Removal Volume (CF)	4,000	400	184,350	14,650	**203,400**	CF
Removal Volume (CY)	148	15	6,828	543	**7,533**	CY
Total Removal Volume (with 10% Contingency) (CY)	163	16	7,511	597	**8,287**	CY

Equipment Staging Area Perimeter	450.00	LF
Equipment Staging Area	10,890.00	SF
Equipment Staging Area	0.25	Acres
Soil Stockpile Area Perimeter and Cap Fence	998.00	LF
Soil Stockpile Area	41,578.00	SF
Soil Stockpile Area	0.95	Acres
Possible Transformer Storage Area Rough Perimeter	1,574.00	LF
Cap Surface Area	42,548.00	SF
Cap Surface Area	4,727.56	SY
Cap Surface Area	0.98	Acres
Road Length	3,105.00	LF
Road Area (assume 18' wide)	6,210.00	SY
Road Area (assume 18' wide)	1.28	Acres
Poly sheeting	2,000.00	SF
Total SF of Staging and Stockpile	52,468.00	SF
Rolls of sheeting needed for setup	26.23	Rolls
Total Excavation Amount with Contingency	8,286.67	CY
Days for excavation (assuming 300 CY/day)	29.00	Days
Wetland Area	0.62901	Acres
Non-Wetland Area	2.16	Acres

APPENDIX B-4
CAPITAL COST ASSUMPTIONS AND UNIT PRICES
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	ASSUMPTIONS	SOURCE
1.0	**Pre-design Investigations**				
1.01	Soil and Sediment Sampling Pre-design Investigation (PDI)	LS	$ 147,084.08	See PDI cost estimate Table, assumes total of 5 days of soil sample collection with a hand auger at Arbuckle Creek (2 samples per locations) and Residential Properties (3 samples per location) to determine horizontal extent of PRG exceedances. Assumed all AOCs will be investigated in one mobilization.	Engineer estimate
1.02	Treatment PDI	LS	$ 215,000.00	To determine appropriate formulation and application of SediMite™ and potential habitat layer (thin layer cap) for Arbuckle Creek Wetlands. Pilot test to last for approximately 1 year. Includes two rounds of sampling (before and after the application), as well as time for Sediment Solutions to develop a study plan. The cost breakdown is as follows: 13% toward amendment materials, 27% to sampling supplies and analytics, 37% for site prep and installation, and 23% for Sediment Solutions time and travel.	Vendor Estimate
2.0	**Mobilization/Demobilization**				
2.01	Construction Equipment Mobilization/Demobilization	LS	$ 12,625.76	Assumes less than 25 mile (50-mile round trip) haul distance for all heavy equipment. Heavy equipment would be mobilized and demobilized to and from the site once each. Assume average 20 ton per equipment. $789.11 for mob and $789.11 demob per piece of heavy equipment (2 days for crew/equipment time). The following pieces of heavy equipment (8) would be mobilized to the property at various points of the project: excavator(s), FE loaders(s), dozers(s), dump trucks(s), rollers(s), graders(s), water trucks(s). Mobilization/demobilization costs vary based on size and scope of excavation required. Assume total of 8 pieces of heavy equipment would be mobilized/demobilized to and from the site (8*$789.11*2 = $12,625.76).	Means 2025, 01 54 36 50 1400
2.02	Field Support Equipment Mobilization/Demobilization	LS	$ 7,200.00	Lump sum cost includes cost for field support equipment. Office trailer mobilization @ $1,500. Conex Mobilization @ $600. Provide/discontinue electrical service to job trailer @ $2,500. Dumpster mobilization @ $550.Office Equipment/Supplies @ $800. Sanitary facilities @$750. Potable water hookup @ $500.	Vendor Quote + 5% inflation.
2.03	Field Support (Equipment, Oversight, Staff)	MONTH	$ 86,433.61	Trailer rental @ $434.77/month (50ft x 10ft). Conex rental @ $146.55/month. Rolloff dumpster (20 CY) rental @ $2500/month. Portable toilet (2) @ $587.12/month. Potable water access @ $1105.17/month. 2 vehicle rentals @ $95/day ($5700/month - 30 days/month). Misc supplies $600/month. Assumes 2 field geologists/engineers oversight @ $157/hr for 12 hrs/day ($75,360/month) for the duration of the project.	Means 2025, 01 52 13 20 0450 - trailer Means 2025, 01 52 13 20 1250 - conex (storage box) Means 2025, 01 54 33 40 6420 - toilet Means 2025, 02 41 19 19 0725 - rolloff Means 2025, 01 54 33 40 7660 - portable water tank
2.04	Field Equipment Procurement/Planning	LS	$ 22,200.00	120 hours @ avg labor rate $185/hour for planning, procurement, contracts management	Engineer estimate
2.05	Field Equipment Mobilization/Demobilization Staff Oversight	LS	$ 9,650.00	40 hrs @ $185/hr for Mid Engineer to be on site for mobilization/demobilization of personnel, equipment, and materials to site ($7,400), 10 hrs @ $225/hr for Project Manager site visit ($2,250)	Engineer estimate
2.06	SediMite Materials Mobilization, Demobilization, and Staging	LS	$ 221,476.00	Includes SediMite Pellets for all Arbuckle Creek and Wetlands, RemBAC PCB Degraders for Arbuckle Creek AC2 (greater than 5 ppm PCBs), and Habitat Layer, plus application equipment.	Vendor Quote
2.07	Initial Mob/Demob Temporary Dewatering System	EA	$ 8,323.26	Frac tanks $4,161.63 each (20,000 gallons). One for active dewatering, one for stockpile area.	Means 2025, 13 05 05 75 0540
3.0	**Site Preparation and Erosion Control**				
3.01	Site Bridge Construction	LS	$ 51,956.90	Bridge from Delta Rd 13, across Arbuckle Creek to access road. Should be ~30 feet long.	Means 2024, 10 88 05 10 1550 (12' bridge) and 10 88 05 10 1600 (40' bridge). Extrapolated between the 2 lengths
3.02	Preconstruction Surveys	ACRE	$ 3,716.79	Assume a topographic survey of the Equipment Staging Area, Soil Stockpile Area, haul roads, and excavation areas. Means cost per acre is $3,716.79	Means 2025, 02 21 13 09 0100
3.03	Temporary Fence	LF	$ 28.58	A residential chain link fence, 6 feet tall ($28.58 per LF). Assumes chain fence to surround part of the Possible Transformer Storage Area where stockpiled soil will be stored (1574 LF) and Equipment Staging Area (450 LF). Signs every 50 LF ($31.54 each).	Means 2025, 32 31 13 25 0100
3.04	Temporary Signage	EA	$ 31.54	Signs every 50 LF ($31.54 each).	Means 2025, 10 14 53 20 2350

DESCRIPTION		UNIT	UNIT COST	ASSUMPTIONS	SOURCE
3.05	Clear and Grub	ACRE	$ 7,162.68	Assumes clearing and grubbing needed for the Equipment Staging Area, Soil Stockpile Area, haul roads, Arbuckle Creek remedial areas, and limited areas of residential property remedial areas. Clear medium trees (12 inch), cut and chip; do not grub stumps.	Means 2025, 31 11 10 10 0200
3.06	Construct Equipment Staging/Soil Stockpile Area(s)	EA	$ 39,259.51	Assumed Equipment Staging Area will be 0.25 acre with a perimeter of 450 LF. Assumed Soil Stockpile Area will be 47,460 SF (1.09 acres) with a perimeter of 1,114 LF based on the total excavation amount. Erosion controls will be placed around the perimeter of the Equipment Staging Area and Soil Stockpile Area @ $13.21/LF= $20,660.44. 60-Mil Poly sheeting will cover the Soil Stockpile Area and clean soil stockpile at the Equipment Staging Area and @ $199.99 per 20' by 100' roll. assume 30 rolls to cover both areas + 1 extra = $5,999.70. Included double for covering stockpiles, and triple for replacements and rips.	Means 2025, 31 25 14 16 1000 & 1250 ; Grainger 2021 (plastic sheeting)
3.07	Temporary Haul and Access Road	SY	$ 7.41	Temporary roads, gravel fill, no surfacing, 4" gravel depth. Assumes Haul Road/Access road will be 18 feet wide, along 3105 feet of roadway (6210 SY)	Means 2025, 01 55 23 50 0050
3.08	Construction/Swamp Mats	EA	$ 2,000.00	To be used in Arbuckle Creek Wetlands excavations. A 16'x4'x8" mat is approximately $500 ea plus $1500 delivery per load.	Engineer and SumCo Eco-Contracting Estimate
3.09	Private Utility Locating	LS	$ 41,202.00	Quote from RI activities to mark and locate all underground utilities over 5 acres	Vendor quote
3.10	Decontamination Pad	EA	$ 8,225.22	Equipment decontamination pad located in stockpile area or treatment area assumed 20' by 40' (800 SF) in size with 6" gravel base ($9.01/SY), graded to divert decontamination fluids ($3.65/SY) into a sump 60-mil high density polyethylene liner ($200 for 20' by 100' roll). Assumes two days to construct decon pad @ $2,200/day $2,500 for mob and demob of heavy equipment (2).	Means 2025, 32 11 23 23 0100 (base); Means 2025 HC, 31 22 16 10 3100 (grading); Grainger 2022 on-line.
3.11	Install Erosion and Sedimentation Controls	LF	$ 13.21	Assumes installation, maintaining, and removal (at end of project) of silt fencing and hay bales/straw wattle to surround the perimeter of each excavation/treatment area.	Means 2025, 31 25 14 16 1000 & 1250
3.12	Arbuckle Creek Temporary By-Pass Pumping System	LS	$ 90,000.00	Assumes $10,000 for construction of temporary sand bag and poly dam, assumes $37,500 per month of temporary by-pass pumping for 2 months, assumes $5,000 for removal of temporary dam.	Engineer estimate
4.0	**Mechanical Excavation and Intrusive Activities**				
4.01	Excavate Contaminated Soil/Sediment	CY	$ 2.65	Assume 1 C.Y hydraulic excavator. Assume 300 CY excavated per day. Days of excavation are rounded up to the nearest day.	Means 2025, 31 23 16 42 0200
4.02	Confirmation Samples for Impacted Excavation Areas	EA	$ 1,000.50	Sidewall sample every 30 LF of excavation to demonstrate horizontal compliance. 50% surcharge for 3 day TAT. Assume 10% will fail and will need resampling. Total PCB Aroclors/8082 Soxhlet ($72)/ Dioxins ($595)	Pace 2025 MOA and quote
4.03	Sample Shipment	EA	$ 250.00	Assumes approx 20 samples per cooler	FedEx, Engineer estimate
4.04	Air/Dust Control Monitoring- Dust Monitor Rental	MONTH	$ 3,913.20	Assume 6 monitor rentals, 4 at the stockpile, 2 at the excavation. TSI Dusttrak li 8530 Monitor @ $652.20/month each. Monitoring during intrusive and backfill activities.	US Environmental MOA 2025
4.05	Water Tank Trailer Rental	DAY	$ 186.00	Water tank trailer, 5000 gallons for dust suppression during intrusive and backfill activities.	Means 2025, 01 54 33 40 6900. 500 gallons for dust suppression.
4.06	Light Equipment Operator for Misting and Dust Monitoring Perimeter	DAY	$ 393.30	Light equipment operator to operate dust monitor and mist area for dust control during intrusive and backfill activities.	Means 2025, 13 11 32 00 1600

	DESCRIPTION	UNIT	UNIT COST	ASSUMPTIONS	SOURCE
4.07	Load/Haul/Unload Excavated Sediment to Staging Area	CY	$ 2.94	Assumes staging areas areas will be within 0.5 miles of excavation. Assumes 16. C.Y truck, 15 min wait/load/unload, 15 MPH Includes Loading & Unloading Truck with Soil. Uses a fluff factor of 1.2	Means 2025, 31 23 23 20 3014
4.08	Amending Wet Sediment	TON	$ 3.60	Assume 2% by weight, purchase delivery and mixing of drying agent into sediment, assumes treatment for excess water. Soil weight (for saturated, well graded sand) is 127.31 lbs/CF. Arbuckle Creek excavations are 184,350 CF total, 2% is 3,687 CF. 127.31 lbs/CF * 3,687 CF = 469,391.97 lbs = 234.7 Tons	Engineer estimate
4.09	Stockpile Management & Temp Cover of Excavated Waste	DAY	$ 1,143.97	Assumes Stockpiles will have poly liner temporary cover (cost included in mobilization) and staff to manage and monitor stockpiles throughout duration of excavation and backfill. 2 Laborers @ $1966.50/week each ($393.3/day), Loader at $3033.75/month ($151.69/day assuming 20 working days/month), Operator cost $25.17/hr ($205.68/day)	Means 2025, 13 11 32 00 1600 (laborers), 01 54 33 20 0460 (Loader and Operator)
4.10	Temporary dewatering and treatment system equipment rental	DAY	$ 416.32	Assumes 4" diaphragm pump (+1 extra). pumping for 8hrs, attended 2 hrs per day. Includes 20 LF of suction hose and 100 LF discharge hose. One setup at excavation area and one setup at soil stockpile area to discharge into frac tanks.	Means 2025, 31 23 19 20 0650
4.11	Perimeter Air Sampling	DAY	$ 194.69	PCBs via NIOSH 5503 (assumes 2 sample/day from stockpile and excavation areas), 7 day TAT $73.50 per sample, air pump ($192.00/month or $6.40/day), shipping fees ($41.29 via FedEx Express Saver for the 2 samples)	Pace 2025 MOA, US Env. 2025 MOA, FedEx estimating
4.12	Equipment Decontamination (30 min per 16cy truck)	DAY	$ 1,230.34	Assume decontamination of heavy vehicles as they leave stockpile area after either dumping or getting loaded with contaminated soil. Includes equipment, water, soap, electricity, and labor. Assume operation during entire duration of excavation activities at a rate of 2 trucks/hour. Pressure washer (5 gpm, 3000 psi) - $951.65/MO (4.79/hr for 8 hr day). 3 Laborers @49.16/hr, 8 hr days. 1% total for cleaning supplies.	Means 2025, 01 54 33 40 5450 (pressure washer); Means Crew - Laborer.
4.13	Sampling Frac Tanks	EA	$ 1,492.70	Assumes 1 sample per 10,000 gallons. Water will be sampled for VOCs @ $88.00, SVOCs @ $205.00, Pesticides @ $87.00, Herbicides @ $225.00, PCBs @ $72.00, Dioxins @ $595, RCRA-8 Metals @ $89.00, and Disposal Characteristics (Flashpoint @ $26.20, pH @ $11.50, Ignitabiliy @ $26.00, Reactive Cyanide @ $34.00, Reactive Sulfide @ $34.00)	Pace 2025 MOA
4.14	Removal of Non-TSCA Water	GAL	$ 0.99	Assumes all wastewater will be non-TSCA $0.35/gallon & Trans at $245/hour portal to portal	Vendor quote +5% for inflation
5.0	**Disposal of Soil and Sediment**				
5.01	Stockpile Characterization Sampling	EA	$ 1,619.70	Assume 1 composite sample per 400 CY stockpile soil. Analyzed for VOCs @ $88.00, SVOCs @ $205.00, Pesticides @ $85.00, Herbicides @ $225.00, PCBs @ $72.00, Dioxins @ $595, RCRA-8 Metals @ $89.00, TCLP Metals @ $129.00, and Disposal Characteristics (Flashpoint @ $26.20, pH @ $11.50, Ignitability @ $26.00, Reactive Cyanide @ $34.00, Reactive Sulfide @ $34.00)	Pace MOA 2025
5.02	Sample Shipment	EA	$ 250.00	Assumes up to 20 sample jars per cooler	FedEx, Engineer estimate
5.03	Load Stockpile to trucks	CY	$ 5.70	1/2 CY Hydraulic Excavator wheel mounted, Medium Material, 40 CY/Hour. Load waste from stockpiles into 12 CY dump trailers for transportation to treatment/disposal facility.	Means 2025, 31 23 16 42 0310
5.04	T&D of Non-TSCA Soil	TON	$ 125.00	Assume all loads except 1 will be Non-TSCA. Soil weight (for dry, well graded sand) is 84 lbs/CF. Total excavations are 231,250*1.1=254,375 CF. 84 lbs/CF * 254,375= 21,367,500 lbs = 10,684 Tons	Vendor Quote (Clean Harbors, 2023)
5.05	T&D of TSCA Soil	TON	$ 550.00	Assume 1 truck load (only 6 CY of TSCA soil, however trucks need a minimum of 22 Tons, per quote)	Vendor Quote (Clean Harbors, 2023)

	DESCRIPTION	UNIT	UNIT COST	ASSUMPTIONS	SOURCE
6.0	**Backfill, Cap, In-Situ Treatment, and Site Restoration**				
6.01	Backfill - Material and placement	CY	$ 3.89	Backfill from a clean stockpile staged in construction staging area, transported to excavations with a dozer, and graded.	Means 2025 31 23 23 14 2420
6.02	Clean Borrow Source Sampling	EA	$ 1,619.70	Assume 1 composite sample per 400 CY stockpile soil. Analyzed for VOCs @ $88.00, SVOCs @ $205.00, Pesticides @ $85.00, Herbicides @ $225.00, PCBs @ $72.00, Dioxins @ $595, RCRA-8 Metals @ $89.00, TCLP Metals @ $129.00, and Disposal Characteristics (Flashpoint @ $26.20, pH @ $11.50, Ignitability @ $26.00, Reactive Cyanide @ $34.00, Reactive Sulfide @ $34.00)	Pace MOA 2025 and quote
6.03	Hi-Cellulose SediMite^{TM} Material and Placement	ACRE	$ 108,500.00	Assumes application rate of 31 metric tons of SediMite per acre (15 MT per day) based on sediment dry bulk density, 0-6 inch treatment depth, and target dose of 5% actived carbon by sediment dry weight. Includes shipping and delivery. Will be applied across all areas of concern (total 2.8 acres).	Vendor Quote
6.04	Hi-Cellulose SediMite^{TM} Per Diem Application	DAY	$ 27,102.00	Per application day - includes application on designated areas and per diem costs of personnel during application.	Vendor Quote
6.05	RemBAC PCB Degraders Material	ACRE	$ 65,500.00	Recommended amendment for Areas with PCBs >5 ppm (currently limited to AC2, 0.597 acres, and Possible Transformer Storage Area, 0.009 acres). This is an aqueous slurry applied to SediMite prior to application. This amendment needs to be evaluated via a pilot test prior to full-scale implementation. Includes shipping and delivery, travel and staging and per diem application costs.	Vendor Quote
6.06	RemBAC PCB Degraders Per Diem Application	DAY	$ 45,942.00	Per application day - includes application on designated areas and per diem costs of personnel during application.	Vendor Quote
6.07	Habitat/Soil Cover Layer Material and Placement	ACRE	$ 42,504.00	Assume 7 cm thickness (3 inches maximum) comprised of 66% sand and 34% topsoil. Due to presence of SediMite and potential amendments, specialty equipment (i.e., heavy pneumatic devises and wetland matting) would need to be used vs standard heavy equipment (e.g., loaders/excavators). Will be applied across all remedial areas (total 3.0 acres).	Vendor Quote
6.08	Habitat/Soil Cover Layer Per Diem Application	DAY	$ 47,800.00	Per application day - includes application on designated areas and per diem costs of personnel during application.	Vendor Quote
6.09	Consolidation Area - Compact excavated Soil	CY	$ 0.19	Compaction, riding Vibrating roller 12" lifts, two passes	Means 2025, 31 23 23 23 5060
6.10	Consolidation Area - Warning/delineation Fabric Layer	SY	$ 2.99	Assume non-woven, 120 lb tensile strength	Means 2025, 31 32 19 16 1550
6.11	Consolidation Area - Load/Haul/Unload Clean Fill	CY	$ 13.72	Loam delivered from a vendor within 20 miles. 16.5CY truck with 40 mile cycle (round trip).	Means 2025, 31 23 23 20 3084
6.12	Consolidation Area - Borrow and Spread Low Permeable Soil (12")	CY	$ 28.03	Using 3/4 CY Front End loader, Includes Material costs for select granular fill	Means 2025, 31 23 23 15 5050
6.13	Consolidation Area - Compact Low Permeable Layer (12")	CY	$ 0.19	Assume use of 1.5 CY FE loader spread from pile to grade	Means 2025, 31 23 23 23 5060
6.14	Consolidation Area - Borrow and Spread Clean Fill- Foundation Layer (6")	BCY	$ 31.27	Using 3/4 CY Front End loader, Includes Material costs for common earth. Uses a fluff factor of 1.2.	Means 2025, 31 23 23 15 4050

DESCRIPTION		UNIT	UNIT COST	ASSUMPTIONS	SOURCE
6.15	Consolidation Area - Compact Clean Fill - Foundation Layer (6")	CY	$ 0.19	Compaction, Riding Vibrating Roller 12" lifts, two passes	Means 2025, 31 23 23 23 5060
6.16	Consolidation Area - Borrow and Spread Topsoil (6")	CY	$ 25.94	Assume use of 1.5 CY FE loader spread from pile to grade.	Means 2025, 31 23 23 15 7060
6.17	Consolidation Area - Hydroseeding with Mulch and Fertilizer	MSF	$ 120.92	Assume utlity mix seed, hydro or air seeding with mulch and fertilizer.	Means 2025, 32 92 19 14 5400
6.18	Consolidation Area - Geotextile Drainage Layer	SY	$ 2.27	Assume adverse conditions, fabric, polyproplyene	Means 2025, 33 41 23 19 0110
6.19	Consolidation Area - Geomembrane Liner	SF	$ 2.66	Membrane Liner System HDPE, 60 mil	Means 2025, 02 56 13 10 0720
6.20	Monitoring Well Installation	LS	$ 120,390.00	Assumes five 2-inch diameter bedrock monitoring wells advanced to 50 ft bgs (~30 ft of overburden) with 10 ft of screen. Assumes wells will be advanced with a sonic rig and includes costs for 10 days of drilling, crew labor, mob/demob, additional equipment/machinery, development labor, well finishes (PVC, bentonite, sand, stickups, bollards), and IDW management, sampling, and disposal.	Engineer Estimate
6.21	Land restoration	ACRE	$ 30,500.00	Purchase, Delivery, and Installation of Riparian Species, Upland Species, Seeding, Planting - for inland staging area(s) and temporary road restoration. Variables in plant sizes and spacing will drive pricing for this item, which is sometimes governed by permitters and town bylaws. Assume $6,000/acre for seeding and $24,500 for mixture of containerized trees (10 ft on center) and containerized shrubs (6 ft on center). Backup: $15,000/acre for restoration grade containerized trees at 10' on center. $35,000/acre for containerized shrubs at 6' on center. Assume all excavation area besides wetlands, and Evan's Road (1200 LF * 18 LF = 21,600 SF, 0.5 Acres) will need to be restored	Vendor Quote [SumCo Eco-Contracting]
6.22	Wetland Restoration	ACRE	$ 125,000.00	Purchase, Delivery, and Installation of Aquatic Plant Species. Planting 2" emergent plug plantings: 1' on center spacing - $125,000/acre. 18" on center spacing - $60,000/acre. 2' on center spacing - $12,000/acre. Assume wetland excavation areas (0.63 acres) will need to be restored.	Vendor Quote [SumCo Eco-Contracting]
6.23	Install Permanent Fence Engineering Control	LF	$ 28.58	A residential chain link fence, 6 feet tall. Assumes chain fence to surround the perimeter of impacted area along populated areas (e.g., roadways, residences, parking areas). To help prevent trespassing.	Means 2025, 32 31 13 25 0100
6.24	Install Permanent Signage Engineering Control	EA	$ 31.54	Signage excludes posts. Assume connected to fencing material and posted 1 every 200 feet.	Means 2025, 10 14 53 20 2350
7.0	**Institutional Controls**				
7.01	Institutional Controls	LS	$ 22,200.00	Assume 120 hours @ $185/hr to prepare institutional controls on site parcels.	Engineer estimate
8.0	**Site Closeout**				
8.01	Site Cleanup	LS	$ 10,800.00	Assumes 1 Mid Scientist ($140/hr) and 1 Jr Scientist ($130/hr) to clean up the site for 40 hours	Engineer estimate
8.02	As-Built Surveys	ACRE	$ 3,716.79	Topographic survey cost per acre. Acreage for each alternative includes the remedial areas and, for Alternative 2, the cap.	Means 2025, 02 21 13 09 0100

DESCRIPTION		UNIT	UNIT COST	ASSUMPTIONS	SOURCE
9.0	**Flood Storage Mitigation/Stormwater Management**				
9.01	Flood Storage Mitigation Costs	ACRE	$ 200,000.00	The objective of this action is to achieve no net loss of flood storage cpacity for the property such that new flood hazards are no created at the Site. 1 acre acquisition at $200,000 based on factors presented in the Use of Best Management Practices (BMPs) in Urban Watersheds, EPA/600/R-04/184, 2004. A remedial alternative may involve adding material to the floodplain above the existing topography and comply with the floodplain related ARARs, without providing compensatory flood plain mitigation, if a demonstration can be made regarding the following: -Filling will only have a de minimis impact on flood storage, flood velocity, and will have ancillary impacts on abutters. -Any caps or covers over contaminated materials will not be significantly damaged by a 100 or 500-year flood event. The cap constructed in Alternative 2 will be outside of the floodplain. -The impact to habitat or wetlands is expected to be neligible as restoration is expected to closely mimic pre-existing conditions. The current assumption is that the above requirements will be met for Alternatives 2 and 3, therefore not requiring additional flood storage mitigation. The alterations to the surface presented in Alternative 4 will require flood storage mitigation for the Arbuckle Creek and residential property remedial areas.	Best Management Practices (BMPs) in Urban Watersheds, EPA/600/R-04/184, 2004, Engineer Estimate
10.0	**Other Costs**				
10.01	Project Management (5%)			Manage the overall project implementation. Includes planning, community relations, bid/contract administration, cost and performance reporting, permitting, legal fees, and construction completion report	OSWER 9355.0-75
10.02	Engineering and Design (8%)			Includes the following: Remedial Design (preliminary, intermediate, and final design), design analysis, plans (including SWPP, QAPP, CMP, HASP, erd.), specification, construction cost estimate and schedule	OSWER 9355.0-75
10.03	Construction Management (6%)			Manage the construction of the remedy. Includes: submittal review; change order review; design modifications; construction observation, survey and tracking; QA/QC documentation, O&M manual, record drawings	OSWER 9355.0-75
10.04	Contingency (Scope 10%, Bid 10%)				OSWER 9355.0-75

Notes:
City Cost Index adjusted for RS Means Values to Beckley, West Virginia.

APPENDIX B-5
OPERATION AND MAINTENANCE COST ASSUMPTIONS AND UNIT PRICES
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	ASSUMPTIONS	SOURCE
OM 1.0	**Site Inspections (annual)**				
OM.1.01	Site Inspections	LS	$ 2,800.00	Assumes 20 hours for Mid Scientist @140/hr (2 10-hr days) including check fencing and signs, review of deed restrictions, onsite inspection of land/wetland plantings.	Engineer estimate
OM 1.02	Land revegetation (1% per year)	ACRE	$ 30,500.00	Assumes installation costs. Repair 1% of the land acreage per year	Vendor Quote
OM 1.03	Wetlands revegetation (1% per year)	ACRE	$ 125,000.00	Assumes installation costs. Repair 1% of the wetlands acreage per year	Vendor Quote
OM 1.04	Fence Repair & Signage Repair (1% per year)	LF	$ 28.58	Assumes installation costs. Repair 1% of the fencing footage per year	Means 2025, 32 31 13 25 0100
OM 1.05	Hydroseeding with Mulch and Fertilizer (1%) per year)	MSF	$ 120.92	Assumes hydroseeding costs. Reapply fertilizer 1% of the area per year	Means 2025, 32 92 19 14 5400
OM 1.06	Topsoil replacement (1% per year)	CY	$ 25.94	Assumes topsoil borrow and spread costs. Replace 1% of topsoil per year	Means 2025, 31 23 23 15 7060
OM 1.07	Mowing	MSF	$ 135.04	Assumes the cap will need to be mowed twice per year	Means 2025, 32 01 90 19 1670
OM 1.08	Cap/Soil Cover Repairs (2% per year of capital costs)	LS	2 % CC	Assumes 2% of the capital cost for consolidation area	Engineer estimate
OM 1.09	Annual O&M Report	LS	$ 10,000.00	Estimated lump sum deliverable cost	Engineer estimate
OM 2.0	**Long Term Monitoring (initial conditions; annually first 5 years; every 5 years after that)**				
OM 2.01	Surface Water and Sediment Sampling Labor	LS	$ 14,060.00	Assume 1 Mid Scientist @$140/hr and 1 Jr Scientist @ $130/hr @ 10 hours/day. Assumes 4 co-located surface water and sediment samples/day (total of 15 locations) plus sample management and shipment. Assume 4 hours Mid Scientist for mobilization prep. Assumes total 5 days field time and 1/2 day prep.	Engineer estimate
OM.2.02	Surface Water and Sediment Sampling Equipment	LS	$ 2,477.00	PPE/consumables including gloves, calibration solutions, tubing, shipping supplies etc ($400), YSI ($109.20/day), turbidity meter ($22.20/day) peri pump ($22.20/day), Trimble GPS Unit ($120/day), Hand Augerx2 ($14.40/day), Generator ($36/day)Travel vehicle ($77/day)	US Environmental MOA 2025, Enterprise Rates
OM.2.03	Surface Water and Sediment Sampling Bottleware (PCBs and Dioxins)	LS	$ 389.89	1 8oz amber each for PCBs and Dioxins @ $61.00/case (24 per case). 15 samples total + 6 QC bottles is 36 bottles or 2 cases. 2 1L ambers each for PCBs and Dioxins (3121-003312) @ 38.27/case (12/case). 15 samples total + 12 QC bottles + 4 EB bottles is 76 bottles or 7 cases.	QEC Order 2023
OM 2.04	Surface Water and Sediment Sampling Analytical Costs	LS	$ 24,679.00	Assume 15 Sediment and 15 Surface Water plus FD, MS, MSD and aqueous EB total 37 samples. Aqueous and solid PCB Aroclors/ 8082 Soxhlet ($72) Dioxins ($595).	Pace 2025 MOA and quote
OM.2.05	Surface Water and Sediment Sampling Shipment	EA	$ 250.00	FedEx, assumes shipping 4 total coolers per day to 2 labs (2 coolers per lab) total of 20 coolers	FedEX, Engineer estimate
OM 2.06	Groundwater Sampling Labor	LS	$ 5,960.00	Assume 1 Mid Scientist @$140/hr and 1 Jr Scientist @ $130/hr @ 10 hours/day. Assumes 4 monitoring well samples/day (total of 8 locations) plus sample management and shipment. Assume 4 hours Mid Scientist for mobilization prep. Assume 2 days field time.	Engineer estimate
OM 2.07	Groundwater Sampling Equipment	LS	$ 1,242.80	PPE/consumables including gloves, calibration solutions, tubing, shipping supplies etc ($400), YSIs ($109.20/day/unit), turbidity meter ($22.20/day/unit), peri pump ($22.20/day/unit), water level meter (18.60/day/unit), Travel vehicle ($77/day)	US Environmental MOA 2025, Enterprise Rates
OM 2.08	Groundwater Sampling Bottleware (PCBs and Dioxins)	LS	$ 153.08	2 1L ambers each for PCBs and Dioxins (3121-003312) @ 38.27/case (12/case). 8 samples total + 12 QC bottles + 4 EB bottles is 48 bottles or 4 cases.	QEC Order 2023
OM 2.09	Groundwater Sampling Analytical Costs	LS	$ 8,004.00	Assume 8 groundwater plus FD, MS, MSD and aqueous EB total 12 samples. Aqueous PCB Aroclors/ 8082 Soxhlet ($72) Dioxins ($595).	Pace 2025 MOA and quote
OM 2.10	Groundwater Sampling Shipment	EA	$ 250.00	FedEx, assumes shipping 6 total coolers per event to 2 labs (3 coolers per lab)	FedEX, Engineer estimate
OM 2.11	Data Validation/Reporting	LS	$ 7,507.50	Assume 0.5 hr per sample (37 samples) @ $155/hr to validate data and 30 hrs Jr Engineer @ $130/hr plus 4 Mid Engineer Hours $185/hr to generate report	Engineer estimate
OM 3.0	**Deed Restrictions/ Institutional Controls (annual)**				
OM.3.01	Deed Restriction Reporting	LS	$ 1,500.00	Assumes 10 hours for reporting @ 150/hr	Previous Work
OM 4.0	**Five-Year Reviews**				
OM.4.01	Inspection	LS	$ 13,000.00	Assumes 100 hours for inspection, prep work @ $130/hr	Previous Work
OM.4.02	Periodic Inspection Report	LS	$ 13,000.00	Assumes 100 hours for reporting @ $130/hr	Previous Work
OM. 5.0	**Other Costs**				
OM 5.01	Project Management (5% of direct costs)				OSWER 9355.0-75
OM 5.02	Contingency (Scope 10%)				OSWER 9355.0-75

Notes:
City Cost Index adjusted for RS Means Values to Beckley, West Virginia.

APPENDIX B-6A
PRESENT VALUE COSTS
ALTERNATIVE 1 – NO ACTION
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Year	Capital	O&M[2]	5-Yr Review	Total	Discount Rate[1]	Present Value
0	$0	$0	$0	$0	7.0%	$0
1	$0	$0	$0	$0	7.0%	$0
2	$0	$0	$0	$0	7.0%	$0
3	$0	$0	$0	$0	7.0%	$0
4	$0	$0	$0	$0	7.0%	$0
5	$0	$0	$0	$0	7.0%	$0
6	$0	$0	$0	$0	7.0%	$0
7	$0	$0	$0	$0	7.0%	$0
8	$0	$0	$0	$0	7.0%	$0
9	$0	$0	$0	$0	7.0%	$0
10	$0	$0	$0	$0	7.0%	$0
11	$0	$0	$0	$0	7.0%	$0
12	$0	$0	$0	$0	7.0%	$0
13	$0	$0	$0	$0	7.0%	$0
14	$0	$0	$0	$0	7.0%	$0
15	$0	$0	$0	$0	7.0%	$0
16	$0	$0	$0	$0	7.0%	$0
17	$0	$0	$0	$0	7.0%	$0
18	$0	$0	$0	$0	7.0%	$0
19	$0	$0	$0	$0	7.0%	$0
20	$0	$0	$0	$0	7.0%	$0
21	$0	$0	$0	$0	7.0%	$0
22	$0	$0	$0	$0	7.0%	$0
23	$0	$0	$0	$0	7.0%	$0
24	$0	$0	$0	$0	7.0%	$0
25	$0	$0	$0	$0	7.0%	$0
26	$0	$0	$0	$0	7.0%	$0
27	$0	$0	$0	$0	7.0%	$0
28	$0	$0	$0	$0	7.0%	$0
29	$0	$0	$0	$0	7.0%	$0
30	$0	$0	$0	$0	7.0%	$0
TOTAL	**$0**					**$0**
					PV O&M	$0

Notes:
[1] Discount rate of 7% per EPA 540-R-00-002, OSWER 9355.0-75, July 2000.
[2] O&M = operations and maintenance

APPENDIX B-6B
CAPITAL COSTS
ALTERNATIVE 1 – NO ACTION
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST
1.0	Not Applicable				
TOTAL DIRECT COSTS					$ -
TOTAL OTHER COSTS					$ -
TOTAL CAPITAL COST FOR ALT-1					$ -

APPENDIX B-6C
OPERATION AND MAINTENANCE COSTS
ALTERNATIVE 1 – NO ACTION
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST[1]	QUANTITY	TOTAL COST
OM 1.0	**Not Applicable**				
	Subtotal				**$ -**
	Project Management (5% of direct costs)				$ -
	Contingency (Scope 10%)				$ -
	Total				**$ -**
TOTAL DIRECT COSTS					**$ -**
TOTAL O&M FOR ALT-1					**$ -**

APPENDIX B-7A
PRESENT VALUE COSTS
ALTERNATIVE 2 - LOW PERMEABILITY CAP
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Year	Capital	O&M[2]	5-Yr Review	Total	Discount Rate[1]	Present Value
0	$3,847,000	$28,023	$0	$3,875,023	7.0%	$3,875,023
1	$0	$59,067	$0	$59,067	7.0%	$55,203
2	$0	$59,067	$0	$59,067	7.0%	$51,592
3	$0	$59,067	$0	$59,067	7.0%	$48,217
4	$0	$59,067	$0	$59,067	7.0%	$45,062
5	$0	$59,067	$26,000	$85,067	7.0%	$60,652
6	$0	$31,044	$0	$31,044	7.0%	$20,686
7	$0	$31,044	$0	$31,044	7.0%	$19,333
8	$0	$31,044	$0	$31,044	7.0%	$18,068
9	$0	$31,044	$0	$31,044	7.0%	$16,886
10	$0	$59,067	$26,000	$85,067	7.0%	$43,244
11	$0	$31,044	$0	$31,044	7.0%	$14,749
12	$0	$31,044	$0	$31,044	7.0%	$13,784
13	$0	$31,044	$0	$31,044	7.0%	$12,882
14	$0	$31,044	$0	$31,044	7.0%	$12,039
15	$0	$59,067	$26,000	$85,067	7.0%	$30,832
16	$0	$31,044	$0	$31,044	7.0%	$10,516
17	$0	$31,044	$0	$31,044	7.0%	$9,828
18	$0	$31,044	$0	$31,044	7.0%	$9,185
19	$0	$31,044	$0	$31,044	7.0%	$8,584
20	$0	$59,067	$26,000	$85,067	7.0%	$21,983
21	$0	$31,044	$0	$31,044	7.0%	$7,498
22	$0	$31,044	$0	$31,044	7.0%	$7,007
23	$0	$31,044	$0	$31,044	7.0%	$6,549
24	$0	$31,044	$0	$31,044	7.0%	$6,120
25	$0	$59,067	$26,000	$85,067	7.0%	$15,674
26	$0	$31,044	$0	$31,044	7.0%	$5,346
27	$0	$31,044	$0	$31,044	7.0%	$4,996
28	$0	$31,044	$0	$31,044	7.0%	$4,669
29	$0	$31,044	$0	$31,044	7.0%	$4,364
30	$0	$59,067	$26,000	$85,067	7.0%	$11,175
TOTAL	**$3,847,000**					**$4,472,000**
					PV O&M	$625,000

Notes:
[1] Discount rate of 7% per EPA 540-R-00-002, OSWER 9355.0-75, July 2000, p. 4-5.
[2] O&M = operations and maintenance

APPENDIX B-7B
CAPITAL COSTS
ALTERNATIVE 2 - LOW PERMEABILITY CAP
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
1.0	**Pre-design Investigations**					
1.01	Soil and Sediment Sampling Pre-design Investigation (PDI)	LS	$ 147,084.08	1	$ 147,084	Engineers Estimate
	Subtotal				**$ 147,084**	
2.0	**Mobilization/Demobilization**					
2.01	Construction Equipment Mobilization/Demobilization	LS	$ 12,625.76	1	$ 12,626	Means 2025, 01 54 36 50 1400
2.02	Field Support Equipment Mobilization/Demobilization	LS	$ 7,200.00	1	$ 7,200	Vendor Quote + 5% inflation.
2.03	Field Support (Equipment, Oversight, Staff)	MONTH	$ 86,433.61	8	$ 691,469	Means 2025, 01 52 13 20 0450 - trailer Means 2025, 01 52 13 20 1250 - conex (storage box) Means 2025, 01 54 33 40 6420 - toilet Means 2025, 02 41 19 19 0725 - rolloff Means 2025, 01 54 33 40 7660 - portable water tank
2.04	Field Equipment Procurement/Planning	LS	$ 22,200.00	1	$ 22,200	Engineer estimate
2.05	Field Equipment Mobilization/Demobilization Staff Oversight	LS	$ 9,650.00	1	$ 9,650	Engineer estimate
2.06	Initial Mob/Demob Temporary Dewatering System	EA	$ 8,323.26	2	$ 16,647	Means 2025, 13 05 05 75 0540
	Subtotal				**$ 759,791**	
3.0	**Site Preparation and Erosion Control**					
3.01	Site Bridge Construction	LS	$ 51,956.90	1	$ 51,957	Means 2024, 10 88 05 10 1550 (12' bridge) and 10 88 05 10 1600 (40' bridge). Extrapolated between the 2 lengths
3.02	Preconstruction Surveys	ACRE	$ 3,716.79	5.27	$ 19,602	Means 2025, 02 21 13 09 0100
3.03	Temporary Fence	LF	$ 28.58	2,024	$ 57,846	Means 2025, 32 31 13 25 0100
3.04	Temporary Signage	EA	$ 31.54	40	$ 1,277	Means 2025, 10 14 53 20 2350
3.05	Clear and Grub	ACRE	$ 7,162.68	5.16	$ 36,933	Means 2025, 31 11 10 10 0200
3.06	Construct Equipment Staging/Soil Stockpile Area(s)	EA	$ 39,259.51	1	$ 39,260	Means 2025, 31 25 14 16 1000 & 1250 ; Grainger 2021 (plastic sheeting)
3.07	Temporary Haul and Access Road	SY	$ 7.41	6,210	$ 46,016	Means 2025, 01 55 23 50 0050
3.08	Construction/Swamp Mats	EA	$ 2,000.00	5	$ 10,000	Engineer and SumCo Eco-Contracting Estimate
3.09	Private Utility Locating	LS	$ 41,202.00	1	$ 41,202	Vendor quote

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
3.10	Decontamination Pad	EA	$ 8,225.22	1	$ 8,225	Means 2025, 32 11 23 23 0100 (base); Means 2025 HC, 31 22 16 10 3100 (grading); Grainger 2022 on-line.
3.11	Install Erosion and Sedimentation Controls	LF	$ 13.21	4,802	$ 63,434	Means 2025, 31 25 14 16 1000 & 1250
3.12	Arbuckle Creek Temporary By-Pass Pumping System	LS	$ 90,000.00	1	$ 90,000	Engineer estimate
	Subtotal				**$ 465,751**	
4.0	**Mechanical Excavation**					
4.01	Excavate Contaminated Soil/Sediment	CY	$ 2.65	8,287	$ 21,960	Means 2025, 31 23 16 42 0200
4.02	Confirmation Samples for Impacted Excavation Areas	EA	$ 1,000.50	176	$ 176,161	Pace 2025 MOA and quote
4.03	Sample Shipment	EA	$ 250.00	9	$ 2,201	FedEx, Engineer estimate
4.04	Air/Dust Control Monitoring- Dust Monitor Rental	MONTH	$ 3,913.20	4	$ 16,374	US Environmental MOA 2025
4.05	Water Tank Trailer Rental	DAY	$ 186.00	84	$ 15,565	Means 2025, 01 54 33 40 6900. 500 gallons for dust suppression.
4.06	Light Equipment Operator for Misting and Dust Monitoring Perimeter	DAY	$ 393.30	84	$ 32,913	Means 2025, 13 11 32 00 1600
4.07	Load/Haul/Unload Excavated Sediment to Staging Area	CY	$ 2.94	8,287	$ 24,363	Means 2025, 31 23 23 20 3014
4.08	Amending Wet Sediment	TON	$ 3.60	234.7	$ 845	Engineer estimate
4.09	Stockpile Management & Temp Cover of Excavated Waste	DAY	$ 1,143.97	84	$ 95,733	Means 2025, 13 11 32 00 1600 (laborers), 01 54 33 20 0460 (Loader and Operator)
4.10	Temporary dewatering and treatment system equipment rental	DAY	$ 416.32	84	$ 34,840	Means 2025, 31 23 19 20 0650
4.11	Perimeter Air Sampling	DAY	$ 194.69	84	$ 16,293	Pace 2025 MOA, US Env. 2025 MOA, FedEx estimating
4.12	Equipment Decontamination (30 min per 16cy truck)	DAY	$ 1,230.34	84	$ 102,961	Means 2025, 01 54 33 40 5450 (pressure washer); Means Crew - Laborer.
4.13	Sampling Frac Tanks	EA	$ 1,492.70	4	$ 5,971	Pace 2025 MOA
4.14	Removal of Non-TSCA Water	GAL	$ 0.99	80,000	$ 79,200	Vendor quote +5% for inflation
	Subtotal				**$ 625,379**	

APPENDIX B-7B
CAPITAL COSTS
ALTERNATIVE 2 - LOW PERMEABILITY CAP
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
5.0	**Backfill, Cap, and Site Restoration**					
5.01	Backfill - Material and placement	CY	$ 3.89	8,287	$ 32,235	Means 2025 31 23 23 14 2420
5.02	Clean Borrow Source Sampling	EA	$ 1,619.70	21	$ 33,555	Pace MOA 2025 and quote
5.03	Consolidation Area - Compact excavated Soil	CY	$ 0.19	8,287	$ 1,574	Means 2025, 31 23 23 23 5060
5.04	Consolidation Area - Warning/delineation Fabric Layer	SY	$ 2.99	4,728	$ 14,135	Means 2025, 31 32 19 16 1550
5.05	Consolidation Area - Load/Haul/Unload Clean Fill	CY	$ 13.72	8,287	$ 113,693	Means 2025, 31 23 23 20 3084
5.06	Consolidation Area - Borrow and Spread Low Permeable Soil (12")	CY	$ 28.03	1,560	$ 43,729	Means 2025, 31 23 23 15 5050
5.07	Consolidation Area - Compact Low Permeable Layer (12")	CY	$ 0.19	1,560	$ 296	Means 2025, 31 23 23 23 5060
5.08	Consolidation Area - Borrow and Spread Clean Fill- Foundation Layer (6")	BCY	$ 31.27	785	$ 24,540	Means 2025, 31 23 23 15 4050
5.09	Consolidation Area - Compact Clean Fill - Foundation Layer (6")	CY	$ 0.19	785	$ 149	Means 2025, 31 23 23 23 5060
5.10	Consolidation Area - Borrow and Spread Topsoil (6")	CY	$ 25.94	785	$ 20,357	Means 2025, 31 23 23 15 7060
5.11	Consolidation Area - Hydroseeding with Mulch and Fertilizer	MSF	$ 120.92	43	$ 5,145	Means 2025, 32 92 19 14 5400
5.12	Consolidation Area - Geotextile Drainage Layer	SY	$ 2.27	4,728	$ 10,732	Means 2025, 33 41 23 19 0110
5.13	Consolidation Area - Geomembrane Liner	SF	$ 2.66	42,548	$ 113,178	Means 2025, 02 56 13 10 0720
5.14	Monitoring Well Installation	LS	$ 120,390.00	1	$ 120,390	Engineer Estimate
5.15	Land restoration	ACRE	$ 30,500.00	2.66	$ 81,049	Vendor Quote [SumCo Eco-Contracting]
5.16	Wetland Restoration	ACRE	$ 125,000.00	0.62901	$ 78,627	Vendor Quote [SumCo Eco-Contracting]
5.17	Install Permanent Fence Engineering Control	LF	$ 28.58	998	$ 28,523	Means 2025, 32 31 13 25 0100
5.18	Install Permanent Signage Engineering Control	EA	$ 31.54	5	$ 157	Means 2025, 10 14 53 20 2350
	Subtotal				**$ 722,065**	

APPENDIX B-7B
CAPITAL COSTS
ALTERNATIVE 2 - LOW PERMEABILITY CAP
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
6.0	**Institutional Controls**					
6.01	Institutional Controls	LS	$ 22,200.00	1	**$ 22,200**	Engineer estimate
7.0	**Site Closeout**					
7.01	Site Cleanup	LS	$ 10,800.00	1	$ 10,800	Engineer estimate
7.02	As-Built Surveys	ACRE	$ 3,716.79	3.76	$ 13,987	Means 2025, 02 21 13 09 0100
	Subtotal				**$ 24,787**	
TOTAL DIRECT COSTS					**$ 2,767,058**	
8.0	**Other Costs (% is dependant on Total Direct Costs)**					
8.01	Project Management (5%)				$ 138,353	OSWER 9355.0-75
8.02	Engineering and Design (8%)				$ 221,365	OSWER 9355.0-75
8.03	Construction Management (6%)				$ 166,023	OSWER 9355.0-75
8.04	Contingency (Scope 10%, Bid 10%)				$ 553,412	OSWER 9355.0-75
TOTAL OTHER COSTS					**$ 1,079,153**	
TOTAL CAPITAL COST FOR ALT-2					**$ 3,847,000**	

APPENDIX B-7C
OPERATION AND MAINTENANCE COSTS
ALTERNATIVE 2 - LOW PERMEABILITY CAP
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST[1]	QUANTITY	TOTAL COST
OM 1.0	**Site Inspections (annual)**				
OM 1.01	Site Inspections	LS	$ 2,800.00	1.00	$ 2,800.00
OM 1.02	Fence Repair & Signage Repair (1% per year)	LF	$ 28.58	9.98	$ 285.23
OM 1.03	Hydroseeding with Mulch and Fertilizer (1%) per year)	MSF	$ 120.92	0.43	$ 51.45
OM 1.04	Topsoil replacement (1% per year)	CY	$ 25.94	7.85	$ 203.57
OM 1.05	Mowing	MSF	$ 135.04	42.55	$ 5,745.68
OM 1.06	Cap/Soil Cover Repairs (2% per year of capital costs)	LS	$ 320,452.52	0.02	$ 6,409.05
OM 1.07	Annual O&M Report	LS	$ 10,000.00	1.00	$ 10,000.00
	Subtotal				**$ 25,495.00**
	Project Management (5% of direct costs)				$ 1,274.75
	Contingency (Scope 10%)				$ 2,549.50
	Total				**$ 29,319.25**
OM 2.0	**Long Term Monitoring (initial conditions; annually first 5 years; every 5 years after that)**				
OM 2.01	Groundwater Sampling Labor	LS	$ 5,960.00	1	$ 5,960.00
OM 2.02	Groundwater Sampling Equipment	LS	$ 1,242.80	1	$ 1,242.80
OM 2.03	Groundwater Sampling Bottleware (PCBs and Dioxins)	LS	$ 153.08	1	$ 153.08
OM 2.04	Groundwater Sampling Analytical Costs	LS	$ 8,004.00	1	$ 8,004.00
OM 2.05	Groundwater Sampling Shipment	EA	$ 250.00	6	$ 1,500.00
OM 2.06	Data Validation/Reporting	LS	$ 7,507.50	1	$ 7,507.50
	Subtotal				**$ 24,368.00**
	Project Management (5% of direct costs)				$ 1,218.40
	Contingency (Scope 10%)				$ 2,436.80
	Total				**$ 28,023.20**
OM 3.0	**Deed Restrictions/ Institutional Controls (annual)**				
OM 3.01	Deed Restriction Reporting	LS	$ 1,500.00	1	$ 1,500.00
	Subtotal				**$ 1,500.00**
	Project Management (5% of direct costs)				$ 75.00
	Contingency (Scope 10%)				$ 150.00
	Total				**$ 1,725.00**
OM 4.0	**Five-Year Reviews**				
OM 4.01	Inspection	LS	$ 13,000.00	1	$ 13,000.00
OM 4.02	Periodic Inspection Report	LS	$ 13,000.00	1	$ 13,000.00
	Subtotal				**$ 26,000.00**
TOTAL DIRECT COSTS					**$ 77,363.00**
TOTAL O&M FOR ALT-2					**$ 85,067.45**

APPENDIX B-8A
PRESENT VALUE COSTS
ALTERNATIVE 3 - REMOVAL WITH OFF-SITE DISPOSAL
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Year	Capital	O&M[2]	5-Yr Review	Total	Discount Rate[1]	Present Value
0	$4,449,000	$0	$0	$4,449,000	7.0%	$4,449,000
1	$0	$0	$0	$0	7.0%	$0
2	$0	$0	$0	$0	7.0%	$0
3	$0	$0	$0	$0	7.0%	$0
4	$0	$0	$0	$0	7.0%	$0
5	$0	$0	$0	$0	7.0%	$0
6	$0	$0	$0	$0	7.0%	$0
7	$0	$0	$0	$0	7.0%	$0
8	$0	$0	$0	$0	7.0%	$0
9	$0	$0	$0	$0	7.0%	$0
10	$0	$0	$0	$0	7.0%	$0
11	$0	$0	$0	$0	7.0%	$0
12	$0	$0	$0	$0	7.0%	$0
13	$0	$0	$0	$0	7.0%	$0
14	$0	$0	$0	$0	7.0%	$0
15	$0	$0	$0	$0	7.0%	$0
16	$0	$0	$0	$0	7.0%	$0
17	$0	$0	$0	$0	7.0%	$0
18	$0	$0	$0	$0	7.0%	$0
19	$0	$0	$0	$0	7.0%	$0
20	$0	$0	$0	$0	7.0%	$0
21	$0	$0	$0	$0	7.0%	$0
22	$0	$0	$0	$0	7.0%	$0
23	$0	$0	$0	$0	7.0%	$0
24	$0	$0	$0	$0	7.0%	$0
25	$0	$0	$0	$0	7.0%	$0
26	$0	$0	$0	$0	7.0%	$0
27	$0	$0	$0	$0	7.0%	$0
28	$0	$0	$0	$0	7.0%	$0
29	$0	$0	$0	$0	7.0%	$0
30	$0	$0	$0	$0	7.0%	$0
TOTAL	**$4,449,000**					**$4,449,000**
					PV O&M	$0

Notes:
[1] Discount rate of 7% per EPA 540-R-00-002, OSWER 9355.0-75, July 2000, p. 4-5.
[2] O&M = operations and maintenance

APPENDIX B-8B
CAPITAL COSTS
ALTERNATIVE 3 - REMOVAL WITH OFF-SITE DISPOSAL
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
1.0	**Pre-design Investigations**					
1.01	Soil and Sediment Sampling Pre-design Investigation (PDI)	LS	$ 147,084.08	1	$ 147,084	Engineer estimate
	Subtotal				**$ 147,084**	
2.0	**Mobilization/Demobilization**					
2.01	Construction Equipment Mobilization/Demobilization	LS	$ 12,625.76	1	$ 12,626	Means 2025, 01 54 36 50 1400
2.02	Field Support Equipment Mobilization/Demobilization	LS	$ 7,200.00	1	$ 7,200	Vendor Quote + 5% inflation.
2.03	Field Support (Equipment, Oversight, Staff)	MONTH	$ 86,433.61	6	$ 518,602	Means 2025, 01 52 13 20 0450 - trailer Means 2025, 01 52 13 20 1250 - conex (storage box) Means 2025, 01 54 33 40 6420 - toilet Means 2025, 02 41 19 19 0725 - rolloff Means 2025, 01 54 33 40 7660 - portable water tank
2.04	Field Equipment Procurement/Planning	LS	$ 22,200.00	1	$ 22,200	Engineer estimate
2.05	Field Equipment Mobilization/Demobilization Staff Oversight	LS	$ 9,650.00	1	$ 9,650	Engineer estimate
2.06	Initial Mob/Demob Temporary Dewatering System	EA	$ 8,323.26	2	$ 16,647	Vendor Quote
	Subtotal				**$ 586,924**	
3.0	**Site Preparation and Erosion Control**					
3.01	Site Bridge Construction	LS	$ 51,956.90	1	$ 51,957	Means 2024, 10 88 05 10 1550 (12' bridge) and 10 88 05 10 1600 (40' bridge). Extrapolated between the 2 lengths
3.02	Preconstruction Surveys	ACRE	$ 3,716.79	5.27	$ 19,602	Means 2025, 02 21 13 09 0100
3.03	Temporary Fence	LF	$ 28.58	2,024.0	$ 57,846	Means 2025, 32 31 13 25 0100
3.04	Temporary Signage	EA	$ 31.54	40.48	$ 1,277	Means 2025, 10 14 53 20 2350
3.05	Clear and Grub	ACRE	$ 7,162.68	5.16	$ 36,933	Means 2025, 31 11 10 10 0200
3.06	Construct Equipment Staging/Soil Stockpile Area(s)	EA	$ 39,259.51	1	$ 39,260	Means 2025, 31 25 14 16 1000 & 1250 ; Grainger 2021 (plastic sheeting)
3.07	Temporary Haul and Access Road	SY	$ 7.41	6,210	$ 46,016	Means 2025, 01 55 23 50 0050
3.08	Construction/Swamp Mats	EA	$ 2,000.00	5	$ 10,000	Engineer and SumCo Eco-Contracting Estimate
3.09	Private Utility Locating	LS	$ 41,202.00	1	$ 41,202	Vendor quote
3.10	Decontamination Pad	EA	$ 8,225.22	1	$ 8,225	Means 2025, 32 11 23 23 0100 (base); Means 2025 HC, 31 22 16 10 3100 (grading); Grainger 2022 on-line.
3.11	Install Erosion and Sedimentation Controls	LF	$ 13.21	4,802	$ 63,434	Means 2025, 31 25 14 16 1000 & 1250
3.12	Arbuckle Creek Temporary By-Pass Pumping System	LS	$ 90,000.00	1	$ 90,000	Engineer estimate
	Subtotal				**$ 465,751**	

APPENDIX B-8B
CAPITAL COSTS
ALTERNATIVE 3 - REMOVAL WITH OFF-SITE DISPOSAL
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
4.0	**Mechanical Excavation**					
4.01	Excavate Contaminated Soil/Sediment	CY	$ 2.65	8,287	$ 21,960	Means 2025, 31 23 16 42 0200
4.02	Confirmation Samples for Impacted Excavation Areas	EA	$ 1,000.50	176	$ 176,161	Pace 2025 MOA and quote
4.03	Sample Shipment	EA	$ 250.00	5.9	$ 1,467	FedEx, Engineer estimate
4.04	Air/Dust Control Monitoring- Dust Monitor Rental	MONTH	$ 3,913.20	2.3	$ 9,147	US Environmental MOA 2025
4.05	Water Tank Trailer Rental	DAY	$ 186.00	47	$ 8,696	Means 2025, 01 54 33 40 6900. 500 gallons for dust suppression.
4.06	Light Equipment Operator for Misting and Dust Monitoring Perimeter	DAY	$ 393.30	47	$ 18,387	Means 2025, 13 11 32 00 1600
4.07	Load/Haul/Unload Excavated Sediment to Staging Area	CY	$ 2.94	8,287	$ 24,363	Means 2025, 31 23 23 20 3014
4.08	Amending Wet Sediment	TON	$ 3.60	234.7	$ 845	Engineer estimate
4.09	Stockpile Management & Temp Cover of Excavated Waste	DAY	$ 1,143.97	47	$ 53,482	Means 2025, 13 11 32 00 1600 (laborers), 01 54 33 20 0460 (Loader and Operator)
4.10	Temporary dewatering and treatment system equipment rental	DAY	$ 416.32	47	$ 19,463	Means 2025, 31 23 19 20 0650
4.11	Perimeter Air Sampling	DAY	$ 194.69	47	$ 9,102	Pace 2025 MOA, US Env. 2025 MOA, FedEx estimating
4.12	Equipment Decontamination (30 min per 16cy truck)	DAY	$ 1,230.34	47	$ 57,520	Means 2025, 01 54 33 40 5450 (pressure washer); Means Crew - Laborer.
4.13	Sampling Frac Tanks	EA	$ 1,492.70	4	$ 5,971	Pace 2025 MOA
4.14	Removal of Non-TSCA Water	GAL	$ 0.99	80,000	$ 79,200	Vendor quote +5% for inflation
	Subtotal				**$ 485,765**	
5.0	**Disposal of Sediment**					
5.01	Stockpile Characterization Sampling	EA	$ 1,619.70	21	$ 33,555	Pace MOA 2025
5.02	Sample Shipment	EA	$ 250.00	13	$ 3,366	FedEx, Engineer estimate
5.03	Load Stockpile to trucks	CY	$ 5.70	8,287	$ 47,234	Means 2025, 31 23 16 42 0310
5.04	T&D of Non-TSCA Soil	TON	$ 125.00	9,375	$ 1,171,885	Vendor Quote (Clean Harbors, 2023)
5.05	T&D of TSCA Soil	TON	$ 550.00	22	$ 12,100	Vendor Quote (Clean Harbors, 2023)
	Subtotal				**$ 1,268,140**	

APPENDIX B-8B
CAPITAL COSTS
ALTERNATIVE 3 - REMOVAL WITH OFF-SITE DISPOSAL
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
6.0	**Backfill and Site Restoration**					
6.01	Backfill - Material and placement	CY	$3.89	8,287	$ 32,235	Means 2025 31 23 23 14 2420
6.02	Clean Borrow Source Sampling	EA	$1,619.70	21	$ 33,555	Pace MOA 2025 and quote
6.03	Land restoration	ACRE	$30,500.00	2.66	$ 81,049	Vendor Quote [SumCo Eco-Contracting]
6.04	Wetland Restoration	ACRE	$125,000.00	0.62901	$ 78,627	Vendor Quote [SumCo Eco-Contracting]
	Subtotal				**$ 225,466**	
7.0	**Site Closeout**					
7.01	Site Cleanup	LS	$ 10,800.00	1	$ 10,800	Engineer estimate
7.02	As-Built Surveys	ACRE	$ 3,716.79	2.8	$ 10,356	Means 2025, 02 21 13 09 0100
	Subtotal				**$ 21,156**	
TOTAL DIRECT COSTS					**$ 3,200,287**	
8.0	**Other Costs (% is dependant on Total Direct Costs)**					
8.01	Project Management (5% of direct costs)				$ 160,014	OSWER 9355.0-75
8.02	Engineering and Design (8% of direct costs)				$ 256,023	OSWER 9355.0-75
8.03	Construction Management (6% of direct costs)				$ 192,017	OSWER 9355.0-75
8.04	Contingency (Scope 10%, Bid 10%)				$ 640,057	OSWER 9355.0-75
TOTAL OTHER COSTS					**$ 1,248,112**	
TOTAL CAPITAL COST FOR ALT-3					**$ 4,449,000**	

APPENDIX B-8C
OPERATION AND MAINTENANCE COSTS
ALTERNATIVE 3 - REMOVAL WITH OFF-SITE DISPOSAL
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST[1]	QUANTITY	TOTAL COST
OM.1.0	**Not Applicable**				
	Subtotal				**$ -**
	Project Management (5% of direct costs)				$ -
	Contingency (Scope 10%)				$ -
	Total				**$ -**
TOTAL DIRECT COSTS					**$ -**
TOTAL O&M FOR ALT-3					**$ -**

APPENDIX B-9A
PRESENT VALUE COSTS
ALTERNATIVE 4 - IN-SITU TREATMENT
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

Year	Capital	O&M[2]	5-Yr Review	Total	Discount Rate[1]	Present Value
0	$4,244,000	$62,230	$0	$4,306,230	7.0%	$4,306,230
1	$0	$82,091	$0	$82,091	7.0%	$76,720
2	$0	$82,091	$0	$82,091	7.0%	$71,701
3	$0	$82,091	$0	$82,091	7.0%	$67,011
4	$0	$82,091	$0	$82,091	7.0%	$62,627
5	$0	$82,091	$26,000	$108,091	7.0%	$77,067
6	$0	$19,861	$0	$19,861	7.0%	$13,234
7	$0	$19,861	$0	$19,861	7.0%	$12,368
8	$0	$19,861	$0	$19,861	7.0%	$11,559
9	$0	$19,861	$0	$19,861	7.0%	$10,803
10	$0	$82,091	$26,000	$108,091	7.0%	$54,948
11	$0	$19,861	$0	$19,861	7.0%	$9,436
12	$0	$19,861	$0	$19,861	7.0%	$8,818
13	$0	$19,861	$0	$19,861	7.0%	$8,241
14	$0	$19,861	$0	$19,861	7.0%	$7,702
15	$0	$82,091	$26,000	$108,091	7.0%	$39,177
16	$0	$19,861	$0	$19,861	7.0%	$6,727
17	$0	$19,861	$0	$19,861	7.0%	$6,287
18	$0	$19,861	$0	$19,861	7.0%	$5,876
19	$0	$19,861	$0	$19,861	7.0%	$5,492
20	$0	$82,091	$26,000	$108,091	7.0%	$27,933
21	$0	$19,861	$0	$19,861	7.0%	$4,797
22	$0	$19,861	$0	$19,861	7.0%	$4,483
23	$0	$19,861	$0	$19,861	7.0%	$4,190
24	$0	$19,861	$0	$19,861	7.0%	$3,915
25	$0	$82,091	$26,000	$108,091	7.0%	$19,916
26	$0	$19,861	$0	$19,861	7.0%	$3,420
27	$0	$19,861	$0	$19,861	7.0%	$3,196
28	$0	$19,861	$0	$19,861	7.0%	$2,987
29	$0	$19,861	$0	$19,861	7.0%	$2,792
30	$0	$82,091	$26,000	$108,091	7.0%	$14,200
TOTAL	**$4,244,000**					**$4,954,000**
					PV O&M	$710,000

Notes:
[1] Discount rate of 7% per EPA 540-R-00-002, OSWER 9355.0-75, July 2000, p. 4-5.
[2] O&M = operations and maintenance

APPENDIX B-9B
CAPITAL COSTS
ALTERNATIVE 4 - IN-SITU TREATMENT
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
1.0	**Pre-design Investigations**					
1.01	Soil and Sediment Sampling Pre-design Investigation (PDI)	LS	$ 147,084.08	1	$ 147,084	Engineer estimate
1.02	Treatment PDI	LS	$ 215,000.00	1	$ 215,000	Vendor Estimate
	Subtotal				**$ 362,084**	
2.0	**Mobilization Demobilization**					
2.01	Construction Equipment Mobilization/Demobilization	LS	$12,625.76	1	$ 12,626	Means 2025, 01 54 36 50 1400
2.02	Field Support Equipment Mobilization/Demobilization	LS	$7,200.00	1	$ 7,200	Vendor Quote + 5% inflation.
2.03	Field Support (Equipment, Oversight, Staff)	MONTH	$86,433.61	4	$ 345,734	Means 2025, 01 52 13 20 0450 - trailer Means 2025, 01 52 13 20 1250 - conex (storage box) Means 2025, 01 54 33 40 6420 - toilet Means 2025, 02 41 19 19 0725 - rolloff Means 2025, 01 54 33 40 7660 - portable water tank
2.04	Field Equipment Procurement/Planning	LS	$ 22,200.00	1	$ 22,200	Engineer estimate
2.05	Field Equipment Mobilization/Demobilization Staff Oversight	LS	$ 9,650.00	1	$ 9,650	Engineer estimate
2.06	SediMite Materials Mobilization, Demobilization, and Staging	LS	$ 221,476.00	1	$ 221,476	Vendor Quote
	Subtotal				**$ 618,886**	
3.0	**Site Preparation and Erosion Control**					
3.01	Site Bridge Construction	LS	$ 51,956.90	1	$ 51,957	Means 2024, 10 88 05 10 1550 (12' bridge) and 10 88 05 10 1600 (40' bridge). Extrapolated between the 2 lengths
3.02	Preconstruction Surveys	ACRE	$ 3,716.79	5.27	$ 19,602	Means 2025, 02 21 13 09 0100
3.03	Temporary Fence	LF	$ 28.58	450.0	$ 12,861	Means 2025, 32 31 13 25 0100
3.04	Temporary Signage	EA	$ 31.54	9	$ 284	Means 2025, 10 14 53 20 2350
3.05	Clear and Grub	ACRE	$ 7,162.68	2.92	$ 20,906	Means 2025, 31 11 10 10 0200
3.06	Temporary Haul and Access Road	SY	$ 7.41	6,210.0	$ 46,016	Means 2025, 01 55 23 50 0050

APPENDIX B-9B
CAPITAL COSTS
ALTERNATIVE 4 - IN-SITU TREATMENT
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
3.07	Construction/Swamp Mats	EA	$ 2,000.00	5	$ 10,000	Engineer and SumCo Eco-Contracting Estimate
3.08	Private Utility Locating	LS	$ 41,202.00	1	$ 41,202	Vendor quote
3.09	Decontamination Pad	EA	$ 8,225.22	1	$ 8,225	Means 2025, 32 11 23 23 0100 (base); Means 2025 HC, 31 22 16 10 3100 (grading); Grainger 2022 on-line.
3.10	Install Erosion and Sedimentation Controls	LF	$ 13.21	4,802	$ 63,434	Means 2025, 31 25 14 16 1000 & 1250
3.11	Arbuckle Creek Temporary By-Pass Pumping System	LS	$ 90,000.00	1	$ 90,000	Engineer estimate
	Subtotal				**$ 364,487**	
4.0	**Intrusive Activities**					
4.01	Air/Dust Control Monitoring- Dust Monitor Rental	MONTH	$ 3,913.20	0.45	$ 1,761	
4.02	Water Tank Trailer Rental	DAY	$ 186.00	9	$ 1,674	
4.03	Light Equipment Operator for Misting and Dust Monitoring Perimeter	DAY	$ 393.30	9	$ 3,540	
	Subtotal				**$ 6,975**	
5.0	**In-Situ Treatment and Site Restoration**					
5.01	Hi-Cellulose SediMiteTM Material and Placement	ACRE	$ 108,500.00	2.8	$ 302,322	Vendor Quote
5.02	Hi-Cellulose SediMiteTM Per Diem Application	DAY	$ 27,102.00	4.0	$ 108,408	Vendor Quote
5.03	RemBAC PCB Degraders Material	ACRE	$ 65,500.00	0.606	$ 39,697	Vendor Quote
5.04	RemBAC PCB Degraders Per Diem Application	DAY	$ 45,942.00	1.00	$ 45,942	Vendor Quote
5.05	Habitat/Soil Cover Layer Material and Placement	ACRE	$ 42,504.00	2.8	$ 118,432	Vendor Quote
5.06	Habitat/Soil Cover Layer Per Diem Application	DAY	$ 47,800.00	4	$ 191,200	Vendor Quote
5.07	Land restoration	ACRE	$ 30,500.00	2.66	$ 81,049	Vendor Quote [SumCo Eco-Contracting]
5.08	Wetland Restoration	ACRE	$ 125,000.00	0.62901	$ 78,627	Vendor Quote [SumCo Eco-Contracting]

APPENDIX B-9B
CAPITAL COSTS
ALTERNATIVE 4 - IN-SITU TREATMENT
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

DESCRIPTION		UNIT	UNIT COST	QUANTITY	TOTAL COST	SOURCE
5.09	Install Permanent Fence Engineering Control	LF	$ 28.58	4,802	$ 137,241	Means 2025, 32 31 13 25 0100
5.10	Install Permanent Signage Engineering Control	EA	$ 31.54	24	$ 757	Means 2025, 10 14 53 20 2350
	Subtotal				**$ 1,103,675**	
6.0	**Institutional Controls**					
6.01	Institutional Controls	LS	$ 22,200.00	1	$ 22,200	
	Subtotal				**$ 22,200**	
7.0	**Site Closeout**					
7.01	Site Cleanup	LS	$ 10,800.00	1	$ 10,800	
7.02	As-Built Surveys	ACRE	$ 3,716.79	2.8	$ 10,356	
	Subtotal				**$ 21,156**	
8.0	**Flood Storage Mitigation/Stormwater Management**					
8.01	Flood Storage Mitigation Costs	ACRE	$ 200,000.00	2.77	$ 553,602	Best Management Practices (BMPs) in Urban Watersheds, EPA/600/R-04/184, 2004, Engineer Estimate
	Subtotal				**$ 553,602**	
TOTAL DIRECT COSTS					**$ 3,053,066**	
9.0	**Other Costs (% is dependant on Total Direct Costs)**					
9.01	Project Management (5% of direct costs)				$ 152,653	
9.02	Engineering and Design (8% of direct costs)				$ 244,245	
9.03	Construction Management (6% of direct costs)				$ 183,184	
9.04	Contingency (Scope 10%, Bid 10%)				$ 610,613	
TOTAL OTHER COSTS					**$ 1,190,696**	
TOTAL CAPITAL COST FOR ALT-4					**$ 4,244,000**	

APPENDIX B-9C
OPERATION AND MAINTENANCE COSTS
ALTERNATIVE 4 - IN-SITU TREATMENT
SHAFFER EQUIPMENT/ARBUCKLE CREEK AREA SUPERFUND SITE
MINDEN, WEST VIRGINIA

	DESCRIPTION	UNIT	UNIT COST[1]	QUANTITY	TOTAL COST
OM 1.0	**Site Inspections (annual)**				
OM 1.01	Site Inspections	LS	$ 2,800.00	1	$ 2,800
OM 1.02	Land revegetation (1% per year)	ACRE	$ 30,500.00	0.0266	$ 810
OM 1.03	Wetlands revegetation (1% per year)	ACRE	$ 125,000.00	0.0063	$ 786
OM 1.04	Fence Repair & Signage Repair (1% per year)	LF	$ 28.58	48.02	$ 1,372
OM 1.05	Annual O&M Report	LS	$ 10,000.00	1.00	$ 10,000
	Subtotal				**$ 15,770**
	Project Management (5% of direct costs)				$ 789
	Contingency (Scope 10%)				$ 1,577
	Total				**$ 18,136**
OM 2.0	**Long Term Monitoring (initial conditions; annually first 5 years; every 5 years after that)**				
OM 2.01	Surface Water and Sediment Sampling Labor	LS	$ 14,060.00	1	$ 14,060
OM 2.02	Surface Water and Sediment Sampling Equipment	LS	$ 2,477.00	1	$ 2,477
OM 2.03	Surface Water and Sediment Sampling Bottleware (PCBs and Dioxins)	LS	$ 389.89	1	$ 390
OM 2.04	Surface Water and Sediment Sampling Analytical Costs	LS	$ 24,679.00	1	$ 24,679
OM 2.05	Surface Water and Sediment Sampling Shipment	EA	$ 250.00	20	$ 5,000
OM 2.06	Data Validation/Reporting	LS	$ 7,507.50	1	$ 7,508
	Subtotal				**$ 54,113**
	Project Management (5% of direct costs)				$ 2,706
	Contingency (Scope 10%)				$ 5,411
	Total				**$ 62,230**
OM 3.0	**Deed Restrictions/ Institutional Controls (annual)**				
OM 3.01	Deed Restriction Reporting	LS	$ 1,500.00	1	$ 1,500
	Subtotal				**$ 1,500**
	Project Management (5% of direct costs)				$ 75
	Contingency (Scope 10%)				$ 150
	Total				**$ 1,725**
OM 4.0	**Five-Year Reviews**				
OM 4.01	Inspection	LS	$ 13,000.00	1	$ 13,000
OM 4.02	Periodic Inspection Report	LS	$ 13,000.00	1	$ 13,000
	Subtotal				**$ 26,000**
TOTAL DIRECT COSTS					**$ 97,383**
TOTAL O&M FOR ALT-4					**$ 108,091**