Final

Shelby Horizons AOC Remedial Investigation

Former Wilkins Air Force Station FUDS Property Number G05OH0972

Prepared for

U.S. Army Corps of Engineers

November 2011

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Executive Summary

The remedial investigation (RI) presented in this report was conducted to assess the nature and extent of impacts to environmental media resulting from former Department of Defense (DoD) activities at the former Wilkins Air Force Station (AFS) Shelby Horizons Area of Concern (AOC) in Shelby, Ohio (site). This RI report is a continuation of the effort begun with the preliminary assessment (PA) and site inspection (SI) of the Shelby Horizons AOC conducted in 2000-2001 by Plexus Scientific Corporation (Plexus). This RI report documents the RI field activities and evaluates the analytical data obtained during both the SI and RI, and presents risk assessments completed to evaluate the risk to human health and the environment associated with site contamination. The primary objective of this RI is to gather information needed to support a decision regarding the need for further action, if any, at the site.

The former Wilkins AFS is a formerly used defense site (FUDS) property located north of Shelby, Ohio, in Richland County. Wilkins AFS was acquired by the U.S. Air Force in 1943 and used as a storage depot until 1961. Currently, an industrial complex and an educational facility occupy the property which is zoned heavy industrial. The Shelby Horizons AOC is an open area now covered with grass or gravel and is used as a parking area for semi-tractor trailers.

During the SI effort, the identification of the geophysical anomalies as possible disposal areas redefined the extent of the Shelby Horizons AOC. A large and a small anomaly were identified. Surface (0 to 0.8 foot below ground surface [bgs]) and subsurface (2 to 4 feet bgs) soil sampling was conducted within the large anomaly. In addition, a soil mercury vapor survey also delineated a small area, less than 800 square feet (ft^2), with detectable levels of mercury vapor contamination at the southern end of the large anomaly.

During the RI surface soil (0 to 0.5 foot bgs) and drainage ditch surface soil samples (0 to 0.5 foot bgs) were collected in and around the anomalies. The RI and SI drainage ditch surface soil, surface soil, and shallow subsurface soil data were evaluated against the December 2009 U.S. Environmental Protection Agency (USEPA) industrial soil screening levels. Although the most reasonable foreseeable future use of the property is industrial, the data also were compared to residential screening levels to assess the potential for unrestricted use.

Concentrations of arsenic exceeded the industrial soil screening levels (1.6 milligrams per kilogram [mg/kg]) at all drainage ditch surface soil, surface soil, and subsurface soil sampling locations. Benzo(a)pyrene was the only polynuclear aromatic hydrocarbon (PAH) detected above industrial soil screening levels. It was detected above industrial soil screening criteria (0.21 mg/kg) in 5 of 19 surface soil sampling locations and in 1 of 5 subsurface soil sampling locations. Benzo(a)pyrene was not detected above the industrial soil screening level in drainage ditch surface soil samples collected from the site drainage ditch.

Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) were not detected above industrial soil screening levels.

No potential source of arsenic associated with historic DoD activities was identified in previous studies and levels of arsenic detected during the RI may be representative of naturally occurring arsenic in soils which can vary significantly in Ohio (Ohio Environmental Protection Agency [Ohio EPA] 2009). The most probable source of benzo(a)pyrene is runoff from the parking area and the occasional use of the AOC as a parking area since Wilkins AFS was closed in 1961, as depicted on aerial photographs.

Three monitoring wells (MW-11, MW-12 and MW-13) were installed around the anomalies and sampled for four quarters between November 2008 and July 2009. The RI groundwater samples were screened against the USEPA maximum contaminant level (MCL). If no MCL exists for a constituent, the December 2009 USEPA tap water screening levels were used. The analytical results of the groundwater samples indicated levels of arsenic (MW-13) and antimony (in MW-12) in excess of MCLs. Organic compounds (PAHs, SVOCs, or VOCs) detected in groundwater did not exceed the applicable USEPA MCLs or tap water screening levels.

A landfill gas survey was completed during the RI in October 2008 along the property fence line north, west, and south of the anomalies. Elevated readings of methane were not observed at the property edge in the upper 2 feet of soil. During the July 2009 groundwater sampling event, elevated levels of methane were detected in the well casings at MW-11 and MW-13 indicating methane had accumulated in the well casings. The detection of methane in the monitoring well casing indicates the presence of methane in the water bearing zone screened by the monitoring wells, but is not necessarily representative of methane in the AOC and in the soil gas around the AOC.

A mercury vapor survey measuring the upper 6 inches of soil vapor was conducted in the large anomaly during the SI activities in August 2000. Mercury vapor was not detected across the northern and central sections of the large anomaly, but was detected in an approximately 800 ft^2 area at the southern end of the large anomaly. These detections were above the December 2009 industrial air criteria of 0.0013 milligram per cubic meter (mg/m^3). Mercury was not detected above the residential soil regional screening level (RSL) in the surface soil (0 to 0.5 inch bgs) or subsurface soil (2 to 3 feet bgs) samples collected near this location during the SI and RI.

A conceptual site model (CSM), developed based on data obtained during the RI and SI sampling efforts, indicates the water table at Shelby Horizons generally occurs at approximately 8 feet bgs and flows in a westerly direction at the Shelby Horizons AOC, following topography, though regional groundwater flow is to the north-northeast. The CSM was further developed to describe the constituent fate and transport, based on potential migration routes and constituent persistence and mobility. Potential migration routes at the Shelby Horizons AOC include groundwater, surface water, and overland migration of dissolved or adsorbed constituents, lateral or vertical migration of gases, and atmospheric migration through particulate or volatile (gaseous) emissions. Potential migration processes affecting site constituents include adsorption, volatilization, dissolution

and precipitation, advection and dispersion, and diffusion, though only the first three are likely to represent significant mechanisms of migration.

A baseline human health risk assessment (HHRA) was conducted to assess current and future health risks associated with exposure to site soil and groundwater under current and potential future site land use. For current land use, the site does not pose unacceptable health risks to the receptors evaluated in this HHRA. Contact with surface soil by industrial workers and trespassers/visitors (adult and youth) would result in noncarcinogenic hazards and carcinogenic risks below or within USEPA target levels for cumulative cancer risks (cancer risk range of $1x10^{-6}$ to $1x10^{-4}$) and noncancer hazards (hazard indices less than or equal to one). For the hypothetical future land use scenario that involves construction at the site, contact with total soil (combined surface and subsurface soil) and groundwater by future construction workers would result in risks and hazards within or below USEPA's acceptable risk range and hazard level.

For residential land use, potential contact with surface soil and total soil (combined surface and subsurface soil) by future residents (child and lifetime) could result in risks and hazards above USEPA's acceptable risk range and hazard level. The risk characterization presented in this assessment provides upper-bound risks for the residential scenario exposure to soil, though residential is not a current or foreseeable future land use. The upper bound risks for the residential scenario do not provide the risk characterization for current or likely future land use.

The ecological risk assessment (ERA) was performed to evaluate the actual or potential ecological effects from exposures to the site. This multi-pathway analysis was based on reasonable, protective assumptions about the potential for ecological receptors (lower trophic and upper trophic terrestrial and aquatic receptors) that could be exposed and be adversely affected by exposure to constituents of potential ecological concern (COPECs).

Potential ecological risks were identified with respect to lower trophic and upper trophic terrestrial receptors within the site. Based on refinements to COPECs identified within the site, it is unlikely that lower trophic level receptors are at risk. Potential ecological risks for upper trophic level receptors via exposure to thallium (all six receptors) may still be present. However, unacceptable risks to local populations of upper trophic level receptors are unlikely based on the assumption used in the ERA that all receptors spend 100 percent of their time at the site, which is unlikely because of the small size of the site. Based on the ERA, it is concluded that the site does not pose unacceptable risk to ecological receptors.

Based on the sampling conducted during the SI and RI and the HHRA, constituent levels do not pose an unacceptable risk to human health. Based on the ERA, the site does not pose an unacceptable risk to ecological receptors.

Although no unacceptable risks to human health or the environment were identified during this remedial investigation, further investigation of the methane gas is recommended to determine representative levels in the subsurface materials in the vicinity of the AOC. In addition, further assessment of mercury vapor in the area of the AOC is recommended to confirm the previous findings of the SI.

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Abbreviations and Acronyms

µg/L	microgram per liter
ABS_{GI}	gastrointestinal absorption factors
ADR	Automated Data Review
AFS	Air Force Station
amsl	above mean sea level
AOC	area of concern
AT	averaging time
AUF	area use factor
β-BHC	beta-hexachlorocyclohexane
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BW	body weight
bw/d	body weight per day
C	constituent concentration at exposure point
CA	constituent concentration in air
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	conversion factor
cm^2	square centimeter
COIP	Central Ohio Industrial Park, Inc.
COPC	constituent of potential concern
COPEC	constituent of potential ecological concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
CR	contact rate
CS	constituent concentration in soil

CSF	cancer slope factor
CSF_d	dermal cancer slope factor
CSM	conceptual site model
DABS	dermal absorption factor
DAD	dermal absorbed dose
DA_{event}	dermally absorbed dose per event
DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethylene
DDT	dichlorodiphenyl trichloroethane
DI_x	dietary intake for constituent x
DO	dissolved oxygen
DoD	Department of Defense
DW	dry weight
EC_{20}	effects concentration for 20 percent of the population
Eco-SSL	ecological soil screening level
ED	exposure duration
EDD	electronic data deliverable
EF	exposure frequency
ELCR	excess lifetime carcinogenic risk
EPC	exposure point concentration
ERA	ecological risk assessment
ESL	ecological screening level
EV	event frequency
FC_{xi}	concentration of constituent x in food item i
FIR	food ingestion rate
f_{oc}	fractional mass of organic carbon in soil
ft^2	square feet
FUDS	formerly used defense site
GCAL	Gulf Coast Analytical Laboratories
GSA	General Services Administration

HCH	hexachlorocyclohexane
HHRA	human health risk assessment
HI	hazard index
HMW	high molecular weight
HQ	hazard quotient
HSA	hollow stem auger
I	intake
ID	identification
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IRIS	Integrated Risk Information System
IR_{soil}	ingestion rate of soil
K_d	soil-water partition coefficient
K_{oc}	organic carbon content of the soil
K_{ow}s	low octanol-water partition coefficients
LC_{50}	concentration lethal to 50 percent of test population
LCG	Louisville Chemistry Guidance
LEL	lower explosive limit
LMW	low molecular weight
LOAEC	lowest observable adverse effect concentration
LOAEL	lowest adverse effect level
LOEC	lowest observed effect concentration
MATC	maximum allowable toxic concentration
MCL	maximum contaminant level
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/L	milligram per liter
mg/m^3	milligrams per cubic meter
mL/g	milliliters per gram

MS	matrix spike
MSD	matrix spike duplicate
mV	millivolts
NCDC	National Climate Data Center
NCEA	National Center for Environmental Assessment
NIH	National Institutes of Health
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NWI	National Wetlands Inventory
ODGS	Ohio Division of Geological Society
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
ORP	oxidation-reduction potential
OSWER	Office of Solid Waste and Emergency Response
PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCTC	Pioneer Career and Technology Center
PDF_i	proportion of diet composed of food item i
PDS	proportion of diet composed of soil
PEF	particulate emission factor
Plexus	Plexus Scientific Corporation
ppm	part per million
PPRTV	Provisional Peer Reviewed Toxicity Value
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control

RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RfD_d	dermal reference dose
RI	remedial investigation
RME	reasonable maximum exposure
RSL	regional screening level
SA	skin surface area available for contact
SC_x	concentration of constituent x in soil
SERA	screening ecological risk assessment
SI	site inspection
site	former Wilkins Air Force Station Shelby Horizons Area of Concern, Shelby, Ohio
SOP	standard operating procedure
SSAF	soil to skin adherence factor
SVOC	semivolatile organic compound
TAL	target analyte list
TRV	toxicity reference value
UCL	upper confidence limit
URF	unit risk factor
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VF	volatilization factor
VOC	volatile organic compound

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SECTION 1

Introduction

CH2M HILL has been contracted by the United States Army Corps of Engineers (USACE), Louisville District, under Contract Number W912QR-04-D-0020, Delivery Order 0023, to perform a remedial investigation (RI) at the Shelby Horizons Area of Concern (AOC) (site). The site is located on the former Wilkins Air Force Station (AFS), Formerly Used Defense Site (FUDS) Property Number G05OH0972. Environmental response actions at FUDS conform to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The RI is being conducted to assess the nature and extent of impacts to environmental media resulting from former Department of Defense (DoD) activities at the AFS. This RI report documents the RI field activities performed in 2008 and 2009 and evaluates the analytical data obtained, including a human health and ecological risk assessment (HHRA and ERA, respectively).

1.1 Purpose of RI

The primary objective of this RI was to gather information needed to support a decision if further action is needed at the site. A preliminary assessment (PA) of the former Wilkins AFS and site inspection (SI) of the Shelby Horizons AOC (Figure 1-2) were conducted in 2000 and 2001 by Plexus Scientific Corporation (Plexus 2000, 2001). Before the start of the PA, the Ohio Environmental Protection Agency (Ohio EPA) identified the Shelby Horizons as a high-priority AOC. At the same time, a separate area of concern on the former Wilkins AFS was identified by Ohio EPA, the Pioneer AOC. The Pioneer AOC is approximately 250 feet south of the Shelby Horizons AOC. The field data collected during the PA and SI investigation activities at the Pioneer AOC in 2001 and 2002 was used to support the discussion of the physical characteristics of the site, and the background wells installed during the subsequent RI at Pioneer AOC were used to support the discussion of contaminant nature and extent.

The results herein support an evaluation of the nature and extent of site-related constituents, and a baseline HHRA and a screening-level ERA. These evaluations are based on the site's current use and zoning of the land as heavy industrial. Future land use is anticipated to remain industrial. Residential screening levels, applicable to properties zoned for residential use, are presented herein for informational purposes only. The data evaluations and risk assessments based on industrial land use were used to evaluate potential follow-up actions, and ultimately support development and evaluation of remedial alternatives.

The major components of the site characterization process are briefly described below:

- Scoping—Initial planning phase of the RI, which includes the PA and SI. These phases were completed from 2000 to 2001 and are documented in the *Preliminary Assessment* and *Site Investigation* (Plexus 2000, 2001).

- Field investigation—Methods conducted as established in the scoping process to meet project data needs. The RI field investigation methods are discussed in Section 3 of this report.
- Site characterization—Evaluates data and defines the nature and extent of contamination. Data from the SI and RI are discussed in Section 4 of this report.
- Risk assessment—Develops the baseline risk assessment to provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action for current and reasonable future industrial land use, and provides additional information on the risk for hypothetical residential use.
- Draft RI report—Produced for review by supporting agency, and provides documentation of data collection and analysis in support of a feasibility study.

The data quality objectives for the site characterization were presented in the *Shelby Horizons AOC Remedial Investigation Work Plan* (CH2M HILL 2008) and are summarized below:

- Perform surface soil sampling at the geophysical anomalies to characterize surface soil for the presence of constituents that may pose an unacceptable risk to human and ecological receptors
- Perform surface soil sampling topographically downgradient of the large geophysical anomaly to evaluate potential runoff of constituents from the anomaly
- Perform surface soil sampling in the drainage ditch to evaluate potential runoff from the large geophysical anomalies
- Monitor landfill gas to determine if either of the two geophysical anomalies observed at the site is producing explosive gases
- Perform groundwater sampling to characterize potential site-related constituents that may be present in groundwater at the AOC

1.2 Site Background

1.2.1 Site Description

The former Wilkins AFS is a FUDS located at the north end of the city of Shelby, Ohio, in Richland County (Figure 1-1). The geographic coordinates of Wilkins AFS are 40 degrees 54 minutes 06 seconds north latitude and 82 degrees 40 minutes 10 seconds west longitude (USGS, 1960a). Wilkins AFS consisted of 486 acres; it was acquired by the U.S. Air Force in 1943 and used as a storage depot. Currently, it is an industrial complex and an educational facility. The former Wilkins AFS is zoned as heavy industrial and is located inside the Shelby city limits (Figure 1-2).

The Shelby Horizons AOC is along the northwestern border of the former Wilkins AFS (Figure 1-3). The geographic coordinates of the Shelby Horizons AOC are 40 degrees 54 minutes 15 seconds north latitude and 82 degrees 40 minutes 32 seconds west longitude. In 2000, a geophysical survey identified two anomalies as possible disposal areas within the Shelby Horizons property. These two geophysical anomalies define the boundaries of the

Shelby Horizons AOC. The anomalies measure approximately 360 feet by 120 feet (Figure 1-4).

The Shelby Horizons AOC is an open, level area on the western end of the Shelby Horizons property. The area is mainly a maintained grassy area with a portion of the property containing a gravel-covered semi-tractor trailer parking area/road, which was constructed by removing 10 inches of soil and replacing it with 10 inches of gravel. This U-shaped gravel road/parking area is depicted on Figure 1-4 as the gravel road. Semi-tractor trailers generally use the northern and western portion of the road for parking. Semi-trailers are typically parked in the grass adjacent to and on top of the AOC where surface and subsurface soil samples were collected. A shallow ditch has also been cut along the south and west of the area to facilitate drainage of rainwater runoff, which drains east toward the western end of the Shelby Horizons building, and likely continues north and enters a north-flowing tributary of Marsh Run (Figure 1-3) (Plexus 2001; Corrigan et al. 2000). Marsh Run is an east-west trending creek that flows in a generally northeast direction for approximately 2 miles before discharging to the Black Fork Mohican River (Figure 1-3).

1.2.2 Site History

Wilkins AFS

Wilkins AFS was built from 1943 to 1944 on 344 acres, later expanded to 486 acres, and included 77 acres of warehouse space and 29 acres used for outdoor storage. The U.S. Air Force activated the 27th Army Air Forces Supply Depot in May 1943. The U.S. Government used this facility to store medical supplies, airplane parts, clothing, rations, and vehicle parts and supplies. As a supply depot, the primary features of the facility were multiple aboveground storage warehouses where various items such as aircraft parts, vehicles, equipment, and clothing were stored, maintained, and redistributed to other areas as needed. Maintenance, equipment repair, cleaning, and preservation of supplies occurred in service buildings to a more limited degree. Depots were designed, constructed, and operated in accordance with standardized military operations reflected in installation reports and technical manuals, and periodically inspected for compliance with military standards.

The planned closure of the former Wilkins AFS was announced on October 2, 1957. In June 1961, the former Wilkins AFS was transferred to the General Services Administration (GSA) to be put up for sale. The former AFS was sold to various businesses, local government entities, the Shelby County Board of Education, and individuals. Currently, the largest property owners are Central Ohio Industrial Park, Inc. (COIP); Shelby Horizons; Pioneer Career and Technology Center (PCTC); and the City of Shelby, Ohio. At the time of the facility closure, there were approximately 60 buildings onsite. Subsequently, several small buildings have been removed, and several others have been built (U.S. Geological Survey [USGS] 1960a). Currently, although some portions of the property are fenced, access is generally unrestricted (Corrigan et al. 2000).

Additional discussions of the facility operational history are presented in the PA and SI documents (Plexus 2000, 2001).

Shelby Horizons AOC

According to documentation presented in the September 2000 PA report (Plexus 2000), a local resident reported in interviews that as a young boy, he and others used metal detectors in the fields approximately 100 yards west of Building 31 (current Shelby Horizons AOC), uncovering various medals dating to World War II, small vials of mercury on several occasions, and what he believed to be full 55-gallon drums on one occasion during a 2- to 3-foot excavation. He did not know how many drums existed or what they contained (Plexus 2000). In 1999, to verify these claims, USACE conducted a site visit. No visible evidence of the reported burial was observed on the ground surface; however, medals have been found on the ground surface during subsequent site visits (USACE 2000).

Based on several interviews conducted in 2000 with a former depot/GSA employee, a disposal area reportedly was located near the perimeter patrol road. The area consisted of trenches about 12 feet wide, 4 to 5 feet deep, and about 40 feet long. Waste placed in the trenches consisted of rubbish, from former Wilkins AFS operations, that was crushed with a bulldozer before being covered with soil (Plexus 2000). Waste also was burned in this location for several years. The employee was not aware of any hazardous material being disposed of in this area (Viers 2000). Available aerial photographs between 1950 and 1995 indicate ground disturbance in the area in 1958 and trenching in 1959, much of which appears to have been filled or converted to other uses based on the 1964 through 1979 photographs (Plexus 2000). A detailed review of property-wide aerial photographs is included in the PA (Plexus 2000), and summarized in Section 1.2.3.

Recently, soil on portions of the site (along the current gravel road/parking area) was scraped and replaced with gravel to create a parking area for semi-tractor trailers, and a ditch has been cut along the south and west sides of the site to facilitate drainage (Corrigan et al. 2000). Ohio EPA conducted a site visit in June 2000 and observed numerous ampoules of possible medical materials in the drainage ditch on the south side of the site (Nabors 2000).

1.2.3 Previous Investigations

Two previous investigations have been conducted at the site. Plexus completed a PA of the site in September 2000 and the SI in March 2001.

Findings of the Preliminary Assessment (2000)

The PA included review of available file information, collection and analysis of historical aerial photographs, interviews with former employees, a comprehensive target survey, and a site reconnaissance. During the review of the historical aerial photographs from 1958, Plexus noticed “surficial scarring and possible trenching” in areas close to the AOC. Plexus determined that widespread scarring in photographs from 1959 was probably to improve drainage conditions and reported that, “No evidence of disposal activity is observed.” A photograph from 1964 appeared to show that the area had been capped with –”truck-sized loads of light-toned material.” The report did not cite any evidence of contamination, but did note that periodic flooding at the AOC “has the potential to transport contaminants (if present) to Marsh Run above the Shelby Water System intake” (Plexus 2000).

Findings of the Site Investigation (2001)

During the SI, soil sampling was conducted within the disturbed area that corresponds to the north-south oriented drainage trench seen in aerial photographs and may have been used for disposal based on interviews conducted during the PA. SI soil samples were collected from seven locations in and around the filled in drainage trench. Four surface and five subsurface samples were collected during the SI (Figure 1-5).

The SI found levels of polynuclear aromatic hydrocarbons (PAHs) and metals above the U.S. Environmental Protection Agency (USEPA) Region 9 preliminary remediation goals (PRGs) for both industrial and residential soil in surface and subsurface soil samples (Plexus 2001).

At the four surface soil locations, arsenic was detected above industrial PRGs at all four locations and benzo(a)pyrene was detected above industrial soil PRGs at two of the four locations.

In additional to these detections above industrial criteria, residential PRGs were exceeded for benzo(a)pyrene at one additional surface soil sample location and ideno(1,2,3-cd)pyrene was detected above residential criteria at one of the four surface soil locations.

At the five subsurface soil locations, arsenic was detected at above industrial soil PRGs at all five locations while only one subsurface location (SI-SB-09) had additional detections of lead, benzo(a)pyrene, benzo(b)fluoranthracene, and dibenzo(a,h)anthracene above industrial PRGs.

In addition to these detections above industrial criteria, residential PRGs were exceeded for iron at all five subsurface soil locations and antimony, mercury, benzo(a)anthracene, and indeno(1,2,3-cd)pyrene were detected above residential criteria at one additional subsurface soil sample location (SI-SB-09).

The SI report concluded that the arsenic and iron levels found in surface and subsurface soil samples at the site may be characteristic of naturally occurring levels present in the soil of Ohio or because of disposal activities in the area (Plexus 2001). The PAH levels, according to the SI report, could be from fly ash or oil runoff from nearby roads and parking areas.

Following soil sampling, a geophysical survey identified two anomalies as possible disposal areas within the Shelby Horizons property, which resulted in redefining the boundaries of the Shelby Horizons AOC to match the extent of these anomalies (Figure 1-4). The larger anomaly is approximately one 22,000 square feet (ft^2) in area and is referred to as the "large anomaly"; the "smaller anomaly" is approximately 1,350 ft^2 in area (Plexus 2001).

A soil mercury vapor survey was also conducted as part of the SI in response to a report by a resident that small vials containing mercury were found at the site. During a subsequent site visit by Ohio EPA in June 2000, numerous vials, with an appearance similar to inoculation vials, were observed in the drainage ditch on the south side of the large anomaly (Nabors 2000). The mercury vapor survey was conducted on the large anomaly only using a Jerome 431 mercury vapor meter that was factory calibrated. The survey consisted of creating a 6-inch-deep hole in the soil and covering the hole with plastic to allow the vapors to collect and equilibrate. Daily normal changes in temperature and barometric pressure

influence soil gas emissions rates. Therefore, each sampling location was allowed to equilibrate for at least 24 hours before mercury vapor sample collection (Plexus 2001).

A geophysical grid was used to place the initial 26 sampling points at 20-foot intervals across the large anomaly. The sampling interval was selected to allow detection of any significant mercury impacted area while providing adequate coverage of the area in a reasonable period of time (Plexus 2001). Seven of the holes filled with water, preventing collection of vapors. Mercury vapor was detected in a single sample location (Point A) at the southern end of the large anomaly (Figure 1-5). After this detection, a sample transect of seven additional sampling points (Points 27 and B through G) was installed around this point at approximately 10-foot intervals. At each of the seven additional locations, low levels of mercury vapor were detected, though concentrations dropped between 70 and 80 percent with distance (for each 10 feet) from the Point A sample (Plexus 2001). Based on these results, the extent of mercury vapor contamination was delineated as an area less than 800 ft^2 near the southern portion of the large anomaly immediately south of the drainage ditch. The mercury vapor survey locations and the screening results for delineation in the southern area are presented on Figure 1-5 and discussed in further detail in Section 4.

In light of the PA and SI findings, it was determined that an evaluation of the nature and extent of site-related constituents in soil and groundwater, and the preparation of an HHRA and ERA were necessary to support a decision regarding the need for further action, if any, at the site. Therefore, an RI was conducted to support a conclusion regarding these objectives.

1.3 Report Organization

This RI report comprises nine sections, including the introduction:

- Section 2 provides general information on the site and its surrounding area, with focused subsections addressing the surface features and topography, meteorology and climate, surface water hydrology, geology, soils, hydrogeology, and demography and land use, and ecology.
- Section 3 summarizes the methods used in the field program for the site, including field sampling activities and methods, investigation-derived waste (IDW), and field changes.
- Section 4 presents the RI results and discusses the nature and extent of the contamination and identifies the site constituents of potential concern (COPCs).
- Section 5 assesses the fate and transport of constituents, discussing the constituent characteristics, potential routes of migration and constituent transport, and constituent persistence and migration.
- Section 6 discusses the baseline HHRA approach, and includes more detailed screening of the COPCs, an exposure assessment, a toxicity assessment, a risk characterization, an uncertainty assessment, the baseline HHRA results for the site considering both the current industrial and hypothetical residential uses, and development of a list of final COPCs.

- Section 7 discusses the ERA and includes a detailed screening of site COPCs, an exposure assessment, a toxicity assessment, a risk characterization, an uncertainty assessment, the ecological results for the site, and development of a list of final COPCs.
- Section 8 presents conclusions and recommendations based on the RI effort.
- Section 9 is a list of references used in preparing the RI report.

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SECTION 2

Physical Characteristics of Study Area

This section presents an overview of the physical characteristics of the site and surrounding area, including information on surface features and topography, meteorology and climate, surface water hydrology, regional and local geology, soils, hydrogeology, groundwater and land use, drinking water supplies, and ecology.

2.1 Surface Setting

The Shelby Horizons property is west of the intersection of Allison Drive and General Road, and west of Building 31 of the former Wilkins AFS property in Shelby City located in Richland County, Ohio (Figure 1-3). The Shelby Horizons AOC is on the western portion of the Shelby Horizons property (northwest corner of the former Wilkins AFS) and currently is used for semi-tractor trailer parking. The Shelby Horizons property is fenced and guarded.

The topography of the site and at the former Wilkins AFS is relatively flat, with gentle sloping to the northeast and northwest. Ditches have been cut at the site to facilitate surface drainage. Ground surface elevations at the former Wilkins AFS range from 1,075 to 1,100 feet above mean sea level (amsl), with the highest point located in the southwest corner of the property (Figure 1-3) (USGS 1960a).

The site, which measures approximately 360 feet by 120 feet, is flat, and consists of a maintained grassy area and a gravel pad, with a small drainage ditch. The top 10 inches of soil in the gravel pad area have been removed and replaced with gravel (Plexus 2000).

2.2 Meteorology

The mean annual precipitation near the former Wilkins AFS, recorded at the Mansfield Lahm Airport National Oceanic and Atmospheric Administration (NOAA) data station, is approximately 43 inches, recorded during the 30-year period of record from 1971 to 2000. Typically, February is the driest month, receiving an average of 2.17 inches of precipitation, while August is the wettest, receiving 4.6 inches of precipitation on average (NOAA National Climate Data Center [NCDC] 2005). Mean annual lake evaporation is 31 inches (U.S. Department of Commerce, undated).

The average temperature in Richland County for a 30-year period of record from 1971 to 2000 is 48.7 degrees Fahrenheit. The coldest month is typically January, at an average of 24.3 degrees Fahrenheit, and the warmest is July, at 71 degrees Fahrenheit average (NOAA NCDC 2005).

2.3 Surface Water Hydrology

General overland drainage at the former Wilkins AFS flows in a northeasterly trending direction, toward Marsh Run and the Black Fork Mohican River (Figure 1-3) (USGS 1960a).

The Black Fork Mohican flows north through the city of Shelby and continues east flowing approximately 15 miles before entering Charles Mill Lake (USGS 1960a, 1960b).

In the immediate vicinity of the Shelby Horizons AOC, surface water (generally limited to intermittent stormwater runoff) enters a ditch located west and south of the AOC (Figure 1-4). This stormwater then flows east within the ditch, passing through a vegetated area where it intersects with a drainage ditch coming in from the southwest.

The offsite drainage can then take two paths to flow north or east. The site drainage that forks north flows through farm fields and wooded areas before ending into Marsh Run (Figure 1-3). The site drainage that stays east enters an intermittent retention pond just west of Allison Road and Building 31 (Figure 1-3). According to the SI (Plexus 2001), this intermittent retention pond drains to a 16-inch-diameter drain tile and Shelby Horizons personnel indicated they do not know where the drain tile discharges, but it is likely that the drain tile continues in a northerly direction and connects with the series of drainage ditches that converge on the northeast side of the Shelby Horizons property. These ditches are located throughout the more developed sections of the former Wilkins AFS (east of Shelby Horizons) and capture much of the overland flow. The flow through the ditches continues offsite east to the Black Fork Mohican River (Roop 2000a; USGS 1960a, 1960b).

2.4 Geology

2.4.1 Regional Geology

In Ohio, the Central Lowlands Physiographic Province is divided into five sections based on characteristic geomorphic features unique to each section (Figure 2-1). The former Wilkins AFS lies in the Central Lowlands Physiographic Province, in the Galion Glaciated Low Plateau of the Till Plains (Brockman 1998). The Galion Glaciated Low Plateau region is described as rolling upland transitional between the gently rolling Till Plains and the hilly Glaciated Allegheny Plateau with thin to thick drift, ranging from 800 to 1,400 feet amsl elevation with moderate relief (Brockman 1998).

Bedrock in the area is the Mississippian Logan and Cuyahoga formations undivided (Figure 2-2). The Logan Formation is a brown to reddish brown, thin- to thick-bedded sandstone, siltstone, and minor shale ranging from 0 to 400 feet thick. The Cuyahoga Formation is a gray to brown, thin- to thick-bedded shale with minor sandstone and siltstone ranging from 50 to 650 feet thick (Ohio Division of Geological Society [ODGS] 1995).

The surficial geology generally consists of lacustrine deposits of clays and silts, massive or laminated, with a loess or colluvial cover from 0.8 to 1.6 feet thick (Figure 2-3). A contact between the lacustrine deposits and end morainal deposits is mapped near the former Wilkins AFS. End moraine deposits are typically composed of till and occur as ridges higher than the surrounding terrain (ODGS 1999).

2.4.2 Local Geology

A bedrock map of the Shelby quadrangle shows that bedrock in the area of the former Wilkins AFS and a large portion of Richland County is the Pleasant Valley Member of the Cuyahoga Formation (Totten 1973; ODGS 1995), a thin-bedded gray siltstone and shale that

is exposed beneath the Black Hand Sandstone along valleys in widely scattered localities. Though the Pleasant Valley Member is the uppermost bedrock over most of the northern half of Richland County, surface exposures are rare because of the covering of glacial drift. Bedrock elevation in the area is mapped at approximately 1,000 feet amsl, and bedrock is generally overlain by between 75 and 85 feet of drift thickness.

A generalized soil map of Richland County shows the site soils are designated as Bennington-Cardington-Cengerburg (Totten 1973). A generalized map of the soil regions of Ohio is presented on Figure 2-4. Native soils encountered beneath the former Wilkins AFS primarily consist of fine-grained lacustrine silts and clays with some sands and gravels encountered. These materials originate from deposits laid down in glacial Lake Shelby (Plexus 2006; Totten 1973). Glacial moraines of the Wisconsinian glaciation are mapped north of, south of, and within the Lake Shelby deposits (Figure 2-3).

Soil boring logs from drilling efforts at the former Wilkins AFS, including the Pioneer and Shelby AOC SIs and the Pioneer AOC RI, indicate that local surficial deposits of up to 69 feet in thickness are mostly silty clays, with some sand, sand and gravel, and sandy clay deposits. Bedrock was reported to be greater than 50 feet below ground surface (bgs) (Ohio Department of Natural Resources [ODNR] 1963, 1964, 2000a, 2000b, 2000c).

A stratigraphic cross-section for Shelby Horizons AOC was created using lithologic data obtained during RI well installation at Shelby Horizons AOC and from the RI well installation performed at the nearby Pioneer AOC in 2003 (Plexus 2006). The well locations used in preparing the cross-section are shown on Figure 2-6, and the cross-section is shown on Figure 2-7. Borings logs for the monitoring wells completed during the Shelby Horizons AOC RI are presented in Appendix A.

Boring logs from the Pioneer AOC SI (Plexus 2001, 2006) also were reviewed in the creation of the cross-section. Soil borings from SB-04 through SB-08 at the Pioneer AOC indicated the presence of predominantly silty clay from shallow depths (as shallow as 0.5 foot bgs) to approximately 20 feet bgs. Soil borings installed during the Shelby Horizons SI were only drilled to depths of four to five feet and were not logged.

The Shelby Horizons RI activities conducted at the site included drilling soil borings for monitoring well installation, as detailed in Section 3. At each of the three boring locations, (Figure 2-6), which were drilled to depths of 22 to 26 feet bgs, the soils were predominantly silty clay and sandy clay. At MW-11, traces of gravel were observed from 4 to 7 feet bgs and 14 to 20 feet bgs, with larger cobble–sized gravel observed from 8.6 to 14 feet bgs. At MW-12, clay with sand was encountered throughout the majority of the boring (from 1.2 to 4 feet bgs and 8 to 22 feet bgs). A clay interval separates the sandy clay horizons at MW-12. This clay interval also is seen at MW-11 from approximately 7 to 8.6 feet bgs. Small lenses of sand and gravel were also encountered at MW-12 from 8.5 to 9 feet bgs and 16.5 to 16.8 feet bgs. Traces of gravel, with fragments up to 0.5-inch, were seen throughout the boring at MW-12. At MW-13, sand and gravel were encountered as small lenses in the clay material at 15.5 to 16 feet bgs and in trace amounts throughout the boring.

2.5 Hydrogeology

2.5.1 Regional Hydrogeology

The former Wilkins AFS is in an area in which wells yielding 3 to 10 gallons of water per minute may be developed from relatively shallow wells drilled into fine-grained glacial deposits, according to the *Groundwater Resources of Richland County Map* developed by ODNR (1979, rev. 1994) (Figure 2-8). However, within the city of Shelby to the south, shallow sand and gravel deposits may potentially yield up to 100 gallons of water per minute from larger-diameter wells.

For reference, Figures 2-9 and 2-10 present the regional unconsolidated and consolidated (bedrock) aquifers potentiometric surface maps, respectively, for Richland County. In the saturated unconsolidated groundwater deposits, groundwater flow is generally to the north and east toward the Black Fork Mohican River, which ultimately flows to the Charles Mill Lake, shown on the middle right side of Figure 2-9. As indicated on Figure 2-10, groundwater flow in bedrock in the northern part of Richland County near the former Wilkins AFS also is primarily to the north and east.

2.5.2 Local Hydrogeology

Because of a limited amount of data specific to the Shelby Horizons AOC, this section includes a description of the hydrogeologic conditions encountered at the adjacent Pioneer AOC during previous SI and RI activities, for comparison with Shelby Horizons site-specific hydrogeology.

During SI drilling efforts at the Pioneer AOC, which is approximately 250 feet south of the Shelby Horizons AOC, groundwater was observed at approximately 10 feet bgs, coinciding with thin sand lenses and/or larger sand deposits between 8 and 20 feet bgs that were observed in several soil borings; these sections represent the uppermost water-bearing zones beneath the property (Plexus 2001). The Pioneer AOC wells are screened within the interbedded clay and sand deposits and had groundwater elevations ranging from 1,072 to 1,077 feet amsl during quarterly monitoring by CH2M HILL in November 2008 (CH2M HILL 2010). Groundwater in the Pioneer AOC was estimated to flow north to northwest.

Groundwater depths in the three Shelby Horizons monitoring wells are generally less than 10 feet bgs, indicating a shallow vadose zone. Groundwater levels were measured in the Shelby Horizons AOC monitoring wells quarterly for one year; potentiometric surface maps based on these data are presented as Figures 2-11 through 2-14. Groundwater elevation data are presented in Table 3-1; elevations in monitoring wells at the site ranged from 1,067 to 1,078 feet amsl, which are similar to those measured at the Pioneer AOC. The groundwater elevations were highest during the winter and spring quarters (November 2008 and January 2009) and lowest during the summer and fall quarters (November 2008 and July 2009).

Groundwater flow at the Shelby Horizons AOC during the four quarterly monitoring events was in a westerly direction. The direction of groundwater flow may be influenced by topography, which is not uncommon in clay- and silt-dominated soils having a shallow water table. The casing elevation for MW-11 is approximately 2 feet lower than the casing elevation for MW-12, indicating surface topography slopes to the west in the area of these

two wells (Figure 2-11). However, for three of the four monitoring quarters, the water table elevation in these two wells differed by approximately 5 to 6 feet, indicating that other factors in addition to topography are affecting groundwater flow. An offsite pond is just northwest of the site and may be a discharge point for groundwater beneath the site. This interpretation of groundwater flow is based on a limited dataset of three data points; thus, potentiometric contours in the Shelby Horizons AOC area are straight lines based on triangulation of data from these wells, and can only provide an indication of groundwater flow in the area of the AOC.

Two Wilkins AFS background wells (WI-BG-01 and WI-BG-02) were installed during the Pioneer AOC RI to evaluate background surface soil and groundwater concentrations compared with the Pioneer AOC surface soil and groundwater concentrations. These background wells are approximately 2,000 feet south of the Shelby Horizons AOC (Figure 2-15). However, potentiometric data from the background wells was not included in this evaluation. Because the distance to the background wells, the shallow water table, variable lithology (for example, sand strata within clayey glacial till), and variations in ground surface topography, the groundwater potentiometric surface between the background wells and the Shelby Horizons AOC cannot be accurately depicted. Groundwater elevations in the background wells are higher than those measured in the Pioneer AOC wells (CH2M HILL 2010) and the Shelby Horizons AOC wells (Table 3-1). This indicates that the background wells are upgradient of the Pioneer AOC and Shelby Horizons AOC, and therefore would not be affected by any potential releases from either AOC.

2.5.3 Demography and Land Use

Active businesses at the former Wilkins AFS include COIP and PCTC, and various others. COIP employs approximately 1,000 people at the former Wilkins AFS (Kovach 2000b; Roop 2000b). The PCTC is a vocational school that serves approximately 800 high school students and approximately 200 adult students, and employs approximately 200 people (PCTC 2009).

The nearest residences are approximately 2,000 feet north and west of the site (Plexus 2001). Within an approximately 0.5-mile radius of the former Wilkins AFS, population density is estimated to be 76 persons per square mile, and beyond 0.5 mile from the site to the south, population density is an estimated 1,832 persons per square mile within the city limits of Shelby (U.S. Census Bureau 2000). In 2008, the total population of Richland County was estimated to be approximately 124,999 (U.S. Census Bureau 2008).

2.5.4 Surface and Groundwater Use

Figure 2-16 shows the locations of surface water features and reservoirs, public water supply wells, and domestic water wells relative to the Shelby Horizons AOC. The City of Shelby is served by a public water supply that obtains water from two reservoirs, with two groundwater supply wells that serve as a backup (Shelby Municipal Utilities 2009).

Reservoir #2 is located approximately 2 miles southeast of the Shelby Horizons AOC, on the south side of the City of Shelby. This Reservoir obtains its water from the Black Fork River Mohican River, upgradient of the site. Reservoir #3 is located approximately 1.25 miles northeast of the site and is resupplied with water from Marsh Run Creek, which receives intermittent surface water discharge from the site area. . The two reservoirs store an approximate 1-year supply of water (Shelby Municipal Utilities 2009). The groundwater

supply wells were installed in 1942 to a depth of approximately 45 feet bgs, and are located behind the North Gamble Street Water Treatment Plant which is approximately 1.25 miles southeast of the site. The well logs for these supply wells filed with ODNR are presented in Appendix B. As discussed in Section 2.5, regional groundwater flow is to the northeast. Therefore, these water supply wells are upgradient of Shelby Horizons AOC and would not be impacted by site groundwater.

According to the City Of Shelby's Annual Water-Quality Report for 2009 (Shelby Municipal Utilities 2009), the public water supply system is considered to have high susceptibility to contamination from numerous potential sources of surface water contamination (agricultural runoff, petroleum storage, feedlots, industrial storm runoff, junk yards, auto repair, etc.) and is treated to meet drinking water quality standards.

The City of Shelby Water Department provides municipal water service to all areas within the Shelby city limits, including businesses within the former Wilkins AFS. Figure 2-16 shows the Shelby city limits. This water supply system serves 4,300 connections (between 9,800 and 10,000 people), including some areas north of the Shelby city line (Plexus 2000). No other public water systems are in the area.

Private water systems not served by the City of Shelby include wells, cisterns, springs, ponds, and hauled water storage tanks. The Richland County Board of Health, with the help of the Private Water Systems division, enforces private water system rules and laws, which are set forth by the Ohio Revised Code and the Ohio Administrative code. Any variances from the health code must be approved by the Board of Health. The Water Systems division issues permits for installation of new private water systems and for alterations of existing systems. The division also provides water testing of private water systems.

Table B-1 (Appendix B) summarizes the information for 42 wells identified in the ODNR Water Well log database within a 1- mile radius of the site. The wells within a 1-mile radius of the site and beyond are shown on Figure 2-16, with the exception of Wilkins AFS site monitoring wells which are not displayed. The majority of the wells are clustered along State Route 61 at least 0.75 miles east (cross-gradient or downgradient) of the site and were installed between 1960 and 1990 in the upper clay and sand at depths between 20 and 60 feet bgs. Some of these locations are currently outside the city limits. The nearest down-gradient or cross-gradient private well is identified as Well Log Number 177301 and is located approximately 2,400 feet to the northwest along London West Road. The well is installed in bedrock to a depth of 121 feet with a screen length of 70 feet.

The nearest surface water body to the site is a farm pond located approximately 190 feet northwest of the AOC. It is not known if the pond has been stocked with fish for recreational fishing or if it is utilized solely for watering of crops and/or livestock. Recreational use of the nearby waterways includes fishing on Marsh Run and the Black Fork Mohican River (Plexus 2001).

2.6 Ecology

Vegetation on the site consists primarily of mowed grasses. A gravel parking area for semi-tractor trailers covers a portion of the site. Photographs of the site taken by Plexus are presented in Appendix C.

The only surface water feature at the Shelby Horizons AOC is an intermittent ditch that runs along the western side of the AOC and through the south portion of the large anomaly; the ditch was created to facilitate drainage (Corrigan et al. 2000). Surface water entering the Shelby Horizons drainage ditch flows east toward the Shelby Horizons building (Figure 1-4). The ditch is dry during most of the year and does not support aquatic life.

Within a 4-mile radius of the former Wilkins AFS, there are approximately 130 acres of scattered wetlands; the nearest being about 7 acres in size and approximately 0.5 mile from the former Wilkins AFS (USEPA 2000; Plexus 2000). Based on a review of the National Wetlands Inventory (NWI) database, no wetland areas were identified on the former Wilkins AFS property. In addition, USGS quadrangles do not show wetlands within 15 downstream miles of the former Wilkins AFS (USGS 1960a, 1960b; Plexus 2000, 2001).

Within a 4-mile radius of the site, there are no known state or federal threatened or endangered species. There are three state-protected plants and one state-endangered plant that potentially inhabit the Black Fork Mohican River approximately 15 stream miles (upstream) from the former Wilkins AFS. The marsh fivefinger (*Potentilla palustris*), large cranberry (*Vaccinium macrocarpon*), and swamp cottonwood (*Populus heterophylla*) are identified as potentially threatened by the state, and the sharp-glumed manna-grass (*Glyceria acutiflora*) is a state-endangered species (Ohio EPA 2000; Plexus 2000).

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SECTION 3

RI Field Investigation

The RI investigation included the installation of three groundwater monitoring wells, quarterly groundwater sampling for 1 year, collection and analysis of 15 surface soil samples and 8 drainage ditch surface soil samples, and a landfill gas survey at the Shelby Horizons AOC. Well installation, soil sampling, and landfill gas monitoring occurred between October 27 and 31, 2008. Well development and first quarter sampling occurred November 10 through 12, 2008. Subsequent quarterly groundwater monitoring occurred January 26–28, April 20–21, and July 27–30, 2009. The fieldwork was conducted in accordance with the USACE- and Ohio EPA-approved Shelby Horizons AOC RI work plan (CH2M HILL 2008). Details of the field investigation are presented below.

3.1 Deviations from RI Work Plan

The landfill gas survey points were relocated in the field in accordance with the guidance of Ghassan Tafla, the Ohio EPA representative for the site. Mr. Tafla recommended that the punch bar not be driven directly into the landfill area. The area of investigation was then changed from 19 locations within the large anomaly to a depth of 2 feet at eight locations along the perimeter of the site to a depth of 2 feet, adjacent to the drainage ditch, to evaluate if a potential future structure to be located along the perimeter area would be affected by landfill gas. Per subsequent discussion with Mr. Tafla and Ohio EPA, USACE, and CH2M HILL personnel/project managers, these sample locations were deemed adequate to characterize gas potential at the site.

The approved work plan proposed one sampling event and one round analysis for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PAHs, and metals for the newly installed wells. However, in accordance with direction from Joan Cullen, the USACE project manager for the former Wilkins AFS, and approved by Mr. Tafla, quarterly groundwater sampling was implemented for 1 year to provide additional groundwater data for the RI evaluation.

During a site meeting held on April 8, 2009, between CH2M HILL, USACE, and Ohio EPA, the first two quarters of groundwater data were reviewed. There were only four detections of SVOCs and one detection of VOCs at low-level concentrations below the applicable screening criteria (USEPA maximum contaminant level [MCL] or December 2009 tap water regional screening levels [RSLs]). The SVOCs detected were 2-methylnaphthalene, benzyl alcohol, bis(2-ethylhexyl) phthalate, and di-n-octylphthalate. With the exceptions of the January detections of bis(2-ethylhexyl) phthalate at MW-12, and 2-methylnaphthalene at MW-13, the SVOCs detected were qualified as estimated concentrations. The VOC detected was toluene in the November 2008 sample at MW-11. Toluene was detected at an estimated concentration below the reporting limit. A consensus was reached that sufficient data had been obtained to evaluate the potential VOC and SVOC constituents of concern; therefore, USACE suggested that analysis of SVOCs and VOCs be discontinued for the remaining last

two quarters of groundwater sampling. Ohio EPA further reviewed the data and agreed to this in an e-mail dated April 14, 2009.

3.2 Monitoring Well Installation and Development

Three monitoring wells were installed at the locations shown on Figure 2-5. The groundwater monitoring wells were installed using a truck-mounted hollow stem auger (HSA) drill rig. The borings were advanced using 4.25-inch-inner diameter augers and were sampled continuously using a 2-inch-inner diameter, 2.5-foot-long split spoon sampler. Boring logs and well completion diagrams for the wells installed during the RI are in Appendix A. The well construction details for MW-11, MW-12, and MW-13 and rationale for selection of well screen intervals are described below:

- MW-11 was installed to a total depth of 24 feet bgs, with a screen interval at 14 to 24 feet bgs, based on a saturated sand and gravel lens located approximately 21 feet bgs.
- MW-12 was installed to a total depth of 22 feet bgs, with a screen interval at 12 to 22 feet bgs, based on saturated sand and gravel at 16.5 feet bgs.
- MW-13 was installed to a total depth of 24 feet bgs, with a screen interval at 14 to 24 feet bgs, based on the presence of saturated sand at approximately 19 feet bgs.

Each well was completed with a 2-inch-diameter polyvinyl chloride (PVC) casing with 10-foot-long screens having 0.01-inch factory-cut slots. The filter pack in each well consisted of "No. 5" sand. The filter pack was placed to depths of approximately 2 feet above the top of the screen. The 2-foot seal was completed with sodium bentonite chips, and the remaining annular space was filled with grout. The surface completions at the wells are approximately 3-foot stick-ups with lockable steel protective casings.

The monitoring wells were developed using a submersible pump. In accordance with the RI work plan (CH2M HILL 2008), wells were considered developed when a minimum of three well volumes of water had been purged and the water quality parameters stabilized. The wells were surged in an effort to set the filter pack and suspend fines in the water column to be pumped out of the well. During well development, the date, time, pH, specific conductance, turbidity, temperature, and volume of water removed were recorded to confirm development in accordance with the work plan. Well development logs are presented in Appendix D.

3.3 Groundwater Sampling

The four groundwater sampling events were conducted in November 2008, January 2009, April 2009, and July 2009. The field sampling sheets for all four quarters are presented in Appendix D. Static groundwater levels were measured during each sampling event. Table 3-1 lists these measurements and corresponding groundwater elevations.

3.3.1 Purging Methodologies

Following well development, the wells were allowed to recover for 2 days before purging and sampling was conducted for the initial groundwater sampling event. The monitoring wells were purged using low-flow purge techniques. A peristaltic pump operated with a car

battery was used to purge each of the wells. A length of tubing was lowered to the middle of the screen interval (approximately 5 feet from the bottom of the well), and water was withdrawn. A water quality meter (YSI multimeter) equipped with a flow-through cell was used to monitor the pH, specific conductance, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO) during purging. A Hach® turbidimeter was used to measure turbidity during purging. Table 3-2 presents the water quality parameters recorded just prior to sampling for all three wells during the four quarterly sampling events. All water quality parameters reached stabilization prior to sampling in accordance with the RI work plan (CH2M HILL 2008), with the exception of DO readings at some locations and ORP for one sample. DO during all events at MW-13 and during the July event at MW-12 deviated by more than 10 percent over the last three readings.

ORP at MW-13 during the November event deviated by more than ±10 millivolts (mV). However, the majority of these DO readings were low (less than 1 milligram per liter [mg/L]), and a deviation of 10 percent means that DO readings cannot change by more than 0.1 mg/L over three readings. The Ohio EPA *Technical Guidance for Ground Water Investigations, Chapter 10 Ground Water Sampling* (Ohio EPA 2006) suggests that specific conductance and two additional parameters be selected to monitor for stability. Temperature, pH, and specific conductance were stable prior to sampling for all samples collected; therefore, the sampled water is considered to be representative of the aquifer.

3.3.2 Sample Collection

Once water quality parameters stabilized and the final readings were recorded, groundwater samples were collected from the peristaltic pump's discharge tube by disconnecting the tube from the flow-through cell prior to filling the required laboratory-supplied sample containers. Samples were analyzed for VOCs, SVOCs, PAHs, and dissolved target analyte list (TAL) metals during the first two quarters of groundwater sampling. As discussed in Section 3.1, during the third and fourth quarters, samples were analyzed for only PAHs and dissolved TAL metals. The samples collected for TAL metals were field filtered using 0.45-micron filters. The groundwater samples were shipped overnight under chain-of-custody control to CT Laboratories in Baraboo, Wisconsin.

3.4 Surface Soil Sampling

Fifteen surface soil samples (from 0 to 6 inches bgs) were collected at the site. Samples were collected from both the large and small anomalies and from the northwest corner of the site to determine the potential for transport to the offsite pond. Nine samples were collected from the large anomaly, two from the smaller anomaly, and four from the area northwest of the anomalies. The sample locations are presented on Figure 3-1. Samples were collected using a stainless steel trowel. Once the desired depth was achieved, the VOC samples were collected first using EnCore system samplers. Samples then were collected for SVOCs, PAHs, and TAL metals using the stainless steel trowel and a disposable aluminum pan. For these parameters, soil was scooped into the disposable pan and homogenized before transfer to the sample containers. Soil samples then were shipped to CT Laboratories of Baraboo, Wisconsin, as detailed in Section 3.8. Surface soil sampling field data, including sample coordinates (approximate locations from the RI work plan [CH2M HILL 2008] and actual field coordinates collected with a Trimble global positioning system), sample identification (ID), sample time, and other applicable notes are in Appendix D.

3.5 Drainage Ditch Surface Soil Sampling

Eight drainage ditch surface soil samples (from 0 to 6 inches bgs) were collected from the base of the drainage ditch that transects the site. This ditch captures storm water runoff and is dry except during periods of precipitation. Because of the intermittent nature of the drainage ditch, these samples are considered part surface soil and part sediment samples but are termed surface soil throughout the document. The locations of the drainage ditch surface soil samples are shown on Figure 3-2. The samples were collected using a stainless steel trowel. Once the appropriate depth was reached, the VOC samples were collected first using EnCore system samplers. Samples then were collected for SVOCs, PAHs, and metals using the stainless steel trowel and a disposable aluminum pan. For these parameters, soil was scooped into the disposable pan and homogenized before transfer to the appropriate sample containers. Samples were analyzed for VOCs, SVOCs, PAHs, and metals by CT Laboratories of Baraboo, Wisconsin, as detailed in Section 3.8. Sampling field notes are in Appendix D.

3.6 Landfill Gas Surveys

Landfill explosive gas monitoring was conducted in accordance with Ohio Administrative Code 3745-27-12, which establishes the explosive gas threshold limit, or lower explosive limit (LEL), in open atmospheres at 5 percent methane by volume. Landfill gas readings were obtained along the perimeter fence line, adjacent to the farmland property to the west and north, and the Pioneer AOC to the south. The soil gas sampling point locations are presented on Figure 3-3. Using a hammer, a punch bar was driven into the ground to 2 feet bgs, then removed, and sample tubing was immediately inserted into the punch bar hole to approximately 1 foot bgs, in accordance with the RI work plan field standard operating procedure (SOP) for landfill explosive gas monitoring (CH2M HILL 2008). Punch bar holes were not sealed during testing, which is in accordance with Ohio Administrative Code 3745-27-12. The tube was attached to the inlet on the portable landfill gas meter, a GEM 2000 gas analyzer, which had been calibrated with methane and hydrogen sulfide standards prior to the survey. The landfill gas meter was used to test the soil vapor for methane, carbon dioxide, hydrogen sulfide, and oxygen. The gas meter pump drew soil gas through the meter, and results were recorded on field forms. . Ambient weather parameters (such as barometric pressure) for results calibration were obtained from the Mansfield Lahm Municipal Airport weather station. The field landfill gas survey logs are presented in Appendix D.

During the third quarter groundwater sampling event (April 2009), water in MW-11 and MW-13 was observed to be bubbling with a gaseous discharge. Therefore, down-well air readings also were collected during the third and fourth quarterly groundwater monitoring events. Down-well measurements were collected after the J-plug was released from the interior well casing and the MultiRAE meter probe was inserted into the top of the well casing to measure the atmosphere just inside and at the top of the casing. LEL readings above what the meter could measure (20 percent) were detected during the third quarter events at MW-11 and MW-13. To further evaluate the nature of these results, during the fourth quarter a methane/landfill gas meter (a GEM 2000 gas analyzer) was used to monitor methane levels that had accumulated inside the well casing between the third and fourth quarter events. After the J-plug was released, a well cap with a tube was placed on the

interior well, and the tube was connected to the GEM 2000 gas analyzer. The significance of the downhole air quality monitoring results, which are listed in Table 3-3, is discussed in Section 4.9.

3.7 Quality Control Sampling and Sample Identification

Quality control (QC) samples were collected during the RI groundwater, surface soil, and drainage ditch surface soil sampling to evaluate precision and bias during field activities and subsequent laboratory analyses. QC samples consisted of field duplicate samples, equipment blanks, matrix spike (MS)/matrix spike duplicates (MSDs), and trip blanks.

QC groundwater and surface water samples were collected in accordance with the quality assurance project plan (QAPP; CH2M HILL 2008). These include:

- Field duplicates at a frequency of 1 per 10 samples
  - Water: Three wells were sampled quarterly, one field duplicate collected each quarterly event, for a total of four duplicate samples.
  - Surface soil: Two surface soil field duplicates were collected for the 15 surface soil locations sampled.
  - Drainage ditch surface soil: One drainage ditch surface soil field duplicate was collected for the eight drainage ditch surface soil locations sampled.
- Equipment blanks (when sampling equipment is reused) at a frequency of 1 per 20 samples
  - Water: Disposable sampling equipment was used during quarterly sampling; however, one equipment blank was collected during the first quarterly event off the submersible pump used to develop the wells.
  - Surface soil: Two equipment blanks were collected off the October 2008 sampling equipment used to collect 15 surface soil samples and 8 drainage ditch surface soil samples.
- Trip blanks (aqueous VOCs only) at a frequency of one per cooler containing VOC samples
  - Water: VOCs were only collected during the first two quarterly groundwater events, and two trip blanks were sent during each of these events, for a total of four trip blanks.
  - Surface soil: two trip blanks were collected and submitted in the coolers with the equipment blanks.
- MS/MSDs at a frequency of 1 per 20 samples
  - Water: Three wells were sampled quarterly, and one MS and MSD samples were collected each quarterly event, for a total of four MS and four MSD samples.
  - Surface soil: Two MS and two MSD samples were collected for the 15 surface soil locations and 8 drainage ditch surface soil locations sampled.

3.8 Sample Identification, Packing and Shipping

Sample containers were labeled with the project name, sample number, analysis to be performed, date and time of collection, and sample processors initials.

Primary sample labels used the following format for sample identification:

MediaLocation-Date

where:

Media: MW = groundwater (for "monitoring well"); SS = surface soil; SD = drainage ditch surface soil samples

Location: Two-digit well identification (for groundwater) or two-digit location identifier (for all other sample types)

Date = mmddyy

For example, a groundwater sample collected from Monitoring Well 12 on May 1, 2009, would be identified as MW12-050109.

QC sample labels will use the following format for sample identification:

QCNumber- date- QCtype

where:

Number: Two-digit unique numerical identifier

Date: mmddyy

QCtype: FD = field duplicate; EB = equipment blank; TB = trip blank; MS = matrix spike; MSD = matrix spike duplicate

Note that QC sample identification was not tied to a media or location. Locations and media were noted on the field sheets, but not on the chain-of-custody.

For example, a duplicate surface soil sample collected from location 6 on May 3, 2009, would be identified as QC01-050309-FD.

The unique sample ID numbers were affixed to each sample container before sample collection and then recorded on the chain-of-custody. Field team members listed the sample ID numbers on the field logs (Appendix D).

The sample team followed the procedures used for proper packaging, shipping, and documentation of samples being transported from the field to the laboratory for analysis as described in the RI work plan (CH2M HILL 2008).

3.9 Data Management and Validation

Sampling and analytical methods and requirements were performed in accordance with the RI work plan (CH2M HILL 2008). Although Gulf Coast Analytical Laboratories (GCAL) was listed as the laboratory in the RI work plan, it was determined just before the first field event

that GCAL could not comply with the laboratory standards presented in the site QAPP (Appendix B of the RI work plan). Therefore, with the review and approval of USACE, CH2M HILL contracted CT Laboratories of Baraboo, Wisconsin, for the laboratory analysis of the RI samples. CH2M HILL formally documented this change in a technical memorandum submitted to USACE on October 24, 2008. This technical memorandum is included in Appendix E.

For most analytes, laboratory method detection levels were below associated MCLs, secondary MCLs, USEPA RSLs, and USEPA Region 5 ecological screening levels (ESLs); if this was not possible, then the best available technology was used to get the lowest possible method detection level. Occasionally, the laboratory method detection limit (MDL) is above the minimum screening level criteria (residential soil or tap water RSLs). This is the case for two VOCs, two PAHs, and eight SVOCs. The compound, RSL, and MDL data is italicized on the analytical data tables (Tables 4-2 and 4-3) to denote these instances. The laboratory analytical data packages are presented in Appendix E.

Processes were established in the RI work plan (CH2M HILL 2008) to ensure that data were of sufficient quality to be used for their intended purpose, and to ensure that data were managed in a manner that ensures their integrity and long-term use, including use of electronic data deliverables (EDDs), laboratory quality assurance (QA)/QC programs, and data verification and validation, as described below.

Analytical data used in this RI must meet standard laboratory specifications for precision, accuracy, completeness, and comparability. CT Laboratories used a QA/QC program to ensure analytical data are of known and documented usable quality. The laboratory followed the RI QAPP, which was an appendix of the RI work plan (CH2M HILL 2008), and their laboratory QA manual. These documents provided guidelines to ensure the reliability and validity of work conducted at the laboratory.

CH2M HILL performed a data review and data verification for all the samples collected and obtained EDDs that are compatible with the Automated Data Review (ADR) software. The laboratory used the EDD error-checking tool in ADR before submittal to CH2M HILL. CH2M HILL then re-verified the quality of the EDD using the EDD checker and performed data review as defined in the Louisville Chemistry Guidelines (LCG) guidelines (USACE 2002), using the QAPP requirements that are incorporated into the ADR software's libraries. CH2M HILL results of the data review and data verification efforts are presented in Appendix E.

CH2M HILL performed a Level IV data validation, as defined in the LCG guidelines (USACE 2002), for the site at a frequency of 10 percent. The remaining 90 percent of the analytical results underwent Level III data review and data verification. Following data review, data verification, and data validation, the analytical data were entered into a central database, which was used to develop the analytical tables for this RI report.

3.10 Civil Surveying

On July 30, 2009, 2LMN Surveyors of Lancaster, Ohio, who are licensed surveyors in the State of Ohio, conducted a survey. The surveyors measured horizontal locations (northing and easting coordinates) and vertical locations, including the elevations of top of casing and

top of ground, to an accuracy of 0.1 foot, for the three monitoring wells at the site. The coordinates were provided in the Ohio State Plane Coordinate System and zone (latest adjustment) for the area. The horizontal datum was reported in North American Datum of 1983 and the vertical datum was reported in North American Vertical Datum of 1988. The survey data are presented in Table 3-1 with the water level data and in Appendix F.

3.11 Decontamination and Investigation-Derived Waste

3.11.1 Decontamination

Sampling and drilling equipment was decontaminated in accordance with the RI work plan (CH2M HILL 2008). Reusable equipment was decontaminated with an Alconox™ and distilled water mixture. A brush was used as needed to remove particulate matter that was present on the equipment. After washing, the equipment was rinsed with potable water followed by a distilled water rinse. The drill rig was pressure washed prior to arrival onsite and again prior to site demobilization. Equipment then was allowed to air dry before use. Decontamination fluids were collected in a 55-gallon drum for disposal as described below.

3.11.2 Investigation-Derived Waste Management

IDW was handled in accordance with federal and state regulations. IDW generated at the site consisted of drill cuttings, purge and development water, and spent decontamination water. The waste was containerized in 55-gallon drums and classified as nonhazardous based on waste characterization sample results (for soil IDW) and groundwater sampling results (for water IDW). In addition, general trash (personal protective equipment, paper towels, etc.) also was containerized during field activities.

Following initial sampling, a waste characterization soil sample, designated SH-IDW-103108, was collected to characterize the site soil IDW for disposal. Soil aliquots were collected from each drum and homogenized to obtain a representative sample of the drill cuttings. Samples were analyzed for complete toxicity characteristic leaching procedure methods and determined to be nonhazardous. These results are documented in Appendix G. Analytical results from the groundwater sampling were used to characterize the liquid IDW.

After completion of sampling events, the waste handling firm (Penn Ohio) was contacted to remove IDW from the site. Penn Ohio was onsite to remove IDW in January 2009, April 2009, and July 2009. Fifteen drums (eight soil IDW, four water IDW, and three trash) were removed from the site on January 26, 2009. Four drums (two water IDW and two trash) were removed from the site on April 21, 2009. Two drums of water IDW were removed from the site on July 30, 2009. Manifests for these IDW pickups are presented in Appendix G. IDW generated during the RI has been removed from the site.

SECTION 4

Nature and Extent of Contamination

This section describes the nature and extent of impacts to drainage ditch surface soil, surface soil, shallow subsurface soil, groundwater, landfill gas, and mercury vapor at the site.
Media and Samples Evaluated

Drainage ditch surface soil, surface and shallow subsurface soil and groundwater data collected during the 2000 SI (Plexus 2001) and 2008-2009 RI were used to evaluate nature and extent, to conduct the HHRA and ERA associated with the site, and form the conclusions and recommendations (Section 8). Detailed risk assessment processes and results are provided in Sections 6 (human health) and 7 (ecological). Nature and extent of contamination is discussed in this section (Section 4).

The following are the samples collected at the Shelby Horizons AOC and evaluated in this report:

- SI samples (2000)
  - 4 Surface soil locations: SI-SS-09, SI-SS-10, SI-SS-15, and SI-SS-16
  - 5 Subsurface soil locations: SI-SB-09 through SI-SB-13
- RI samples (2008-2009)
  - 8 Drainage ditch surface soil locations: SD-01 through SD-08
  - 15 Surface soil locations: SS-01 through SS-15
  - 3 Groundwater sampling locations: MW-11 through MW-13
  - 7 Landfill gas sampling locations: LG-01 through LG-07

Analytical results for SI surface and shallow subsurface soil data (for detected compounds) are presented in Table 4-1, and full tabulated analytical results are provided in Appendix H. The laboratory analytical reports for the SI data were provided in the Plexus SI report (Plexus 2001). Analytical results for the RI surface soil data are presented in Table 4-2 and the laboratory analytical reports are provided in Appendix E on CD. Analytical data for the RI groundwater samples are presented in Table 4-3 and the laboratory analytical reports are provided in Appendix E on CD. Monitoring results for the landfill gas locations are presented in Table 4-4 and the field logs are provided in Appendix D.

In addition to the SI and RI samples, eight surface soil samples (seven primary and one duplicate) and ten groundwater samples (two wells each sampled during five events) were collected on an undeveloped section of the former Wilkins AFS and are used as background locations to compare site data to background concentrations. The undeveloped area is approximately 2,500 feet south of Shelby Horizons AOC. Figure 2-15 shows the location of the background surface soil samples and the background wells. Seven primary and one duplicate (eight total) background surface soil samples and one round of groundwater samples from two background wells were collected in April 2003 as part of the Pioneer AOC RI (Plexus 2006). A supplemental Pioneer AOC RI investigation was conducted between

November 2008 and July 2009 where groundwater samples for 3 metals only (arsenic, thallium, and manganese) were collected from the two background wells (CH2M HILL 2010). Analytical data tables for the background surface soil and groundwater data are in Appendix I.

- Background samples from within the former Wilkins AFS (2003)
  - 7 Surface soil samples locations: WI-BG-SS-31 through WI-BG-SS-37
  - 2 Groundwater sampling locations: WI-BG-01 and WI-BG-02

4.1 SI and Background Sample Nomenclature

Soil data from the previous SI investigation (Plexus 2001) and soil data collected during the RI use the same nomenclature (for example, SS-09, SS-10, and SS-15 are used during each event). Therefore, to distinguish between the SI samples and the RI samples, all SI samples will be referred to in this report with an "SI-" designator prior to the sample name. For example, SI-SS-09 refers to the SI sample while SS-09 refers to the RI sample.

Background surface soil and groundwater samples have a "WI-BG-" designator prior to the sample name to distinguish them as background samples from the former Wilkins AFS.

4.2 Laboratory Analytes Discussed

The following lists the laboratory analytes evaluated in this report:

- SI samples (2000)
  - Surface soil: Metals, PAHs, SVOCs, VOCs, pesticides, and polychlorinated biphenyls (PCBs)
  - Subsurface soil: Metals, PAHs, SVOCs, VOCs, pesticides, and PCBs
- RI samples (2008-2009)
  - Surface soil: Metals, PAHs, SVOCs, and VOCs
  - Groundwater sampling: Metals, PAHs, SVOCs, and VOCs
- Background samples from within the former Wilkins AFS (2003)
  - Surface soil samples: Metals, PAHs, and SVOCs
  - Groundwater sampling: Metals, PAHs, SVOCs, and VOCs

For the SI samples and the background samples, PAHs were analyzed by USEPA Method 8310 and as SVOCs by USEPA Method 8270 SIM. Method 8310 is more specific to a smaller list of compounds and was used to achieve a lower reporting limit (Plexus 2006). Both method results (8310 and 8270 SIM) are discussed as PAH results and exceedances in the nature and extent evaluation below.

4.3 Screening Levels

As discussed in Section 1, the former Wilkins AFS is zoned as heavy industrial, and future land use will likely continue as industrial. Although this is an industrial site, the December

2009 USEPA residential and industrial soil RSLs (USEPA 2009a) were both used for comparison of the drainage ditch surface soil, surface soil, and shallow subsurface soil sample results. However, conclusions on the nature and extent are based on comparison to the industrial RSLs.

For groundwater, both the USEPA MCL and the December 2009 regional tap water screening levels (USEPA 2009a) are presented with sample results. The MCL is used as the primary screening criteria; however, if no MCL exists, then the December 2009 tap water RSL is used as the RI screening criteria.

Occasionally, the laboratory MDL is above the minimum screening level criteria (residential soil or tap water RSLs). In these instances where data is not-detected at the MDL, but the MDL is above the minimum screening criteria, data is italicized on the tables to denote these instances and the data is still treated as a non-detect for evaluation purposes. This is the case for the following analytes:

- Soil:
  - SVOC: n-nitrosodimethylamine
- Groundwater:
  - PAHs: benzo(a)pyrene, dibenzo(a,h)anthracene
  - SVOCs: 1,2-diphenylhydrazine; 3,3'-dichlorobenzidine; bis(2-chloroethoxy)methane; bis(2-chloroethyl)ether; hexachlorobenzene; n-nitrosodimethylamine; n-nitroso-di-n-propylamine; and pentachlorophenol
  - VOCs: 1,2-dibromo-3-chloropropane and 1,2-dibromoethane (EDB)

4.4 Data Validation Qualifiers

As discussed in Section 3.9, CH2M HILL performed a data review and data verification for all the samples collected during the RI. Data validation flags were assigned to some results during that review. Validation flags are assigned according to the RI QAPP, which was an appendix of the RI work plan (CH2M HILL 2008). CH2M HILL results of the data review and data verification efforts are presented in Appendix E. The data flags assigned to the RI data are defined below:

- J = The analyte was positively identified; the associated numerical value is below the laboratory MDL necessary to accurately and precisely measure the analyte in the sample, therefore, the value is the approximate concentration of the analyte in the sample.
- R = The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte could not be verified.
- B= The analyte was detected in the associated method or field blank as well as the samples.

- U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- UJ = The analyte was not detected above the reported sample quantitation limit; however, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

4.5 Drainage Ditch Surface Soil

During the RI, drainage ditch surface soil samples were collected along the intermittent drainage ditch. As discussed in Sections 2 and 3, the drainage ditch routes surface water runoff away from the site, but is dry most of the year and does not support aquatic life. Eight locations were sampled and analyzed for metals, PAHs, SVOCs, and VOCs. The locations and extent of drainage ditch surface soil samples in excess of RI industrial screening levels for metals are included on Figure 4-1, and analytical results are presented in Table 4-2. Drainage ditch surface soil samples were not collected as part of the SI.

4.5.1 Metals

Twenty-two of 23 metals analyzed were detected in the drainage ditch surface soil samples, as listed in Table 4-2. Of the 22 metals detected, only arsenic was detected in excess of its industrial soil RSLs (1.6 milligrams per kilogram [mg/kg]). Arsenic concentrations ranged from 6.1 to 13.4 mg/kg. Arsenic concentrations also exceeded the residential soil RSL (0.39 mg/kg). No other metals exceeded either industrial or residential soil RSL. Arsenic exceeding the industrial soil RSL occurred at all drainage ditch surface soil sampling locations and was not limited to or concentrated in one particular area of the drainage ditch (Figure 4-1).

Based on published data, the arsenic in the drainage ditch surface soil at the site may be naturally occurring. According to the *Closure Plan Review Guidance For RCRA* [Resource Conservation and Recovery Act] *Facilities* developed by Ohio EPA's Division of Hazardous Waste Management (Ohio EPA 2009a), concentrations of total arsenic in background soil is often highly variable in Ohio, and this heterogeneity makes the designation of a generic standard difficult. According to this document, 13 mg/kg can be considered to be representative of "normal" or background arsenic concentrations (Ohio EPA 2009a).The maximum arsenic concentration detected in the drainage ditch surface soil samples during the RI was 13.4 mg/kg. In comparison, arsenic concentrations collected at the surface soil background locations 2,500 feet south of the site, ranged from 9.8 to 12.1 mg/kg. Since the site drainage ditch surface soil samples have arsenic detected near or below the "normal" occurrence of arsenic in Ohio soil and the Wilkins AFS background concentrations, site arsenic concentrations could be considered similar to "normal" background Ohio concentrations.

4.5.2 Polynuclear Aromatic Hydrocarbons

All 16 PAH compounds analyzed were detected in the RI drainage ditch surface soil samples; none exceeded industrial soil RSLs. One compound, benzo(a)pyrene, was detected

at concentrations in excess of the residential soil RSL of 0.015 mg/kg at six locations (SD-01, SD-02, SD-05, SD-06, SD-07, and SD-08) and ranged from 0.016 to 0.081 mg/kg.

The exceedances of benzo(a)pyrene against the residential soil RSL occurred along most of the length of the drainage ditch, with the exception of two samples along the southwestern side of the ditch. The presence of benzo(a)pyrene in the drainage ditch surface soil may be because of migration of the surrounding surface soil to the ditch or stormwater runoff from adjacent paved surfaces (roads or parking lots).

4.5.3 Semivolatile Organic Compounds

Four SVOCs were detected in the RI drainage ditch surface soil samples: 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, dibenzofuran, and di-n-butylphthalate. None was detected above industrial (or residential) soil RSLs.

4.5.4 Volatile Organic Compounds

No VOCs were detected in drainage ditch surface soil samples collected in the RI.

4.5.5 Drainage Ditch Surface Soil Summary

As shown on Figure 4-1, arsenic was the only compound detected in excess of its industrial soil RSLs (1.6 mg/kg). Exceedances occurred at all locations and were not limited to or concentrated in one particular area of the site. The arsenic in the drainage ditch surface soil may be naturally occurring due to the consistent distribution of arsenic detected across the site, the maximum site detected concentration of 13.4 mg/kg, published data for Ohio (Ohio EPA 2009a), which lists arsenic at normal concentrations of 13 mg/kg, and comparison with arsenic detected at the Wilkins AFS background surface soil samples, which had an average concentration of 11.06 mg/kg. PAHs and SVOCs did not exceed industrial soil RSLs. VOCs were not detected.

4.6 Surface Soil

During the RI field effort, surface soil samples were collected from 15 locations (SS-01 through SS-15) both within and outside the anomalies, and analyzed for metals, PAHs, SVOCs, and VOCs. During the SI field event, surface soil samples were collected from four locations (SI-SS-09, SI-SS-10, SI-SS-15, and SI-SS-16) in and around the large anomaly and analyzed for metals, PAHs, SVOCs, VOCs, pesticides, and PCBs. Refer to Figure 3-2 for the RI surface soil sampling locations and Figure 1-5 for the SI surface soil sampling locations.

The locations of any surface soil samples in excess of industrial soil RI screening levels for metals are included on Figure 4-2. Figure 4-3 shows the locations of surface soil samples in excess of industrial soil RI screening levels for PAHs. The nature and extent of each constituent type in excess of both the industrial and residential soil RSLs are discussed below.

4.6.1 Metals

All 23 metals analyzed during the RI sampling effort in 2008 and 24 metals analyzed during the SI sampling in 2000 were detected in at least one sample from the 19 surface soil sample locations (Tables 4-1 and 4-2). However, only arsenic was detected above the industrial soil

RSL. Arsenic, cobalt, and mercury were detected in excess of residential soil screening levels. These are discussed in more detail below.

Industrial Soil RSL Exceedances

Arsenic

Arsenic exceeded the 1.6 mg/kg industrial soil RSL in all 15 RI surface soil samples, with results ranging from 2.1 to 14.3 mg/kg. These exceedances of the arsenic industrial RSL occurred at all sample locations and were not limited to or concentrated in one particular area of the anomalies; the highest concentration (14.3 mg/kg) was in the duplicate sample at SS-07. As shown on Figure 4-2, SS-07 is at the southeastern end of the large anomaly.

Arsenic results from the SI surface soil samples (Plexus 2001) were similar to the RI results: four surface soil samples collected from outside and within the large anomaly exceeded the industrial soil RSL, with concentrations ranging from 6.6 to 17 mg/kg (Table 4-1). These results were as follows: 9.8 mg/kg at SI-SS-09, 12.1 mg/kg at SI-SS-10, 6.6 mg/kg at SI-SS-15, and 17.0 mg/kg at SI-SS-16. The highest result, at SI-SS-16, was outside of either anomaly, at the end of a drain surface at the southeastern section of the drainage ditch.

As discussed in the previous section for drainage ditch surface soil, the presence of arsenic in the surface soil may be because of naturally occurring levels of arsenic, as all detected site concentrations were at or near potential background conditions for Ohio (13 mg/kg) (Ohio EPA 2009a) and the Wilkins AFS background concentrations average concentration of 11.06 mg/kg. The maximum arsenic concentration detected in the surface soil samples during the RI and SI was 17.0 mg/kg, and 6 of 19 soil samples recorded values greater than 13 mg/kg.

Residential Soil RSL Exceedances

Detailed discussions of metals that exceed the residential soil RSL only are presented below.

Cobalt

Cobalt did not exceed the 300 mg/kg industrial soil RSL in any soil sample collected during the RI or SI. It exceeded the residential soil RSL of 23 mg/kg at three sample locations within (SS-04 and SS-10) and outside of (SS-13) the anomalies, with the highest concentration (229 mg/kg) detected at SS-04 in the center of the large anomaly (Figure 4-2).

Cobalt concentrations from SI surface soil samples did not exceed the residential soil RSLs.

Cobalt was detected at all seven background Wilkins AFS surface soil sample locations. However, the detections do not exceed the residential soil RSL (Appendix I, Table I-1).

Mercury

Mercury was not detected above the industrial soil RSL (34 mg/kg) in any sample collected during the RI or SI. However, mercury was detected above the residential soil RSL of 5.6 mg/kg at one RI sampling location (SS-03) and one SI location (SI-SS-09). Mercury was detected at concentrations of 5.8 and 6.1 mg/kg, respectively. Both samples are on the northwestern side of the large anomaly within 50 feet of each other (Figure 4-2). These samples are not located in the same area as the detected mercury vapor (Figure 1-5). Mercury vapor was detected in a small area (less than 800 ft^2) in the southern portion of the large anomaly during the SI. Surface soil samples collected near the SI mercury vapor area (SS-08 and SS-09) and others along the southern drainage ditch (SS-06 and SS-07) were significantly less than the residential soil RSL for mercury.

Mercury concentrations were below the residential RSL in the remaining RI and SI surface soil sample locations.

Mercury was detected in all seven background Wilkins AFS surface soil sample locations. However, the detections do not exceed the residential soil RSL (Appendix I, Table I-1).

4.6.2 Polynuclear Aromatic Hydrocarbons

All sixteen PAHs were detected in the RI surface soil samples (Table 4-2), and 15 of 16 PAHs were detected in surface soil during the SI investigation (Table 4-1). Only one compound, benzo(a)pyrene, exceeded the industrial soil RSL. Four others were detected in excess of the residential soil RSL: benzo(a)anthracene; benzo(b)fluoranthene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene.

Industrial Soil RSL Exceedances

Benzo(a)pyrene

Three RI surface soil samples (SS-02, SS-03, and SS-11), all within the large or small anomalies, exceeded the 0.21 mg/kg industrial soil RSL for benzo(a)pyrene at concentrations of 0.22, 0.23, and 0.25 mg/kg, respectively (Table 4-2). The remaining 12 samples exceeded the 0.015 mg/kg residential soil RSL.

Two SI surface soil samples (SI-SS-09 and SI-SS-10) exceeded the industrial soil RSL (0.21 mg/kg). The highest concentrations benzo(a)pyrene at these locations were 0.45 and 0.62 mg/kg, respectively. One surface soil sample (SI-SS-16) exceeded residential soil RSLs for benzo(a)pyrene at 0.086 mg/kg.

As shown on Figure 4-3, benzo(a)pyrene exceeding the industrial soil RSL were concentrated within the upper center of the large anomaly (SI-SS-09, SS-02, and SS-03), at the southwestern edge of the large anomaly near the drainage ditch (SS-10), and at SS-11 in the small anomaly.

Benzo(a)pyrene was detected at all seven background Wilkins AFS surface soil sample locations. One location (WI-BG-SS-31) had concentrations (0.036 mg/kg) exceeding the residential soil RSL (0.015 mg/kg) (Appendix I, Table I-1).

Residential Soil RSL Exceedances

Detailed discussions of PAHs that exceed the residential soil RSL only are presented below.

Benzo(a)anthracene

During the RI surface soil sampling, benzo(a)anthracene concentrations exceeded the residential soil RSL of 0.015 mg/kg at nine sample locations, with concentrations ranging from 0.17 to 0.3 mg/kg (Table 4-2). The highest concentration (0.3 mg/kg) detected during the RI was at SS-03, located at the edge of the small anomaly and just off the edge of the gravel road at the site.

SI concentrations exceeding the residential soil RSL of 0.015 mg/kg occurred at two of four surface soil sample locations (SI-SS-09 and SI-SS-10). The highest detected concentrations were 0.42 to 0.47 mg/kg, respectively (Table 4-1). These locations are both along the western side of the large anomaly (Figure 4-3).

Benzo(a)anthracene was detected at six of seven background Wilkins AFS surface soil sample locations. However, the background detections did not exceed the residential soil RSL (Appendix I, Table I-1).

Benzo(b)fluoranthene

In RI surface soil samples, 11 locations (SS-01 through SS-06, SS-08, SS-11, SS-12, SS-14, and SS-15) exceeded the residential soil RSL of 0.15 mg/kg. Concentrations ranged from 0.23 to 0.38 mg/kg (Table 4-2).

Two SI samples collected from within the site anomalies (SI-SS-09 and SI-SS-10) exceeded the residential soil RSL, at the highest detected concentrations of 0.55 and 0.55 mg/kg, respectively (Table 4-1).

Benzo(b)fluoranthene was detected at all seven background Wilkins AFS surface soil sample locations. However, the background detections did not exceed the residential soil RSL (Appendix I, Table I-1).

Dibenz(a,h)anthracene

The residential soil RSL of 0.015 mg/kg was exceeded at 10 locations sampled during the RI (SS-01, SS-02, SS-03, SS-04, SS-05, SS-06, SS-11, SS-12, SS-14, and SS-15), with concentrations ranging from 0.017 to 0.034 mg/kg.

The residential soil RSL was exceeded at one location sampled during the SI SI-SS-09). The detected concentration was 0.048 mg/kg.

Dibenzo(a,h)anthracene was detected at two of seven background Wilkins AFS surface soil sample locations. However, the background detections did not exceed the residential soil RSL (Appendix I, Table I-1).

Indeno(1,2,3-cd)pyrene

There were no exceedances of the indeno(1,2,3-cd)pyrene residential soil RSL in RI samples. Indeno(1,2,3-cd)pyrene exceeded the residential soil RSL (0.15 mg/kg) in two SI surface soil sample locations (SI-SS-09 and SI-SS-10) at concentrations of 0.27 and 0.89 mg/kg, respectively. These locations are both along the western side of the large anomaly (Figure 4-3).

Ideno(1,2,3-cd)pyrene was detected at all seven background Wilkins AFS surface soil sample locations. However, the background detections did not exceed the residential soil RSL (Appendix I, Table I-1).

4.6.3 Semivolatile Organic Compounds

Four SVOCs were detected in the RI surface soil samples: 2-methylnaphthalene, benzoic acid, bis(2-ethylhexyl)phthalate, and dibenzofuran. None exceeded the industrial or residential soil RSLs (Table 4-2).

Four SVOCs (2-methylnaphthalene, carbazole, dibenzofuran, and diethyl phthalate) were detected in SI soil samples SI-SS-09, SI-SS-10, and SI-SS-16. None exceeded industrial or residential soil RSLs. These results are detailed in Table 4-1.

SVOCs were detected at all seven background Wilkins AFS surface soil sample locations. However, the background detections did not exceed the residential soil RSL (Appendix I, Table I-1).

4.6.4 Volatile Organic Compounds

Three VOCs were detected in the RI surface soil samples: acetone, dichlorodifluoromethane, and trichlorofluoromethane. None exceeded the respective industrial or residential soil RSLs.

Two VOCs were detected in SI surface soil samples: chloroform and methylene chloride. Neither exceeded industrial or residential soil RSLs.

VOCs were not analyzed for the Wilkins AFS background samples.

4.6.5 Pesticides and Polychlorinated Biphenyls

Pesticide and PCB analysis was not conducted on RI surface soil samples, because there were no exceedances of the residential soil RSLs for these compounds during SI sampling, as outlined below.

Four pesticides were detected in the SI surface soil samples: 4,4-dichlorodiphenyl dichloroethane (DDD); 4,4-dichlorodiphenyl dichloroethylene (DDE); 4,4-dichlorodiphenyl trichloroethane (DDT); and beta-hexachlorocyclohexane (β-BHC). Location SI-SS-10 had one exceedance, while location SI-SS-16 had three exceedances. Pesticides were not detected above the industrial or residential soil RSLs.

Three of the four detected compounds were DDT compounds, which may be present because of agricultural runoff, as these sample locations with detections were adjacent to the site drainage ditch.

No PCBs were detected in the SI surface samples.

Pesticides and PCBs were not analyzed for the Wilkins AFS background samples.

4.6.6 Surface Soil Summary

As shown on Figure 4-2, arsenic was the only metal detected above industrial soil RSLs (1.6 mg/kg), and it was detected at all 19 RI and SI sample locations. Arsenic at the site may be naturally occurring because of the consistent distribution of arsenic detected across the site, the maximum site detected concentration of 17.0 mg/kg in surface soil, published data for Ohio (Ohio EPA 2009a) which lists arsenic at normal concentrations of 13 mg/kg, and comparison with arsenic detected at the Wilkins AFS background surface soil samples, which had an average concentration of 11.06 mg/kg.

As shown on Figure 4-3, benzo(a)pyrene exceeded the industrial soil RSL at five sampling locations; no other PAHs exceeded industrial soil RSLs. All surface soil samples collected during the RI and SI, with the exception of SI-SS-15, exceeded at least one PAH compound for its residential soil RSL. PAHs were detected in the Wilkins AFS background surface soil samples, but all detections were below industrial soil RSLs.

Since the site has been zoned as heavy industrial for many years, and continues to be used for industrial (manufacturing and transportation) operations, industrial soil RSLs are the

most appropriate screening levels for evaluation of site soil conditions. The most likely potential source(s) of PAHs to the site, which is primarily grass and gravel-covered, are most likely runoff from vehicles in the site parking areas, from offsite vehicle use, or from historic site burial activities.

No SVOCs, VOCs, pesticides, or PCBs exceeded industrial or residential soil RSLs.

4.7 Subsurface Soil

Shallow subsurface soil samples were not collected during the RI or the Wilkins AFS background soil sampling effort. Therefore, only SI samples are discussed in this section.

Five shallow subsurface soil samples (SI-SB-09 through SI-SB-13) were collected during the SI effort from depths of approximately 2 to 4 feet bgs. Data from these samples (for detected compounds) are presented in Table 4-1. Two of the subsurface soil samples were collocated with surfaces soil samples SI-SS-09 and SI-SS-10, and three others within the large anomaly.

The locations of the subsurface soil samples in excess of industrial RSLs for metals are included on Figure 4-4, and subsurface soil sample locations in excess of industrial RSLs for PAHs are included on Figure 4-5. The nature and extent of each constituent type in excess of both the industrial and residential soil RSLs are discussed below.

4.7.1 Metals

All 24 metals analyzed were detected in the five subsurface soil samples, but detected concentrations were consistently highest at SI-SB-09. Three metals were detected in excess of industrial soil RSLs (arsenic, lead, and mercury), and one metal was detected in excess of the residential soil RSL only (antimony).

Industrial Soil RSL Exceedances

Arsenic

Arsenic exceeded the industrial RSL of 1.6 mg/kg at all five subsurface sample locations, with concentrations ranging from 9.2 to 21.8 mg/kg. The highest concentration was at SI-SB-11 on the northeastern side of the large anomaly (Figure 4-4). SI-SB-12 and SI-SB-13 had arsenic detected at concentrations of 16.8 and 13.9 mg/kg, respectively. These locations also are on the eastern side of the large anomaly.

As discussed in the previous sections, the presence of arsenic in the soil may be because of naturally occurring levels of arsenic. Detected site concentrations at locations SI-SB-12 and SI-SB-13 were at or near potential background conditions for Ohio (13 mg/kg) (Ohio EPA 2009a) and locations SI-SB-09 and SI-SB-10 were below 13 mg/kg. However, the 21.8 mg/kg detection at SI-SB-11 is outside the Ohio background range and may be because of site activities.

Lead

Lead exceeded the industrial soil RSL of 800 mg/kg in one subsurface soil sample location (SI-SB-09) in the large anomaly, with a concentration of 1,190 mg/kg. None of the other subsurface soil samples exceeded the lead residential soil RSL of 400 mg/kg. The concentration of lead at SI-SB-09 was two orders of magnitude higher than the other four sampling locations, indicating that this exceedance may be because of site activities.

Mercury

The mercury concentration in one subsurface soil sample (SI-SB-09) exceeded the industrial soil RSL of 34 mg/kg at a concentration of 45.4 mg/kg, which was significantly higher than other subsurface soil sample locations. The concentration of mercury at SI-SB-09 was two orders of magnitude higher than the other four sampling locations, indicating that this exceedance may be because of site activities.

Residential Soil RSL Exceedances

Detailed discussions of metals that exceed the residential soil RSL only are presented below.

Antimony

Antimony did not exceed the industrial soil RSL of 410 mg/kg at any of the five subsurface soil sample locations. However, it was in excess of the residential RSL of 31 mg/kg at one location (SI-SB-09) at a concentration of 31.6 mg/kg.

4.7.2 Polynuclear Aromatic Hydrocarbons

In SI subsurface soil samples, 14 of 16 analyzed PAHs were detected in subsurface soil (Table 4-1). However, only benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected above their respective industrial RSLs. All of these detections above industrial soil RSL occurred at SI-SB-09. Two other compounds were detected in excess of their respective residential soil RSLs: benzo(a)anthracene and indeno(1,2,3-cd)pyrene. These also were at SI-SB-09.

Industrial Soil RSL Exceedances

Benzo(a)pyene

Concentrations of benzo(a)pyrene exceeded the 0.21 mg/kg industrial soil RSL in one of five subsurface soil samples (SI-SB-09) at a concentration of 2.1 mg/kg. None of the remaining four subsurface soil samples exceeded industrial or residential soil RSLs.

Benzo(b)fluoranthene

One sample location (SI-SB-09) exceeded the industrial soil RSL of 2.1 mg/kg for benzo(b)fluoanthene, with a concentration of 2.5 mg/kg.

Dibenz(a,h)anthracene

One dibenz(a,h)anthracene concentration (SI-SB-09) exceeded the industrial soil RSL of 0.21 mg/kg. The detected concentration was 0.380 mg/kg. No other subsurface samples were detected in excess of the 0.015 mg/kg residential soil RSL for the compound.

Residential Soil RSL Exceedances

Detailed discussions of PAHs that exceed the residential soil RSL only are presented below.

Benzo(a)anthracene

Benzo(a)anthracene was not detected in excess of the 2.1 mg/kg industrial soil RSL in any subsurface soil samples. At SI-SB-09, within the northern portion of the large anomaly (Figure 4-4), the sample concentration (1.9 mg/kg) exceeded the residential soil RSL of 0.15 mg/kg.

Indeno(1,2,3-cd)pyrene

There were no exceedances of the 2.1 mg/kg indeno(1,2,3-cd)pyrene industrial soil RSL in SI samples. One sample location (SI-SB-09) exceeded the residential soil RSL of 0.15 mg/kg, with a concentration of 1.5 mg/kg.

4.7.3 Semivolatile Organic Compounds

Five SVOCs were detected in SI subsurface soil samples: bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, carbazole, dibenzofuran, and diethyl phthalate. The detections were primarily from samples SI-SB-09 and SI-SB-13. However, SVOCs were not detected above industrial or residential soil RSLs. The detections are detailed in Table 4-1.

4.7.4 Volatile Organic Compounds

Three VOCs were detected in subsurface samples: acetone, methylene chloride, and toluene. Detections of methylene chloride and toluene were at SI-SB-09, while the detection of acetone was at SI-SB-13. VOCs were not detected above industrial or residential soil RSLs. The detections are detailed in Table 4-1.

4.7.5 Pesticides and Polychlorinated Biphenyls

Four pesticide and two PCB compounds were detected in one subsurface soil sample (SI-SB-09). All detections were below industrial and residential soil RSLs.

4.7.6 Subsurface Soil Summary

In summary, exceedances of metals and PAHs above industrial soil RSLs were focused at one sample location: SI-SB-09. Concentrations of metals and PAHs were much higher at this location than in other subsurface samples.

4.8 Groundwater

Analytical results for groundwater samples collected from the site monitoring wells during the RI are discussed below and presented in Table 4-3.

In November 2008, following the installation and development of MW-11, MW-12, and MW-13, all three wells were sampled and analyzed for dissolved TAL metals, PAHs, SVOCs, and VOCs. Three additional quarterly rounds of sampling were conducted in January, April, and July 2009. The January event included the same analyses as in November 2008, and during the April and July events, groundwater samples were analyzed for dissolved TAL metals and PAHs only, as discussed in Section 3.1. The monitoring well locations are shown on Figure 2-6.

Both the USEPA MCL and the regional tap water screening levels (USEPA 2009a) were used for comparison with sample results. The MCL was used as the primary screening level. If no MCL has been established for a constituent, then the December 2009 tap water RSL was used as the RI screening level. Table 4-3 lists the MCL, tap water criteria, the RI screening level used, and the screening level source in the next column. Groundwater laboratory reports for quarterly events are provided in Appendix E on CD. Figure 4-6 presents the locations groundwater in excess of RI screening levels for metals. The nature and extent of each constituent type are discussed below.

4.8.1 Dissolved Metals

Seventeen dissolved metals were detected in the onsite monitoring wells during the four sampling events, as indicated in Table 4-3; of these, only antimony and arsenic exceeded applicable screening levels.

MCL and Tapwater RSL Exceedances

Antimony

Antimony exceeded the RI screening level (the USEPA MCL) of 0.006 mg/L in only one sample: at MW-12 in the January 2009 sample (0.0078 mg/L). This location is upgradient of the large anomaly. Antimony was not detected, however, at MW-11, which is roughly downgradient of MW-12, and was detected just once, below the screening level, at MW-13 (0.0035 mg/L in April 2009), which is crossgradient to MW-12. The presence of antimony above the screening level thus is likely an isolated occurrence at MW-12.

Antimony was not detected in the groundwater sampled collected from the Wilkins AFS background wells in April 2003 (Appendix I, Table I-2). Antimony was not part of the background well analytical suite during the subsequent RI addendum quarterly sampling event (Appendix I, Table I-3).

Arsenic

Arsenic was detected above the USEPA MCL (0.01 mg/L) at MW-13 during the first three quarterly events; these concentrations ranged from 0.0106 to 0.0182 mg/L. MW-13 is crossgradient to the anomalies rather than downgradient (Figures 2-11 through 2-14).

Arsenic was detected above the tap water RSL of 0.000045 mg/L in MW-11 during the first three quarterly events; these concentrations ranged from 0.0041 to 0.009 mg/L.

For the July 2009 sampling event, arsenic was detected in the method blank. Any detected results for this sampling event that was less than five times the concentration in the method blank was qualified with the "B" flag, and therefore qualified as not detected (Table 4-3).

Arsenic occurs naturally in soil in Ohio either in the mineral pyrite or other sulfide minerals, or is adsorbed to iron oxides. Arsenic can be released to groundwater by the oxidation of pyrite to iron oxides under oxidizing conditions, or by the reduction of iron oxides under reducing conditions. DO and ORP measurements for MW-11 and MW-13 (Table 3-2) indicate general reducing conditions; in addition, methane was measured in the casings of these two wells at concentrations ranging from approximately 50 to 90 percent (indicating reducing conditions). However, the dissolved iron concentrations in MW-11 and MW-13 were lower than would be expected for reducing conditions (less than 0.5 mg/L), so it is unclear if the reduction of iron oxides is the source of the dissolved arsenic in these two wells. DO for well MW-12 ranged from 4.79 to less than 1; the ORP measurements ranged from approximately 57 to 128 mV, indicating oxidizing conditions in this well. Arsenic was not detected in MW-12.

In addition, arsenic was detected at the Wilkins AFS background wells. During the April 2003 sampling, arsenic was detected at concentrations above the tap water RSL but below the MCL at both wells. During the subsequent quarterly monitoring in 2008 and 2009, arsenic was detected at well WI-BG-01 above the tap water RSL, but below the MCL during the first two quarters. The arsenic MCL exceedances in MW-13 do not appear to be related

to the anomalies as indicated by the hydraulic gradients in groundwater, thus it is possible that arsenic in groundwater at the site is naturally occurring.

4.8.2 Polynuclear Aromatic Hydrocarbons

Six PAH compounds were detected in samples from site wells during the four quarterly sampling events (Table 4-3): acenaphthene, benzo(b)fluoranthene, fluoranthene, naphthalene, phenanthrene, and pyrene. PAHs also were detected in several of the method blanks. Results that were less than five times the concentrations in the method blanks were qualified as not detected ("B" flag in Table 4-3). All detected PAHs were detected at concentrations below their respective screening levels; all PAH detections except for one were flagged with a "J," indicating estimated values (Appendix E).

4.8.3 Semivolatile Organic Compounds

During the first two quarterly rounds of groundwater sampling at the site, four SVOCs were detected in samples (Table 4-3); all were below their respective screening levels. These compounds were 2-methylnaphthalene, benzyl alcohol, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate. All SVOCs were detected at concentrations below their respective screening levels and the detections except for two were flagged with a "J," indicating estimated values (Appendix E).

4.8.4 Volatile Organic Compounds

No VOCs were detected in primary samples from site wells during the first two quarterly sampling rounds when VOCs were collected. One VOC (toluene) was detected in a duplicate sample from MW-11. However, it did not exceed the applicable screening level (MCL of 1 microgram per liter [µg/L]). The result in the November 2008 duplicate sample was detected slightly above the laboratory MDL and qualified as estimated with a "J" flag.

4.8.5 Groundwater Summary

As shown on Figure 4-6, only arsenic and antimony exceeded the MCL. Antimony was not detected in the single 2003 sample from the Wilkins AFS background wells, and arsenic was detected in the background wells, but at concentrations below the MCL. Arsenic was detected throughout the site surface soil and shallow subsurface soil above industrial soil RSL. Arsenic could be related to naturally occurring site conditions. These exceedances of MCLs at wells MW-12 and MW-13 do not appear to be related to the site geophysical anomalies since these well locations are up or side gradient of the geophysical anomalies as indicated by the western direction of groundwater flow (Figures 2-11 through 2-14).

4.9 Landfill Gas Monitoring Results

Results of the landfill gas survey are listed in Table 3-3, which also includes the location IDs, sample location coordinates, and parameter readings given by the Gem 2000. As discussed in Section 3.1, the landfill gas monitoring locations were moved to the perimeter fence line adjacent to the neighboring farmland to the north and west, and the Pioneer AOC to the south in accordance with Ohio EPA's direction during the field event (Figure 3-3). Methane was not detected at any of the RI landfill gas sample locations, and carbon monoxide was detected at concentrations of 0.1 to 0.2 part per million (ppm). LEL readings ranged from 0.0 to 0.4 percent of the LEL at location LG-05B. These results suggest that landfill gases in

the filled areas at the site are not migrating from the immediate area through the shallow clayey soils. The results of the landfill gas survey are presented in Figure 4-7.

Because bubbling inside MW-11 and MW-13 was observed during collection of static water levels in April 2009, LEL readings were collected from the well casings during the April and July 2009 quarterly groundwater monitoring events, and are included in Table 3-3. LEL readings greater than the MultiRAE field meter could measure (20 percent) were recorded during the third event (April 2009) at MW-11 and MW-13. Therefore, during the fourth quarter event, a GEM 2000 multigas meter was used to measure landfill gas that had accumulated in the upper casing of the site wells. In July 2009, MW-11 and MW-13 measured at a peak of 90.5 and 49.7 percent methane, respectively. Low oxygen levels (less than 15 percent) also were noted in MW-11 and MW-13 during both events and at MW-12 in April. Measurements of ambient air in the breathing zone around the wells indicated no elevated levels of methane, carbon dioxide, or VOCs (via the photoionization detector), normal levels of oxygen, and no elevated LEL readings. Gas readings taken down the well indicate that methane is present in the subsurface and has accumulated in the well casing; however, these measurements are not a quantitative assessment of methane in and around the AOC. The downwell monitoring results are also presented on Figure 4-7.

The elevated methane readings inside the wells could be related to the proximity of MW-11 and MW-13 to the AOC landfill area, as gas may more easily migrate into the screened interval of the well than through the clay subsurface, collecting in the well casing. It should be noted that the Ohio Geological Survey Emergency Oil and Gas Well Locator map (ODNR 2010) indicates there is a natural gas field in the northwestern section of Richland County, with 14 wells (both producing and plugged) within 2 miles of the former Wilkins AFS and six wells within 2 miles of the Shelby Horizons property. Total depths of the six wells closest to Shelby Horizons property range from 295 to 4,065 feet bgs, and one well is still producing (all others are plugged) (ODNR 2010). However, it is unlikely that the natural gas field is the source of the methane detected in the site monitoring wells, given the distance of the well field from the site and the depths of the gas wells in the well field.

4.10 SI Mercury Vapor Results

As discussed in Section 1.2.3, a mercury vapor survey was conducted on the large anomaly during the SI activities in August 2000. Mercury vapor was only detected in an approximately 800 ft^2 section in the southern portion of the large anomaly (Figure 1-5). Detected concentrations ranged from 0.001 to 0.178 milligram per cubic meter (mg/m^3), which exceeded the December 2009 industrial air RSL of 0.0013 mg/m^3.

Mercury vapor was not collected during the RI activities. Mercury was not detected above the residential soil RSL in the soil samples collected near this area: two surface soil samples (SS-08 and SS-09), one subsurface soil sample (SI-SB-13), and two drainage ditch surface soil samples (SS-06 and SS-07).

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SECTION 5

Constituent Fate and Transport

A conceptual site model (CSM) was developed for the site based on data obtained during the prior SI and the current RI sampling efforts. The purpose of the CSM is to illustrate generalized concepts for site geologic and hydrogeologic conditions as they relate to site constituent sources, constituent migration pathways, and chemical and physical processes that occur at the site. The CSM is presented in Figure 5-1. The information portrayed in the CSM is further developed in this section to enhance the understanding of the site with respect to how past operations and activities on the property may have affected the surrounding environment, and attempt to accurately describe the current and potential future migration and levels of COPCs.

The discussion of fate and transport is based upon assumptions made using current and past property data, property history, and basic information about site conditions.

5.1 Conceptual Site Model

The CSM (Figure 5-1) presents generalized concepts for site geologic and hydrogeologic conditions. As discussed in Section 2, the water table at site wells generally occurs at a depth of approximately 8 feet bgs in a zone of predominantly silt and clay interspersed with occasional sand and gravel lenses. Groundwater at the site flows in a general westerly direction (Figures 2-11 through 2-14). Surface drainage at the site is generally in an easterly direction through the drainage ditch. After this drainage ditch leaves the site, it diverges to the north and east and directs water north toward the tributary to Marsh Run and east toward the Black Fork Mohican River. Figure 5-1 illustrates the groundwater and overland flow directions; these are a general indication of potential constituent migration via groundwater and overland flow.

Methane was not detected at sampling locations along the perimeter of the Shelby Horizons AOC, but measured in MWs during quarterly sampling events. This methane likely migrated to the monitoring well through more permeable groundwater-bearing zones beneath the filled areas. The origin of methane in the subsurface has not been determined.

5.2 Potential Migration Routes

Potential migration routes at the site include: groundwater, surface water, overland migration (via overland water or sediment movement) of dissolved or adsorbed constituents, lateral or vertical migrations of gases, and atmospheric migration through particulate (dust) or volatile (gaseous) emissions.

A chemical migration pathway is a route by which a chemical travels following a release or spill from a source. Based upon the nature and extent of contamination as discussed in Section 4, the potential routes of migration that exist at the site are:

- Migration (vertical and horizontal) through saturated and unsaturated zones

- Surface transport of soil and surface water constituents through overland flow
- Atmospheric transport and resuspension of particulate matter via prevailing winds
- Transport of soluble constituents within groundwater

Migration of constituents through saturated and unsaturated soil zones could occur at the site as dissolved transport through groundwater or surface water; however, as discussed in Section 5.4, most of the constituents present at the site have low solubility in water and thus have a limited potential for transport within water.

Transport of soil and sediment COPCs is most likely to occur via surface water runoff in overland flow or flow within the site drainage ditches. There also is potential for migration of COPCs from soil or sediment through airborne dust migration. However, large portions of the site are covered with moderate vegetation, reducing the surface water runoff or airborne transport, with the exception of surface water flow within the drainage ditch during periods of heavy precipitation.

The physical and chemical properties relating to persistence of the site constituents strongly influence their fate and transport processes. Persistence is the measure of how long a constituent will remain in the environment. The primary environmental factors and processes that affect the persistence of the constituents fall into the following basic categories, which will be discussed in this section according to classes (organics and inorganics):

- Abiotic transformation processes, such as oxidation-reduction reactions, hydrolysis, and photolysis, which are affected by concentration of other ions in the medium, water chemistry, pH, soil moisture, and organic matter content

- Biological transformation and/or degradation processes, such as the presence of macro- and microorganisms

5.2.1 Inorganic Constituents (Metals)

Both abiotic and biological processes can affect the persistence of metals in soil, sediment, groundwater, and surface water. Metals may undergo chemical transformations such as changes in oxidation states, but they do not degrade, and will remain in the environment in one form or another.

An important factor in determining which species of an element is available for reaction and will persist in the environment is the ORP (or redox potential). Generally, the reduced forms of a metal are more soluble than the oxidized form. According to Appendix E of the *USEPA Class V Underground Injection Control Study* (USEPA 1999a), other factors, such as change in pH and biological activity, can also influence redox potential.

Inorganic constituents found in soil and groundwater at the site above applicable USEPA screening levels include arsenic, cobalt, mercury, antimony, and lead, although arsenic was the only constituent consistently detected in all media (Tables 4-1, 4-2, and 4-3). In groundwater, arsenic can be affected by redox reactions. An alkaline pH can also affect dissolution potential by reducing arsenic- from arsenate to the more soluble arsenite- and releasing it into solution, as reported in the journal *Environmental Science and Technology* (Masscheleyn et al. 1991). Conditions at MW-11 and MW-13, where arsenic concentrations in groundwater exceeded USEPA tap water screening levels, were marginally reducing: at

MW-11, ORP ranged from -79.8 to 134 mV, with very low DO values (0.03 to 0.64 mg/L). ORP values at MW-13 ranged from -2.4 to -125 mV (Table 3-2), while DO values ranged from 0 to 1.62 mg/L. Under more oxidizing conditions, such as those at MW-12, where ORP values ranged from 57.5 to 128.2 mV, the primary form of arsenic is likely to be arsenate and generally will remain stable, which may contribute to arsenic not being detected in MW-12.

5.2.2 Organic Constituents

The persistence of organic constituents varies by the specific compound and is affected by hydrolysis, neutralization of organic compounds, and decomposition resulting from biological degradation by soil microorganisms. Microbial processes are usually the dominant decomposition pathway for organic constituents (USEPA 1999a). Factors shown to influence the rate of organic constituent degradation in soil include temperature, organic matter in soil, the nature of the microbial community, and the presence of microbial food substrates (Plexus 2006).

Polynuclear Aromatic Hydrocarbons

PAHs of interest at the site are benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene. These PAHs were most prevalent in surface soil. Of particular interest is benzo(a)pyrene, which was the only PAH compound that exceeded the industrial soil RSL (1.6 mg/kg) in all drainage ditch surface soil, surface soil, and shallow subsurface soil samples. The persistence of a PAH compound within the soil environment is roughly proportional to the number of fused benzene rings that comprise each compound (USEPA 1999a). By this reasoning, benzo(a)anthracene, which has a four-ring SVOC, will degrade more rapidly in soil than the other PAHs of interest, which contain more benzene rings, but all will be relatively slow to degrade compared to VOCs or simpler SVOCs. PAHs generally also have a low solubility in water, but if they reach the dissolved phase, may be degraded through time via biodegradation.

5.3 Constituent Migration Processes

Mobility is the measure of a constituent's ability to be transported in the environment over time. A constituent may move under the influence of gravity (as with light or dense nonaqueous phase liquids), or under the influence of groundwater flow as with dissolved constituents. This section describes the processes that control such movement through site groundwater, surface water, soil, and sediment. Fundamental processes that affect constituent migration include adsorption, fixation (including precipitation and dissolution), volatilization, sorption and desorption, advection and dispersion, and diffusion. These processes are discussed below in regards to conditions and constituents present at the site.

5.3.1 Adsorption

The migration of constituents through the subsurface is a function of the extent to which they are adsorbed to soil or sediment particles. This potential for adsorption to soil or sediment is described by the K_d value, the soil-water partition coefficient of the constituent, which represents the ratio of the change in concentration of the constituent on soil to the change in concentration of the constituent in groundwater. When the sorption of hydrophobic compounds is expressed as a function of the organic carbon content of the soil,

a constant (K_{oc}) is generated which is a property of the compound being sorbed (USEPA 1999a). This value is equal to:

$$K_{oc} = (K_d)/(f_{oc})$$

Where: K_{oc} is equal to the partition coefficient (K_d) divided by f_{oc}, the fractional mass of organic carbon in soil. K_{oc} is dependent on the nature of the adsorbing species and is independent of other soil properties.

The sediment/water partition coefficient (K_d) can be estimated for a variety of soil if the organic carbon content of each soil is known and the K_{oc} has been determined for a hydrophobic compound. In general, the higher the K_{oc} (measured in milliliters per gram [mL/g]), the more likely a chemical is to bind to soil than to remain in water. For instance, many SVOCs are generally relatively immobile in the subsurface environment and preferentially bind to soil, thus will not travel in groundwater as easily as constituents with higher solubilities. Table 5-1 lists the partition coefficient and other physical and chemical properties affecting persistence and mobility of constituents detected in above USEPA industrial or residential screening levels at the site. All of the PAH compounds exceeding the RI screening levels (either industrial or residential soil RSLs) have very high K_{oc} values (ranging from 176,900 in benzo[a]anthracene to 1,951,000 in indeno[1,2,3-cd]pyrene), indicating a strong immobility in these compounds.

5.3.2 Volatilization

Volatilization is the movement of a constituent from the liquid or solid phase to a gas phase, and typically is expressed for a given compound as either the Henry's Law Constant or vapor pressure. In general, a larger Henry's Law Constant or vapor pressure values indicate a greater tendency to volatilize. Volatilization is primarily a means for constituent mobility at interfaces such as surface water to air or soil to air.

Since vapor pressure values for VOCs are generally much higher than for SVOCs or PAHs, and no VOCs were identified at the site in excess of groundwater or soil screening levels, volatilization is not expected to be a primary migration mechanism of site constituents. As indicated in Table 5-1, the Henry's Law Constant values for PAHs detected above RI screening levels are very low, on the order of 10^{-5} to 10^{-7} atm-m^3/mole. Vapor pressure values for these compounds range from 1.4×10^{-4} to 5.0×10^{-7} at 20 degrees Celsius.

Inorganic constituents, though frequently detected in site samples, are unlikely to volatilize, with the exception of mercury, which has a potential to volatilize from soil or groundwater. There is potential for mercury vapor transport in the subsurface, particularly in the areas of elevated mercury vapor identified in the SI mercury vapor survey. The area where mercury vapor was identified in the SI is less than 800 ft^2 and located near the southern portion of the large anomaly immediately south of the drainage ditch. The amount of mercury removed or mobilized by volatilization appears to be affected by the solubility of the mercury compounds added to the soil (USEPA 1999a), and inversely related to soil adsorption capacity (McLean and Bledsoe 1992).

5.3.3 Dissolution and Precipitation

Dissolution and precipitation of constituents are largely a function of, and directly proportional to, solubility. Constituents with higher solubility will enter water or liquid

solutions much more readily than less soluble constituents. VOCs are generally more soluble in water than SVOCs and PAHs. As Table 5-1 indicates, the water solubility (in milligrams per liter) of organic site constituents above RI screening levels (industrial and residential RSLs for soil, USEPA tap water or MCL screening levels for groundwater) is low (the highest was benzo[a]anthracene at 0.01 mg/L).

In metals, dissolution and precipitation of metals also depends on the species' ORP and the pH of the soil or groundwater system, as well as the presence of other anions and competing cations that exceed the matrix solubility product constant. Metal precipitation also is affected by the presence of other anions that can cause a metal to form insoluble inorganic compounds.

5.3.4 Advection and Dispersion

Advection is the mass transport of constituents within the flow of the water in which they are dissolved. The direction and rate of such transport is generally directly related to that of groundwater or surface water, though these dissolved compounds also are subject to sorption processes by solid surfaces (that is, soil or sediment) that the water comes in contact with, which could result in a lower advection rate than the water. As defined in *Physical and Chemical Hydrogeology* (Domenico and Schwartz 1990), dispersion occurs when fluid movement causes a zone of mixing to develop between a fluid of one type or composition that is adjacent to or being displaced by a fluid of another composition. As surface water at the site is only occasionally present, and constituent presence in groundwater is irregular and inconsistent with groundwater flow direction, advection and dispersion are not considered significant mechanisms of migration at the site.

5.3.5 Diffusion

Diffusion is the movement of a constituent from an area of high concentration to one of low concentration. Diffusion likely plays a limited role in the migration of metals (specifically arsenic) in groundwater from areas of high concentration to areas of lower concentrations.

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SECTION 6

Human Health Risk Assessment

This section presents the results of the HHRA evaluating potential risks to human health from residual site constituents detected in soil, drainage ditch surface soil, and groundwater at the site. The objective of the HHRA is to evaluate and document the potential risks to human health associated with current and potential future exposures to constituents if no remedial action is taken. Thus, this assessment represents the risks in a "no remedial action scenario."

The HHRA incorporates the general methodology described in the following guidance sources:

- *Risk Assessment Guidance for Superfund* [RAGS], *Volume 1, Human Health Evaluation Manual*, Part A (USEPA 1989a)
- *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual*, Supplemental Guidance, Standard Default Exposure Factors (USEPA 1991)
- *Soil Screening Guidance: User Guide* (USEPA 1996)
- *Exposure Factors Handbook* (USEPA 1997a)
- *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual*, Part D (USEPA 2001)
- *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual*, Part E—Supplemental Guidance for Dermal Risk Assessment (USEPA 2004)
- *Assessing Compounds without Formal Toxicity Values Available for Use in Human Health Risk Assessment* (Ohio EPA 2005a)
- *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual*, Part F—Supplemental Guidance for Inhalation Risk Assessment (USEPA 2009a)
- Integrated Risk Information System (IRIS; USEPA 2010b)

The supporting tables for this HHRA are presented in RAGS Part D format (USEPA 2001) in Appendix J.

6.1 Human Health Exposure Conceptual Site Model

The purpose of the CSM is to present an overview of site conditions, potential constituent migration pathways, and exposure pathways to potential receptors. Figure 6-1 presents the CSM for human exposure for the site associated with soil, drainage ditch surface soil, and groundwater for the HHRA. Table 1 in Appendix J summarizes the potential exposure pathways and scenarios considered for the site.

The site is an open, level area on the western end of the Shelby Horizons property (Figure 1-4). Two anomalies, likely former disposal area trenches, which were identified by geophysical survey within the Shelby Horizons property during the SI (Plexus 2001), comprise the Shelby Horizons AOC. The larger anomaly of the two is approximately 0.5 acre (21,780 ft^2) in area, and the smaller anomaly is approximately 1,350 ft^2 in area (Plexus 2001). The site is almost entirely mowed grass with a portion of the property containing a gravel-covered semi-tractor trailer parking area, which was constructed by removing 10 inches of soil and replacing it with 10 inches of gravel. A shallow ditch also has been cut along the southern and western areas of the AOC to facilitate drainage of rainwater runoff. The ditch is dry during most of the year. Because of the intermittent presence of water in the drainage ditch, contact with surface water from rainwater runoff was not considered a potentially significant complete exposure pathway.

Potential current receptors include industrial workers from nearby buildings or the semi-tractor trailer parking area and trespasser/visitors. The current receptors may come in contact with surface soil. Exposure routes for surface soil may include incidental ingestion of and dermal contact with the surface soil, and inhalation of particulate and volatile emissions from surface soil.

Potential future receptors include industrial workers, trespasser/visitors, future residents and construction workers. It is assumed that the future receptors could be exposed to surface and subsurface soil if future residential houses or additional industrial buildings are constructed or excavation activities occur onsite and the soil is reworked, bringing subsurface soil to the surface. However, there are no plans for a future site use different from the current use. Exposure routes for the surface and subsurface soil are the same as those for current surface soil, incidental ingestion of the soil, dermal contact with the soil, and inhalation of particulate and volatile emissions from soil.

Potable water supplies for the former Wilkins AFS and the surrounding area within city limits are provided by municipal water from the Shelby Water Department. The municipal water system obtains its water from two surface water intakes and uses groundwater as a backup. There are two large-diameter groundwater wells for municipal supply backup approximately 0.6 mile southeast and upgradient of the former Wilkins AFS; there are no potable water intakes or wells used for water supply at the former Wilkins AFS.

VOCs were not detected in groundwater at the site; therefore, vapor intrusion into current or future buildings was not considered a potentially complete exposure pathway.

6.2 Scope of Risk Assessment

The primary objective of the HHRA is to assess current and future health risks associated with exposure to site soil and groundwater under current and potential future site conditions. The risk assessment consists of the following components:

- **Identification of COPCs**—identification of the constituents found onsite and selection of the COPCs. COPCs identified in this screening are the focus of the subsequent evaluation in the risk assessment

- **Exposure Assessment**—identification of the potential pathways of human exposure, characterization of the potentially exposed populations, and estimation of the magnitude, frequency, and duration of exposures
- **Toxicity Assessment**—assessment of the potential adverse effects of the COPCs and compilation of the toxicity values used for developing numerical risk estimates
- **Risk Characterization**—integration of the results of the exposure assessment and toxicity assessment to develop numerical estimates of health risks
- **Uncertainty Assessment**—identification and discussion of sources of uncertainty associated with the data, methodology, and values used in the risk assessment

These components are described briefly in the following sections.

6.3 Identification of Constituents of Potential Concern

The data evaluated in the HHRA consist of soil and groundwater samples collected during the SI and RI. Sample analyses for VOCs, SVOCs, pesticides/PCBs, herbicides, explosives, and inorganics were used in the HHRA.

Screening against human health risk-based criteria to identify COPCs further reduced the dataset for each environmental medium quantitatively evaluated.

6.3.1 Data Summary and Evaluation

Detailed results of the sampling at the site are presented in Section 4. For purposes of the HHRA, analytical results for VOCs, SVOC, and pesticides/PCBs from surface soil and subsurface soil collected in August 2000 for the SI (Plexus 2001); and VOCS, SVOCs, PAHs, and metals in surface soil, drainage ditch surface soil, and VOCs, SVOCs, PAHs, and dissolved metals in groundwater collected in October 2008 were compiled and evaluated as single exposure unit. Because of the close proximity of the surface soil samples (collected from 0 to 2 feet bgs) and drainage ditch surface soil samples (collected from 0 to 6 inches bgs), data from these locations were combined for evaluation and identified hereafter as surface soil in the HHRA. Details of the samples collected in 2000 are provided in the SI report (Plexus 2001). A discussion of the samples collected in 2008 is provided Section 3; detailed results of the sampling are presented in Section 4. CH2M HILL validated data collected during the RI (October 2008) (Appendix E).

Table 6-1 lists the samples and analytical parameters that were evaluated in the HHRA. All of the data selected for inclusion in the risk assessment were evaluated to determine their reliability for use in the quantitative risk assessment. A review of the data identified the following criteria for data usability:

- Data qualified with a J (estimated) were treated as detected concentrations.
- Data qualified with an R (rejected) were excluded from the risk assessment. These include data that did not meet the goal for completeness (the percentage of valid or usable measurements compared to planned measurements).
- Data qualified with a B (blank contamination) were used in the risk assessment as if these constituents were not detected.

- For duplicate samples, the greater of the two concentrations was used as the sample concentration in calculating exposure point concentrations (EPCs).
- One-half the reporting limit was used to determine COPC status, for analytes that were not detected. Following identification as a COPC, the analyte reporting limit was used in calculating EPCs.

6.3.2 Selection of Constituents of Potential Concern

All of the detected constituents were screened following the procedures described below. The maximum detected concentration of each constituent in each medium was compared to the criteria discussed below to select the COPCs for the medium. If the maximum concentration exceeded the criteria, the constituent was selected as a COPC. Additionally, for constituents that were not detected, one-half the reporting limit was compared to the screening criteria to identify COPCs for quantitative evaluation in the HHRA. The COPC screening is presented in Appendix J, Table 2.1 through 2.5.

- **Soil (Risk-Based Screening):** The maximum detected constituent concentrations in surface soil and total soil were compared to USEPA RSLs for residential contact with soil (USEPA 2009b) RSLs based on noncarcinogenic effects were adjusted (divided by 10) to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table.
- **Soil (Background Screening):** Metals detected at the site may be naturally occurring concentrations and not related to historical site activities. A background screening, consisting of a comparison of soil concentrations to the lower mean reported soil concentrations from the *Guidance for Developing Ecological Screening Levels* (USEPA 2005a) and the mean background concentrations from the nearby Pioneer AOC at the former Wilkins AFS (Plexus 2006). Table 6-2 presents a summary of the background screening levels. Background levels for metals in soil were used for risk assessment screening levels if they were higher than USEPA-adjusted RSLs for residential and industrial soil contact.
- **Air (Soil):** Although direct soil contact RSLs include the incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions pathways, the soil-to-air pathway was evaluated separately in the screening process to focus on COPCs with potentially significant contribution to hazards and risks. Ambient concentrations of particulate and volatile emissions from soil were estimated to select COPCs for the soil-to-air exposure pathway. The particulate and volatile emissions from soil and associated ambient air concentrations were estimated following USEPA's *Soil Screening Guidance: User Guide* (USEPA 1996) and USEPA's RAGS, Part F (USEPA 2009a). The air concentrations were modeled using the maximum detected soil concentrations. These modeled values for surface soil and combined surface and subsurface soil were compared to RSLs for residential ambient air.
- **Groundwater:** The maximum detected concentrations in groundwater were compared with the RSLs for tap water, adjusted as described above (USEPA 2009b).
- **Essential Human Nutrients:** Constituents considered essential nutrients, present at low concentrations (that is, only slightly elevated above naturally occurring levels), and toxic

only at very high doses were eliminated from the quantitative risk analysis. These constituents include calcium, magnesium, phosphorous, potassium, and sodium. Although iron also is considered an essential nutrient and is toxic at only very high doses, iron was included in the HHRA because a provisional toxicity value is available.

6.3.3 Summary of Constituents of Potential Concern

Table 6-3 identifies the constituents that were selected as COPCs for each of the media. Six SVOCs (n-nitrosodimethylamine; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; dibenz[a,h]anthracene; and indeno[1,2,3-cd]pyrene) were selected as COPCs. Although, n-nitrosodimethylamine was not detected, it was selected as a COPC because one-half the reporting limit was greater than the screening level. Benzo(k)fluoranthene and chrysene also were selected as COPCs, based on the selection criterion of a constituent from the same class, carcinogenic polynuclear aromatic hydrocarbon (cPAH). Seven metals (aluminum, arsenic, chromium, cobalt, iron, manganese, and mercury) were selected as COPCs. The same COPCs were identified for combined surface and subsurface soil with the addition of antimony, cadmium, lead, and vanadium selected as COPCs. For the soil-to-air pathway for surface soil and combined surface and subsurface soil, one metal (chromium) was retained as a COPC.

Two VOCs (1,2-dibromo-3-chloropropane and dibromomethane), 11 SVOCs (1,2-diphenylhydrazine; 3,3'-dichlorobenzidine; 4,6-dinitro-2-methylphenol; 4-nitrophenol; benzo[a]pyrene; benzo[k]fluoranthene; bis[2-chloroethyl]ether; chrysene; hexachlorobenzene; n-nitrosodimethylamine; and n-nitroso-di-n-propylamine), and three metals (arsenic, chromium, and manganese) were retained as COPCs in groundwater. All of the groundwater COPCs, with the exception of manganese, were not detected and were selected as COPCs because one-half their respective reporting limits were greater than the screening levels. Benzo(a)anthracene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene also were selected as COPCs, based on the selection criterion of a constituent from the same class, cPAH. For the groundwater-to-air pathway, the two VOCs (1,2-dibromo-3-chloropropane and dibromomethane) that were retained as COPCs in groundwater were included for evaluation.

6.4 Exposure Assessment

Exposure assessment is the estimation of the likelihood, magnitude, frequency, duration, and routes of exposure to a constituent. “Exposure” refers to the potential contact of an individual (or receptor) with a constituent. Exposure can occur when constituents migrate from a source to an exposure point, or when a receptor comes into direct contact with contaminated media.

The three components of exposure assessment include:

- Characterization of exposure setting
- Identification of exposure pathways
- Quantification of exposure

6.4.1 Characterization of Exposure Setting

Characterization of exposure setting consists of two parts: (1) characterization of the site with respect to the physical characteristics and (2) characterization of the site with respect to human populations at or near the site.

Physical Characteristics

A description of the Shelby Horizons AOC is included in Section 2. Section 2 describes the site demography, land use and physical setting, including the surface water hydrology, topography, geology, and hydrogeology.

Potentially Exposed Populations

The former Wilkins AFS consists of 486 acres occupied by an industrial complex and an educational facility. The Shelby Horizons AOC is an open level area that measures approximately 320 feet by 120 feet on the western end of the property. Table 1 in Appendix J summarizes the potentially exposed populations at the site. The receptors were discussed in Section 6.1.

6.4.2 Identification of Exposure Pathways

An exposure pathway can be described as the physical course that a COPC takes from the point of release (or source) to a receptor. To be complete, an exposure pathway must have all of the following components:

- A source (such as constituent residues in soil)
- A mechanism for chemical release and migration (such as leaching)
- An environmental transport medium (such as groundwater)
- A point or site of potential human contact (exposure point, such as drinking water)
- A route of intake (for example, incidental ingestion of groundwater used as a drinking water source)

In the absence of any one of these components, an exposure pathway is considered incomplete, and, by definition, there is no risk or hazard. In some cases, a receptor may contact a source directly, eliminating the release and transport pathways.

The potential exposure pathways for the site were identified in the CSM (Figure 6-1) and are listed in Table 1 in Appendix J. The following subsections discuss the elements of the exposure pathways for the site.

Constituent Sources

As shown on Figure 6-1, the initial source of contamination is believed to be from historical facility operational chemical handling and storage and waste trenches at the site.

Release and Transport Mechanisms

Constituent fate and transport, including constituent mobility and persistence, and the potential constituent migration pathways and release mechanisms at the site are discussed in Section 4.

Exposure Points and Exposure Routes

Exposure points are the locations where humans could contact site-related contamination. Onsite exposure points include soil and groundwater beneath the site. Offsite exposure points are groundwater downgradient of the site and ambient air. Table 1 in Appendix J describes the exposure pathways that were considered for evaluation, and presents the rationale for evaluation of the exposure pathway.

Section 6.1 identifies the potential receptors and exposure pathways. In summary, the current land use exposure routes for quantitative evaluation include the following:

- Trespasser/Visitor (adult and youth): incidental ingestion of, dermal contact with, and inhalation of volatile and particulate emissions from surface soil
- Industrial worker: ingestion of, dermal contact with, and inhalation of volatile and particulate emissions from surface soil

The future land use exposure routes include the current pathways and the following:

- Resident (adult and child)—incidental ingestion of, dermal contact with, and inhalation of volatile and particulate emissions from surface soil and total soil (combined surface and subsurface soil)
- Construction worker— incidental ingestion of, dermal contact with, and inhalation of particulate and volatile emissions from total soil (combined surface and subsurface soil), and dermal contact with and inhalation of volatile emissions from shallow groundwater

6.4.3 Quantification of Exposure

Exposure is quantified by estimating the EPCs of COPCs in environmental media and COPC intake by the receptor.

Exposure Concentrations

EPCs are estimated constituent concentrations that a receptor may contact and are specific to each exposure medium. EPCs may be directly measured or estimated using environmental fate and transport models. Constituent concentrations in soil and groundwater were measured for this assessment. Fate and transport modeling conducted for the site risk assessment included estimating fugitive dust and volatile emissions from soil following the methods in USEPA's *Soil Screening Guidance: User Guide* (USEPA 1996), as listed in Tables 2.2, 2.2A, 2.4, and 2.4A in Appendix J, and estimating volatile emissions from groundwater in an open excavation for a construction scenario using a Two-Film Volatilization Model (Table 7.10.RME Supplement B in Appendix J).

Fewer than five samples were available for groundwater; therefore, the maximum detected concentrations of the COPCs across the site were used as the reasonable maximum exposure (RME) EPCs.

ProUCL software Version 4.00.04 (USEPA 2009c) was used to determine the distribution that the data fit and to calculate the 95 percent upper confidence limits (UCLs) for the surface soil and combined surface and subsurface soil. ProUCL identifies three possible data distributions: normal distribution, log-normal distribution, and gamma distribution. The UCL calculation method is then selected based on the data distribution (that is, normal, log-

normal, gamma, or nonparametric if the data do not fit any of the distributions). The recommendations outlined in the ProUCL software documentation were followed to select the appropriate UCL (USEPA 2009c). The maximum detected concentration was used as the EPC in cases where the estimated 95 percent UCL was greater than the maximum detected concentration.

Tables 3.1.RME through 3.6.RME in Appendix J present the EPCs for the COPCs for each medium and the rationale for the selected EPC.

Estimation of Constituent Intakes

Intake is the amount of a constituent entering the exposed receptor's body. Intakes of COPCs through contact with exposure media, such as incidental ingestion and dermal contact with soil, are expressed using algorithms provided in USEPA guidance (USEPA 1989a, 2004). The generalized equation for calculating constituent intakes is as follows:

$$I\ (mg/kg-day) = \frac{C\ x\ CR\ x\ EF\ x\ ED}{BW\ x\ AT}$$

Where:

- I = intake (milligrams per kilogram per day [mg/kg-day])
- C = constituent concentration at exposure point (the EPC; mg/L or mg/kg)
- CR = contact rate, or amount of contaminated medium contacted per unit time or event (L/day or mg/event)
- EF = exposure frequency (days/year)
- ED = exposure duration (years)
- BW = body weight of exposed individual (kg)
- AT = averaging time, or period over which exposure is averaged (days)

The algorithms for estimating intakes of COPCs for individual exposure pathways are provided below.

Incidental Ingestion of Soil

The equation to calculate intake from the incidental ingestion of soil can be expressed as:

$$CDI\ (mg/kg-day) = \frac{CS\ x\ IR_{soil}\ x\ EF\ x\ ED\ x\ CF}{BW\ x\ AT}$$

Where:

- CDI = chronic daily intake (mg/kg-day)
- CS = constituent concentration in soil at exposure point (mg/kg)
- IR_{soil} = ingestion rate of soil (mg/day)
- EF = exposure frequency (days/year)
- ED = exposure duration (years)
- CF = conversion factor (1×10^{-6} kg/mg)
- BW = body weight of exposed individual (kg)
- AT = averaging time, or period over which exposure is averaged (days)

Dermal Contact with Soil

The dose from dermal contact with soil can be estimated from the following equation:

$$DAD(mg/kg-day) = \frac{DA_{event}\ x\ SA\ x\ EV\ x\ EF\ x\ ED}{BW\ x\ AT}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	dermally absorbed dose per event (mg/cm^2-event)
SA	=	skin surface area available for contact (cm^2)
EV	=	event frequency (events/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight of exposed individual (kg)
AT	=	averaging time, or period over which exposure is averaged (days)

The dermally absorbed dose per event can be estimated using the following equation:

$$DA_{event}\ (mg/cm^2 - event) = CS\ x\ CF\ x\ SSAF\ x\ DABS$$

Where:

DA_{event}	=	dermally absorbed dose per event (mg/cm^2-event)
CS	=	constituent concentration in soil at exposure point (mg/kg)
CF	=	conversion factor (1×10^{-6} kg/mg)
SSAF	=	soil to skin adherence factor (unitless)
DABS	=	dermal absorption factor (days/year)

The DABS values are obtained from USEPA's RAGS, Part E (USEPA 2004). A DABS of 0.13 was used for PAHs, a DABS of 0.1 was used for other SVOCs, a DABS of 0.03 was used for arsenic, and a DABS of 0.01 was used for the rest of the inorganic COPCs. The methods presented in USEPA's RAGS, Part E (USEPA 2004) were used to evaluate dermal exposure to groundwater for construction worker receptors.

Inhalation of Volatiles and Particulates from Soil

The methods presented in USEPA's RAGS, Part F (USEPA 2009a) were used to evaluate inhalation exposures. The intake associated with the inhalation of constituents in air involves five steps as described in the following equations:

1. Calculation of Inhalation Intake Factor

$$EC\left(mg/m^3\right) = \frac{CA\ x\ ET\ x\ EF\ x\ ED}{AT}$$

Where:

EC	=	exposure concentration in air (milligrams per cubic meter [mg/m^3])
CA	=	constituent concentration in air (mg/m^3)
ET	=	exposure time (hrs/day)
EF	=	exposure frequency (days/year)

ED	=	exposure duration (years)
AT	=	averaging time, or period over which exposure is averaged (years × 365 days/year × 24 hours/day)

2. Calculation of Constituent Concentration in Air

$$CA\left(\frac{mg}{m^3}\right) = \frac{1}{\text{PEF}} + \frac{1}{VF}$$

Where:

CA	=	constituent concentration in air (mg/m^3)
PEF	=	particulate emission factor (m^3/kg)
VF	=	volatilization factor (m^3/kg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AT	=	averaging time, or period over which exposure is averaged (days)

3. Calculation of Particulate Emission Factor

$$PEF\left(\frac{m^3}{kg}\right) = \frac{Q}{C}\, x\, \frac{3600}{0.036\, x\,(1-V)\, x\,\left(\frac{U_m}{U_t}\right)^3\, x\, F_x}$$

Where:

PEF	=	particulate emission factor (m^3/kg)
Q/C	=	inverse of the mean concentration at center of square source (g/m^2-s per kg/m^3) (85.63178)
V	=	fraction of vegetative cover (unitless) (0.5)
U_m	=	mean annual wind speed (m/s) (4.83)
U_t	=	equivalent threshold value of wind speed at 7 meters (m/s) (11.32)
F_x	=	function dependent on U_m/U_t (unitless)

This PEF value were calculated using the methodology presented in USEPA *Soil Screening Guidance: User's Guide* (1996) and assuming values for 0.5-acre source area and Cleveland, Ohio, climatic zone.

4. Calculation of Volatilization Factor

$$VF\left(\frac{m^3}{kg}\right) = \frac{Q}{C}\, x\, \frac{(3.14\, x\, D_A\, x\, T)^{1/2}\, x\, 10^{-4}\left(\frac{m^2}{cm^2}\right)}{2\, x\, \rho_b\, x\, D_A}$$

Where:

VF	=	volatilization factor (m^3/kg)
Q/C	=	inverse of the mean concentration at center of square source (g/m^2-s per kg/m^3) (85.63178)
D_A	=	apparent diffusivity (cm^2/s)
T	=	exposure interval (s) (9.5x10^8)
ρ_b	=	dry soil bulk density (g/cm^3) (1.5)

5. Calculation of Apparent Diffusivity

$$D_A\left(cm^2/s\right)=\frac{\left(\left(\theta_a^{10/3}\ x\ D_i\ x\ H'\right)+\left(\theta_w^{10/3}\ x\ D_w\right)\right)/n^2}{\rho_b\ K_d+\theta_w+\ \theta_a\ H'}$$

Where:

D_A	=	apparent diffusivity (cm^2/s)
θ_a	=	air-filled soil porosity (L_{air}/L_{soil}) ($n-\theta_w$)
θ_w	=	water-filled soil porosity (L_{water}/L_{soil}) (0.15)
n	=	total soil porosity (L_{pore}/L_{soil}) (0.43)
D_i	=	diffusivity in air (cm^2/s; chemical-specific)
D_w	=	diffusivity in water (cm^2/s; chemical-specific)
H'	=	Henry's Law Constant (dimensionless; chemical-specific)
ρ_b	=	dry soil bulk density (g/cm^3) (1.5)
ρ_s	=	soil particle density (g/cm^3) (2.65)
K_d	=	soil to water partition coefficient (cm^3/g) ($K_{oc} \times f_{oc}$)
K_{oc}	=	soil organic carbon partition coefficient (cm^3/g; chemical-specific)
f_{oc}	=	fraction organic carbon in soil (g/g) (0.006)

Note that the chemical-specific volatilization factor (VF) for soil is considered applicable only for soil COPCs that are volatile (such as Henry's Law Constant of 1×10^{-5} atm-m^3/mole or greater and with a molecular weight of less than 200 grams per mole). Table 2.2A in Appendix J provides chemical-specific VFs and their associated input parameters for all COPCs in the HHRA.

Dermal Contact with Groundwater

The methods presented in USEPA's RAGS, Part E (USEPA 2004) were used to evaluate dermal exposure to groundwater for construction worker receptors.

The dose from dermal contact with groundwater can be estimated from the following equations:

$$DAD\,(mg/kg-day)=\frac{DA_{event}\ x\ SA\ x\ EV\ x\ \ EF\ x\ ED}{BW\ x\ AT}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	dermally absorbed dose per event (mg/cm^2-event)
SA	=	skin surface area available for contact (cm^2)
EV	=	event frequency (events/year)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight of exposed individual (kg)
AT	=	averaging time, or period over which exposure is averaged (days)

1. DA_{event} for Inorganics:

$$DA_{event}\ (mg/cm^2 - event) = CW\ x\ K_p\ x\ t_{event}\ x\ 0.001\ {}^{mg}\!/_{\mu g}\ x\ 0.001\ {}^{L}\!/_{cm^3}$$

Where:

DA_{event} = dermally absorbed dose per event (mg/cm²-event)
CW = constituent concentration in groundwater (µg/L)
K_p = permeability coefficient (cm/hr; chemical-specific)
t_{event} = event duration (hr/event)

2. DA_{event} for Organics:

For $t_{event} \leq t^*$:

$$DA_{event}\ (mg/cm^2 - event) = 2\ x\ FA\ x\ CW\ x\ K_p \sqrt{\frac{6\ \tau_{event}\ x\ t_{event}}{\pi}}$$

Where:

DA_{event} = dermally absorbed dose per event (mg/cm²-event)
CW = constituent concentration in groundwater (µg/L)
FA = fraction absorbed water (dimensionless; chemical-specific)
K_p = permeability coefficient (cm/hr; chemical-specific)
τ_{event} = lag time per event (hr/event; chemical-specific)
t_{event} = event duration (hr/event)

For $t_{event} > t^*$:

$$DA_{event}\ (mg/cm^2 - event) = FA\ x\ CW\ x\ K_p \left[\frac{t_{event}}{1+B} + 2\ \tau_{event} \left(\frac{1+3B+3B^2}{(1+B)^2} \right) \right]$$

Where:

DA_{event} = dermally absorbed dose per event (mg/cm²-event)
CW = constituent concentration in groundwater (µg/L)
FA = fraction absorbed water (dimensionless; chemical-specific)
K_p = permeability coefficient (cm/hr; chemical-specific)
B = ratio of permeability coefficient of compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless; chemical-specific)
τ_{event} = lag time per event (hr/event; chemical-specific)
t_{event} = event duration (hr/event)

The intake equation requires exposure parameters specific to each exposure pathway. Many of the exposure parameters have default values, which were used for this assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and duration, are provided in USEPA guidance. Tables 4.1.RME through 4.6.RME in Appendix J identify the exposure parameters and intake equations for each of the scenarios evaluated in the risk assessment.

To estimate exposure via dermal contact with soil, two additional parameters are necessary. The first parameter, the dermal absorption fraction, estimates the amount of a constituent in soil that would be absorbed by the skin. The absorption fractions used are from USEPA's RAGS Part E (USEPA 2004). The second additional parameter necessary to estimate dermal exposure to constituents in soil is the adherence factor. The adherence factor estimates the amount of soil that adheres to the skin per unit of surface area. The adherence factors were obtained from USEPA RAGS Part E (USEPA 2004) and are included in the Tables 4.1.RME through 4.6.RME in Appendix J.

The methods presented in the USEPA RAGS Part E (USEPA 2004) for estimating dermal exposure to water were used to evaluate dermal exposure to groundwater for construction workers. The models for groundwater are shown in Table 4.6 in Appendix J. Values for the chemical-specific parameters used in the models were obtained from the USEPA's RAGS Part E (USEPA 2004) and are presented in Table 7.10.RME Supplement A in Appendix G.

6.5 Toxicity Assessment

The toxicity assessment describes the relationship between the magnitude of exposure to a constituent and possible severity of adverse effects, and weighs the quality of available toxicological evidence. This assessment provides, where possible, a numerical estimate of the increased likelihood and/or severity of adverse effects associated with constituent exposure (USEPA 1989a). The toxicity assessment identifies the toxicity values for the COPCs used in the estimation of potential health effects. Health effects are divided into two broad groups: noncarcinogenic and carcinogenic. This division of classification is because health risks are calculated quite differently for carcinogenic and noncarcinogenic effects, and separate toxicity values have been developed for carcinogenic and noncarcinogenic effects.

USEPA recommends that a tiered approach be used to obtain the toxicity values, the reference doses (RfDs) and cancer slope factors (CSFs), used to calculate noncancer and cancer risks, respectively (USEPA 2003a). The sources of toxicity values are as follows:

- Tier 1: USEPA's IRIS database (USEPA 2010b)
- Tier 2: Provisional Peer Reviewed Toxicity Value (PPRTV) database maintained by the USEPA's National Center for Environmental Assessment (NCEA) and the Superfund Health Risk Technical Support Center
- Tier 3: Other USEPA and non-USEPA sources including NCEA, Agency for Toxic Substances and Disease Registry, Health Effects Assessment Summary Tables (USEPA 1997b), California Environmental Protection Agency, USEPA's Office of Water, and World Health Organization

The use of provisional toxicity values, such as those from the PPRTV database, increases the uncertainty of the quantitative risk estimate. If no toxicity values were available for a detected constituent, surrogate constituents were selected and their RSLs were used for the COPC selection process.

6.5.1 Toxicity Information for Noncarcinogenic Effects

Noncarcinogenic effects are quantified by comparing exposure or intake to either RfDs or reference concentrations (RfCs). The RfD is a health-based criterion, expressed as constituent intake rate in units of mg/kg-day, used in evaluating noncarcinogenic effects. The RfD is based on the assumption that thresholds exist for certain toxic effects such as liver or kidney damage, but may not exist for other toxic effects such as carcinogenicity. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime of exposure (USEPA 1989a). The RfD is used to evaluate adverse effects from the oral route of exposure. The RfC is used to evaluate adverse effects from inhalation exposure.

Chronic RfDs and RfCs are developed to evaluate potential toxicity for long-term exposure (more than 7 years of exposure). Subchronic RfDs and RfCs are sometimes used to evaluate exposures of durations ranging from 2 weeks to 7 years, which may be more appropriate to address childhood (1 to 6 years) and construction worker (less than 1 year) exposure durations. Subchronic values are generally less available from data sources than other types of toxicity information. Sometimes in toxicity sources, like IRIS (USEPA 2010b), chronic value estimates are from subchronic data. If the original data were multiplied by an uncertainty factor of 10 to account for the transformation from a subchronic value to a chronic value, then the chronic value can be divided by 10 to obtain a subchronic value. In the absence of an acceptable subchronic toxicity value, chronic values were used conservatively in the HHRA to evaluate exposure pathways.

6.5.2 Toxicity Information for Carcinogenic Effects

Potential carcinogenic effects are quantified using oral CSFs and inhalation unit risk factors (URFs). The CSF is defined as a plausible upper-bound estimate of the probability of a cancer effect per unit intake of a constituent over a lifetime (USEPA 1989a). CSFs and URFs may be derived from the results of chronic animal bioassays, human epidemiological studies, or both. For carcinogens, risks are estimated as the probability that an individual will develop cancer over a lifetime because of exposure to the carcinogen. Cancer risk from exposure to contamination represents the anticipated excess or incremental cancer risk, which is cancer occurrence in addition to normally expected rates of cancer development over the average adult lifetime of 70 years.

6.5.3 Estimated Toxicity Values for Dermal Exposure

Toxicity values have not been developed for the dermal absorption pathway. In general, the oral CSFs and oral RfDs are expressed as administered doses (that is, the amount of a constituent administered per unit time and weight). Conversely, exposures resulting from the dermal pathway are expressed as absorbed doses. Therefore, it is necessary to adjust the oral toxicity value to account for the chemical-specific absorption efficiency. Dermal toxicity values were derived from the oral toxicity values. Dermal RfDs and CSFs were estimated from oral toxicity values using chemical-specific gastrointestinal absorption factors (ABS_{GI}) to calculate total absorbed dose, as described in USEPA dermal risk assessment guidance (USEPA 2004) using the equations shown below.

The dermal reference dose (RfD_d) is derived by multiplying the oral RfD by the ABS_{GI}:

$$RfD_d = RfD_o \times ABS_{GI}$$

Where:

RfD_d	=	Dermal reference dose (mg/kg-day)
RfD_o	=	Oral reference dose (mg/kg-day)
ABS_{GI}	=	Fraction of constituent absorbed in the gastrointestinal tract (unitless)

The dermal CSF (CSF_d) is derived by dividing the oral CSF by the ABS_{GI}:

$$CSF_d = \frac{CSF_o}{ABS_{GI}}$$

Where:

CSF_d	=	Dermal cancer slope factor $(mg/kg\text{-}day)^{-1}$
CSF_o	=	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
ABS_{GI}	=	Fraction of constituent absorbed in the gastrointestinal tract (unitless)

The ABS_{GI} values used in the HHRA were obtained from USEPA's *RAGS, Volume I: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment) Final (USEPA 2004). When chemical-specific ABS_{GI} values are unavailable, a default ABS_{GI} value of 1 for organic and inorganic chemicals (USEPA 2004) were used. The dermal RfDs are included in Appendix J, Table 5.1. The dermal CSFs are presented in Appendix J, Table 6.1.

6.5.4 Constituents without Available USEPA Toxicity Values

Some COPCs at the site may not have RfDs or CSFs because the noncarcinogenic and/or carcinogenic effects of these constituents are not yet determined. In these cases, toxicity values from a constituent with similar toxicological properties and approved toxicity values may be used as a surrogate. Surrogates were selected based on previous recommendations from USEPA. The surrogates are identified in Appendix J, Tables 2.1 through 2.5.

Lead, which was retained as a COPC for total soil, does not have available published toxicity factors. Lead is regulated by USEPA based on blood-lead uptake using a physiologically based pharmakokinetic model called the Integrated Exposure Uptake Biokinetic (IEUBK) Model. As a screening tool, lead is screened at 400 mg/kg in soil. The maximum detected concentration of lead in the total soil (1,190 mg/kg) exceeded the soil screening level. However, lead was detected at a concentration above the screening level in only one of 34 samples. Lead was not included in the quantitative risk estimates because a dose-response toxicity value is not available for this constituent. Exposure to lead is quantitatively evaluated based on blood-lead uptake modeling using USEPA tools and guidance (USEPA 1994a, 2003b) that recommends evaluating average soil lead concentration across the exposure area. The average soil lead concentration at the site is 55.1 mg/kg. Therefore, since the average lead concentration in soil was below the screening level, lead was not evaluated further.

6.6 Risk Characterization

Risk characterization combines the results of the previous elements of the risk assessment to evaluate the potential health risks associated with exposure to the COPCs.

6.6.1 Noncarcinogenic and Carcinogenic Risk Estimation Methods

Potential human health risks are discussed independently for carcinogenic and noncarcinogenic constituents because of the different toxicological endpoints, relevant exposure duration, and methods used to characterize risk. Some constituents may produce both noncarcinogenic and carcinogenic effects, and were evaluated in both groups. The methodology used to estimate noncarcinogenic hazards and carcinogenic risks are described below. Following the description of the methodology, the noncarcinogenic hazards and carcinogenic risks for the site are discussed.

Noncarcinogenic Hazard Estimation

Noncarcinogenic health risks are estimated by comparing the calculated intake to an RfD. The calculated intake divided by the RfD is equal to the hazard quotient (HQ):

$$HQ = Intake / RfD$$

The intake and RfD represent the same exposure period (that is, chronic or subchronic) and the same exposure route (that is, oral intakes are divided by oral RfDs). An HQ that exceeds 1 (that is, the intake exceeds the RfD) indicates there is a potential for adverse health effects associated with exposure to that constituent.

To assess the potential for noncarcinogenic health effects posed by exposure to multiple constituents, a hazard index (HI) approach is used (USEPA 1986). This approach assumes that noncarcinogenic hazards associated with exposure to more than one constituent are additive. Synergistic or antagonistic interactions between constituents are not considered. The HI may exceed 1 even if all of the individual HQs are less than 1. HIs also are added across exposure routes and media to estimate the total noncarcinogenic health effects to a receptor posed by exposure through multiple routes and media. An HI greater than 1 indicates there is some potential for adverse noncarcinogenic health effects associated with exposure to the constituents of concern. However, if the HI is greater than 1, it is possible to separate the HI by target organ/effect, to determine if the HI for a specific target organ/effect is greater than 1. If the HI for each target organ/effect is not above 1, it can be assumed that there is no unacceptable noncarcinogenic hazard to the receptor.

Carcinogenic Risk Estimation

The potential for carcinogenic effects due to exposure to site-related constituents is evaluated by estimating the excess lifetime carcinogenic risk (ELCR). ELCR is the excess incremental increase in the probability of developing cancer during one's lifetime because of the assumed exposures to the site over an individual's risks without exposure to the site.

Carcinogenic risk is calculated by multiplying the intake by the CSF.

$$ELCR = Intake \times CSF$$

The combined risk from exposure to multiple constituents was evaluated by adding the risks from individual constituents. Risks also were added across the exposure routes and media if an individual would be exposed through multiple routes and to multiple media.

When a cumulative carcinogenic risk to an individual receptor under the assumed RME exposure conditions at the site exceeds 100 in a million (that is, 10^{-4} excess carcinogenic risk), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) generally requires remedial action to reduce risks at the site (USEPA 1991). If the cumulative risk is less than 10^{-4}, action generally is not required, but may be warranted if a risk-based chemical-specific standard (for example, MCL) is exceeded.

6.6.2 Risk Assessment Results

The results of the risk characterization are presented below by receptor. The risks are calculated in Appendix J, Tables 7.1.RME through 7.10.RME. The risks are summarized in Appendix J, Tables 9.1.RME through 9.10.RME. Appendix J, Tables 10.1.RME through 10.4.RME show the receptor scenarios with a total HI greater than 1 and/or total carcinogenic risks greater than 1×10^{-5}. Constituents that contribute HIs greater than 0.1 or carcinogenic risks greater than 1×10^{-6} are included in the tables.

Current/Future Industrial Worker

The risk assessment assumed that a current/future industrial worker could be exposed to surface soil through incidental ingestion and dermal contact and to particulate and volatile emissions from surface soil through inhalation. Table 9.1.RME, Appendix J summarizes the hazard and risk to the current/future industrial worker.

The RME noncarcinogenic hazard (0.05) is less than USEPA's target HI of 1. The RME carcinogenic risk (1.3×10^{-5}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}. Arsenic (6.6×10^{-6}) is the primary contributor to the carcinogenic risk.

Current/Future Adult Trespasser/Visitor

The risk assessment assumed that a current/future adult trespasser/visitor could be exposed to surface soil through incidental ingestion and dermal contact and to particulate and volatile emissions from surface soil through inhalation. Table 9.2.RME, Appendix J summarizes the hazard and risk to the current/future adult trespasser/visitor.

The RME noncarcinogenic hazard (0.069) is less than USEPA's target HI of 1. The RME carcinogenic risk (1.8×10^{-6}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

Current/Future Youth Trespasser/Visitor

The risk assessment assumed that a current/future youth trespasser/visitor could be exposed to surface soil through incidental ingestion and dermal contact and to particulate and volatile emissions from surface soil through inhalation. Table 9.3.RME, Appendix J summarizes the hazard and risk to the current/future youth trespasser/visitor.

The RME noncarcinogenic hazard (0.21) is less than USEPA's target HI of 1. The RME carcinogenic risk (2.0×10^{-6}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

Future Adult Resident (Noncarcinogenic Hazard)

The risk assessment assumed that a future adult resident could be exposed to surface soil through incidental ingestion and dermal contact and to particulate and volatile emissions from surface soil through inhalation. Table 9.4.RME, Appendix J summarizes the hazard to the future adult resident.

The RME noncarcinogenic hazard (0.68) is less than USEPA's target HI of 1.

The risk assessment assumed that a future adult resident could be exposed to total soil (combined surface and subsurface soil) through incidental ingestion and dermal contact and to particulate and volatile emissions from total soil through inhalation. Table 9.7.RME, Appendix J summarizes the hazard to the future adult resident.

The RME noncarcinogenic hazard (0.69) is below is less than USEPA's target HI of 1.

Carcinogenic risks were not calculated for an adult resident but were calculated for a lifetime resident, following USEPA guidance.

Future Child Resident (Noncarcinogenic Hazard)

The risk assessment assumed that a future child resident could be exposed to surface soil through incidental ingestion and dermal contact and to particulate and volatile emissions from surface soil through inhalation. Table 9.5.RME, Appendix J summarizes the hazard to the future child resident.

The RME noncarcinogenic hazard (6.3) for surface soil exposure exceeds USEPA's target HI of 1. The primary contributor to hazard is cobalt (HI = 4.4) which is also related to the single target organ (thyroid) exceeding the target HI of 1.

The risk assessment assumed that a future child resident could be exposed to total soil through incidental ingestion and dermal contact and to particulate and volatile emissions from total soil through inhalation. Table 9.8.RME, Appendix J summarizes the hazard to the future child resident.

The RME noncarcinogenic hazard (6.3) for total soil exposure exceeds USEPA's target HI of 1. The primary contributor to hazard is cobalt (HI = 3.6) which also is related to the single target organ (thyroid) exceeding the target HI of 1.

Carcinogenic risks were not calculated for a child resident but were calculated for a lifetime resident, following USEPA guidance.

Future Lifetime Resident (Carcinogenic Risk)

The risk assessment assumed that a future lifetime resident could be exposed to surface soil through incidental ingestion and dermal contact, to surface water (pore water) through incidental ingestion and dermal contact, and to particulate and volatile emissions from surface soil through inhalation. Table 9.6.RME, Appendix J, summarizes the carcinogenic risk to the future lifetime resident.

The RME carcinogenic risk (5.5×10^{-5}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

The risk assessment assumed that a future lifetime resident could be exposed to total soil through incidental ingestion and dermal contact and to particulate and volatile emissions from total soil through inhalation. Table 9.9.RME, Appendix J, summarizes the carcinogenic risk to the future lifetime resident.

The RME carcinogenic risk (5.5×10^{-5}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

Future Construction Worker

The risk assessment assumed that a future construction worker could be exposed to shallow groundwater in an excavation through dermal contact and inhalation, to total soil through incidental ingestion and dermal contact, and to particulate and volatile emissions from total soil through inhalation during excavation and construction activities. Table 9.10.RME in Appendix J summarizes the hazard and risk to the future construction worker.

The RME noncarcinogenic hazard (0.083) is below USEPA's target HI of 1. The RME carcinogenic risk (2.4×10^{-6}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

6.7 Uncertainty Associated with Human Health Assessment

The risk measures used in human health risk assessments are not fully probabilistic estimates of risk, but are conditional estimates given that a set of assumptions about exposure and toxicity are valid. Thus, it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective (USEPA 1989a).

6.7.1 General Uncertainty in Constituent of Potential Concern Selection

The sampling that was conducted at the site generally focused on areas of known or suspected impact from past site use, based on previous sampling information and observations during previous construction activities. Therefore, the uncertainty in sampling and the possibility of missing a location impacted by site constituents is expected to be minimal. The uncertainty associated with the data analysis is minimal, as the data were fully validated before use in the risk assessment.

The general assumptions used in the COPC selection process were conservative to ensure that compounds which should be considered COPCs were not eliminated from the quantitative risk assessment and that the highest possible risk was estimated. RSLs based on residential assumptions were used to select the COPCs for all of the scenarios, including nonresidential scenarios.

Constituents that were not detected in any of the samples within a medium were not carried through the risk assessment. However, the one-half the reporting limit for the nondetected constituents were compared to the COPC screening criteria. For groundwater, a number of VOCs, SVOCs, and metals were not detected but have reporting limits that exceeded the screening level. The reporting limits were generally an order of magnitude greater than the screening value or MCL. There is some uncertainty associated with undetected constituents that have reporting limits above the screening levels; however, based on past site use and concentrations of those constituents detected in the Site media, this is expected to overstate potential risks. A level of bias associated with J-qualified and UJ-qualified data indicates

whether the concentration was biased high or low. The data were used in the risk assessment as reported with J or UJ qualifiers, as if the bias was unknown. The use of J-qualified and UJ-qualified data as the reported concentration may result in either under- or overestimation of the actual concentrations based on the level of bias.

6.7.2 Uncertainty Associated with Exposure Assessment

The risk assessment assumed that concentrations would remain constant throughout the exposure period and that these concentrations occur everywhere throughout the site. This assumption likely results in an over-estimation of risk.

Uncertainty in the exposure assessment generally was treated with conservative decision rules and assumptions, and therefore, the uncertainty likely over-estimates actual exposure to COPCs. Several exposure pathways evaluated by this HHRA, such as assuming residential homes will be constructed at the site in the future, are hypothetical and are not anticipated to exist in the future. There is no current residential land use; however, use of residential assumptions for soil exposure likely overestimates potential risks because this area is industrial.

The exposure factors used for the quantitation of exposure were conservative and reflect worst-case or upper-bound assumptions on the exposure. The reliability of the values chosen for the exposure factors also contributes substantially to the uncertainty of the resulting risk estimates. Because most of the exposure factors are worst-case or upper-bound assumptions, the resulting risks are worst-case and likely overestimate the actual risk.

The future soil exposure scenario adds additional conservatism by assuming that the subsurface soil will become surface soil during any future construction activities, and that future receptors may come in contact with what is the current surface soil and current subsurface soil in the future. During many construction projects, clean fill material such as topsoil is placed over the soil that is disturbed during excavation projects. The topsoil material generally is needed to support growth of grass and other landscape plants. This would decrease the possibility of future exposure to both the current surface and subsurface soil after construction activities.

6.7.3 Uncertainty Associated with Toxicity Assessment

Uncertainty associated with the noncarcinogenic toxicity factors is included in Appendix J, Tables 5.1 and 5.2. Several uncertainty factors were applied by USEPA to extrapolate dose points from animal studies to humans. These uncertainty factors range between 1 and 3,000. Additional modifying factors also are used based on the professional judgment of USEPA. Therefore, a high degree of uncertainty exists in the noncarcinogenic toxicity criteria, based on the available scientific data for each constituent. The noncarcinogenic toxicity factors are most likely an over-estimate of actual toxicity.

The uncertainty associated with CSFs is mostly associated with the low dose extrapolation, where carcinogenicity at low doses is assumed to be a linear response. This is a conservative assumption, which introduces a high degree of uncertainty into slope factors extrapolated from this area of the dose-response curve. The CSFs are based on the assumption that there is no threshold level for carcinogenicity; however, most of the experimental studies indicate

the existence of a threshold level. Therefore, CSFs developed by USEPA represent upper-bound estimates. Carcinogenic risks generated in this assessment should be regarded as upper-bound estimates of the potential carcinogenic risks, rather than an accurate representation of carcinogenic risk. The true carcinogenic risk is likely to be less than the predicted value (USEPA 1989a).

As stated in the US Office of Science Technology and Policy, linearized multi-stage procedure leads to plausible upper limit to risk that is consistent with some proposed mechanisms of carcinogenesis. Such an estimate, however, does not necessarily give realistic prediction of risk. While linear extrapolation maybe appropriate for potent electrophilic carcinogens, the use of such conservative procedure for less potent substances which may induce tumors through perturbation of normal physiology, may not be warranted.

Additional uncertainty is inherent in the prediction of relative sensitivities of different species of animals and the applicability of animal data to humans.

There is a large degree of uncertainty associated with the oral-to-dermal adjustment factors (based on constituent-specific ABS_{GI}) used to transform the oral RfDs and CSFs based on administered doses to dermal RfDs and CSFs based on absorbed doses. It is not known if the adjustment factor results in an underestimation or overestimation of the actual toxicity associated with dermal exposure.

Surrogate constituents were used for detected constituents without screening levels and toxicity values. The use of surrogate constituents may underestimate or overestimate the potential risks or hazards.

6.7.4 Uncertainty in Risk Characterization

The uncertainties identified in each component of the risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and constituents contributes to uncertainty based on the interactions of constituents such as additivity, synergism, potentiation, and susceptibility of exposed receptors. The simple assumption of additivity used for this site may or may not be accurate and may over- or underestimate risk; however, a better alternative is not available at this time.

6.8 Human Health Risk Summary

This HHRA was performed to evaluate potential current and future risks associated with detected constituents at the site. Surface soil, subsurface soil, and groundwater analytical data were evaluated in the HHRA. Risks at the site were evaluated for exposure to:

- Surface soil for current industrial workers and trespassers/visitors (adult and youth)
- Surface and subsurface soil for future construction workers and residents
- Shallow groundwater for future construction workers

Table 6-4 and Tables 9.1.RME through 9.10.RME in Appendix J summarize the cancer risks and HIs. Tables 10.1.RME through 10.4.RME in Appendix J show only the constituents that contributed HIs above 0.1 to total cumulative receptor HIs greater than 1 or carcinogenic risks greater than 10^{-5} that contributed to total cumulative receptor carcinogenic risks greater than 10^{-5}.

For current land use, the site does not pose unacceptable health risks to any of the receptors evaluated in this HHRA. Contact with surface soil by industrial workers and trespassers/ visitors (adult and youth) would result in noncarcinogenic hazards and carcinogenic risks below or within USEPA's target levels.

Potential contact with surface soil by future residents (child and lifetime) may result in risks and hazards above Ohio EPA's acceptable risk level and hazard level.

The future land use scenarios evaluated in this assessment were conservative, since it is likely that land use will not change. The site is not currently residential, and future land use is anticipated to remain similar to current use. Additionally, groundwater at the site is not a current potable source, and it is not expected or reasonable that it will be used for potable use in the future. Potential contact with surface soil and total soil (combined surface and subsurface soil) by future child residents may result in hazards above USEPA's acceptable hazard level. Potential risks and hazards for contact with total soil (combined surface and subsurface soil) and groundwater by future construction workers would result in noncarcinogenic hazards and carcinogenic risks below or within USEPA target levels.

SECTION 7

Ecological Risk Assessment

This section presents the ERA that was conducted to assess the potential risk to ecological receptors at the site from exposure to site-related constituents. The ERA for the site consists of a screening ecological risk assessment (SERA; Steps 1 and 2 of the ERA process) and the first step (Step 3) of the baseline ecological risk assessment (BERA). This ERA was conducted in accordance with EM 200-1-4, *Risk Assessment Handbook: Volume II – Environmental Evaluation* (USACE 1996) and *Ecological Risk Assessment Guidance Document* (Ohio EPA 2008), as well as incorporating input from the following documents:

- *Guidelines for Ecological Risk Assessment* (USEPA 1998)
- *Ecological Risk Assessment Guidance for Superfund* (USEPA 1997c)
- *Framework for Ecological Risk Assessment* (USEPA 1992)
- *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1999b)
- *USEPA Region 3: Interim Ecological Risk Assessment Guidelines* (USEPA 1994b)
- *Wildlife Exposure Factors Handbook, Volume I of II* (USEPA 1993)
- *RAGS, Volume II: Environmental Evaluation Manual* (USEPA 1989b)
- EP 200-1-15, Standard Scopes of Work for HTRW Risk Assessments, Final (USACE 2001)
- *Tri-Service Remedial Project Manager's Technical Handbook for Ecological Risk Assessment* (Simini et al. 2000)
- Ecological Risk Assessment Issue Papers (USEPA 1994c)
- ECO Updates, Volumes 1 and 2 (Office of Solid Waste and Emergency Response [OSWER]) (USEPA 1991-1994)

The objective of this ERA is to determine whether constituents of potential ecological concern (COPECs) are present at the site, and if present, whether additional action/evaluation is warranted. This section is comprised of the following subsections:

- **Section 7.1—Problem Formulation:** characterizes the site setting and develops an ecological CSM, including an identification of assessment endpoints and measures of effects and selection of receptors for evaluation
- **Section 7.2—Screening Assessment:** completes the SERA
- **Section 7.3—Refined Risk Characterization:** completes the first step (Step 3) of the BERA

- **Section 7.4—Risk Description:** evaluates the outcomes of the SERA and Step 3 of the BERA, and identifies uncertainties associated with those risk estimates
- **Section 7.5—Ecological Risk Conclusions:** summarizes the outcome of the ERA

7.1 Problem Formulation

The problem formulation established the goals, scope, and focus of the ERA. As part of the screening problem formulation, the environmental setting of the site was characterized in terms of the habitats and biota known or likely to be present. The types and concentrations of constituents present in ecologically relevant media also were described based on available analytical data. A CSM was developed that describes potential source areas, transport pathways and exposure media, exposure pathways and routes, and receptors. Assessment endpoints and measures of effects were selected to evaluate those receptors for which critical exposure pathways exist. The fate, transport, and toxicological properties of the constituents present, particularly the potential for bioaccumulation, also were considered during this process.

7.1.1 Ecological Setting

Historical aerial photographs of the former Wilkins AFS taken in 1950, 1958, 1959, 1964, 1971, 1988, and 1995 can be found in the PA document for the site (Plexus 2000) and show the vegetative communities over time throughout the former Wilkins AFS, including the Shelby Horizons AOC area.

In 1950, the Shelby Horizons AOC was barren of trees and agricultural use was evident. A small, uncut plot of trees was south of the area. In 1958, the site remained devoid of trees; surficial scaring is evident, with possible trenching. In 1959, widespread scarring because of limited fill and grading activity is visible. In 1964, some scarring is still evident; the site is still devoid of trees. In 1971, the area appears vegetated and the immediate area surrounding the site has been converted to agricultural use. In 1979, the area continues to revegetate. Some trees are present east and southeast of the area. In 1988 and 1995, little change is seen; the area is still vegetated, and some trees are east and southeast of the area. Agricultural lands are seen to the north and west. A large settling basin is seen to the north-northwest of the site.

Currently, vegetation on the site consists primarily of mowed grasses. A gravel parking area for semi-tractor trailers covers a portion of the site. Photographs of the site are presented in Appendix C.

The only onsite surface water feature is a ditch that runs along the south and west sides of the AOC; the ditch was created to facilitate drainage (Corrigan et al. 2000). The ditch is dry during most of the year and does not support aquatic life. As discussed in Section 2.3, the offsite drainage can then take two paths to flow north or east. The site drainage that forks north flows through farm fields and wooded areas before ending into Marsh Run (Figure 1-3). The site drainage that stays east enters an intermittent retention pond just west of Allison Road and Building 31 (Figure 1-3). According to the SI (Plexus 2001), this intermittent retention pond drains to a 16-inch-diameter drain tile and Shelby Horizons personnel indicated they do not know where the drain tile discharges, but it is likely that the drain tile continues in a northerly direction and connects with the series of drainage ditches that

converge on the northeast side of the Shelby Horizons property. These ditches are located throughout the more developed sections of the former Wilkins AFS (east of Shelby Horizons) and capture much of the overland flow. The flow through the ditches continues offsite east to the Black Fork Mohican River (Roop 2000a; USGS 1960a, 1960b).

Based on a review of the NWI database, no wetland areas are identified for the site. Within a 4-mile radius are approximately 130 acres of scattered wetlands; the nearest being about 7 acres in size and approximately 0.5 mile northwest of the former Wilkins AFS (USEPA 2000; Plexus 2000).

Within a 4-mile radius of the site, there are no known state or federal threatened or endangered species. There are three state-protected plants and one state-endangered plant that potentially inhabit the Black Fork Mohican River approximately 15 stream miles from the former Wilkins AFS. The marsh fivefinger (*Potentilla palustris*), large cranberry (*Vaccinium macrocarpon*), and swamp cottonwood (*Populus heterophylla*) are identified as potentially threatened by the state and the sharp-glumed manna-grass (*Glyceria acutiflora*) is a state-endangered species (Ohio EPA 2000; Plexus 2000).

This ERA focused on evaluating potential impacts to terrestrial receptors only, and the media within the ditch is treated as soil in this ERA.

7.1.2 Conceptual Site Model

The CSM relates potentially exposed receptor populations with potential source areas based upon physical site characteristics and complete exposure pathways. Important components of the CSM are identifying potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptor groups. Actual or potential exposures of ecological receptors associated with a site were determined by identifying the most likely, and most important, pathways of constituent release and transport. A complete exposure pathway has three components: (1) a source of constituents that results in a release to the environment; (2) a pathway of constituent transport through an environmental medium; and (3) an exposure or contact point for an ecological receptor. The main objective of the CSM in the SERA was to identify any complete and critical exposure pathways that may be present. Figure 7-1 illustrates a diagrammatic terrestrial ecological CSM. Key components of the CSM are discussed in the following subsections.

Potential Source Areas

The initial tier of the CSM describes the primary sources and the mechanisms by which constituents from these source areas are released and distributed within the habitats of the site. As discussed in Section 1.2, the area originally was identified as an AOC based on separate reports from a local resident and a former employee. The site may have been used as a disposal area. Information provided by the local resident and former employee is provided in Section 1.2.2. The disposal area was reported to be located near the perimeter patrol road. The area consisted of trenches about 12 feet wide, 4 to 5 feet deep, and 40 feet long. Waste placed in the trenches consisted of rubbish from former Wilkins AFS operations that was crushed with a bulldozer prior to covering with soil. Waste was burned in this location for several years. The employee was not aware of any hazardous material being disposed of in this area (Viers 2000).

Migration and distribution of COPECs throughout the terrestrial and aquatic habitats are principally the result of volatilization/particulates and runoff of contaminated soil from the current potential source areas.

Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source to ecologically relevant media (surface soil, sediment, and surface water) where exposures may occur. The primary mechanisms for constituent transport from the source areas include the following:

- Direct release during historical site activities to site surface soil
- Transport of stormwater runoff via surficial runoff and/or direct release of constituents to the ditch
- Infiltration of constituents that have been released to surface soil and/or that have been released directly to subsurface soil into groundwater
- Uptake by biota such as invertebrates, plants, and small mammals from surface soil and transfer through the food chain to upper trophic level receptors (that is, birds and mammals) via the consumption of contaminated prey

Exposure Pathways and Routes

An exposure pathway links a source with one or more receptors through exposure via one or more media and exposure routes, and it is assumed that receptors are exposed to media regardless of contamination. Exposure, and thus potential risk, can occur only if complete exposure pathways exist. Figure 7-1 presents the potentially complete exposure pathways to ecological receptors at and adjacent to the site and are discussed below. An exposure route describes the specific mechanism(s) by which a receptor is exposed to a constituent present in an environmental medium. The only potentially complete exposure pathway for this site is the exposure of ecological receptors to site-related constituents in onsite soil.

Although there is the potential for constituents to have entered groundwater after leaching into soil, available information indicates that groundwater does not discharge onsite or in the immediately adjacent area, and there is no potential for ecological receptors to be exposed to constituents within this media. This transport pathway therefore was not evaluated further in the ERA. As discussed previously, the ditch at the site is dry most of the year; therefore, there is no potential for ecological receptors to be exposed to constituents with in surface water.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a constituent present in an environmental medium.

The following terrestrial receptor groups could be exposed to constituents in onsite soil:

- Terrestrial plants primarily through their root surfaces via water and nutrient uptake.
- Soil invertebrates through direct contact and ingestion.
- Terrestrial wildlife (avian and mammalian) through: (1) incidental ingestion of contaminated abiotic media (soil) during feeding activities; (2) ingestion of contaminated plant and/or animal tissues for constituents that have entered food webs; or (3) direct

(dermal) contact with contaminated abiotic media. (These routes, where applicable at the Site, are depicted in Figure 7-1.)

Based on the general fate properties (for example, relatively high adsorption to solids) of the site-related constituents likely to remain in onsite soil (SVOCs) and the protection offered by hair or feathers, potential dermal exposures for upper trophic level receptors are not considered significant relative to ingestion exposures and were not evaluated in this ERA. The upper trophic level receptors considered in this ERA also are unlikely to be exposed to significant airborne sources of constituents via inhalation because the primary constituents likely to remain at the site are expected to be adsorbed to soil, and the potential for exposure via inhalation would be minimal. Incidental ingestion of soil during feeding, preening, or grooming activities, however, is considered in the risk estimates.

Assessment Endpoints and Measures of Effects

The problem formulation includes selecting ecological endpoints, which are based on the CSM. Two types of endpoints, assessment endpoints and measures of effects, are defined as part of the ERA process (USEPA 1997c). An assessment endpoint is an explicit expression of the environmental component or value to be protected. Measures of effects are measurable ecological characteristics related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment endpoints and measures of effects are summarized by USEPA (1997c) and discussed in detail by Suter (1989, 1993).

Table 7-1 presents the assessment and measurement endpoints used in the ERA and the receptors (discussed in the following section) associated with each endpoint. Terrestrial habitats occur within and adjacent to the site; as a result, terrestrial receptors were evaluated.

Although additional relevant endpoints could be used logically to evaluate potential risks from COPECs, endpoints were selected for evaluation that would, in a focused approach, best characterize the ecological risks using data and information currently available for this site.

Receptors

Receptors are the components of an ecosystem that are potentially affected by a chemical or other stressor. Endpoints are characteristics of an ecological component that may be affected by a stressor. It is difficult, if not impossible, to assess potential impacts to every endpoint for every possible receptor; therefore, “key” receptors and endpoints were selected to be representative species in the major feeding guilds and habitats onsite.

The focus of the receptor selection process was on individual species, groups of species (such as lower trophic receptors [that is, soil invertebrates] and upper trophic receptors [that is, birds and mammals]), or functional groups (that is, feeding guilds) potentially at risk, rather than on higher organizational levels such as communities and ecosystems. Each trophic level is comprised of many different species and encompasses numerous feeding guilds; for example, upper trophic level receptors include a variety of birds and mammals in various feeding guilds such as herbivores, insectivores, and carnivores. After evaluating the types of populations, communities, and habitats present on the site, key receptor species were selected considering the following (USACE 1996; States et al. 1978):

- Likelihood of exposure
- Sensitivity to the COPECs
- Critical to the structure and function of the particular ecosystem which they inhabit
- Threatened, endangered, or of special concern
- Recreational value
- Indicative of important changes in the ecosystem
- Amount of exposure and/or toxicity data available for evaluation

The species selected as receptors of concern represent a range of feeding relationships within the habitats occurring on and surrounding the site. It is important to note that even though a select few receptor species were chosen for evaluation in this ERA, they serve as common representative species for the site and subsequently will represent risk to other species within comparable feeding guilds (that is, the American robin will represent the feeding guild of other invertivorous birds).

Birds and mammals within several feeding guilds were selected from the Ohio EPA list of receptors to serve as key receptors in this ERA (see the following table). Species were selected based upon the criteria noted above and on assessment endpoints, onsite habitats, and feeding habits.

Key Wildlife Receptors	
	Target Species by Habitat
Feeding Guild	**Terrestrial Habitat**
Herbivore	Deer mouse (*Peromyscus maniculatus)*, mourning dove (*Zenaida macroura)*
Invertivore	American robin (*Turdus migratorius*), short-tailed shrew (*Blarina brevicauda)*
Carnivore	Red-tailed hawk (*Buteo jamaicensis)*, red fox (*Vulpes vulpes)*

7.2 Screening Assessment

The following sections complete the SERA for the evaluation of potential impacts to lower trophic level species (that is, plants and invertebrates) and wildlife from the presence of constituents in soil. Section 7.2.1 summarizes the data used for the evaluation; Section 7.2.2 outlines the approach used to screen for lower trophic level and wildlife risks; Section 7.2.3 discusses the approach used to estimate receptor exposure; Section 7.2.4 summarizes the literature-based toxicity values used for comparison to evaluate the potential for adverse effect; and Section 7.2.5 presents the approach used to characterize risks in the SERA**.**

7.2.1 Analytical Data Summary and Selection

The first step in the ERA was to determine which data would be included in the evaluation. Surface soil data collected in August 2000 for the SI and surface soil samples collected in October 2008 for the RI were used in the ERA. The August 2000 surface soil samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and metals; the October 2008 samples were analyzed for VOCS, SVOCs, and metals. Details of the samples collected in 2000 are provided in the SI report (Plexus 2001). A discussion of the samples collected in 2008 is provided Section 3.3; detailed results of the sampling are presented in Section 4.1.

Details on data quality for the samples collected during the SI (August 2000) were provided in the SI report (Plexus 2001). CH2M HILL validated data collected by during the RI (October 2008) (Appendix E).

A review of the data identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as unqualified detected concentrations.
- Data qualified with an R (rejected) were not used in the risk assessment.
- Data qualified with a B (blank contamination) were used in the risk assessment as if these constituents were not detected.
- U-qualified data were treated as nondetected concentrations.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.

For this ERA, all surface soil data collected during the SI and RI sampling events were grouped into a single exposure unit. As discussed previously, media samples from the ditch were treated as soil.

7.2.2 Screening Assessment Approach

The screening assessment evaluated the potential for adverse effects to both lower trophic level receptors (plants and invertebrates) from direct exposure to Site soil and the potential adverse effects to upper trophic level receptors (that is, birds and mammals) from the ingestion of prey that have accumulated constituents via the food web. Preliminary COPECs were identified using the following process for surface soil:

- Inorganic constituents for each media were compared to background and eliminated if the maximum site concentrations were less than the background maximum and/or upper threshold limit.
- Constituents exceeding background or in cases where background data were not available were compared to media specific screening values.
- If maximum constituent concentrations exceeded respective screening values, the constituent was retained for further evaluation.
- Detected constituents without screening values also were retained for further evaluation.
- Nondetected constituents with laboratory reporting limits exceeding respective screening values and nondetected constituents without screening values were not retained as COPECs, but are discussed in the uncertainty section.

7.2.3 Screening Exposure Assessment

The principal activity associated with the exposure assessment is estimating constituent concentrations in applicable media to which the receptors may be exposed. These concentrations are termed exposure point concentrations EPCs. This is accomplished

through the selection of appropriate sets of the available analytical data using a set of criteria (validation status, sampling date, etc.). Once the analytical datasets are selected, EPCs are calculated as a particular point on the distribution of concentrations. At the screening level (Step 2), the EPC is the maximum detected concentration. To prepare a conservative assessment, the maximum reporting limit for constituents analyzed for but not detected were compared to medium-specific screening values. This was done to ascertain whether detection limits were less than or equal to constituent concentrations at which potential adverse effects to ecological receptors could occur.

7.2.4 Screening Effects Assessment

The purpose of the screening effects assessment is to establish constituent exposure levels (screening values) that represent conservative thresholds for adverse ecological effects.

Background Comparison

The maximum detected concentrations of naturally occurring inorganic constituents were compared to background concentrations for each given media. Soil concentrations were compared to the background soil concentrations (Table 7-2) for inorganic constituents. Background concentrations for most constituents are the mean detected concentration for surface soil samples (0 to 0.5 foot bgs) collected from the Pioneer AOC (Plexus 2006), which is south and southeast of the Shelby Horizons AOC. The remaining background concentrations are based on their mean reported background concentration for Ohio (Ohio EPA 2005b). The maximum detected concentrations of barium and chromium were less than established background concentrations. These two constituents were eliminated from further evaluation.

Medium-Specific Screening Values (Direct Exposures)

Numerous types of screening level ecological toxicity benchmarks have been developed to be protective of organisms using a variety of habitats. Consequently, the ecological benchmarks represent medium-specific constituent concentrations considered protective of biota inhabiting that medium. Ecological benchmarks were obtained from a variety of sources, including federal and state regulatory values, USEPA and other agency reports, and scientific literature. A list of benchmarks selected for this ERA is provided in Table 7-3.

The maximum detected concentration of a constituent within a medium was compared with the hierarchal screening benchmark for that medium. If a constituent exceeded its medium-specific benchmark, it was retained as a COPEC. In addition, if a benchmark was not available for a constituent, it also was retained as a COPEC. Within the site, the potential direct exposure medium was limited to soil. As such, the ecological benchmarks are summarized below for soil. In addition, PAHs were evaluated based on calculated total high molecular weight (HMW) and total low molecular weight (LMW) classes (for nondetected constituents, one-half the detection limit was used).

As noted in Ohio EPA 2008, the following hierarchy of sources was used to obtain soil benchmarks:

- USEPA ecological soil screening levels (Eco-SSLs). (Note: The lower of the two values for plants or invertebrates was selected for direct exposure evaluation of the lower trophic receptors.) (http://www.epa.gov/ecotox/ecossl/)

- PRGs for ecological endpoints (Efroymson et al. 1997a) (http://www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf)
- USEPA Region 5 ESLs (USEPA 2003c)

Ingestion Screening Values (Food Web Exposures)

Food web exposure was assessed for surface soil by direct comparison to the USEPA Eco-SSLs for terrestrial mammals/birds (lower of the two values) and Region 5 ESLs for soil when Eco-SSLs were not available (Table 7-4). The soil ESLs represent a conservative screening value that is the lowest value for a given constituent that is protective from exposure via direct contact, ingestion, or food web exposure. The Region 5 soil ESLs are based predominantly on exposure to a masked shrew (*Sorex cinerus*); therefore, at this stage of the screening, food web exposure was not estimated for upper trophic level terrestrial receptors. Detected constituents exceeding respective benchmarks, or where benchmarks were not available were retained for further evaluation.

7.2.5 Screening Risk Calculation

In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper trophic level receptor species) were compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of COPECs for each medium-pathway-receptor combination evaluated or a conclusion of acceptable risk.

Identification of COPECs

COPECs were identified using the HQ method. HQs were calculated by dividing the constituent concentration in the medium being evaluated by the corresponding medium-specific screening value, or by dividing the exposure dose by the corresponding ingestion screening value. Constituents with HQs greater than 1 were considered a COPEC in the SERA. Detected constituents for which toxicological data were not available also were retained as COPECs in the SERA.

HQs exceeding 1 indicate the potential for risk because the constituent concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates were derived using intentionally conservative assumptions such that HQs greater than 1 do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies constituent-pathway-receptor combinations requiring further evaluation. HQs less than 1 indicate that risks are very unlikely (USEPA 1997c), enabling a conclusion of no unacceptable risk to be reached with high confidence.

Table 7-5 summarizes the COPECs identified in surface soil because of the direct exposure evaluation. Table 7-6 presents a summary of HQs for food web exposures for terrestrial receptors (based on soil screening levels protective of terrestrial receptors). The following table summarizes the COPECs identified by medium and exposure scenario.

COPEC Summary (Step 2)

COPEC	Direct Exposure[a]	Food Web Exposures
	Surface Soil	Terrestrial Receptors[b]
Inorganics		
Aluminum	✓	**NSV[c]**
Antimony	—	✓
Cadmium	—	✓
Cobalt	√	✓
Copper	—	✓
Iron	**NSV**	**NSV**
Lead	—	✓
Manganese	✓	—
Mercury	✓	✓
Selenium	✓	✓
Thallium	✓	✓
Vanadium	✓	✓
Zinc	✓	✓
Pesticide/Polychlorinated Biphenyls		
DDT, p,p'-	✓	✓
Hexachlorocyclohexane, beta-	NSV	NSV
Semivolatile Organic Compounds		
Benzoic acid	NSV	NSV
Dibenzofuran	NSV	NSV
Di-n-butyl phthalate	✓	✓
Carbazole	NSV	NSV
Diethylene glycol, monobutyl ether	NSV	NSV
Naphthalene	✓	✓
Total high-molecular-weight PAHs	—	✓

Notes:

[a]Direct exposures based on maximum concentration for each media.

[b]Food web exposures for terrestrial receptors were based on comparison of maximum constituent concentration to USEPA Region 5 ESL (based on exposure to a masked shrew [*Sorex cinerus*]) and USEPA Eco-SSLs for mammals and avian receptors

[c]No screening value available. Constituent was retained as COPEC and further evaluated in the risk characterization section.

✓ = Constituent is a COPEC for the given exposure scenario.

— = Constituent is not a COPEC for the giving exposure scenario.

7.3 Refined Risk Characterization

The SERA resulted in a set of COPECs for surface soil at the site. This set of COPECs includes constituents with HQs exceeding 1 (based upon maximum exposures) and detected constituents lacking screening values.

According to Superfund guidance (USEPA 1997c), Step 3 initiates the problem formulation phase of the BERA (identified as Step 3A by USACE [Wentzel et al. 2000]). The BERA begins with a preliminary step in which the conservative assumptions employed in the SERA are refined and risk estimates are recalculated using the same CSM. In addition, the reevaluation may include consideration of other factors such as background and upgradient data, detection frequency, and constituent-specific bioavailability.

The assumptions, parameter values, and methods that were modified for the preliminary Step 3 re-evaluation were as follows:

- EPCs were based on 95 percent UCLs; in cases where 95 percent UCLs could not be calculated maximum concentrations were used. The 95 percent UCLs were calculated most recent version of ProUCL (version 4.00.04; USEPA 2009c); refer to Appendix K for ProUCL outputs for calculation of 95 percent UCLs.
- A two-tiered evaluation was used to evaluate upper trophic level terrestrial receptors:
  - EPCs based on 95 percent UCLs were compared to USEPA Region 5 ESLs.
  - Constituents exceeding HQs of 1 were retained for evaluation using receptor-specific food web models.

Only complete and critical pathways identified in the SERA were re-evaluated at this stage; similarly, only COPECs and receptors identified in the SERA as requiring further evaluation were considered. Although some aspects of the estimation of exposure were modified in Step 3A (see above), the screening values (effects) used in stage were the same as the values used in the SERA.

7.3.1 Direct Exposures

The comparison of 95 percent UCL COPEC concentrations in surface soil to soil screening levels is presented in Table 7-7. For constituents with an insufficient number of samples to calculate 95 percent UCL concentrations (that is, fewer than eight samples), the maximum detected concentrations were compared to soil screening levels.

The following constituents in surface soil within Shelby Horizons AOC were retained as COPECs based on 95 percent UCL HQs exceeding 1:

- Inorganic—aluminum, cobalt, manganese, mercury, selenium, thallium, and vanadium
- Pesticides/PCBs—DDT
- SVOCs—naphthalene

Constituents without screening values also were retained as COPECs: iron, beta-hexachlorocyclohexane (HCH), benzoic acid, dibenzofuran, carbazole, and monobutyl ether diethylene glycol.

7.3.2 Food Web Exposures

For terrestrial receptors, a two-tiered evaluation was conducted which included an initial comparison of 95 percent UCL concentrations to the USEPA Region 5 ESLs for soil. Constituents with HQs greater than 1 were retained and were then evaluated via food web exposure for each terrestrial receptor.

Table 7-8 presents the results of the 95 percent UCL concentrations to the USEPA Region 5 ESLs for soil. For constituents with an insufficient number of samples to calculate 95 percent UCL concentrations (that is, fewer than eight samples), the maximum detected concentrations were compared to soil screening levels.

The following constituents in surface soil within the site were retained as COPECs based on 95 percent UCL HQs exceeding 1:

- Inorganic—antimony, cadmium, lead, mercury, selenium, thallium, vanadium, and zinc
- Pesticides/PCBs—DDT
- SVOCs—naphthalene and total HMW PAHs

Constituents without screening values also were retained as COPECs: aluminum, iron, beta-HCH, benzoic acid, dibenzofuran, di-n-butyl phthalate, carbazole, and monobutyl ether diethylene glycol.

Constituents retained as COPECs were further evaluated via receptor specific food web models. Food web exposures were evaluated for six terrestrial receptors: deer mouse, short-tailed shrew, red fox, American robin, mourning dove, and red-tailed hawk. Dietary items for these receptors for which tissue concentrations were modeled include plants, soil invertebrates (earthworms), and small mammals. The models and parameter values for calculating these tissue concentrations are outlined below.

For the screening exposure estimates, the uptake of constituents from the abiotic media into these food items was based on, or modeled from, central tendency estimated (for example, median or mean) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature, where available. BCFs and BAFs used in this ERA are presented in Tables 7-9 and 7-10. A default factor of 1 was used only when data were not available in the literature for a constituent.

For receptor species used in food web modeling, the dietary intake (that is, dose) of each constituent (in mg constituent per kg of body weight per day) was calculated by using species-specific life history information, where available, and the following formula (modified from USEPA 1993):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)]]}{BW}(AUF)$$

Where:

DI_x	=	Dietary intake for constituent x (mg constituent/kg body weight/day)
FIR	=	Food ingestion rate (kg/day, dry-weight)
FC_{xi}	=	Concentration of constituent x in food item i (mg/kg, dry-weight)
PDF_i	=	Proportion of diet composed of food item i (dry-weight basis)
SC_x	=	Concentration of constituent x in soil (mg/kg, dry-weight)
PDS	=	Proportion of diet composed of soil (dry-weight basis)
BW	=	Body weight (kg, wet-weight)
AUF	=	Area use factor; percent (decimal) of habitat used by receptor

Receptor-specific values used as inputs to this equation are provided in Table 7-11. It was assumed that constituents were 100 percent bioavailable to the receptor, and it also was assumed that each receptor spent 100 percent of its time at the site (that is, an AUF of 1 was assumed). Central tendency estimates (for example, mean, median, or midpoint) for body weight and ingestion rate were used to develop exposure estimates for upper trophic level receptors (Table 7-11). Central tendency estimates for these exposure parameters are more relevant for a BERA because these better represent the characteristics of a greater proportion of the individuals in the population. Populations (rather than individual organisms) were emphasized during development of the assessment endpoints for the ERA.

Ingestion screening values for these constituents and the receptor species evaluated (or suitable surrogate species) via food-web modeling were obtained from the literature. Toxicological information for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (such as laboratory mice) where necessary. Toxicity studies involving long-term (that is, chronic) exposure were used preferentially. Survival, growth, and reproduction were emphasized as toxicological endpoints because these are the most relevant to maintaining viable populations and are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicological studies were available from the literature, the most appropriate study was selected for each receptor species based upon study design, study methodology, study duration, study endpoint, and test species. Ingestion-based screening values were derived for both chronic no observed adverse effect level (NOAEL) and chronic lowest adverse effect level (LOAEL) endpoints. The applicable uncertainty factors from Table 7-12 were applied to derive these screening values, where necessary. Ingestion screening values for mammals and birds are summarized in Tables 7-13 and 7-14, respectively.

The HQs based on 95 percent UCL exposure doses for the six terrestrial receptors evaluated using food web models are provided in Table 7-15. Based upon a comparison to NOAELs, the short-tailed shrew, deer mouse, American robin, and mourning dove exposure scenarios for mercury resulted in HQs greater than 1, while exposure scenarios for thallium resulted in HQs greater than 1 for all six receptors. In addition, NOAEL-based HQ for exposure of aluminum to the short-tailed shrew resulted in an HQ greater than 1.

The HQs based on comparison of 95 percent UCL exposure doses to the maximum allowable toxic concentrations (MATCs) also exceeded 1 for exposure of mercury to the short-tailed shrew and deer mouse and for thallium exposure for all receptors except the red-tailed hawk. The HQ for aluminum exceeded 1 for only the short-tailed shrew.

Based on comparison to LOAELs, the 95 percent UCL-based HQs exceeded 1 for the short-tailed shrew and deer mouse for exposure to mercury and for the short-tailed shrew, deer mouse, red fox, and American robin exposure to thallium. As a result, mercury and thallium were retained as COPECs for upper trophic receptors.

7.3.3 Uncertainty Assessment

Uncertainties are present in all ERAs because of the limitations of the available data and the need to make certain assumptions and extrapolations based upon incomplete information. In addition, the use of various models (for example, uptake and food web exposures) each

carries with it some associated uncertainty as to how well the model reflects actual conditions. The uncertainties in this ERA are mainly attributable to the following factors:

- **Duplicate analyses—**When evaluating samples with field duplicates, the value used in the ERA was always the detected concentration when one result was a detect and the duplicate was a nondetect, regardless of the nondetected value. In these cases, the use of the detect has less uncertainty because it represents an actual measured value (versus an upper limit bound). In situations when both values in the parent and duplicate were both detected or both nondetected, the maximum concentration was used.

- **Ingestion screening values (toxicity reference values [TRVs])—**Data on the toxicity of some constituents to the upper trophic level receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation and extrapolation for ERAs because so few wildlife species have been tested directly for most constituents. The uncertainties associated with toxicity extrapolation were minimized by selecting the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet.

- **Direct exposure screening values—**Some constituents in site-related media were detected but had no available screening value. Even though these constituents were identified as COPECs, potential risks could not be determined for these constituents and they are not considered risk drivers. The focus of this assessment was on detected constituents with ecotoxicological (effects) data. These constituents are typically the most common/important risk drivers. While there is some uncertainty with the inability to consider constituents without screening values as part of the risk evaluation in this assessment, that uncertainty is considered low because of the attention paid the COPCs with screening values in the same chemical groups. For constituents with screening values, care was taken to measure concentrations using analytical methods that could measure below appropriate action (screening) levels.

- **Constituent mixtures and cumulative concentrations—**Information on the ecotoxicological effects of constituent interactions is generally lacking, which required (as is standard for ERAs) that the constituents be evaluated on an individual basis during the comparison to screening values. This could result in an underestimation of risk (if there are additive or synergistic effects among constituents) or an overestimation of risks (if there are antagonistic effects among constituents).

  For soil, total LMW and HMW concentrations were calculated and evaluated, and individual compounds from these groups were addressed. There are a couple types of uncertainty associated with this part of the assessment. First, the practice of using one-half the nondetect value when summing the sample-specific concentrations could have potentially overestimated the concentration, and thus potential for risks. Secondly, assuming a cumulative concentration for these groups could either overestimate risk (assuming additivity) or result in the possibility of overlooking the impacts from individual compounds. However, the uncertainty associated with combining concentrations was considered low because more ecotoxicological data are available for the grouped (totaled) constituents relative to individual constituents.

- **Receptor species selection—**Reptiles and amphibians also are potential receptors in association with site habitats, but were not evaluated quantitatively even when exposure pathways were likely to be complete. For food web exposures, these taxonomic groups were evaluated using other fauna (birds and mammals) as surrogates because of the general lack of taxon-specific ingestion-based toxicological data. This represents an uncertainty in the ERA.

- **Food web exposure modeling—**Constituent concentrations in aquatic food items (wetland/aquatic plants, benthic invertebrates, fish, and frogs) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and BAFs introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a conservative (screening) or reasonable (baseline) estimate of potential food web exposure concentrations.

  Another source of uncertainty was the use of default assumptions (values) for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for most bioaccumulative constituents were readily available from the literature and were used in this ERA, the use of a default factor of 1 to estimate the concentration of some constituents in receptor prey items is a source of uncertainty.

- **95 Percent UCLs versus mean media concentrations—**As is typical in an ERA, a finite number of environmental media samples were used to develop the exposure estimates. At the Step 3 level of assessment, 95 percent UCLs were used to represent EPCs; however, some UCLs could not be calculated because of small samples sizes. In these situations, the maximum concentration was used by default. A 95 percent UCL is considered a conservative estimate and could over estimate risks; therefore, some uncertainty exists for these EPCs. However, use of 95 percent UCL ensured that some constituents were not overlooked as COPCs and resulted in a more comprehensive assessment.

- **Detected constituents lacking screening values—**Several constituents were detected in various media without media-specific screening values. These constituents were primarily SVOC and VOC constituents that have low octanol-water partition coefficients (K_{ow}s) and are not known to be highly bioaccumulative. In addition, these constituents were not widely detected within the various media, further indicating that these are not likely related to historical activities at the site. As a result, though there is uncertainty around these constituents, it is unlikely that at the concentration and frequency detected that these constituents pose unacceptable risk

- **Nondetected constituents with reporting limits exceeding screening values—**Several constituents were not detected; however, laboratory reporting limits exceeded the screening value. Although we do not have detected concentrations for constituents with reporting limits greater than respective screening value, there is some degree of uncertainty with respect to these constituents.

7.4 Risk Description

The risk description is the part of the ERA in which the risk assessors integrate and interpret the available information into conclusions about risks to the assessment endpoints. The integration and interpretation of information is in a qualitative form, given the measures of effects used to evaluate risk and the risk estimation technique employed. Essentially, the risk description is a technical narrative supporting the risk estimates and a critical interpretation of the ecological significance of those estimates.

The risk description has two primary elements. The first is the ecological risk summary, which summarizes the results of the risk estimation and discusses the uncertainties associated with the integral steps of the ERA. This section contains the weight-of-evidence analysis. A weight-of-evidence analysis summarizes the results of the risk estimation and uncertainty analysis and assesses confidence in the risk estimates through a discussion of the different lines of evidence. The second element is the interpretation of ecological significance, which may be described in terms of the spatial and temporal extent of effects and, when possible, as an estimation of the recovery potential once the stressor is removed (Norton et al. 1992). Another element, a discussion of the effect of additional data or analyses on uncertainty, also is provided.

7.4.1 Ecological Risk Summary

As discussed in the problem formulation, a number of endpoints were measured and evaluated to provide a weight-of-evidence approach to the assessment of risk. Not all endpoints are equivalent in their ecological significance.

The role of the weight-of-evidence approach in the risk characterization is to assess the measures of effects findings and their associated uncertainty to determine whether there could be potential impacts to assessment endpoints. Agreement between different lines of evidence increases confidence in the conclusions derived in the risk estimation. When lines of evidence disagree, it is important to distinguish between true inconsistencies and those related to uncertainty and variability associated with each measure of effect. As with assigning qualitative significance ratings to the measures of effects, professional judgment is required when evaluating the various results and conflicting lines of evidence.

The following were considered when evaluating the individual lines of evidence in the weight-of-evidence analysis (USEPA 1997c).

- **Relevance of evidence to the assessment endpoint—**Often lines of evidence more closely linked to the assessment endpoints have greater importance than those not as closely linked.
- **Relevance of evidence to the conceptual model—**Some lines of evidence may be particularly useful in verifying points of the conceptual model (for example, biomarker results may confirm exposure to COPECs).
- **Sufficiency and quality of data and experimental design used in key studies—**For example: Were enough samples collected, and were testing protocols followed?
- **Strength of cause and effect relationships—**Precise attribution of effect to stressor is usually not possible when multiple stressors are present; however, observed or

predicted effects should coincide somewhat with current or predicted stressor distribution.

- **Relative uncertainties of each line of evidence—**The limitations of each line of evidence must always be considered when evaluating the relative strength of each line of evidence.

The assessment methods used in this ERA considered only comparisons of media concentrations or modeled doses with benchmark values. Consequently, the measures of effects were roughly equivalent in their ecological significance or in their ability to predict risk. Although only one line of evidence was used in this assessment, a weight-of-evidence approach was presented to help describe the risk at each site. The framework for this approach was developed by the New England Weight of Evidence Workgroup and is detailed in *A Weight-of-Evidence Approach for Evaluating Ecological Risks* (Menzie et al. 1996).

Scoring Measures of Effects

In the weight-of-evidence evaluation, 11 attributes of each measure of effect were evaluated. Each of the 11 attributes considered (Table 7-16) was assigned a weighting factor of high, medium, or low. Subsequently, for each of the measures of effects evaluated in an assessment endpoint (in this case only one per assessment endpoint), a qualitative score was assigned to each attribute (Table 7-17). Based on the scores of the individual attributes (all attributes were considered of equal importance), an overall score of low to high was assigned to each measure of effect indicating how well the measure of effect represents the assessment endpoint. Table 7-18 presents a summary of weights assigned to the modeled exposure and the measure of effect associated with all of the assessment endpoints evaluated in this risk assessment. In addition, a brief summary of the rationale used to determine that attribute score is presented.

The endpoint score assigned to each measure of effect was an average of the scores from the 11 attributes. The modeled exposure and effects line of evidence had six medium and four high attribute scores (one attribute was not applicable) and was therefore given an overall score of medium-high.

Magnitude of Response in Measures of Effects

The magnitude of the response in a measure of effect was considered together with the measure of effect weight in judging the overall weight of evidence. The magnitude of response was divided into two questions:

1. Does the measure of effect indicate the presence or absence of harm (yes, no, or undetermined)?

2. Is the response low or high?

The endpoint weight of evidence of harm and magnitudes of responses for all measures of effects are presented in Table 7-19. For the site, evidence of harm was indicated for lower trophic receptors (that is, plants and invertebrates), herbivorous birds and mammals, and invertivorous birds and mammals. The magnitude of harm was considered low for all of the measures of effects except for lower trophic receptors, deer mouse, and short-tailed shrew, which were considered high (Table 7-19).

Concurrence Among Measures of Effects

The third and final component of the weight-of-evidence approach involved examining concurrence among measures of effects as they related to the assessment endpoint. The methodology for displaying the level of concurrence involved graphically plotting the letter designation of each measure of effect within a matrix that also included the weight of each endpoint and the associated degree of response. Since in this risk assessment only one measure of effect per assessment endpoint was evaluated, the concurrence discussion is not provided.

7.4.2 Interpretation of Ecological Significance

The interpretation of ecological significance evaluated responses observed in the measures of effects and those expected in the assessment endpoints and judged whether any expected response could be considered ecologically significant. It is important to clarify that statistical significance and ecological significance are not synonymous, and that the primary goal of this portion of the risk assessment was to assign significance to responses that reasonably could be expected to affect ecosystem structure and function. The goal of the interpretation of ecological significance was to provide the risk manager with some context for evaluating the risk estimate in the context of determining whether there is an unacceptable baseline risk, and to evaluate the management goals (that is, protection of ecological and human health), and if remedial action is warranted.

The following five criteria are proposed for evaluating adverse changes in assessment endpoints (USEPA 1997c; USACE 1996; Ohio EPA 2008):

- Nature of effects
- Intensity of effects
- Spatial scale
- Temporal scale
- Potential for recovery

The extent to which the five criteria were evaluated depended on the scope and complexity of the risk assessment. In evaluating the nature and intensity of effects, the risk assessor distinguished adverse ecological changes that were different than those expected as part of normal ecosystem variability, or that result in little or no significant alteration of the system.

Spatial and temporal scales also need to be considered in assessing the significance of effects. The duration, extent, and pattern of stressors need to be considered in the context of the surrounding landscape. Depending on the types of effects, habitats, and potential receptors present, effects to small areas may be as, if not more, ecologically significant than impacts to larger, less critical areas. The duration of any effect is dependent on the persistence of the stressors and how often receptors may come into contact with the stressors. Even short-term effects can be ecologically significant if exposure occurs during critical life stages of receptors, or results in an acute response.

The final consideration in evaluating ecological significance was the rate and extent to which ecosystem recovery is possible. Recovery is defined as the rate and extent of return of a population or community to a condition that existed before the introduction of stressors (USEPA 1997c).

Because ecosystems are dynamic and, even under natural conditions, are constantly changing in response to factors other than anthropogenic stressors, it may be unrealistic to expect that an ecosystem will be able to return to exactly the same state that existed prior to its being disturbed, with or without removal of the stressors.

This discussion evaluated and attributed a level of ecological significance and risk to any adverse response predicted from COPECs associated with the site. It is important to realize that, owing to the complexity of constituents and environments identified onsite, precise attribution of effects to specific chemicals or chemical groups was not attempted. In addition, as noted previously, measures of effects reflecting changes in an individual are appropriate given that toxicity of constituents to individual organisms can have consequences at the population, community, and ecosystem level (USACE 1996; Ohio EPA 2008). As such, potential risks to individual target receptors noted below were extrapolated to higher levels of ecosystem organization.

The comparison of soil concentrations to benchmarks resulted in a qualitative evaluation identifying whether potential impacts to the associated floral and faunal communities were possible based on the estimated COPEC concentrations in the respective medium. While the ecological significance of these lines of evidence may not be as great as other measures of effects, this endpoint can serve as a tool in establishing causal links between COPECs and effects, as described in following subsections. In general, conservative assumptions were used to evaluate exposure and develop TRVs in the avian and mammalian exposure models.

As presented previously, the overall weight-of-evidence rating of the benchmark comparisons and avian and mammalian receptor modeling is considered medium-high.

Based on the risk calculations represented in Section 7.3, COPECs were identified in media based on direct exposures. The following section presents a detailed discussion of the potential for the COPECs that pose unacceptable risk to receptor populations. Table 7-20 summarizes the findings of ecological significance.

Based on a comparison of soil concentrations to benchmarks, lower trophic receptors may be at risk because of exposure to aluminum, cobalt, manganese, mercury, selenium, thallium, vanadium, DDT, and naphthalene. Risk from constituents retained as COPECs because they lack screening values (that is, beta-HCH, benzoic acid, dibenzofuran, di-n-butyl phthalate, carbazole, and monobutyl ether diethylene glycol) represents an uncertainty in the evaluation.

Based on results of the food web modeling, invertivorous mammals may be at risk because of aluminum, mercury, and thallium. Herbivorous mammals may be at risk to mercury and thallium, while carnivorous mammals may be at risk to thallium. Birds may be at risk from mercury and thallium.

7.5 Ecological Risk Refinements

This section discusses the COPECs identified in surface soil at the site to support risk management decisions. As presented in Section 7.3, the following COPECs were identified at the site:

- Potential unacceptable risk to lower trophic receptors via direct exposures to:
  - Metals—aluminum, cobalt, manganese, mercury, selenium, thallium, and vanadium
  - Pesticides/PCBs—DDT
  - SVOCs—naphthalene
- Potential unacceptable risk to upper trophic receptors as indicated by the food web modeling:
  - Terrestrial mammals—mercury and thallium
  - Terrestrial birds—mercury and thallium

Each constituent identified as a COPEC was further evaluated with the following consideration:

- Uncertainty of the risk estimates based on conservative screening thresholds
- Application of less conservative toxicity reference values to bound the risk estimates

7.5.1 Screening Threshold Values

This ERA was conducted using conservative direct exposure screening values. In some cases, screening values are derived using uncertainty factors due to limited toxicological studies to derive screening values. As a result of applying uncertainty factors, in many cases risk to lower receptors is overestimated. This section discusses the direct screening values for constituents identified as COPECs.

Based on the direct exposure aluminum, cobalt, manganese, mercury, selenium, thallium, vanadium, DDT, and naphthalene were identified as COPECs in surface soil at the site.

Aluminum was detected in all 27 samples, and all 27 samples exceeded the direct exposure screening value of 50 mg/kg. The 95 percent UCL for the data is 10,650 mg/kg, which resulted in an HQ of 213. The screening value used in this ERA is the plant benchmark. The soil screening value for soil microbes as listed in Efroymson et al. (1997b) is 600 mg/kg. According to USEPA (2003c), it is recognized that aluminum is ubiquitous in nature and there is a natural variability of aluminum soil concentrations, and because of the availability of conservative soil screening benchmarks (Efroymson et al. 1997b, 1997c), aluminum is often identified as a COPC for ERAs. Furthermore, the soil screening benchmarks provided by Efroymson et al. (1997b) are based on laboratory toxicity testing using aluminum solution amendments to test soil. Comparisons of total aluminum soil concentrations to solution based screening values are deemed by USEPA to be inappropriate. In addition, it is considered that aluminum may pose risk only to lower trophic receptors in soil where pH is less than 5.5. However, pH was not measured in soil at the site. Though given that the vegetation onsite did not appear stressed and given that soils in the eastern United States commonly have aluminum concentration up to 33,000 mg/kg (Efroymson et al. 1997b), it is unlikely that aluminum poses risk to lower trophic terrestrial receptors. As a result, no further evaluation with respect to aluminum is warranted.

Cobalt was detected in 26 of 27 surface soil samples; however, only three samples exceeded the screening value of 13 mg/kg. The 95 percent UCL for the data is 102.8 mg/kg, which resulted in an HQ of 8. The screening value used in this ERA is the USEPA Eco-SSL (plants). The studies used to derive the screening level were reviewed. The basis for each toxicity

value reported for each study was the effects concentration for 20 percent of the population (EC_{20}); these are presented below.

Data Used to Derive Eco-SSL for Cobalt			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
TN & Associates, Inc. 2000	Alfalfa	EC_{20}	0.6
TN & Associates, Inc. 2000	Barley	EC_{20}	29.8
TN & Associates, Inc. 2000	Radish	EC_{20}	14.5
TN & Associates, Inc. 2000	Alfalfa	EC_{20}	13.4
TN & Associates, Inc. 2000	Barley	EC_{20}	36.4
TN & Associates, Inc. 2000	Radish	EC_{20}	45.2
Data Not Used to Derive Eco-SSL for Cobalt			
Rehab and Wallace, 1978	Cotton	LOAEC	100

Notes:
EC_{20} = Effect concentration for 20% of test population
LOAEC = lowest observable adverse effect concentration

The range of EC_{20} values for the six studies used to derive the Eco-SSL ranged from 0.6 to 45.2 mg/kg. The EC_{20} is a conservative screening value for the Site given the limited habitat onsite and as a result, the LOAEC listed in the table above would be more appropriate. When compared to the LOAEC the 95 percent UCL-based HQ is only slightly above 1 (1.03) and the mean HQ is well below 1. Given the low frequency of exceedance of the Eco-SSL, the low magnitude of exceedance of the LOAEC, it is unlikely that cobalt poses unacceptable risk to lower trophic terrestrial receptors. As a result, no further evaluation of cobalt is warranted.

Manganese was detected in all 27 samples; 17 samples exceeded the direct exposure screening value of 220 mg/kg. The 95 percent UCL for the data is 444 mg/kg, which resulted in an HQ of 2. The screening value used in this ERA is the USEPA Eco-SSL (plants). The confidence in the screening value is low due to the limited literature data from which it was derived (that is, using plant toxicity data from four studies); the data are presented in the table below.

Data Used to Derive Eco-SSL for Manganese			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg dw)**
Reid 1965	Barley	EC_{20}	71
Reid 1965	Barley	EC_{20}	71
Rehab and Wallace 1978	Cotton	EC_{20}	707
Foy et al. 1998	Nile grass	EC_{20}	707
		Geometric Mean	220

Notes:
EC_{20} = Effect concentration for 20% of text population
dw = dry weight

Given this uncertainty, a range of toxicity values was used to better assess risk to lower trophic level receptors. The following summarizes studies through which these additional values were derived:

- Terrestrial plants—Very limited data on the effects of manganese to terrestrial plants via exposure to soil. Wallace et al. (1977) reported reduced stem weight in plants grown in a soil with the addition of 500 mg/kg manganese.
- Soil microbes—Limited data on the effects of manganese to on soil microbes. Efroymson et al. (1997a) presented four reported toxicity values representing a variety of functional measures. The documented lowest observed effect concentrations (LOECs) ranged from 100 to 1,375 mg/kg mercury. Efroymson et al. (1997a) reported 100 mg/kg manganese as the no observed effect concentration (NOEC) of the four reported effective values.
- Soil invertebrates—A USEPA Eco-SSL for invertebrates of 450 has been derived using the data in the table below.

Data Used to Derive Invertebrates Eco-SSL for Manganese

Reference	Test Organism	Toxicity Parameter	Toxicity Value Soil Concentration (mg/kg dw)
Kuperman et al. 2002	Barley	EC_{20}	116
Phillips et al. 2002	Barley	EC_{20}	1,209
Simini et al. 2002	Cotton	EC_{20}	629
		Geometric Mean	450

Notes:
EC_{20} = Effect concentration for 20% of text population
dw = dry weight

When compared to the Eco-SSL for invertebrates (450 mg/kg), the 95 percent UCL-based HQ is less than 1. Given the low magnitude of exceedance of the invertebrate Eco-SSL, it is unlikely that manganese poses unacceptable risk to lower trophic terrestrial receptors. As a result, no further evaluation of manganese is warranted.

Mercury was detected in 26 of 27 samples; 19 samples exceeded the direct exposure screening value of 0.1 mg/kg. The 95 percent UCL for the data is 3.9 mg/kg, which resulted in an HQ of 39. Direct exposure was evaluated by comparing sample specific concentrations to a commonly used ecological benchmark based on effects to earthworm (0.1 mg/kg from Efroymson et al. 1997a). While this ecological benchmark is appropriate for screening assessments and selection of COPCs, it should be noted that the confidence in the screening value is low because of the limited literature data from which it was derived (Efroymson et al. 1997a). Given this uncertainty, a range of toxicity values was used to better assess risk to lower trophic level receptors. The following summarizes studies through which these additional values were derived:

- Terrestrial plants—Very limited data on the effects of mercury to terrestrial plants via exposure to soil. Kabata-Pendias and Pendias (1984) reported unspecified toxic effects on plants grown in a surface soil with the addition of 0.3 mg/kg mercury. Panda et al.

(1992) evaluated the effects on germination and growth of barley planted in solid waste deposits of a chloralkali plant and derived an NOEC of 34.9 mg/kg mercury.

- Soil invertebrates—The effects of mercury on earthworms are limited to two studies. Abbasi and Soni (1983) working with the earthworm (*Octochaetus pattoni*), found that survival and cocoon production were reduced 65 and 40 percent, respectively, at 0.5 mg/kg mercury, the lowest concentration tested. An NOEC of 0.1 mg/kg was derived by dividing the LOEC of 0.5 mg/kg by a safety factor of 5. Beyer et al. (1985) investigated the effect of methyl mercury on earthworm (*Eisenia fetida*) survival and segment regeneration and derived a methyl mercury NOEC of 2.5 mg/kg.
- Soil microbes—The most robust dataset on the effects of mercury to lower trophic level terrestrial receptors is on soil microbes. Efroymson et al. (1997a) presented 27 reported toxicity values representing a variety of functional measures. The documented LOECs ranged from 0.1 to 5,015 mg/kg mercury. Efroymson et al. (1997a) reported 30 mg/kg mercury as the 10th percentile NOEC of the 27 reported effective values.

The range of NOEC values from these studies range from 2.5 to 34.9 mg/kg. When compared to the NOEC, the 95 percent UCL-based HQ would range from 0.11 to 1.6. Given the low magnitude of exceedance of the NOEC, it is unlikely that mercury poses unacceptable risk to lower trophic terrestrial receptors. As a result, no further evaluation of mercury is warranted.

Selenium was detected in 12 of 27 surface soil samples of which 10 exceeded the Eco-SSSL of 0.52 mg/kg. The 95 percent UCL HQ for this dataset was 0.67, which resulted in an HQ of 1.3. The Eco-SSL used in this ERA was derived using plant toxicity data from eight studies presented in the table below.

Data Used to Derive Eco-SSL for Selenium

Reference	Test Organism	Toxicity Parameter	Toxicity Value Soil Concentration (mg/kg)
TN & Associates, Inc. 2000	Alfalfa	EC_{20}	0.1
TN & Associates, Inc. 2000	Barley	EC_{20}	0.2
TN & Associates, Inc. 2000	Brassica	EC_{20}	0.2
Singh et al. 1980a	Raya	MATC	1.4
Singh et al. 1980b	Berseem	MATC	1.6
Wan et al. 1988	Alfalfa	MATC	0.9
Wan et al. 1988	Alfalfa	MATC	0.9
Singh and Singh 1979	Cowpea	MATC	0.8

Notes:
EC_{20} = Effect concentration for 20% of text population
MATC = maximum acceptable toxicant concentration

The MATCs listed above range from 0.8 to 1.6 mg/kg; when compared to the MATCs, a less conservative toxicity value than the EC_{20}, surface soil samples exhibited concentrations were below several of the values. Given that the selenium 95 percent UCL HQ (1.3) is slightly

above 1 and concentrations were below several of the MATCs, it is unlikely that selenium poses risk to lower trophic receptors. As a result, no further evaluation with respect to selenium is warranted.

Thallium was detected in 8 of 27 surface soil samples at concentrations ranging from 1.1 to 273 mg/kg, of which all eight exceed the soil screening value of 1 mg/kg. The 95 percent UCL HQ for this dataset was 164.8, which resulted in an HQ of 165. Six of the eight samples exhibited thallium concentrations between 1.1 and 6.6 mg/kg. The two highest concentrations of thallium were 264 and 273 mg/kg. The soil screening value used in the ERA was based on one plant toxicity study, as reported in Efroymson et al. (1997a) and as a result, the confidence of this screening value is relatively low. Given the relatively low frequency of detection and the fact that six of the eight samples exhibited relatively low thallium concentrations, it is unlikely that thallium poses unacceptable risk to lower trophic receptors and as a result no further evaluation is warranted.

Vanadium was detected in all 27 samples; the 27 samples exceeded the direct exposure screening value of 2 mg/kg for plants. The 95 percent UCL for the data is 22.34 mg/kg, which resulted in an HQ of 11. The screening value for vanadium is derived based on one study according to Efroymson et al. (1997c) and is considered of low confidence. A more reliable and less conservative benchmark of 20 mg/kg was reported in Efroymson et al. (1997b) and is protective of soil and litter invertebrates/heterotrophic processes. When compared to this benchmark, the resulting HQ (based on the 95 percent UCL) is only slightly above 1 (1.1). Given this low magnitude of exceedance, it is unlikely that vanadium poses unacceptable risk to lower trophic terrestrial receptors.

DDT was detected in two of four surface soil samples, of which both samples exceeded the soil screening benchmark of 0.0035 mg/kg. Because of the small samples size, a 95 percent UCL was not calculated. The HQ based on the maximum detected concentration (0.019 mg/kg) was 5. The benchmark used in this ERA was the USEPA Region 5 ESL for surface soil (USEPA 2003c) and is based on exposure to the masked shrew. Eco-SSL benchmarks were not available based on exposure to lower trophic receptors; however, several studies were evaluated (USEPA 2007a) and summarized below.

Plant Toxicity Data for DDT (USEPA, 2007a)			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
Pareek and Gaur 1970	Common bean	MATC	7.1
Rajanna and De la Cruz 1977	Cotton	NOAEC	50
Rajanna and De la Cruz 1977	Soybean	NOAEC	50
Rajanna and De la Cruz 1977	Corn	NOAEC	50
Rajanna and De la Cruz 1977	Wheat	NOAEC	50
Invertebrate Toxicity Data for DDT (USEPA, 2007a)			
Harris 1966	Common cricket	LC_{50}	0.08
Harris 1966	Common cricket	LC_{50}	1.75
Harris 1966	Common cricket	LC_{50}	3.1

Plant Toxicity Data for DDT (USEPA, 2007a)			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
Harris 1966	Common cricket	LC_{50}	4.1
Harris 1966	Common cricket	LC_{50}	4.3
Harris 1966	Common cricket	LC_{50}	11.4
Harris 1966	Common cricket	LC_{50}	4.2
Harris 1966	Common cricket	LC_{50}	11.8
Harris 1966	Common cricket	LC_{50}	20.4
Harris 1966	Common cricket	LC_{50}	45.3
Harris 1966	Common cricket	LC_{50}	77.2

Notes:
LC_{50} = Concentration lethal to 50 percent of test population

All surface soil samples exhibited DDT concentrations well below the toxicity values for plants and invertebrates. Given this, no further evaluation of DDT is warranted with respect to lower trophic receptors.

Naphthalene was detected in 24 of 27 samples; however, only four samples exceeded the direct exposure screening value of 0.099 mg/kg. The 95 percent UCL for the data is 0.137 mg/kg, which resulted in an HQ of 1.4. The screening value used in the direct exposure scenario was the USEPA Region 5 ESL, which is based on protectiveness of the masked shrew. Based on a literature review, limited toxicological studies have been conducted on lower trophic terrestrial receptor exposure to naphthalene. Given the low frequency of exceedance of the Region 5 ESL and low magnitude of exceedance, it is unlikely that naphthalene poses unacceptable risk to lower trophic terrestrial receptors, and as a result, no further evaluation is warranted.

7.5.2 Toxicity Reference Values

This ERA was conducted using conservative TRV for upper trophic receptors. In some cases, screening values are derived using uncertainty factors because of limited toxicological studies to derive screening values. As a result of applying uncertainty factors in many cases, risk to upper trophic receptors is overestimated. This section discusses the TRVs for mercury and thallium, the COPECs identified for upper trophic receptors in surface soil at the site.

Mercury was identified as a potential COPEC based on the NOAEL HQs greater than 1 ranging from 3.5 to 19.5, LOAEL HQs ranging from 1.3 to 5.6, and MATC HQs ranging from 1.4 to 10.4 in upper trophic receptors. Fourteen studies measuring the toxicity of dietary mercury to birds via injection or oral ingestion are available in the literature (Bouton et al. 1999; Heinz 1974, 1975, 1976, 1979, 1980; Hill and Soares 1987; Kreitzer and Heinz 1974; Leander et al. 1977; Peakall and Lincer 1972; Scheuhammer 1988; Spalding et al. 2000; Spann et al. 1986; Stoews et al. 1971). Observed adverse effects on reproduction (including reduced egg production, hatchability, offspring survival, and eggshell thickness), growth, survival,

and behavior (including altered avoidance response, motivation to hunt prey, thermoregulation, maintenance, and learning response behaviors) resulting from dietary exposure were reported in mallards, young great egrets, Japanese quail, zebra finch, bobwhites, and pigeons. LOAELs ranged from 0.05 mg/kg body weight per day (bw/d) for egg production and altered behavior in offspring of mallards (Heinz 1975, 1979) to 62 mg/kg bw/d for offspring mortality of Japanese quail (Hill and Soares 1987). NOAELs ranged from 0.05 mg/kg bw/d for offspring survival, altered behavior in offspring of mallards (Heinz 1974, 1976) to 62 mg/kg bw/d for eggshell thickness in American kestrels (Peakall and Lincer 1972). At the lowest LOAEL of 0.05 mg/kg bw/d, offspring production was reduced, and avoidance response and maternal response behavior in ducklings was impaired in mallard ducks fed mercury for multiple generations (Heinz 1975, 1979), but no effects on reproduction were reported Heinz (1974, 1976).

The LOAEL and NOAEL of 0.3 and 0.05 mg/kg bw/d mercury reported by Heinz (1974) were selected as the TRVs. The Heinz (1974) study reported both an LOAEL and NOAEL for reproductive effects in mallards and is the study with the lowest reported significant NOAEL and LOAEL. The LOAEL and NOAEL of 0.72 and 1.4 mg/kg bw/d mercury reported by Scheuhammer (1988) is the median from the data reported above. When compared to these LOEAL and NOAEL values, the resulting HQs (based on the 95 percent UCL) for terrestrial birds are less than 1. Given the low magnitude of exceedance of these LOEAL and NOEAL values, it is unlikely that mercury poses unacceptable risk to upper trophic terrestrial receptors.

Nine toxicity studies on dietary mercury using mink and laboratory rodents are available in the literature (Aulerich et al. 1974; Dansereau et al. 1999; Hughes and Annau 1976; Schroeder and Mitchener 1975; Verschuuren et al. 1976; Wobeser et al. 1976a, 1976b; Wren et al. 1987a, 1987b). In the literature evaluated for TRV selection, observed adverse effects of mercury exposure included increased mortality, depressed growth, altered offspring behavior, and reproductive effects. The mechanisms of exposure included dietary ingestion, drinking water ingestion, and injection. LOAELs ranged from 0.0084 mg/kg bw/d for growth of rats (Verschuuren et al. 1976) to 3 mg/kg bw/d for reproduction and offspring behavior of mice (Hughes and Annau 1976). NOAELs reported in the reviewed literature ranged from 0.02 mg/kg bw/d for reproduction of mink (Dansereau et al. 1999) to 2 mg/kg bw/d for reproduction and offspring behavior of mice (Hughes and Annau 1976). At the lowest LOAEL, growth was reduced in rats fed 0.084 mg/kg bw/d mercury as mercuric chloride for three generations (Verschuuren et al. 1976). The next lowest LOAELs (ranging from 0.07 to 0.12 mg/kg bw/d) were calculated from Dansereau et al. (1999) where mink were fed a diet for several generations made up of 20 percent mink feed, 40 percent eviscerated chicken carcasses (constituent free), and 40 percent field-collected fish from the Robert Bourassa Reservoir, Quebec. LOAELs for reduced whelping success and adult mortality were 0.07 and 0.12 mg/kg bw/d mercury, respectively (Dansereau et al. 1999).

No effect on whelping was reported in mink fed 0.02 mg/kg bw/d mercury. Mortality was reported in mink fed 0.12 mg/kg bw/d mercury; however, these results were contradicted in the paper by Dansereau et al. (1999). Mink growth and survival were adversely affected following 93 days of exposure to 0.25 mg/kg bw/d mercury and 2 months exposure to 0.64 mg/kg bw/d (Wobeser et al. 1976b; Aulerich et al. 1974). No effect on mink growth or survival was observed in mink fed 0.16 mg/kg bw/d or less (Wobeser et al. 1976a, 1976b).

In addition, survival, body weight, and behavior (avoidance behavior) of offspring from rats given 3 mg/kg bw mercury as a single injection during gestation (Hughes and Annau 1976). No effect on these endpoints was reported following an injection of 2 mg/kg bw mercury. Growth and mortality were unaffected in rats given 0.07 mg/kg bw/d mercury via drinking water ingestion (Schroeder and Mitchener 1975).

The LOAEL and NOAEL of 0.07 and 0.02 mg/kg bw/d, respectively, reported by Dansereau et al. (1999) was used as the TRVs for mercury. They were the lowest toxicity values reported for mink. The median LOAEL and NOAEL from the literature discussed above was 3 and 2 mg/kg bw/d mercury reported by Hughes and Annau (1976). When compared to these LOEAL and NOAEL values, the resulting HQs (based on the 95 percent UCL) for terrestrial mammals are less than 1. Given the low magnitude of exceedance of these LOEAL and NOEAL values, it is unlikely that mercury poses unacceptable risk to upper trophic terrestrial receptors.

Thallium was identified as a potential COPEC based on the NOAEL HQs greater than 1 ranging from 1.7 to 375.7, LOAEL HQs ranging from 3.3 to 75.1, and MATC HQs ranging from 1.4 to 168 in upper trophic receptors. These HQs were based on the 95 percent UCL. When the mean concentration (70.74 mg/kg) is used in the food web model, the NOAEL HQs greater than 1 range from 1.3 to 161.3; LOAEL HQs range from 1.4 to 32.3; and MATC HQs range from 3.2 to 72.1.

The TRV used in this ERA for thallium was based on a subchronic LOAEL of 0.74 mg/kg/d (Sample et al. 1996). As indicated above, an uncertainty factor of 4 was applied to convert the subchronic LOAEL of 0.74 mg/kg/d to a chronic LOAEL of 0.185 mg/kg/d. Removing the uncertainty factors would provide a less conservative exposure assessment.

7.6 Ecological Risk Conclusions

This ERA was performed to evaluate the actual or potential ecological effects from exposures to the site. This multi-pathway analysis was based on reasonable, protective assumptions about the potential for ecological receptors (lower trophic and upper trophic terrestrial and aquatic receptors) to be exposed to and be adversely affected by exposure to COPCs.

The upper trophic receptors were selected as surrogate species representing estimated exposure and subsequently risk to other species within comparable feeding guilds. Key wildlife receptors include the deer mouse, American robin, mourning dove, short-tailed shrew, red-tailed hawk, and red fox.

Potential ecological risks were identified with respect to lower trophic and upper trophic terrestrial receptors within the site. Refinements to the ERA were then conducted in which COPECs were further evaluated with respect to uncertainties associated with screening thresholds and TRVs. Based on the results of the refinements to the COPECs identified within the site, it is unlikely that lower trophic receptors are at risk. Potential ecological risks for upper trophic receptors via exposure to thallium (all six receptors) may still be present.

However, unacceptable risks to local populations of upper trophic level receptors are unlikely based on the assumption, used in the ERA, that all receptors spend 100 percent of their time at the site. The general home ranges of the receptors of concern are deer mouse—

0.06 hectare; American robin—0.5 hectare; mourning dove—956 hectares; short-tailed shrew—0.39 hectare; red-tailed hawk—233 hectares; and red fox—400 hectares. The site is approximately 0.18 hectare. For the mourning dove, red-tailed hawk, and red fox, the site would represent only a small fraction of these receptors' home range, and predicted risks to local populations would not be expected to be unacceptable. For the American robin and short-tailed shrew, the site could represent 36 to 46 percent of their home ranges, respectively. Predicted risks would be less than those based on the assumption that 100 percent of receptor time is spent on the site. The site would represent 100 percent of the home range for the deer mouse. However, it is expected that the site would support only a small number of deer mice and that would not pose an unacceptable risk to local populations.

Based on the ERA and subsequent refinements presented above, it is concluded that the site does not pose unacceptable risk to ecological receptors.

SECTION 8

Summary and Conclusions

The former Wilkins AFS is a FUDS located in the northern end of the city of Shelby, Ohio. The former Wilkins AFS was acquired by the U.S. Air Force in 1943 and was used as a storage depot. Currently, it is occupied by an industrial complex and an educational facility, and is zoned as heavy industrial. The Shelby Horizons AOC is an open, level area on the western end of the Shelby Horizons property, and is a maintained grassy area containing a gravel-covered semi-tractor trailer parking area/road. A shallow ditch also has been cut along the south and west of the area to facilitate drainage of rainwater runoff, which drains east toward the western end of the Shelby Horizons building, and continues north and east.

The Shelby Horizons AOC area reportedly was used as a disposal area. The area reportedly included trenches about 12 feet wide, 4 to 5 feet deep, and about 40 feet long. Waste placed in the trenches consisted of rubbish from former Wilkins AFS operations, which was crushed with a bulldozer before being covered with soil. Waste also was reportedly burned at this location for several years.

The geology in the area of the site consists of siltstone bedrock overlain by 70 to 80 feet of glacial soils. The RI borings encountered soils consisting of generally fine-grained, silty to sandy clay. Groundwater in the site soil flows generally to the west. Drainage ditches at the site direct storm water east and north offsite towards Marsh Run and the Black Fork Mohican River.

A PA was performed at the site in September 2000, and an SI in was performed at the site in March 2001. The SI consisted of limited surface and subsurface soil sampling, and a geophysical survey to identify areas of buried waste. Two geophysical anomalies were identified at the site, the large anomaly and the small anomaly.

A soil mercury vapor survey also was conducted in the area of the large geophysical anomaly as part of the SI in response to a report by a resident that small vials of mercury were found at the site. An area of subsurface mercury vapor approximately 800 ft^2 in extent was identified in the southern portion of the large geophysical anomaly. Some PAHs and metals detected in soil samples exceeded screening levels, so an RI was performed to determine the nature and extent of constituents at the site, and to determine if unacceptable risks to human health and the environment exist at the site.

The RI was conducted in accordance with the Shelby Horizons AOC RI work plan (CH2M HILL 2008), approved by the Ohio EPA. The RI included installing three groundwater monitoring wells, quarterly groundwater sampling for 1 year, collecting and analyzing 15 surface soil samples and 8 drainage ditch surface soil samples, and conducting a landfill gas survey at the Shelby Horizons AOC. At the suggestion of Ohio EPA, the landfill gas survey was moved from the planned 15 locations in and around the AOC to the 8 locations along the perimeter fence of the Shelby Horizons property to minimize disturbance and potential hazards associated with digging in the fill area. The bulk of the

fieldwork was performed in October and November 2008. Subsequent quarterly groundwater monitoring occurred in January, April, and July 2009.

During the SI effort, surface (0 to 0.8 foot bgs) and subsurface (2 to 4 feet bgs) soil sampling were conducted within the large geophysical anomaly suspected of being a disposal area based on historical aerial photographs. During the RI, surface soil samples (0 to 0.5 foot bgs) were collected in and around both of the geophysical anomalies and the drainage ditch running through and adjacent to the large anomaly. The RI and SI soil data were compared to the December 2009 USEPA industrial RSLs based on current and planned future land use. Although the site is expected to remain industrial for the near future, the data also were compared to more conservative residential RSLs for informational purposes.

8.1 Drainage Ditch Surface Soil Samples

In the drainage ditch surface soil samples, arsenic was detected at all sampling locations and was the only metal detected in excess of its industrial soil RSLs (1.6 mg/kg). The maximum concentration of arsenic in the drainage ditch surface soil was 13.4 mg/kg. Ohio EPA guidance suggests that arsenic soil concentrations of 13 mg/kg or less may be naturally occurring (Ohio EPA 2009). Arsenic detected in the Wilkins AFS background surface soil samples had an average concentration of 11.06 mg/kg, which is similar to the drainage ditch surface soil arsenic concentrations.

No PAHs exceeded industrial soil RSLs; one PAH (benzo[a]pyrene) exceeded the residential RSL. None of the detected SVOCs exceeded industrial or residential RSLs. VOCs were not detected in the drainage ditch surface soil samples.

8.2 Surface Soil Samples

Arsenic was detected at all 19 RI and SI sample locations and was the only metal detected above industrial soil RSLs (1.6 mg/kg) in the surface soil samples. The maximum concentration of arsenic in the surface soil samples was 17 mg/kg. Although this is slightly higher than the maximum arsenic concentration in the drainage ditch surface soil samples and the normal Ohio background concentration (13 mg/kg), arsenic in the surface soil may also be naturally occurring because of its ubiquitous presence in the soil samples.

No mercury results exceeded the industrial RSL, including samples located near the area containing subsurface mercury vapor in the southern portion of the large geophysical anomaly. Mercury concentrations exceeded the residential RSL at two surface soil sample locations, but neither of the samples was near the subsurface mercury vapor area.

Benzo(a)pyrene exceeded the industrial soil RSL of 0.21 mg/kg at five sampling locations; no other PAHs exceeded industrial soil RSLs. The benzo(a)pyrene concentrations in the five samples exceeding the industrial RSL ranged from 0.22 to 0.62 mg/kg. All surface soil samples collected during the RI and SI, with the exception of SI-SS-15, contained at least one PAH compound exceeding its residential soil RSL. PAHs were detected in the Wilkins AFS background surface soil samples; however, all detections were below industrial soil RSLs.

The most likely potential source(s) of PAHs in surface soil at the site, which is primarily grass- and gravel-covered, would be runoff from the site parking areas and occasional use of the AOC for parking vehicles.

No SVOCs, VOCs, pesticides, or PCBs in the surface soil samples exceeded industrial or residential soil RSLs.

8.3 Subsurface Soil

Five shallow subsurface soil samples (SI-SB-09 through SI-SB-13) were collected during the SI from depths of approximately 2 to 4 feet bgs.

Arsenic, lead, and mercury exceeded industrial RSLs, and antimony exceeded the residential soil RSL. Arsenic exceeded the industrial RSL of 1.6 mg/kg at all five subsurface sample locations, with concentrations ranging from 9.2 to 21.8 mg/kg. Lead exceeded the industrial soil RSL of 800 mg/kg in one subsurface soil sample location (SI-SB-09) in the large geophysical anomaly, at a concentration of 1,190 mg/kg. The mercury concentration in one subsurface soil sample (SI-SB-09) exceeded the industrial soil RSL of 34 mg/kg at a concentration of 45.4 mg/kg, which was significantly higher than mercury concentrations at other subsurface soil sampling locations.

Benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were the only PAHs detected in subsurface soil above their respective industrial RSLs. All of these detections above industrial soil RSL occurred at sampling location SI-SB-09. Two PAHs (benzo[a]anthracene and indeno[1,2,3-cd]pyrene) exceeded their respective residential soil RSLs. These also occurred at sampling location SI-SB-09.

Five SVOCs, three VOCs, four pesticides, and two PCBs were detected in the subsurface soil; however, none of these detections exceeded industrial or residential screening levels. The majority of these detections occurred in the sample collected at SI-SB-09.

8.4 Groundwater

Three monitoring wells (MW-11, MW-12, and MW-13) were installed around the geophysical anomalies and sampled for four quarters between November 2008 and July 2009. The analytical results of the groundwater samples indicated levels of arsenic (in MW-11 and MW-13) and antimony (in one of four sampling events for MW-12) in excess of screening levels. Organic compounds detected in groundwater did not exceed screening levels.

8.5 Landfill Gas

The landfill gas survey was completed in October 2008 in the shallow soil along the property fence line north, west, and south of the two anomalies. Methane was not detected at the property edge in the upper 2 feet of soil, suggesting landfill gases in the filled areas at the site are not migrating from the immediate area through the upper two feet of soil.

During fourth quarter groundwater sampling events, methane was detected in MW-11 and MW-13. Methane is commonly formed by the decomposition of organic waste such as household trash. The detection of methane in these well casings indicates the presence of methane in the subsurface water-bearing zone screened by these two monitoring wells, but levels reported are not necessarily representative of methane in the subsurface. Even though the landfill gas survey did not indicate the presence of methane in the shallow soils, methane could potentially migrate through the water bearing zone.

8.6 Mercury Vapor

A survey that measured mercury vapor in the upper 6 inches of soil was conducted in the area around the large anomaly in August 2000. Mercury vapor was not detected across the northern and central sections of the large anomaly, but was detected in an approximately 800 square-foot area at the southern end of the large anomaly. These detections exceeded the December 2009 industrial air criteria of 0.0013 mg/m^3. Mercury was not detected above the residential soil RSL in the surface soil (0 to 0.5 inch bgs) or subsurface soil (2 to 3 feet bgs) samples collected near this location during the SI and RI.

8.7 Risk Assessment Conclusions

Human health risks at the site were evaluated for exposure to:

- Surface soil for current industrial workers
- Trespassers/visitors (adult and youth)
- Surface and subsurface soil for future construction workers, and residents
- Shallow groundwater for future construction workers

For the industrial worker, the HI (0.05) is less than USEPA's target HI of 1. The carcinogenic risk (1.3×10^{-5}) is within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}. Arsenic (6.6×10^{-6}) is the primary contributor to the carcinogenic risk. As previously discussed, arsenic may be naturally occurring, and if the arsenic risk were removed, the carcinogenic risk would be within USEPA's risk management range of 1×10^{-6} to 1×10^{-4}.

For current land use (industrial), the site does not pose unacceptable health risks to any of the other (trespassers/visitors) receptors evaluated in the HHRA.

Contact with surface soil by trespassers/visitors (adult and youth) would result in carcinogenic risks within the USEPA's risk management range of 1×10^{-6} to 1×10^{-4} and the noncancer HIs below the USEPA target HI of 1. Hypothetical contact with surface soil and total soil (combined surface and subsurface soil) by future residents (lifetime) may result in risks within USEPA's risk management range of 1×10^{-6} to 1×10^{-4} and hazards below USEPA's target HI of 1 for adult residents, but above 1 for child residents.

For the construction worker scenario, cumulative carcinogenic risk (2.4×10^{-6}) would be within USEPA's risk management range of 1×10^{-6} to 1×10^{-4} and the noncancer HI (0.08) is less than USEPA's target HI of 1 for potential contact with total soil (combined surface and subsurface soil) and groundwater.

An ERA was performed to evaluate the actual or potential ecological effects from exposures to the site. Several birds and mammals were selected as representative receptors:

- Herbivore: deer mouse, mourning dove
- Invertivore: American robin, short-tailed shrew
- Carnivore: red-tailed hawk, red fox

It is unlikely that lower trophic level receptors (plants and invertebrates) are at risk. Potential ecological risks for upper trophic level receptors (birds and mammals) via exposure to thallium (all six receptors) may be present. However, unacceptable risks to local

populations of upper trophic level receptors are unlikely based on the assumption that all receptors spend 100 percent of their time at the site. The general home ranges of all the upper level trophic level receptors except the deer mouse are greater than the extent of the site. Predicted risks would be less than those based on the assumption that 100 percent of receptor time is spent on the site. The site would represent 100 percent of the home range for the deer mouse. However, the site would only support a small number of deer mice and would not pose an unacceptable threat to local populations of deer mice.

Based on the ERA and subsequent refinements presented above, it is concluded that the site does not pose an unacceptable risk to ecological receptors.

Based on the sampling conducted during the SI and RI and the HHRA, constituent levels do not pose an unacceptable risk to human health. Based on the ERA, the site does not pose an unacceptable risk to ecological receptors.

Although no unacceptable risks to human health or the environment were identified during this remedial investigation, further investigation of the methane gas is recommended to determine representative levels in the subsurface materials in the vicinity of the AOC. In addition, further assessment of mercury vapor in the area of the AOC is recommended to confirm the previous findings of the SI.

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SECTION 9

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Tables

TABLE 3-1

Shelby Horizons AOC - Measured Groundwater Elevations

Shelby Horizons AOC Remedial Investigation

Former Wilkins Air Station, Shelby, Ohio

				11/10/2008		**1/26/2009**		**4/20/2009**		**7/27/2009**	
Well Name	**Top of Casing (ft amsl)**	**Northing**	**Easting**	Water Level (ft bgs)	Elevation (ft bgs)	Water Level (ft bgs)	Elevation (ft bgs)	Water Level (ft bgs)	Elevation (ft bgs)	Water Level (ft bgs)	Elevation (ft bgs)
MW-11	1080.97	451190.75	1919856.02	13.86	1067.11	10.15	1070.82	9.48	1071.49	9.01	1071.96
MW-12	1081.85	451240.99	1920034.16	9.22	1072.63	5.49	1076.36	3.77	1078.08	7.47	1074.38
MW-13	1080.51	450772.85	1919904.57	9.68	1070.83	7.69	1072.82	5.91	1074.60	7.27	1073.24

ft amsl - feet above mean sea level

ft bgs - feet below ground surface

TABLE 3-2
Shelby Horizons AOC - Water Quality Field Parameters
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

		Water Column Data			Water Quality Parameters					
Well ID	**Date**	**Initial DTW (ft btoc)**	**Total Depth (ft btoc)**	**Height of Water Column**	**pH**	**DO (mg/L)**	**Specific Conductance (ms/cm)**	**ORP (mV)**	**Temperature (^{o}C)**	**Turbidity (NTU)**
MW-11	11/12/2008	11.46	27.16	15.70	7.91	0.64	0.605	134.0	12.80	5.8
	1/27/2009	10.15	27.16	17.01	8.15	0.30	0.572	-118.1	8.22	3.1
	4/20/2009	6.80	27.18	20.38	8.07	0.14	0.594	-79.8	9.36	5.95 [1]
	7/29/2009	7.36	27.19	19.83	9.07	0.03	0.605	-102.9	16.18	10.3
MW-12	11/11/2008	9.32	22.96	13.64	7.03	4.79	1.034	88.9	10.54	2.29
	1/28/2009	5.49	22.72	17.23	7.27	0.66	0.991	35.3	1.91	3.0
	4/20/2009	3.67	22.65	18.98	6.99	0.22	0.942	128.2	8.98	5.56
	7/29/2009	7.46	22.64	15.18	7.03	0.01	0.918	57.5	17.18	4.14
MW-13	11/11/2008	10.69	26.57	15.88	7.72	0.62	0.739	-2.4	10.50	26.2
	1/27/2009	7.69	26.57	18.88	7.77	0.56	0.684	-55.2	6.44	60.6
	4/21/2009	5.30	26.57	21.27	7.65	1.62	0.713	-125.0	8.15	100
	7/29/2009	7.10	26.60	19.50	7.73	-0.01 [2]	0.690	-124.6	16.68	44.3

Parameters shown were recorded immediately before sampling

[1] Reading collected prior to final sampling parameters. Final reading was not recorded on the field form.

[2] Do reading written on the field form is a negative number, which is not an actual value for the amount of dissolved oxygen in the system. This indicates low DO, likely near zero, and the discrepancy off of zero may be due to changing barometric pressure from the time when the meter was calibrated.

DTW is the static water level before purging
ft btoc - feet below top of casing
DO - dissolved oxygen
ORP - oxidation reduction potential
mg/L - milligrams per liter
ms/cm - microsiemens per centimeter
ORP - Oxidation Reduction Potential
mV - millivolts
°C = degrees Celsius
NTU - Nephalometric Turbidity Units

TABLE 3-3
Landfill Gas Survey Monitoring and Downwell Air Quality Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Landfill Gas Survey Monitoring

Location ID	Northing	Easting	Date	Time	Punchbar hole depth (in)	Parameters			
						Methane	CO_2 (ppm)	% O_2	LEL (%)
LG-01B	451272.15	1919836.64	10/31/2008	1200	12	0.0	0.1	20.7	0.1
LG-02B	451176.39	1919835.09	10/31/2008	1208	12	0.0	0.1	20.9	0.1
LG-03B	451012.20	1919844.12	10/31/2008	1215	12	0.0	0.2	21.0	0.1
LG-04B	450910.09	1919844.24	10/31/2008	1223	12	0.0	0.1	21.1	0.0
LG-05B	450735.23	1919846.36	10/31/2008	1228	6	0.0	0.0	21.1	0.4
LG-06B	450739.26	1919963.22	10/31/2008	1233	12	0.0	0.0	21.1	0.0
LG-07B	450742.83	1920062.03	10/31/2008	1235	12	0.0	0.0	21.1	0.1
LG-08B	451276.10	1919950.70	10/31/2008	1242	18	0.0	0.2	21.0	0.1

Downwell Air Quality Monitoring

Well ID	Date	PID Reading (ppm)	LEL (%)	H_2S (ppm)	% O_2	Methane (GEM 2000 Reading %)	CO_2 (ppm)
MW-11	4/20/2009	0.0	>20%	0.0	12.9	--	--
	7/29/2009	0.0	--	--	0.0	90.5	0.2
MW-12	4/20/2009	0.0	0.0	0.0	12.0	--	--
	7/29/2009	0.0	--	--	20.4	0.0	0.1
MW-13	4/21/2009	0.0	>20%	0.0	14.7	--	--
	7/29/2009	0.0	--	--	7.9	49.7	0.5

Note:
-- - Not available/ not collected
The GEM 2000 meter was only used during the July 2009 event
Down well readings were only collected in April and July 2009
LEL - lower explosive limit
H2S - hydrogen sulfide
O2 - Oxygen
CO2 - carbon dioxide
ppm - parts per million

TABLE 4-1
SI Surface Soil and Subsurface Soil Analytical Results: Plexus SI
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Surface Soil												Subsurface Soil								
	Sample ID				SI-SS-09			SI-SS-10			SI-SS-15			SI-SS-16			SI-SB-09			SI-SB-10			SI-SB-11		
	Sample depth (feet)				0.3-0.8			0-0.5			0-0.5			0-0.5			2-3			2-3			2-4		
	Sample Date	EPA	EPA	RI	22-Aug-00			29-Aug-00			13-Aug-00			13-Aug-00			29-Aug-00			29-Aug-00			22-Aug-00		
Method	Lab	Industrial Soil	Residential Soil	Screening Level	STL-CAN			STL-CAN			STL-CAN			STL-CAN			STL-CAN			STL-CAN			STL-CAN		
Group	Analyte				Result	LF	VF	Result	LF	VF	Result	LF	VF	Result	LF	VF	Result	LF	VF	Result	LF	VF	Result	LF	VF
		(mg/kg)	(mg/kg)	(mg/kg)																					
Metals	Aluminum	990,000	77,000	990,000	12400		J,c	10300		J,c	9560		J,c	11100		J,c	18400		J,c	16200		J,c	13600		J,c
Metals	Antimony	410	31	410	0.62	B		--	U		--	U		0.91	B		31.6			--	U		0.96	B	
Metals	Arsenic	1.6	0.39	1.6	9.8			12.1			6.6			17.0			9.3			9.2			21.8		
Metals	Barium	190,000	15,000	190,000	78.2			72.1			48.8			153			470			125			105		
Metals	Beryllium	2,000	160	2,000	--	B	U,o	0.41	B		0.31	B		1.2			0.32	B		0.75			--		U,o
Metals	Cadmium	800	70	800	0.43	B		1.1	B		--	U		0.64			12.2			0.50	B		--	U	
Metals	Calcium	--	--	--	4380			52900			3570			8780			27600			3910			6310		
Metals	Chromium	1,500,000	120,000	1,500,000	15.2			15.1			13.9			16.7			139			21.8			21.2		
Metals	Cobalt	300	23	300	7.3			8.9			5.2	B		6.4			8.5			9.8			11.2		
Metals	Copper	41,000	3,100	41,000	41.7		J,o	25.3			14.5			51.7			294			24.1			35.9		J,o
Metals	Iron	720,000	55,000	720,000	20000			22800			17000		J,c	17200		J,c	28500			24100			30400		J,l
Metals	Lead	800	400	800	28.3			17.5			9.1			48.0			1190			16.4			17.2		
Metals	Magnesium	--	--	--	13200			12500			2150			2310			6170			3610			4120		
Metals	Manganese	23,000	1,800	23,000	308			417			138			204			448			550			190		
Metals	Mercury	34	5.6	34	6.1			0.05	B		0.056	B		2.6			45.4			0.14			0.083	B	
Metals	Nickel	20,000	1,500	20,000	24.7			26.3		J,s	18.3			20.3			35.4		J,s	30.9		J,s	40.0		
Metals	Potassium	--	--	--	1880			2080			1040			1460			1790			1470			1590		
Metals	Selenium	5,100	390	5,100	--	B	U,p	--	U		1.1	B		1.9	B		--	U		--	U		--	B	U,p
Metals	Silver	5,100	390	5,100	0.23	B		--	U		--	U		0.77	B		27.8		J,c	--	U		--	U	
Metals	Sodium	--	--	--	--	U		71.4	B		77.3	B		110	B		445.0	B		--	U		--	U	
Metals	Thallium	--	--	--	--	U		--	U		--	U		--	U		--	U		--	U		--	U	
Metals	Vanadium	5,200	390	5,200	22.0			26.6			24.0			26.9			32.6			38.1			42.6		
Metals	Zinc	310,000	23,000	310,000	113		J,s	89.2			41.2	B		139			1640			79.0			103	L	J,s
Metals	Cyanide	20,000	1,600	20,000	--	U		--	U		--	U		0.33	B		0.42	B		--	U		--	U	
VOCs	Acetone	630,000	61,000	630,000	--	U		--	U		--	U		--	U		--	U	UJ,s	--	U		--	U	
VOCs	Chloroform	1.5	0.29	1.5	0.008			--	U		--	U		--	U		--	U	UJ,s	--	U		--	U	
VOCs	Methylene chloride	53	11.0	53	--	U		0.0015	J		--	U		--	U		0.0033	J	J,s	0.0027	J		--	U	
VOCs	Toluene	45,000	5,000	45,000	--	U		--	U		--	U		--	U		0.0015	J		--	U		--	U	
SVOCs	2,4-Dinitrophenol	1,200	120	1,200	--	U	UJ,c	--	U	UJ,c	--	U	R,c	--	U	R,c	--	U	UJ,c	--	U	UJ,c	--	U	UJ,c
SVOCs	2-Methylnaphthalene	4,100	310	4,100	0.053	J		--	U	UJ,l	--	U		0.700			0.076	J	J,l	--	U	UJ,l	--	U	
SVOCs	bis(2-Ethylhexyl) phthalate	120	35	120	--	U		--	U		--	U		--	U		0.130	J		--	U		--	U	
SVOCs	Butyl benzyl phthalate	910	260	910	--	U		--	U		--	U		--	U		--	U		--	U		--	U	
SVOCs	Carbazole	---	---	---	0.083	J		--	U	UJ,l	--	U		--	U		0.250	J	J,l	--	U	UJ,l	--	U	
SVOCs	Dibenzofuran	---	---	---	--	U		--	U	UJ,l	--	U		0.160	J		0.084	J	J,l	--	U	UJ,l	--	U	
SVOCs	Diethyl phthalate	490,000	49,000	490,000	--	U		0.170	J	J,l	--	U		--	U		0.310	J	J,l	--	U	UJ,l	--	U	
SVOCs	Hexachlorocyclopentadiene	3,700	370	3,700	--	U	R,l	--	U		--	U	UJ,l	--	U	UJ,l	--	U		--	U		--	U	R,l

TABLE 4-1
SI Surface Soil and Subsurface Soil Analytical Results: Plexus SI
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Surface Soil												Subsurface Soil								
	Sample ID				**SI-SS-09**			**SI-SS-10**			**SI-SS-15**			**SI-SS-16**			**SI-SB-09**			**SI-SB-10**			**SI-SB-11**		
	Sample depth (feet)				**0.3-0.8**			**0-0.5**			**0-0.5**			**0-0.5**			**2-3**			**2-3**			**2-4**		
	Sample Date	**EPA**	**EPA**	**RI**	**22-Aug-00**			**29-Aug-00**			**13-Aug-00**			**13-Aug-00**			**29-Aug-00**			**29-Aug-00**			**22-Aug-00**		
Method	**Lab**	**Industrial Soil**	**Residential Soil**	**Screening Level**	**STL-CAN**			**STL-CAN**			**STL-CAN**			**STL-CAN**			**STL-CAN**			**STL-CAN**			**STL-CAN**		
Group	**Analyte**				**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**
SVOCs/PAHs	Acenaphthene	33,000	3,400	33,000	**0.072**	J		--	U	UJ,l	--	U		--	U		**0.130**	J	J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Anthracene	170,000	17,000	170,000	**0.140**	J		**0.053**	J	J,l	--	U		--	U		**0.440**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Benzo(a)anthracene	2.1	0.15	2.1	**0.420**			**0.260**	J	J,l	--	U		**0.120**	J		**1.9**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Benzo(a)pyrene	0.21	0.015	0.21	**0.370**	J		**0.300**	J	J,l	--	U		**0.100**	J		**2.1**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	**0.550**			**0.410**			--	U		**0.150**	J		**2.5**			--	U		--	U	
SVOCs/PAHs	Benzo(ghi)perylene	---	--	---	**0.210**	J		**0.170**	J	J,l	--	U		**0.069**	J		**1.4**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Benzo(k)fluoranthene	21	1.5	21	**0.180**	J		**0.110**	J	J,l	--	U		--	U		**0.820**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Chrysene	210	15	210	**0.530**			**0.360**	J		--	U		**0.150**	J		**2.1**			--	U		--	U	
SVOCs/PAHs	Dibenz(a,h)anthracene	0.21	0.015	0.21	**0.048**	J		--	U	UJ,l	--	U		--	U		**0.380**	J	J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Fluoranthene	22,000	2,300	22,000	**1.1**			**0.570**		J,l	--	U		**0.250**	J		**3.4**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Fluorene	22,000	2,300	22,000	**0.068**	J		--	U	UJ,l	--	U		--	U		**0.140**	J	J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	**0.210**	J		**0.170**	J	J,l	--	U		**0.059**	J		**1.5**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Naphthalene	18	3.6	18	**0.056**	J		--	U	UJ,l	--	U		**0.470**			**0.210**	J	J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Phenanthrene	---	--	---	**0.800**			**0.330**	J	J,l	--	U		**0.440**			**2.0**		J,l	--	U	UJ,l	--	U	
SVOCs/PAHs	Pyrene	17,000	1,700	17,000	**1.0**			**0.590**			--	U		**0.210**	J		**3.5**			--	U		--	U	
PAHs	Acenaphthylene	33,000	3,400	33,000	--	U	R,l	--	U	R,l	--	U	R,l	--	U	R,l	--	U	R,l	--	U	R,l	--	U	R,l
PAHs	Benzo(a)anthracene	2.1	0.15	2.1	**0.400**			**0.470**			--	U		**0.078**	J		**1.7**			--	U		--	U	
PAHs	Benzo(a)pyrene	0.21	0.015	0.21	**0.450**			**0.620**		J,c	--	U		**0.086**	J		**2.1**		J,c	--	U		--	U	
PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	**0.390**	PG		**0.550**			--	U		**0.066**	J		**1.8**			--	U		--	U	
PAHs	Benzo(ghi)perylene	---	--	---	**0.220**	J		**0.180**	J	J,c	--	U		--	U		**0.680**	J	J,c	--	U		--	U	
PAHs	Benzo(k)fluoranthene	21	1.5	21	**0.180**			**0.200**	J		--	U		**0.028**	J		**0.890**			--	U	UJ,c	--	U	
PAHs	Chrysene	210	15	210	**0.430**			**0.520**			--	U		**0.130**			**1.8**			--	U		--	U	
PAHs	Fluoranthene	22,000	2,300	22,000	**1.6**	PG	J,g	--	PG	R,c	--	U		--	U		--	PG	R,c	--	U		--	U	
PAHs	Fluorene	22,000	2,300	22,000	**0.087**	J		**0.120**	J		--	U		--	U		**0.230**	J		--	U		--	U	
PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	**0.270**			**0.890**		J,c	--	U		--	U		**1.3**	PG	J,c	--	U		--	U	
PAHs	Naphthalene	18	3.6	18	--	U		--	U		--	U		**0.370**	J	J,g	--	U		--	U		--	U	
PAHs	Phenanthrene	---	--	---	**0.870**	J		**1.2**	J		--	U		**0.400**	J		**2.7**	J		--	U		--	U	
PAHs	Pyrene	17,000	1,700	17,000	**1.5**			**2.0**	PG		--	U		**0.180**	J	J,g	**5.4**			--	U		--	U	
Pesticides	4,4'-DDD	7.2	2.0	7.2	--	U		--	U	UJ,l	--	U		**0.009**	J	J,s	**0.062**	J	J,l	--	U	UJ,l	--	U	
Pesticides	4,4'-DDE	5.1	1.4	5.1	--	U		--	U	UJ,l	--	U		**0.023**		J,s	**0.056**	J	J,l	--	U	UJ,l	--	U	
Pesticides	4,4'-DDT	7.0	1.7	7.0	--	U		**0.019**	J		--	U		**0.012**	J	J,s	**0.018**	J	J,g	--	U		--	U	
Pesticides	Beta-bhc	0.96	0.27	0.96	**0.0035**	J	J,c	--	U		--	U		--	U		**0.041**	J	J,g	--	U		--	U	
PCBs	Aroclor 1254	0.74	0.22	0.74	--	U		--	U		--	U		--	U		**0.110**			--	U		--	U	
PCBs	Aroclor 1260	0.74	0.22	0.74	--	U		--	U		--	U	UJ,c	--	U	UJ,c	**0.100**			--	U		--	U	

Notes:
EPA Screening values are December 2009 USEPA RSLs
All data presented in milligrams per kilogram (mg/kg)
Detections are shown in bold Exceedances above the industrial screening criteria are shaded
=--Not detected
LF - Laboratory Flag; See Table G-4 for definitions VF - Validation Flag; See Table G-5 for definitions
J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration
N The analysis indicates the present of an analyte for which there is presumptive evidence to make a tentative identification.
R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presenceor absence of the analyte cannot be verified.
U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Data presented is from the Site Investigation Report (Plexus, 2001)

TABLE 4-1
SI Surface Soil and Subsurface Soil Analytical Results: Plexus SI
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Subsurface Soil											
	Sample ID				SI-SB-12			SI-SB12			SI-SB-112 (Duplicate)			SI-SB-13		
	Sample depth (feet)				2-4			2-4			2-4			2-3		
	Sample Date	EPA	EPA	RI	22-Aug-00			22-Aug-00			22-Aug-00			29-Aug-00		
Method	Lab	Industrial Soil	Residential Soil	Screening Level	Heritage			STL-CAN			STL-CAN			STL-CAN		
Group	Analyte				Result	LF	VF	Result	LF	VF	Result	LF	VF	Result	LF	VF
		(mg/kg)	(mg/kg)	(mg/kg)												
Metals	Aluminum	990,000	77,000	990,000	**9920**		J,c	**14000**		J,c	**12800**		J,c	**11500**		J,c
Metals	Antimony	410	31	410	**1.0**	B		--	U		**0.62**	B		--	U	
Metals	Arsenic	1.6	0.39	1.6	**16.8**			**15.0**		J,n	**15.4**			**13.9**		
Metals	Barium	190,000	15,000	190,000	**83.4**			**110**			**88.9**			**97.4**		
Metals	Beryllium	2,000	160	2,000	--		U,o	**0.50**		J,c	--		U,o	**0.58**	B	
Metals	Cadmium	800	70	800	--	U		**0.50**	J		--	U		**0.71**	B	
Metals	Calcium	--	--	--	**63400**			**6000**		J,c	**4670**			**3430**		
Metals	Chromium	1,500,000	120,000	1,500,000	**19.1**			**20**	J		**18.8**			**18.1**		
Metals	Cobalt	300	23	300	**9.0**			**14**	J		**10.9**			**13.9**		
Metals	Copper	41,000	3,100	41,000	**28.2**		J,o	**29**			**27.2**		J,o	**33.4**		
Metals	Iron	720,000	55,000	720,000	**29500**		J,c	**32000**			**29300**		J,c	**33700**		
Metals	Lead	800	400	800	**14.9**			**15**	J		**13.4**			**18.9**		
Metals	Magnesium	--	--	--	**2890**			**3800**			**2980**			**3780**		
Metals	Manganese	23,000	1,800	23,000	**210**			**510**			**267**			**801**		
Metals	Mercury	34	5.6	34	**0.18**			**0.10**	J	J,c	**0.2**			**0.049**	B	
Metals	Nickel	20,000	1,500	20,000	**30.1**			**37**			**32.0**			**45.4**		J,s
Metals	Potassium	--	--	--	**1460**			**1500**			**1560**			**2010**		
Metals	Selenium	5,100	390	5,100	--	B	U,p	**0.77**	J	J,c	--	B	U,p	--	U	
Metals	Silver	5,100	390	5,100	--	U		--	U		--	U		--	U	
Metals	Sodium	--	--	--	--	U		**78**	J	J,s	--	U		**61.8**	B	
Metals	Thallium	--	--	--	--	U		**0.52**	J	J,n	--	U		--	U	
Metals	Vanadium	5,200	390	5,200	**42.3**			**34**			**38.9**			**28.5**		
Metals	Zinc	310,000	23,000	310,000	**72.2**		J,s	**84**			**73.7**		J,s	**102**		
Metals	Cyanide	20,000	1,600	20,000	--	U		--	U		--	U		--	U	
VOCs	Acetone	630,000	61,000	630,000	--	U		--	U		--	U		**0.0026**	J	J,l
VOCs	Chloroform	1.5	0.29	1.5	--	U		--	U		--	U		--	U	
VOCs	Methylene chloride	53	11.0	53	--	J	U,z	--	U		--	U		**0.002**	J	
VOCs	Toluene	45,000	5,000	45,000	--	U		--	U		--	U		--	U	
SVOCs	2,4-Dinitrophenol	1,200	120	1,200	--	U		--	U	UJ,c	--	U	UJ,c	--	U	UJ,c
SVOCs	2-Methylnaphthalene	4,100	310	4,100	--	U		--	U		--	U		--	U	UJ,l
SVOCs	bis(2-Ethylhexyl) phthalate	120	35	120	--	U		--	U		--	U		--	U	
SVOCs	Butyl benzyl phthalate	910	260	910	--	U		--	U		--	U		--	U	
SVOCs	Carbazole	---	---	---	--	U		--	U		--	U		--	U	UJ,l
SVOCs	Dibenzofuran	---	---	---	--	U		--	U		--	U		--	U	UJ,l
SVOCs	Diethyl phthalate	490,000	49,000	490,000	--	J	U,z	--	U		--	U		**0.097**	J	J,l
SVOCs	Hexachlorocyclopentadiene	3,700	370	3,700	--	U	UJ,l	--	U	R,l	--	U	R,l	--	U	

TABLE 4-1
SI Surface Soil and Subsurface Soil Analytical Results: Plexus SI
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Subsurface Soil											
	Sample ID					**SI-SB-12**			**SI-SB12**			**SI-SB-112 (Duplicate)**			**SI-SB-13**	
	Sample depth (feet)					**2-4**			**2-4**			**2-4**			**2-3**	
	Sample Date	**EPA**	**EPA**	**RI**		**22-Aug-00**			**22-Aug-00**			**22-Aug-00**			**29-Aug-00**	
Method	**Lab**	**Industrial Soil**	**Residential Soil**	**Screening Level**		**Heritage**			**STL-CAN**			**STL-CAN**			**STL-CAN**	
Group	**Analyte**				**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**	**Result**	**LF**	**VF**
SVOCs/PAHs	Acenaphthene	33,000	3,400	33,000	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Anthracene	170,000	17,000	170,000	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Benzo(a)anthracene	2.1	0.15	2.1	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Benzo(a)pyrene	0.21	0.015	0.21	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	--	U		--	U		--	U		--	U	
SVOCs/PAHs	Benzo(ghi)perylene	---	--	---	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Benzo(k)fluoranthene	21	1.5	21	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Chrysene	210	15	210	--	U		--	U		--	U		--	U	
SVOCs/PAHs	Dibenz(a,h)anthracene	0.21	0.015	0.21	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Fluoranthene	22,000	2,300	22,000	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Fluorene	22,000	2,300	22,000	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Naphthalene	18	3.6	18	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Phenanthrene	---	--	---	--	U		--	U		--	U		--	U	UJ,l
SVOCs/PAHs	Pyrene	17,000	1,700	17,000	--	U		--	U		--	U		--	U	
PAHs	Acenaphthylene	33,000	3,400	33,000	--	U		--	U	R,l	--	U	R,l	--	U	R,l
PAHs	Benzo(a)anthracene	2.1	0.15	2.1	--	U		--	U		--	U		--	U	
PAHs	Benzo(a)pyrene	0.21	0.015	0.21	--	U		--	U		--	U		--	U	
PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	--	U		--	U		--	U		**0.0043**	J	
PAHs	Benzo(ghi)perylene	---	--	---	--	U		--	U		--	U		--	U	
PAHs	Benzo(k)fluoranthene	21	1.5	21	--	U		--	U		--	U		--	U	UJ,c
PAHs	Chrysene	210	15	210	**0.0013**	J	J,g	--	U		--	U		--	U	
PAHs	Fluoranthene	22,000	2,300	22,000	--	U		--	U		--	U		**0.015**	J	
PAHs	Fluorene	22,000	2,300	22,000	--	U		--	U		--	U		--	U	
PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	--	U		--	U		--	U		--	U	
PAHs	Naphthalene	18	3.6	18	--	U		--	U		--	U		--	U	
PAHs	Phenanthrene	---	--	---	--	U		--	U		--	U		--	U	
PAHs	Pyrene	17,000	1,700	17,000	**0.0032**	J		--	U		--	U		--	U	
Pesticides	4,4'-DDD	7.2	2.0	7.2	--	U		--	U		--	U	UJ,s	--	U	UJ,l
Pesticides	4,4'-DDE	5.1	1.4	5.1	--	U		--	U		--	U	UJ,s	--	U	UJ,l
Pesticides	4,4'-DDT	7.0	1.7	7.0	--	U		--	U		--	U	UJ,s	--	U	
Pesticides	Beta-bhc	0.96	0.27	0.96	--	U		--	U		--	U	UJ,s	--	U	
PCBs	Aroclor 1254	0.74	0.22	0.74	--	U		--	U		--	U		--	U	
PCBs	Aroclor 1260	0.74	0.22	0.74	--	U		--	U		--	U		--	U	

Notes:
EPA Screening values are December 2009 USEPA RSLs
All data presented in milligrams per kilogram (mg/kg)
Detections are shown in bold Exceedances above the industrial screening criteria are shaded
=--Not detected
LF - Laboratory Flag; See Table G-4 for definitions VF - Validation Flag; See Table G-5 for definitions
J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
NJ The analysis indicates the presence of an analyte that has been tentatively identified and the associated numerical value represents its approximate concentration
N The analysis indicates the present of an analyte for which there is presumptive evidence to make a tentative identification.
R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presenceor absence of the analyte cannot be verified.
U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Data presented is from the Site Investigation Report (Plexus, 2001)

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment						
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	SD01-102908	SD02-102908	SD03-102908	SD04-102908	SD05-102908	SD06-102908	QC14-102908-FD (SD06 Duplicate)
Metals	Aluminum	990000	77000	990000	EPA, Industrial Soil	**9410**	**11000**	**11200**	**10100 J**	**9660**	**12000**	**12600**
Metals	Antimony	410	31	410	EPA, Industrial Soil	**0.57 J**	**0.22 J**	0.2 U	0.2 UJ	0.2 U	0.2 U	0.2 U
Metals	Arsenic	1.6	0.39	1.6	EPA, Industrial Soil	**13.4**	**6.1**	**7.7**	**9.8 J**	**12.3**	**9**	**9.3**
Metals	Barium	190000	15000	190000	EPA, Industrial Soil	**123**	**107**	**101**	**97.9 J**	**132**	**105**	**111**
Metals	Beryllium	2000	160	2000	EPA, Industrial Soil	**0.94**	**0.7**	**0.59**	**0.58 J**	**0.59**	**0.69**	**0.69**
Metals	Cadmium	800	70	800	EPA, Industrial Soil	**0.74**	**0.52**	**0.22**	**0.46 J**	**0.64**	**0.54**	**0.51**
Metals	Calcium	---	---	---	---	**7700**	**5790**	**4140**	**6340 J**	**9950**	**5090**	**5080**
Metals	Chromium	1500000	120000	1500000	EPA, Industrial Soil	**14.3**	**12.2**	**12.4**	**13 J**	**16.7**	**15.3**	**15.6**
Metals	Cobalt	300	23	300	EPA, Industrial Soil	**4.8**	**4.3**	**3.6**	**8.6 J**	**11.1**	**8.7**	**9.6**
Metals	Copper	41000	3100	41000	EPA, Industrial Soil	**39.9**	**28.3**	**16.3**	**22.5 J**	**25.5**	**20.7**	**20.6**
Metals	Iron	720000	55000	720000	EPA, Industrial Soil	**16000 J**	**15500 J**	**17200 J**	**23000 J**	**24300 J**	**20700 J**	**20600 J**
Metals	Lead	800	400	800	EPA, Industrial Soil	**57**	**14.3**	**10.7**	**13.5 J**	**49.8**	**13.8**	**14.4**
Metals	Magnesium	---	---	---	---	**2770**	**2160**	**1920**	**3170 J**	**3510**	**3590**	**3590**
Metals	Manganese	23000	1800	23000	EPA, Industrial Soil	**214**	**122**	**88.8**	**662 J**	**849**	**539**	**508**
Metals	Mercury	34	5.6	34	EPA, Industrial Soil	**2.1**	**0.3**	**0.22**	**0.15**	**0.21**	**0.076**	**0.079**
Metals	Nickel	20000	1500	20000	EPA, Industrial Soil	**15.1**	**16.1**	**12.4**	**23 J**	**27.2**	**25.1**	**25.7**
Metals	Potassium	---	---	---	---	**941**	**792**	**562**	**634 J**	**820**	**1050**	**1020**
Metals	Selenium	5100	390	5100	EPA, Industrial Soil	**0.83 J**	**0.67 J**	0.47 U	**0.58 J**	**0.76 J**	**0.48 J**	0.48 U
Metals	Silver	5100	390	5100	EPA, Industrial Soil	**0.86**	**0.072 J**	0.036 U	**0.066 J**	**0.11 J**	0.036 U	**0.045 J**
Metals	Sodium	---	---	---	---	**54.2 J**	**39.6 J**	**41.4 J**	**40.3 J**	**52.7 J**	**56.9 J**	**59.8 J**
Metals	Thallium	---	---	---	---	0.57 U	0.61 U	0.59 U	0.58 UJ	0.59 U	0.6 U	0.6 U
Metals	Vanadium	5200	390	5200	EPA, Industrial Soil	**21.9 J**	**24.7 J**	**24.6 J**	**24.8 J**	**29.3 J**	**25.4 J**	**24.8 J**
Metals	Zinc	310000	23000	310000	EPA, Industrial Soil	**108**	**63.9**	**38.5**	**49 J**	**79**	**71.9**	**71.8**
PAHs	Acenaphthene	33000	3400	33000	EPA, Industrial Soil	**0.014**	0.0017 UJ	0.0017 U	**0.002 J**	**0.0046 J**	0.0017 UJ	**0.014 J**
PAHs	Acenaphthylene	---	---	---	---	**0.0031 J**	0.0017 UJ	0.0016 U	0.0016 UJ	0.0016 U	0.0017 U	0.0017 U
PAHs	Anthracene	170000	17000	170000	EPA, Industrial Soil	**0.032**	**0.0019 J**	0.0018 U	**0.0035 J**	**0.012**	0.0018 UJ	**0.051 J**
PAHs	Benzo(a)anthracene	2.1	0.15	2.1	EPA, Industrial Soil	**0.098**	**0.013 J**	**0.0023 J**	**0.016 J**	**0.033**	**0.0036 J**	**0.091 J**
PAHs	Benzo(a)pyrene	0.21	0.015	0.21	EPA, Industrial Soil	**0.081**	**0.016 J**	**0.0023 J**	**0.014 J**	**0.03**	**0.0033 J**	**0.073 J**
PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	EPA, Industrial Soil	**0.12**	**0.029 J**	**0.0043 J**	**0.021 J**	**0.045**	**0.0056 J**	**0.094 J**
PAHs	Benzo(g,h,i)perylene	---	---	---	---	**0.048**	**0.014 J**	**0.0023 J**	**0.0098 J**	**0.027**	**0.0026 J**	**0.031 J**
PAHs	Benzo(k)fluoranthene	21	1.5	21	EPA, Industrial Soil	**0.037**	**0.0071 J**	0.0018 U	**0.0077 J**	**0.011**	0.0018 UJ	**0.034 J**
PAHs	Chrysene	210	15	210	EPA, Industrial Soil	**0.11**	**0.019 J**	**0.0029 J**	**0.019 J**	**0.038**	**0.0053 J**	**0.076 J**
PAHs	Dibenzo(a,h)anthracene	0.21	0.015	0.21	EPA, Industrial Soil	**0.013**	**0.0027 J**	0.0017 U	**0.0024 J**	**0.0052 J**	0.0017 UJ	**0.0093 J**
PAHs	Fluoranthene	22000	2300	22000	EPA, Industrial Soil	**0.2**	**0.025 J**	**0.0042 J**	**0.034 J**	**0.064**	**0.0081 J**	**0.21 J**
PAHs	Fluorene	22000	2300	22000	EPA, Industrial Soil	**0.013**	0.0019 UJ	0.0018 U	**0.002 J**	**0.0053 J**	0.0019 UJ	**0.015 J**
PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	EPA, Industrial Soil	**0.039**	**0.011 J**	**0.0019 J**	**0.0078 J**	**0.016**	**0.0019 J**	**0.032 J**
PAHs	Naphthalene	18	3.6	18	EPA, Industrial Soil	**0.12**	**0.013 J**	**0.005 J**	**0.013 J**	**0.0081**	**0.0031 J**	**0.0044 J**
PAHs	Phenanthrene	---	---	---	---	**0.22**	**0.019 J**	**0.0052 J**	**0.027 J**	**0.05**	**0.0062 J**	**0.15 J**
PAHs	Pyrene	17000	1700	17000	EPA, Industrial Soil	**0.16**	**0.022 J**	**0.0036 J**	**0.028 J**	**0.053**	**0.0068 J**	**0.16 J**
SVOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.018 U	0.019 U	0.019 U	0.018 U	0.019 U	0.019 U	0.019 U
SVOCs	1,2-Diphenylhydrazine	2.2	0.61	2.2	EPA, Industrial Soil	0.036 U	0.039 U	0.038 U	0.037 U	0.037 U	0.038 U	0.038 U
SVOCs	2,4,5-Trichlorophenol	62000	6100	62000	EPA, Industrial Soil	0.12 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 U	0.13 U
SVOCs	2,4,6-Trichlorophenol	160	44	160	EPA, Industrial Soil	0.087 U	0.093 U	0.09 U	0.088 UJ	0.089 U	0.091 U	0.091 U
SVOCs	2,4-Dichlorophenol	1800	180	1800	EPA, Industrial Soil	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
SVOCs	2,4-Dimethylphenol	12000	1200	12000	EPA, Industrial Soil	0.088 U	0.094 U	0.091 U	0.089 UJ	0.09 U	0.092 U	0.092 U
SVOCs	2,4-Dinitrophenol	1200	120	1200	EPA, Industrial Soil	0.25 U	0.27 U	0.26 U	0.25 UJ	0.26 U	0.26 U	0.26 U
SVOCs	2,4-Dinitrotoluene	5.5	1.6	5.5	EPA, Industrial Soil	0.026 U	0.028 U	0.027 U	0.026 U	0.027 U	0.028 U	0.028 U
SVOCs	2,6-Dinitrotoluene	620	61	620	EPA, Industrial Soil	0.035 U	0.038 U	0.037 U	0.036 U	0.036 U	0.037 U	0.037 U
SVOCs	2-Chloronaphthalene	82000	6300	82000	EPA, Industrial Soil	0.015 U	0.016 U	0.015 U	0.015 U	0.015 U	0.016 U	0.016 U
SVOCs	2-Chlorophenol	5100	390	5100	EPA, Industrial Soil	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
SVOCs	2-Methylnaphthalene	4100	310	4100	EPA, Industrial Soil	**0.24**	**0.033 J**	0.022 U	0.022 U	0.022 U	0.023 U	0.023 U
SVOCs	2-Methylphenol (o-cresol)	---	---	---	---	0.13 U	0.13 U	0.13 U	0.13 UJ	0.13 U	0.13 U	0.13 U
SVOCs	2-Nitroaniline	6000	610	6000	EPA, Industrial Soil	0.03 U	0.032 U	0.031 U	0.03 U	0.03 U	0.031 U	0.031 U
SVOCs	2-Nitrophenol	---	---	---	---	0.14 U	0.15 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
SVOCs	3,3'-Dichlorobenzidine	3.8	1.1	3.8	EPA, Industrial Soil	0.32 U	0.34 U	0.33 U	0.32 UJ	0.33 U	0.34 U	0.33 U

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment						
					Sample Location and Date>>	SD01-102908	SD02-102908	SD03-102908	SD04-102908	SD05-102908	SD06-102908	QC14-102908-FD (SD06 Duplicate)
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Screening Level Source							
SVOCs	3-Nitroaniline	---	---	---	---	0.036 U	0.039 U	0.038 U	0.037 UJ	0.037 U	0.038 U	0.038 U
SVOCs	4,6-Dinitro-2-methylphenol	---	---	---	---	0.081 U	0.086 U	0.084 U	0.082 UJ	0.083 U	0.085 U	0.085 U
SVOCs	4-Bromophenyl phenyl ether	---	---	---	---	0.011 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
SVOCs	4-Chloro-3-methylphenol	---	---	---	---	0.1 U	0.11 U	0.11 U	0.1 U	0.11 U	0.11 U	0.11 U
SVOCs	4-Chloroaniline	---	---	---	---	0.074 U	0.079 U	0.077 U	0.075 UJ	0.076 U	0.078 U	0.078 U
SVOCs	4-Chlorophenyl phenyl ether	---	---	---	---	0.035 U	0.038 U	0.037 U	0.036 U	0.036 U	0.037 U	0.037 U
SVOCs	4-Methylphenol (m/p-cresol)	---	---	---	---	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
SVOCs	4-Nitroaniline	86	24	86	EPA, Industrial Soil	0.035 U	0.038 U	0.037 U	0.036 U	0.036 U	0.037 U	0.037 U
SVOCs	4-Nitrophenol	---	---	---	---	0.38 U	0.4 U	0.39 U	0.38 U	0.39 U	0.4 U	0.39 U
SVOCs	Aniline	300	85	300	EPA, Industrial Soil	0.07 UJ	0.074 UJ	0.072 UJ	0.07 R	0.071 UJ	0.073 UJ	0.073 UJ
SVOCs	Benzoic acid	2500000	240000	2500000	EPA, Industrial Soil	0.33 UJ	0.35 UJ	0.34 UJ	0.33 UJ	0.34 UJ	0.35 UJ	0.35 UJ
SVOCs	Benzyl alcohol	62000	6100	62000	EPA, Industrial Soil	0.089 UJ	0.095 UJ	0.092 UJ	0.09 R	0.091 UJ	0.093 UJ	0.093 UJ
SVOCs	bis(2-chloroethoxy)methane	1800	180	1800	EPA, Industrial Soil	0.023 U	0.024 U	0.024 U	0.023 U	0.023 U	0.024 U	0.024 U
SVOCs	bis(2-chloroethyl)ether	1.0	0.21	1.0	EPA, Industrial Soil	0.016 U	0.017 U	0.017 U	0.016 UJ	0.016 U	0.017 U	0.017 U
SVOCs	Bis(2-chloroisopropyl) ether	---	---	---	---	0.013 U	0.013 U	0.013 U	0.013 UJ	0.013 U	0.013 U	0.013 U
SVOCs	bis(2-ethylhexyl)phthalate	120	35	120	EPA, Industrial Soil	0.032 U	0.034 U	0.033 U	**0.036 J**	**0.062 J**	0.034 U	0.033 U
SVOCs	Butylbenzylphthalate	910	260	910	EPA, Industrial Soil	0.027 U	0.029 U	0.028 U	0.028 U	0.028 U	0.029 U	0.029 U
SVOCs	Dibenzofuran	1000	78	1000	EPA, Industrial Soil	**0.068 J**	0.045 U	0.044 U	0.043 U	0.043 U	0.044 U	0.044 U
SVOCs	Diethylphthalate	490000	49000	490000	EPA, Industrial Soil	0.043 U	0.046 U	0.045 U	0.044 U	0.044 U	0.046 U	0.045 U
SVOCs	Dimethylphthalate	---	---	---	---	0.03 U	0.032 U	0.031 U	0.03 U	0.03 U	0.031 U	0.031 U
SVOCs	Di-n-butylphthalate	62000	6100	62000	EPA, Industrial Soil	**0.098 J**	**0.059 J**	0.047 U	**0.09 J**	**0.049 J**	**0.17 J**	**0.077 J**
SVOCs	Di-n-octylphthalate	---	---	---	---	0.044 U	0.048 U	0.046 U	0.045 U	0.046 U	0.047 U	0.047 U
SVOCs	Hexachlorobenzene	1.1	0.3	1.1	EPA, Industrial Soil	0.017 U	0.018 U	0.018 U	0.017 U	0.018 U	0.018 U	0.018 U
SVOCs	Hexachlorobutadiene	22	6.2	22	EPA, Industrial Soil	0.035 U	0.038 U	0.037 U	0.036 UJ	0.036 U	0.037 U	0.037 U
SVOCs	Hexachlorocyclopentadiene	3700	370	3700	EPA, Industrial Soil	0.03 U	0.032 U	0.031 U	0.03 UJ	0.03 U	0.031 U	0.031 U
SVOCs	Hexachloroethane	120	35	120	EPA, Industrial Soil	0.019 U	0.021 U	0.02 U	0.02 UJ	0.02 U	0.02 U	0.02 U
SVOCs	Isophorone	1800	510	1800	EPA, Industrial Soil	0.031 U	0.033 U	0.032 U	0.031 U	0.032 U	0.032 U	0.032 U
SVOCs	Nitrobenzene	24	4.8	24	EPA, Industrial Soil	0.046 U	0.049 U	0.047 U	0.046 UJ	0.047 U	0.048 U	0.048 U
SVOCs	*n-Nitrosodimethylamine*	*0.034*	*0.0023*	*0.034*	*EPA, Industrial Soil*	*0.16 U*	*0.17 U*	*0.17 U*	*0.16 UJ*	*0.16 U*	*0.17 U*	*0.17 U*
SVOCs	n-Nitroso-di-n-propylamine	0.25	0.069	0.25	EPA, Industrial Soil	0.034 U	0.037 U	0.036 U	0.035 U	0.035 U	0.036 U	0.036 U
SVOCs	n-Nitrosodiphenylamine	350	99	350	EPA, Industrial Soil	0.019 U	0.021 U	0.02 U	0.02 UJ	0.02 U	0.02 U	0.02 U
SVOCs	Pentachlorophenol	9	3	9	EPA, Industrial Soil	0.08 U	0.085 U	0.083 U	0.081 UJ	0.082 U	0.084 U	0.084 U
SVOCs	Phenols	180000	18000	180000	EPA, Industrial Soil	0.15 U	0.16 U	0.15 U	0.15 UJ	0.15 U	0.16 U	0.16 U
SVOCs	Pyridine	1000	78	1000	EPA, Industrial Soil	0.078 R	0.083 R	0.08 R	0.078 R	0.08 R	0.081 R	0.081 R
VOCs	1,1,1-Trichloroethane	38000	8700	38000	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	1,1,2,2-Tetrachloroethane	2.8	0.56	2.8	EPA, Industrial Soil	0.0015 U	0.0013 UJ	0.0013 U	0.0012 UJ	0.0013 UJ	0.0013 UJ	0.0012 UJ
VOCs	1,1,2-Trichloroethane	5.3	1.1	5.3	EPA, Industrial Soil	0.00083 U	0.00071 U	0.00071 U	0.00064 U	0.00069 U	0.00072 U	0.00065 U
VOCs	1,1-Dichloroethane	17	3.3	17	EPA, Industrial Soil	0.00041 U	0.00035 U	0.00035 U	0.00032 U	0.00035 U	0.00036 U	0.00033 U
VOCs	1,1-Dichloroethene	1100	240	1100	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	1,2,3-Trichlorobenzene	490	49	490	EPA, Industrial Soil	0.0022 U	0.0019 UJ	0.0019 U	0.0017 UJ	0.0018 UJ	0.0019 UJ	0.0017 UJ
VOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.0022 U	0.0019 UJ	0.0019 U	0.0017 UJ	0.0018 UJ	0.0019 UJ	0.0017 UJ
VOCs	1,2-Dibromo-3-chloropropane	0.069	0.0054	0.069	EPA, Industrial Soil	0.0015 U	0.0013 UJ	0.0013 U	0.0012 UJ	0.0013 UJ	0.0013 UJ	0.0012 UJ
VOCs	1,2-Dibromoethane (EDB)	0.17	0.034	0.17	EPA, Industrial Soil	0.00041 U	0.00035 U	0.00035 U	0.00032 U	0.00035 U	0.00036 U	0.00033 U
VOCs	1,2-Dichlorobenzene	9800	1900	9800	EPA, Industrial Soil	0.0012 U	0.0011 UJ	0.0011 U	0.00095 UJ	0.001 UJ	0.0011 UJ	0.00098 UJ
VOCs	1,2-Dichloroethane	2.2	0.43	2.2	EPA, Industrial Soil	0.00083 U	0.00071 U	0.00071 U	0.00064 U	0.00069 U	0.00072 U	0.00065 U
VOCs	1,2-Dichloropropane	4.5	0.89	4.5	EPA, Industrial Soil	0.00083 U	0.00071 U	0.00071 U	0.00064 U	0.00069 U	0.00072 U	0.00065 U
VOCs	1,3-Dichlorobenzene	---	---	---	---	0.0017 U	0.0014 UJ	0.0014 U	0.0013 UJ	0.0014 UJ	0.0014 UJ	0.0013 UJ
VOCs	1,4-Dichlorobenzene	12	2.4	12	EPA, Industrial Soil	0.0019 U	0.0016 UJ	0.0017 U	0.0015 UJ	0.0016 UJ	0.0017 UJ	0.0015 UJ
VOCs	2-Butanone (MEK)	200000	28000	200000	EPA, Industrial Soil	0.0083 U	0.0071 U	0.0071 U	0.0064 U	0.0069 U	0.0072 U	0.0065 U
VOCs	2-Hexanone	1400	210	1400	EPA, Industrial Soil	0.0069 U	0.0059 U	0.0059 U	0.0053 UJ	0.0058 U	0.006 U	0.0055 U
VOCs	4-Methyl-2-pentanone (MIBK)	53000	5300	53000	EPA, Industrial Soil	0.004 U	0.0034 U	0.0034 U	0.0031 U	0.0033 U	0.0035 U	0.0032 U
VOCs	Acetone	630000	61000	630000	EPA, Industrial Soil	0.0083 R	0.0071 R	0.01 B	0.0064 R	0.0069 R	0.0072 R	0.0065 R
VOCs	Benzene	5.4	1.1	5.4	EPA, Industrial Soil	0.00041 U	0.00035 U	0.00035 U	0.00032 U	0.00035 U	0.00036 U	0.00033 U
VOCs	Bromochloromethane	---	---	---	---	0.00083 U	0.00071 U	0.00071 U	0.00064 U	0.00069 U	0.00072 U	0.00065 U
VOCs	Bromodichloromethane	1.4	0.27	1.4	EPA, Industrial Soil	0.00055 U	0.00047 U	0.00047 U	0.00042 U	0.00046 U	0.00048 U	0.00044 U

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment						
					Sample Location and Date>>	SD01-102908	SD02-102908	SD03-102908	SD04-102908	SD05-102908	SD06-102908	QC14-102908-FD (SD06 Duplicate)
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Screening Level Source							
VOCs	Bromoform	220	61	220	EPA, Industrial Soil	0.00097 U	0.00082 U	0.00083 U	0.00074 UJ	0.00081 U	0.00084 U	0.00076 U
VOCs	Bromomethane	32	7.3	32	EPA, Industrial Soil	0.0017 U	0.0014 U	0.0014 U	0.0013 UJ	0.0014 U	0.0014 U	0.0013 U
VOCs	Carbon disulfide	3700	820	3700	EPA, Industrial Soil	0.0014 U	0.0012 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U
VOCs	Carbon tetrachloride	1.2	0.25	1.2	EPA, Industrial Soil	0.00097 U	0.00082 U	0.00083 U	0.00074 U	0.00081 U	0.00084 U	0.00076 U
VOCs	Chlorobenzene	1400	290	1400	EPA, Industrial Soil	0.0011 U	0.00094 U	0.00094 U	0.00085 UJ	0.00092 U	0.00096 U	0.00087 U
VOCs	Chloroethane	---	---	---	---	0.00055 U	0.00047 U	0.00047 U	0.00042 U	0.00046 U	0.00048 U	0.00044 U
VOCs	Chloroform	1.5	0.29	1.5	EPA, Industrial Soil	0.00055 U	0.00047 U	0.00047 U	0.00042 U	0.00046 U	0.00048 U	0.00044 U
VOCs	Chloromethane	500	120	500	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	cis-1,2-Dichloroethene	10000	780	10000	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	cis-1,3-Dichloropropene	---	---	---	---	0.00083 U	0.00071 U	0.00071 U	0.00064 UJ	0.00069 U	0.00072 U	0.00065 U
VOCs	Dibromochloromethane	3.3	0.68	3.3	EPA, Industrial Soil	0.00097 U	0.00082 U	0.00083 U	0.00074 U	0.00081 U	0.00084 U	0.00076 U
VOCs	Dichlorodifluoromethane	780	180	780	EPA, Industrial Soil	0.0011 U	0.00094 U	0.00094 U	0.00085 U	0.00092 U	0.00096 U	0.00087 U
VOCs	Ethylbenzene	27	5.4	27	EPA, Industrial Soil	0.00097 U	0.00082 U	0.00083 U	0.00074 UJ	0.00081 U	0.00084 U	0.00076 U
VOCs	Isopropylbenzene	---	---	---	---	0.00083 U	0.00071 U	0.00071 U	0.00064 UJ	0.00069 U	0.00072 U	0.00065 U
VOCs	m&p-Xylenes	17000	3400	17000	EPA, Industrial Soil	0.0023 U	0.002 U	0.002 U	0.0018 UJ	0.002 U	0.002 U	0.0019 U
VOCs	Methyl tert-butyl ether (MTBE)	220	43	220	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	Methylene chloride	53	11	53	EPA, Industrial Soil	0.0026 R	0.01 B	0.02 B	0.002 R	0.01 B	0.0023 R	0.0021 R
VOCs	o-Xylene	19000	3800	19000	EPA, Industrial Soil	0.0014 U	0.0012 U	0.0012 U	0.0011 UJ	0.0012 U	0.0012 U	0.0011 U
VOCs	Styrene	36000	6300	36000	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 UJ	0.00058 U	0.0006 U	0.00055 U
VOCs	Tetrachloroethene	2.6	0.55	2.6	EPA, Industrial Soil	0.0012 U	0.0011 U	0.0011 U	0.00095 U	0.001 U	0.0011 U	0.00098 U
VOCs	Toluene	45000	5000	45000	EPA, Industrial Soil	0.00083 U	0.00071 U	0.00071 U	0.00064 UJ	0.00069 U	0.00072 U	0.00065 U
VOCs	trans-1,2-Dichloroethene	690	150	690	EPA, Industrial Soil	0.00083 U	0.00071 U	0.00071 U	0.00064 U	0.00069 U	0.00072 U	0.00065 U
VOCs	trans-1,3-Dichloropropene	---	---	---	---	0.0011 U	0.00094 U	0.00094 U	0.00085 UJ	0.00092 U	0.00096 U	0.00087 U
VOCs	Trichloroethene	14	2.8	14	EPA, Industrial Soil	0.00069 U	0.00059 U	0.00059 U	0.00053 U	0.00058 U	0.0006 U	0.00055 U
VOCs	Trichlorofluoromethane	3400	790	3400	EPA, Industrial Soil	0.0012 U	0.0011 U	0.0011 J	0.00095 U	0.001 U	0.0011 U	0.00098 U
VOCs	Vinyl chloride	1.7	0.06	1.7	EPA, Industrial Soil	0.00097 U	0.00082 U	0.00083 U	0.00074 U	0.00081 U	0.00084 U	0.00076 U

EPA Screening values are December 2009 USEPA RSLs
Chromium III screening criteria used for chromium comparison
All data presented in milligrams per kilograms (mg/kg)
--- - criteria not established
Detections are shown in bold
Exceedances above the industrial screening criteria are shaded
Laboratory method detection limit listed for non-detects
Compounds in italics indicate that the method detection limit is higher than the mimimum screening criteria/ level.
U - Analyte analyzed but not detected
UJ - Analyte analyzed not detected, quantitation limit is estimated
R - Rejected for project use
J - Estimated concentration
B - Analyte qualified due to blank contamination

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment		Surface Soil							
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	SD07-102908	SD08-102908	SS01-103008	SS02-103008	QC09-103008-FD (SS02 Duplicate)	SS03-103008	SS04-103008	SS05-103008	SS06-103008	SS07-103008
Metals	Aluminum	990000	77000	990000	EPA, Industrial Soil	**8760**	**9730**	**5070**	**2450**	**2590**	**8000**	**1730**	**6200**	**8300**	**8900**
Metals	Antimony	410	31	410	EPA, Industrial Soil	0.21 U	0.21 U	**0.23 J**	**0.33 J**	**0.3 J**	**0.29 J**	**0.24 J**	0.19 U	0.19 U	0.2 U
Metals	Arsenic	1.6	0.39	1.6	EPA, Industrial Soil	**11.6**	**10.3**	**9.6**	**3.8**	**3**	**11**	**2.9**	**11**	**9.7**	**11**
Metals	Barium	190000	15000	190000	EPA, Industrial Soil	**119**	**57.8**	**42.3**	**20.7**	**22**	**74.1**	**15.4**	**50.7**	**68.6**	**101**
Metals	Beryllium	2000	160	2000	EPA, Industrial Soil	**0.59**	**0.49**	**0.22**	**0.03 J**	**0.26 J**	**0.44**	0.0043 U	**0.31**	**0.46**	**0.47 J**
Metals	Cadmium	800	70	800	EPA, Industrial Soil	**0.81**	**0.17**	**0.24**	**0.3**	**0.3**	**1.9**	**0.4**	**0.7**	**0.57**	**0.77**
Metals	Calcium	---	---	---	---	**13500**	**3950**	**78900**	**141000 J**	**246000 J**	**32600**	**160000**	**47900**	**20900**	**12200**
Metals	Chromium	1500000	120000	1500000	EPA, Industrial Soil	**12.2**	**13.1**	**8.2**	**4.6**	**4.7**	**11**	**3.5**	**7.9**	**10.6**	**13**
Metals	Cobalt	300	23	300	EPA, Industrial Soil	**9.1**	**5.5**	**4.5**	**1.3**	**1.3**	**5.3**	**229**	**5.4**	**5.7**	**8.9**
Metals	Copper	41000	3100	41000	EPA, Industrial Soil	**21**	**21.9**	**13.2**	**10.1**	**10.5**	**24.3**	**7.2**	**17.5**	**18.3**	**19.6**
Metals	Iron	720000	55000	720000	EPA, Industrial Soil	**23200 J**	**23400 J**	**14700 J**	**4900 J**	**10200 J**	**17500 J**	**3460 J**	**23700 J**	**23200 J**	**22500 J**
Metals	Lead	800	400	800	EPA, Industrial Soil	**40.7**	**10.3**	**9.6**	**4.4**	**4.4**	**32.6**	**2.7**	**11.3**	**14.6**	**47.4**
Metals	Magnesium	---	---	---	---	**4380**	**2490**	**20900**	**29900 J**	**66100 J**	**8890**	**31900**	**15200**	**6580**	**3860**
Metals	Manganese	23000	1800	23000	EPA, Industrial Soil	**814**	**274**	**259**	**125 J**	**303 J**	**246**	**117 J**	**248**	**252**	**712 J**
Metals	Mercury	34	5.6	34	EPA, Industrial Soil	**0.29**	**0.036**	**0.021**	**1.3**	**1.5**	**5.8**	**0.13**	**0.099**	**0.15**	**0.49**
Metals	Nickel	20000	1500	20000	EPA, Industrial Soil	**21.9**	**20.7**	**14.1**	**5.7**	**5.8**	**15.7**	**4.5**	**15.8**	**16**	**18.1**
Metals	Potassium	---	---	---	---	**970**	**912**	**846**	**408 J**	**441 J**	**977**	**346 J**	**874**	**887**	**979**
Metals	Selenium	5100	390	5100	EPA, Industrial Soil	**0.97 J**	0.49 U	0.45 U	0.44 U	0.44 U	**0.5 J**	0.43 U	0.45 U	0.46 U	**0.89 J**
Metals	Silver	5100	390	5100	EPA, Industrial Soil	**0.14**	0.036 U	0.034 U	0.033 U	0.033 U	**0.33**	0.032 U	0.034 U	0.034 U	**0.089 J**
Metals	Sodium	---	---	---	---	**50.1 J**	**36.5 J**	**93 J**	**78.9 J**	**77.1 J**	**56.3 J**	**87.8 J**	**59.2 J**	**42.9 J**	**47.4 J**
Metals	Thallium	---	---	---	---	0.63 U	0.61 U	**2.7**	**5.7**	**5.5**	0.59 U	**6.6**	**1.1 J**	0.57 U	0.59 U
Metals	Vanadium	5200	390	5200	EPA, Industrial Soil	**21.9 J**	**27.4**	**13 J**	**8.7 J**	**16.5 J**	**18.4 J**	**6.9 J**	**14.1 J**	**18.9 J**	**21.4**
Metals	Zinc	310000	23000	310000	EPA, Industrial Soil	**75.1**	**79.1**	**39.5**	**20.4**	**21.2**	**94.8**	**53.2**	**50.7**	**57.2**	**133**
PAHs	Acenaphthene	33000	3400	33000	EPA, Industrial Soil	**0.0022 J**	**0.0036 J**	**0.018**	**0.023 J**	**0.012 J**	**0.016**	**0.0049 J**	**0.02**	**0.025**	0.0017 U
PAHs	Acenaphthylene	---	---	---	---	0.0017 U	0.0017 U	**0.002 J**	0.0015 U	0.0015 U	**0.0028 J**	0.0015 U	0.0016 U	0.0016 U	0.0016 U
PAHs	Anthracene	170000	17000	170000	EPA, Industrial Soil	**0.0045 J**	**0.0071**	**0.037**	**0.055 J**	**0.023 J**	**0.035**	**0.014**	**0.053**	**0.064**	**0.0033 J**
PAHs	Benzo(a)anthracene	2.1	0.15	2.1	EPA, Industrial Soil	**0.018**	**0.019**	**0.17**	**0.22**	**0.15**	**0.22**	**0.12**	**0.19**	**0.18**	**0.017**
PAHs	Benzo(a)pyrene	0.21	0.015	0.21	EPA, Industrial Soil	**0.017**	**0.02**	**0.17**	**0.22**	**0.16**	**0.23**	**0.15**	**0.17**	**0.16**	**0.017**
PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	EPA, Industrial Soil	**0.03**	**0.028**	**0.25**	**0.33**	**0.23**	**0.38**	**0.23**	**0.26**	**0.24**	**0.029**
PAHs	Benzo(g,h,i)perylene	---	---	---	---	**0.011**	**0.011**	**0.092**	**0.085**	**0.1**	**0.11**	**0.059**	**0.063**	**0.047**	**0.0071 J**
PAHs	Benzo(k)fluoranthene	21	1.5	21	EPA, Industrial Soil	**0.0072**	**0.0096**	**0.078**	**0.098**	**0.079**	**0.13**	**0.081**	**0.085**	**0.079**	**0.0099**
PAHs	Chrysene	210	15	210	EPA, Industrial Soil	**0.024**	**0.022**	**0.17**	**0.24**	**0.17**	**0.26**	**0.16**	**0.2**	**0.19**	**0.022**
PAHs	Dibenzo(a,h)anthracene	0.21	0.015	0.21	EPA, Industrial Soil	**0.0026 J**	**0.0026 J**	**0.021**	**0.025**	**0.023**	**0.03**	**0.016**	**0.019**	**0.016**	**0.0023 J**
PAHs	Fluoranthene	22000	2300	22000	EPA, Industrial Soil	**0.039**	**0.053**	**0.35**	**0.51**	**0.32**	**0.5**	**0.26**	**0.4**	**0.4**	**0.039**
PAHs	Fluorene	22000	2300	22000	EPA, Industrial Soil	**0.0023 J**	**0.0035 J**	**0.017**	**0.023 J**	**0.011 J**	**0.014**	**0.0042 J**	**0.018**	**0.025**	0.0019 U
PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	EPA, Industrial Soil	**0.0093**	**0.01**	**0.083**	**0.088**	**0.087**	**0.11**	**0.061**	**0.062**	**0.05**	**0.0065 J**
PAHs	Naphthalene	18	3.6	18	EPA, Industrial Soil	**0.019**	**0.0027 J**	**0.007**	**0.0071**	**0.01**	**0.037**	**0.0032 J**	**0.0085**	**0.0091**	**0.004 J**
PAHs	Phenanthrene	---	---	---	---	**0.039**	**0.039**	**0.21**	**0.28 J**	**0.16 J**	**0.23**	**0.091**	**0.24**	**0.27**	**0.02**
PAHs	Pyrene	17000	1700	17000	EPA, Industrial Soil	**0.032**	**0.042**	**0.3**	**0.4**	**0.27**	**0.39**	**0.22**	**0.33**	**0.32**	**0.031**
SVOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.02 U	0.019 U	0.018 U	0.017 U	0.018 U	0.019 UJ	0.017 U	0.018 U	0.018 U	0.019 U
SVOCs	1,2-Diphenylhydrazine	2.2	0.61	2.2	EPA, Industrial Soil	0.04 U	0.039 U	0.036 U	0.035 U	0.035 U	0.038 UJ	0.034 U	0.036 U	0.037 U	0.038 U
SVOCs	2,4,5-Trichlorophenol	62000	6100	62000	EPA, Industrial Soil	0.13 U	0.13 U	0.12 U	0.11 U	0.12 U	0.12 UJ	0.11 U	0.12 U	0.12 U	0.12 U
SVOCs	2,4,6-Trichlorophenol	160	44	160	EPA, Industrial Soil	0.095 U	0.092 U	0.086 U	0.083 U	0.084 U	0.09 UJ	0.081 U	0.086 U	0.087 U	0.09 U
SVOCs	2,4-Dichlorophenol	1800	180	1800	EPA, Industrial Soil	0.12 U	0.11 U	0.1 U	0.1 U	0.1 U	0.11 UJ	0.099 U	0.1 U	0.11 U	0.11 U
SVOCs	2,4-Dimethylphenol	12000	1200	12000	EPA, Industrial Soil	0.096 U	0.094 U	0.087 U	0.084 U	0.085 U	0.091 UJ	0.082 U	0.087 U	0.088 U	0.091 U
SVOCs	2,4-Dinitrophenol	1200	120	1200	EPA, Industrial Soil	0.28 U	0.27 U	0.25 U	0.24 U	0.24 U	0.26 UJ	0.23 U	0.25 U	0.25 U	0.26 U
SVOCs	2,4-Dinitrotoluene	5.5	1.6	5.5	EPA, Industrial Soil	0.029 U	0.028 U	0.026 U	0.025 U	0.025 U	0.027 UJ	0.024 U	0.026 U	0.026 U	0.027 U
SVOCs	2,6-Dinitrotoluene	620	61	620	EPA, Industrial Soil	0.039 U	0.038 U	0.035 U	0.034 U	0.034 U	0.037 UJ	0.033 U	0.035 U	0.035 U	0.037 U
SVOCs	2-Chloronaphthalene	82000	6300	82000	EPA, Industrial Soil	0.016 U	0.016 U	0.015 U	0.014 U	0.014 U	0.015 UJ	0.014 U	0.015 U	0.015 U	0.015 U
SVOCs	2-Chlorophenol	5100	390	5100	EPA, Industrial Soil	0.14 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 UJ	0.12 U	0.12 U	0.13 U	0.13 U
SVOCs	2-Methylnaphthalene	4100	310	4100	EPA, Industrial Soil	**0.043 J**	0.023 U	0.021 U	0.021 U	0.021 U	**0.065 J**	0.02 U	0.021 U	0.022 U	0.023 U
SVOCs	2-Methylphenol (o-cresol)	---	---	---	---	0.14 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 UJ	0.12 U	0.12 U	0.13 U	0.13 U
SVOCs	2-Nitroaniline	6000	610	6000	EPA, Industrial Soil	0.033 U	0.032 U	0.029 U	0.028 U	0.029 U	0.031 UJ	0.028 U	0.029 U	0.03 U	0.031 U
SVOCs	2-Nitrophenol	---	---	---	---	0.15 U	0.15 U	0.14 U	0.13 U	0.13 U	0.14 UJ	0.13 U	0.14 U	0.14 U	0.14 U
SVOCs	3,3'-Dichlorobenzidine	3.8	1.1	3.8	EPA, Industrial Soil	0.35 U	0.34 U	0.32 U	0.3 U	0.31 U	0.33 UJ	0.3 U	0.32 U	0.32 U	0.33 U

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment				Surface Soil					
					Sample Location and Date>>	SD07-102908	SD08-102908	SS01-103008	SS02-103008	QC09-103008-FD (SS02 Duplicate)	SS03-103008	SS04-103008	SS05-103008	SS06-103008	SS07-103008
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Screening Level Source										
SVOCs	3-Nitroaniline	---	---	---	---	0.04 U	0.039 U	0.036 U	0.035 U	0.035 U	0.038 UJ	0.034 U	0.036 U	0.037 U	0.038 U
SVOCs	4,6-Dinitro-2-methylphenol	---	---	---	---	0.089 U	0.086 U	0.08 U	0.077 U	0.078 U	0.084 UJ	0.076 U	0.08 U	0.081 U	0.084 U
SVOCs	4-Bromophenyl phenyl ether	---	---	---	---	0.013 U	0.012 U	0.011 U	0.011 U	0.011 U	0.012 UJ	0.011 U	0.011 U	0.011 U	0.012 U
SVOCs	4-Chloro-3-methylphenol	---	---	---	---	0.11 U	0.11 U	0.1 U	0.099 U	0.1 U	0.11 UJ	0.097 U	0.1 U	0.1 U	0.11 U
SVOCs	4-Chloroaniline	---	---	---	---	0.081 U	0.079 U	0.073 UJ	0.071 UJ	0.072 UJ	0.077 UJ	0.069 UJ	0.073 UJ	0.074 UJ	0.077 UJ
SVOCs	4-Chlorophenyl phenyl ether	---	---	---	---	0.039 U	0.038 U	0.035 U	0.034 U	0.034 U	0.037 UJ	0.033 U	0.035 U	0.035 U	0.037 U
SVOCs	4-Methylphenol (m/p-cresol)	---	---	---	---	0.14 U	0.13 U	0.12 U	0.12 U	0.12 U	0.13 UJ	0.12 U	0.12 U	0.13 U	0.13 U
SVOCs	4-Nitroaniline	86	24	86	EPA, Industrial Soil	0.039 U	0.038 U	0.035 U	0.034 U	0.034 U	0.037 UJ	0.033 U	0.035 U	0.035 U	0.037 U
SVOCs	4-Nitrophenol	---	---	---	---	0.41 U	0.4 U	0.37 U	0.36 U	0.36 U	0.39 UJ	0.35 U	0.37 U	0.38 U	0.39 U
SVOCs	Aniline	300	85	300	EPA, Industrial Soil	0.076 UJ	0.074 UJ	0.069 UJ	0.066 UJ	0.067 UJ	0.072 UJ	0.065 UJ	0.069 UJ	0.07 UJ	0.072 UJ
SVOCs	Benzoic acid	2500000	240000	2500000	EPA, Industrial Soil	0.36 UJ	0.35 UJ	**0.44 J**	0.32 UJ	0.32 UJ	0.34 UJ	0.31 UJ	0.33 UJ	0.33 UJ	0.34 UJ
SVOCs	Benzyl alcohol	62000	6100	62000	EPA, Industrial Soil	0.098 UJ	0.095 UJ	0.088 U	0.085 U	0.086 U	0.092 UJ	0.083 U	0.088 U	0.089 U	0.093 U
SVOCs	bis(2-chloroethoxy)methane	1800	180	1800	EPA, Industrial Soil	0.025 U	0.024 U	0.023 U	0.022 U	0.022 U	0.024 UJ	0.021 U	0.023 U	0.023 U	0.024 U
SVOCs	bis(2-chloroethyl)ether	1.0	0.21	1.0	EPA, Industrial Soil	0.018 U	0.017 U	0.016 U	0.015 U	0.015 U	0.017 UJ	0.015 U	0.016 U	0.016 U	0.017 U
SVOCs	Bis(2-chloroisopropyl) ether	---	---	---	---	0.014 U	0.013 U	0.012 U	0.012 U	0.012 U	0.013 UJ	0.012 U	0.012 U	0.013 U	0.013 U
SVOCs	bis(2-ethylhexyl)phthalate	120	35	120	EPA, Industrial Soil	0.035 U	0.034 U	**0.042 J**	0.03 U	0.031 U	0.033 UJ	0.03 U	**0.037 J**	0.032 U	0.033 U
SVOCs	Butylbenzylphthalate	910	260	910	EPA, Industrial Soil	0.03 U	0.029 U	0.027 U	0.026 U	0.026 U	0.028 UJ	0.026 U	0.027 U	0.027 U	0.028 U
SVOCs	Dibenzofuran	1000	78	1000	EPA, Industrial Soil	0.046 U	0.045 U	0.042 U	0.04 U	0.041 U	**0.049 J**	0.039 U	0.042 U	0.042 U	0.044 U
SVOCs	Diethylphthalate	490000	49000	490000	EPA, Industrial Soil	0.048 U	0.046 U	0.043 U	0.041 U	0.042 U	0.045 UJ	0.04 U	0.043 U	0.043 U	0.045 U
SVOCs	Dimethylphthalate	---	---	---	---	0.033 U	0.032 U	0.029 U	0.028 U	0.029 U	0.031 UJ	0.028 U	0.029 U	0.03 U	0.031 U
SVOCs	Di-n-butylphthalate	62000	6100	62000	EPA, Industrial Soil	0.05 U	**0.11 J**	0.16 B	0.15 B	0.15 B	0.17 B	0.15 B	0.16 B	0.16 B	0.17 B
SVOCs	Di-n-octylphthalate	---	---	---	---	0.049 U	0.047 U	0.044 U	0.042 U	0.043 U	0.046 UJ	0.041 U	0.044 U	0.045 U	0.046 U
SVOCs	Hexachlorobenzene	1.1	0.3	1.1	EPA, Industrial Soil	0.019 U	0.018 U	0.017 U	0.016 U	0.017 U	0.018 UJ	0.016 U	0.017 U	0.017 U	0.018 U
SVOCs	Hexachlorobutadiene	22	6.2	22	EPA, Industrial Soil	0.039 U	0.038 U	0.035 U	0.034 U	0.034 U	0.037 UJ	0.033 U	0.035 U	0.035 U	0.037 U
SVOCs	Hexachlorocyclopentadiene	3700	370	3700	EPA, Industrial Soil	0.033 U	0.032 U	0.029 U	0.028 U	0.029 U	0.031 UJ	0.028 U	0.029 U	0.03 U	0.031 U
SVOCs	Hexachloroethane	120	35	120	EPA, Industrial Soil	0.021 U	0.021 U	0.019 U	0.018 U	0.019 U	0.02 UJ	0.018 U	0.019 U	0.019 U	0.02 U
SVOCs	Isophorone	1800	510	1800	EPA, Industrial Soil	0.034 U	0.033 U	0.03 U	0.029 U	0.03 U	0.032 UJ	0.029 U	0.03 U	0.031 U	0.032 U
SVOCs	Nitrobenzene	24	4.8	24	EPA, Industrial Soil	0.05 U	0.049 U	0.045 U	0.044 U	0.044 U	0.047 UJ	0.043 U	0.045 U	0.046 U	0.047 U
SVOCs	*n-Nitrosodimethylamine*	*0.034*	*0.0023*	*0.034*	*EPA, Industrial Soil*	*0.18 U*	*0.17 U*	*0.16 UJ*	*0.15 UJ*	*0.15 UJ*	*0.17 UJ*	*0.15 UJ*	*0.16 UJ*	*0.16 UJ*	*0.17 UJ*
SVOCs	n-Nitroso-di-n-propylamine	0.25	0.069	0.25	EPA, Industrial Soil	0.038 U	0.036 U	0.034 U	0.033 U	0.033 U	0.036 UJ	0.032 U	0.034 U	0.034 U	0.036 U
SVOCs	n-Nitrosodiphenylamine	350	99	350	EPA, Industrial Soil	0.021 U	0.021 U	0.019 U	0.018 U	0.019 U	0.02 UJ	0.018 U	0.019 U	0.019 U	0.02 U
SVOCs	Pentachlorophenol	9	3	9	EPA, Industrial Soil	0.088 U	0.085 U	0.079 U	0.076 U	0.077 U	0.083 UJ	0.074 U	0.079 U	0.08 U	0.083 U
SVOCs	Phenols	180000	18000	180000	EPA, Industrial Soil	0.16 U	0.16 U	0.15 U	0.14 U	0.14 U	0.15 UJ	0.14 U	0.15 U	0.15 U	0.15 U
SVOCs	Pyridine	1000	78	1000	EPA, Industrial Soil	0.085 R	0.083 R	0.077 R	0.074 R	0.075 R	0.081 R	0.072 R	0.077 R	0.078 R	0.081 R
VOCs	1,1,1-Trichloroethane	38000	8700	38000	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	1,1,2,2-Tetrachloroethane	2.8	0.56	2.8	EPA, Industrial Soil	0.0012 UJ	0.0011 UJ	0.001 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ
VOCs	1,1,2-Trichloroethane	5.3	1.1	5.3	EPA, Industrial Soil	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	1,1-Dichloroethane	17	3.3	17	EPA, Industrial Soil	0.00034 U	0.0003 U	0.00027 U	0.0003 U	0.0003 U	0.00031 U	0.00033 U	0.00033 U	0.00033 U	0.00034 U
VOCs	1,1-Dichloroethene	1100	240	1100	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	1,2,3-Trichlorobenzene	490	49	490	EPA, Industrial Soil	0.0018 UJ	0.0016 UJ	0.0015 UJ	0.0016 UJ	0.0016 UJ	0.0017 UJ	0.0017 UJ	0.0018 UJ	0.0018 UJ	0.0018 UJ
VOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.0018 UJ	0.0016 UJ	0.0015 UJ	0.0016 UJ	0.0016 UJ	0.0017 UJ	0.0017 UJ	0.0018 UJ	0.0018 UJ	0.0018 UJ
VOCs	1,2-Dibromo-3-chloropropane	0.069	0.0054	0.069	EPA, Industrial Soil	0.0012 UJ	0.0011 UJ	0.001 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ
VOCs	1,2-Dibromoethane (EDB)	0.17	0.034	0.17	EPA, Industrial Soil	0.00034 UJ	0.0003 U	0.00027 UJ	0.0003 U	0.0003 U	0.00031 UJ	0.00033 U	0.00033 UJ	0.00033 UJ	0.00034 UJ
VOCs	1,2-Dichlorobenzene	9800	1900	9800	EPA, Industrial Soil	0.001 UJ	0.00089 UJ	0.00082 UJ	0.0009 UJ	0.00089 UJ	0.00094 UJ	0.00098 UJ	0.00099 UJ	0.00099 UJ	0.001 UJ
VOCs	1,2-Dichloroethane	2.2	0.43	2.2	EPA, Industrial Soil	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	1,2-Dichloropropane	4.5	0.89	4.5	EPA, Industrial Soil	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	1,3-Dichlorobenzene	---	---	---	---	0.0013 UJ	0.0012 UJ	0.0011 UJ	0.0012 UJ	0.0012 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0014 UJ
VOCs	1,4-Dichlorobenzene	12	2.4	12	EPA, Industrial Soil	0.0016 UJ	0.0014 UJ	0.0013 UJ	0.0014 UJ	0.0014 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0016 UJ
VOCs	2-Butanone (MEK)	200000	28000	200000	EPA, Industrial Soil	0.0067 U	0.0059 U	0.0054 U	0.006 U	0.0059 U	0.0063 U	0.0066 U	0.0066 U	0.0066 U	0.0068 U
VOCs	2-Hexanone	1400	210	1400	EPA, Industrial Soil	0.0056 UJ	0.005 U	0.0045 UJ	0.005 U	0.0049 U	0.0052 UJ	0.0055 U	0.0055 UJ	0.0055 UJ	0.0056 UJ
VOCs	4-Methyl-2-pentanone (MIBK)	53000	5300	53000	EPA, Industrial Soil	0.0032 U	0.0029 U	0.0026 U	0.0029 U	0.0029 U	0.003 U	0.0032 U	0.0032 U	0.0032 U	0.0033 U
VOCs	Acetone	630000	61000	630000	EPA, Industrial Soil	0.0067 R	0.0059 R	0.0054 U	0.006 U	0.0059 U	0.0063 U	0.0066 U	0.0066 U	0.0066 U	0.0068 U
VOCs	Benzene	5.4	1.1	5.4	EPA, Industrial Soil	0.00034 U	0.0003 U	0.00027 U	0.0003 U	0.0003 U	0.00031 U	0.00033 U	0.00033 U	0.00033 U	0.00034 U
VOCs	Bromochloromethane	---	---	---	---	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	Bromodichloromethane	1.4	0.27	1.4	EPA, Industrial Soil	0.00045 UJ	0.0004 U	0.00036 UJ	0.0004 U	0.0004 U	0.00042 UJ	0.00044 U	0.00044 UJ	0.00044 UJ	0.00045 UJ

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Sediment					Surface Soil				
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	SD07-102908	SD08-102908	SS01-103008	SS02-103008	QC09-103008-FD (SS02 Duplicate)	SS03-103008	SS04-103008	SS05-103008	SS06-103008	SS07-103008
VOCs	Bromoform	220	61	220	EPA, Industrial Soil	0.00078 UJ	0.00069 U	0.00063 UJ	0.0007 U	0.00069 U	0.00073 UJ	0.00076 U	0.00077 UJ	0.00077 UJ	0.00079 UJ
VOCs	Bromomethane	32	7.3	32	EPA, Industrial Soil	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0014 U
VOCs	Carbon disulfide	3700	820	3700	EPA, Industrial Soil	0.0011 U	0.00099 U	0.00091 U	0.001 U	0.00099 U	0.001 U	**0.0012 J**	0.0011 U	0.0011 U	0.0011 U
VOCs	Carbon tetrachloride	1.2	0.25	1.2	EPA, Industrial Soil	0.00078 U	0.00069 U	0.00063 U	0.0007 U	0.00069 U	0.00073 U	0.00076 U	0.00077 U	0.00077 U	0.00079 U
VOCs	Chlorobenzene	1400	290	1400	EPA, Industrial Soil	0.0009 UJ	0.00079 U	0.00073 UJ	0.0008 U	0.00079 U	0.00083 UJ	0.00087 U	0.00088 UJ	0.00088 UJ	0.0009 UJ
VOCs	Chloroethane	---	---	---	---	0.00045 U	0.0004 U	0.00036 U	0.0004 U	0.0004 U	0.00042 U	0.00044 U	0.00044 U	0.00044 U	0.00045 U
VOCs	Chloroform	1.5	0.29	1.5	EPA, Industrial Soil	0.00045 U	0.0004 U	0.00036 U	0.0004 U	0.0004 U	0.00042 U	0.00044 U	0.00044 U	0.00044 U	0.00045 U
VOCs	Chloromethane	500	120	500	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	cis-1,2-Dichloroethene	10000	780	10000	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	cis-1,3-Dichloropropene	---	---	---	---	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	Dibromochloromethane	3.3	0.68	3.3	EPA, Industrial Soil	0.00078 U	0.00069 U	0.00063 U	0.0007 U	0.00069 U	0.00073 U	0.00076 U	0.00077 U	0.00077 U	0.00079 U
VOCs	Dichlorodifluoromethane	780	180	780	EPA, Industrial Soil	0.0009 U	0.00079 U	**0.0045 J**	**0.0019 J**	**0.012 J**	**0.005 J**	**0.0057 J**	**0.0043 J**	**0.0058 J**	**0.0072 J**
VOCs	Ethylbenzene	27	5.4	27	EPA, Industrial Soil	0.00078 UJ	0.00069 U	0.00063 UJ	0.0007 U	0.00069 U	0.00073 UJ	0.00076 U	0.00077 UJ	0.00077 UJ	0.00079 UJ
VOCs	Isopropylbenzene	---	---	---	---	0.00067 UJ	0.00059 U	0.00054 UJ	0.0006 UJ	0.00059 UJ	0.00063 UJ	0.00066 UJ	0.00066 UJ	0.00066 UJ	0.00068 UJ
VOCs	m&p-Xylenes	17000	3400	17000	EPA, Industrial Soil	0.0019 UJ	0.0017 U	0.0015 UJ	0.0017 U	0.0017 U	0.0018 UJ	0.0019 U	0.0019 UJ	0.0019 UJ	0.0019 UJ
VOCs	Methyl tert-butyl ether (MTBE)	220	43	220	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	Methylene chloride	53	11	53	EPA, Industrial Soil	0.0021 R	0.0019 R	0.0017 U	0.0019 U	0.0019 U	0.002 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
VOCs	o-Xylene	19000	3800	19000	EPA, Industrial Soil	0.0011 UJ	0.00099 U	0.00091 UJ	0.001 U	0.00099 U	0.001 UJ	0.0011 U	0.0011 UJ	0.0011 UJ	0.0011 UJ
VOCs	Styrene	36000	6300	36000	EPA, Industrial Soil	0.00056 UJ	0.0005 U	0.00045 UJ	0.0005 U	0.00049 U	0.00052 UJ	0.00055 U	0.00055 UJ	0.00055 UJ	0.00056 UJ
VOCs	Tetrachloroethene	2.6	0.55	2.6	EPA, Industrial Soil	0.001 U	0.00089 U	0.00082 UJ	0.0009 UJ	0.00089 UJ	0.00094 UJ	0.00098 UJ	0.00099 UJ	0.00099 UJ	0.001 UJ
VOCs	Toluene	45000	5000	45000	EPA, Industrial Soil	0.00067 U	0.00059 U	**0.0026 J**	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	trans-1,2-Dichloroethene	690	150	690	EPA, Industrial Soil	0.00067 U	0.00059 U	0.00054 U	0.0006 U	0.00059 U	0.00063 U	0.00066 U	0.00066 U	0.00066 U	0.00068 U
VOCs	trans-1,3-Dichloropropene	---	---	---	---	0.0009 U	0.00079 U	0.00073 U	0.0008 U	0.00079 U	0.00083 U	0.00087 U	0.00088 U	0.00088 U	0.0009 U
VOCs	Trichloroethene	14	2.8	14	EPA, Industrial Soil	0.00056 U	0.0005 U	0.00045 U	0.0005 U	0.00049 U	0.00052 U	0.00055 U	0.00055 U	0.00055 U	0.00056 U
VOCs	Trichlorofluoromethane	3400	790	3400	EPA, Industrial Soil	0.001 U	0.00089 U	0.00082 U	**0.0022 J**	0.00089 U	0.00094 U	0.00098 U	**0.0014 J**	0.00099 U	0.001 U
VOCs	Vinyl chloride	1.7	0.06	1.7	EPA, Industrial Soil	0.00078 U	0.00069 U	0.00063 U	0.0007 U	0.00069 U	0.00073 U	0.00076 U	0.00077 U	0.00077 U	0.00079 U

EPA Screening values are December 2009 USEPA RSLs
Chromium III screening criteria used for chromium comparison
All data presented in milligrams per kilograms (mg/kg)
--- - criteria not established
Detections are shown in bold
Exceedances above the industrial screening criteria are shaded
Laboratory method detection limit listed for non-detects
Compounds in italics indicate that the method detection limit is higher than the mimimum screening criteria/ level.
U - Analyte analyzed but not detected
UJ - Analyte analyzed not detected, quantitation limit is estimated
R - Rejected for project use
J - Estimated concentration
B - Analyte qualified due to blank contamination

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Surface Soil								
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	QC08-103008-FD (SS07 Duplicate)	SS08-103008	SS09-103008	SS10-103008	SS11-103008	SS12-103008	SS13-103008	SS14-103008	SS15-103008
Metals	Aluminum	990000	77000	990000	EPA, Industrial Soil	8650	8310	8060	1000	7860 J	7280	1980	7990	8670
Metals	Antimony	410	31	410	EPA, Industrial Soil	0.2 U	0.19 U	0.24 J	0.17 J	0.18 UJ	0.2 U	0.19 U	0.19 U	0.2 U
Metals	Arsenic	1.6	0.39	1.6	EPA, Industrial Soil	14.3	9.2	10.6	3.1	6.8 J	10.8	2.1	13.7	7.8
Metals	Barium	190000	15000	190000	EPA, Industrial Soil	131	65.9	83.4	8.2	54.2 J	102	13.5	103	71.8
Metals	Beryllium	2000	160	2000	EPA, Industrial Soil	0.81 J	0.43	0.58	0.0041 U	0.41 J	1.3	0.11	1.3	0.87
Metals	Cadmium	800	70	800	EPA, Industrial Soil	1.1	0.4	0.52	0.069	0.25 J	0.41	0.083	0.54	0.42
Metals	Calcium	---	---	---	---	8350	22600	18100	162000	33900 J	4660	236000 J	6850	12300
Metals	Chromium	1500000	120000	1500000	EPA, Industrial Soil	13.1	11.5	10.9	3.1	9.5 J	9.6	3.3	10.3	11.1
Metals	Cobalt	300	23	300	EPA, Industrial Soil	10.4	7.5	6.3	162	4.3 J	4.9	206	4.6	5.7
Metals	Copper	41000	3100	41000	EPA, Industrial Soil	24.8	17.5	31.6	5.4	10 J	25.9	6.3	28.5	16.4
Metals	Iron	720000	55000	720000	EPA, Industrial Soil	25100 J	18300 J	18700 J	2570 J	16100 J	14300 J	4270 J	15100 J	17600 J
Metals	Lead	800	400	800	EPA, Industrial Soil	50.7	15.2	27.6	1.8	16.9 J	25.9	2.6	31.4	26.6
Metals	Magnesium	---	---	---	---	3580 J	6880	6040	36000	5690 J	1720	44100 J	2250	3290
Metals	Manganese	23000	1800	23000	EPA, Industrial Soil	1310 J	315	316	100	190 J	256	151	205	329
Metals	Mercury	34	5.6	34	EPA, Industrial Soil	0.51	0.53	0.31	0.056	0.17 J	0.33	0.043	0.92	0.16
Metals	Nickel	20000	1500	20000	EPA, Industrial Soil	21.8	15.8	16.7	3.1	9.8 J	15.4	4.1	13.4	13.8
Metals	Potassium	---	---	---	---	925	831	949	283 J	868	1020	358 J	942	1080
Metals	Selenium	5100	390	5100	EPA, Industrial Soil	1.2 J	0.46 U	0.58 J	0.41 U	0.43 UJ	0.81 J	0.44 U	0.63 J	0.66 J
Metals	Silver	5100	390	5100	EPA, Industrial Soil	0.036 U	0.14	0.16	0.031 U	0.033 U	0.084 J	0.033 U	0.31	0.036 U
Metals	Sodium	---	---	---	---	38.8 J	40.1 J	46 J	79.7 J	255	43.7 J	85.4 J	48.5 J	35.9 J
Metals	Thallium	---	---	---	---	0.6 U	264	273	6.7	0.54 UJ	0.58 U	6.1	0.57 U	0.6 U
Metals	Vanadium	5200	390	5200	EPA, Industrial Soil	22.7	18.6	20.4	5.7	20.3 J	21.5	9.5	20.8	22.1
Metals	Zinc	310000	23000	310000	EPA, Industrial Soil	146	57.3	77.7	12.3	35.2 J	64	9.4	97	53.8
PAHs	Acenaphthene	33000	3400	33000	EPA, Industrial Soil	0.0028 J	0.015	0.01	0.0028 J	0.073 J	0.024	0.0057	0.025	0.0096
PAHs	Acenaphthylene	---	---	---	---	0.0017 U	0.0016 U	0.0016 U	0.0014 U	0.0015 U	0.0016 U	0.0015 U	0.0016 U	0.0019 J
PAHs	Anthracene	170000	17000	170000	EPA, Industrial Soil	0.0054 J	0.036	0.03	0.0075	0.12 J	0.059	0.017	0.076	0.03
PAHs	Benzo(a)anthracene	2.1	0.15	2.1	EPA, Industrial Soil	0.021	0.13	0.095	0.039	0.3 J	0.17	0.054	0.19	0.13
PAHs	Benzo(a)pyrene	0.21	0.015	0.21	EPA, Industrial Soil	0.021	0.12	0.086	0.042	0.25 J	0.14	0.047	0.15	0.12
PAHs	Benzo(b)fluoranthene	2.1	0.15	2.1	EPA, Industrial Soil	0.033	0.17	0.12	0.063	0.36 J	0.2	0.065	0.21	0.18
PAHs	Benzo(g,h,i)perylene	---	---	---	---	0.014 J	0.033	0.057	0.032	0.099 J	0.082	0.028	0.087	0.05
PAHs	Benzo(k)fluoranthene	21	1.5	21	EPA, Industrial Soil	0.011	0.058	0.038	0.021	0.14 J	0.067	0.022	0.071	0.059
PAHs	Chrysene	210	15	210	EPA, Industrial Soil	0.024	0.13	0.099	0.056	0.27 J	0.17	0.056	0.17	0.13
PAHs	Dibenzo(a,h)anthracene	0.21	0.015	0.21	EPA, Industrial Soil	0.0032 J	0.011	0.015	0.0072	0.034 J	0.022	0.0074	0.023	0.017
PAHs	Fluoranthene	22000	2300	22000	EPA, Industrial Soil	0.049	0.27	0.2	0.087	0.77 J	0.34	0.12	0.36	0.25
PAHs	Fluorene	22000	2300	22000	EPA, Industrial Soil	0.0025 J	0.013	0.01	0.0028 J	0.086 J	0.023	0.0054 J	0.025	0.0092
PAHs	Indeno(1,2,3-cd)pyrene	2.1	0.15	2.1	EPA, Industrial Soil	0.011 J	0.034	0.047	0.026	0.12 J	0.071	0.024	0.077	0.058
PAHs	Naphthalene	18	3.6	18	EPA, Industrial Soil	0.0052	0.013	0.049	0.0021 J	0.013	0.12	0.0021 J	0.11	0.019
PAHs	Phenanthrene	---	---	---	---	0.031	0.17	0.15	0.042	0.71 J	0.32	0.072	0.32	0.13
PAHs	Pyrene	17000	1700	17000	EPA, Industrial Soil	0.039	0.22	0.17	0.072	0.57 J	0.28	0.097	0.29	0.19
SVOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.019 U	0.018 U	0.018 UJ	0.016 UJ	0.017 U	0.019 U	0.018 U	0.018 U	0.019 U
SVOCs	1,2-Diphenylhydrazine	2.2	0.61	2.2	EPA, Industrial Soil	0.038 U	0.037 U	0.037 UJ	0.033 UJ	0.035 U	0.037 U	0.035 U	0.037 U	0.038 U
SVOCs	2,4,5-Trichlorophenol	62000	6100	62000	EPA, Industrial Soil	0.13 U	0.12 U	0.12 UJ	0.11 UJ	0.11 U	0.12 UJ	0.12 U	0.12 U	0.13 U
SVOCs	2,4,6-Trichlorophenol	160	44	160	EPA, Industrial Soil	0.091 U	0.087 U	0.087 UJ	0.078 UJ	0.082 U	0.088 UJ	0.084 U	0.087 U	0.091 U
SVOCs	2,4-Dichlorophenol	1800	180	1800	EPA, Industrial Soil	0.11 U	0.11 U	0.11 UJ	0.096 UJ	0.1 U	0.11 UJ	0.1 U	0.11 U	0.11 U
SVOCs	2,4-Dimethylphenol	12000	1200	12000	EPA, Industrial Soil	0.092 U	0.088 U	0.089 UJ	0.079 UJ	0.084 U	0.09 UJ	0.085 U	0.088 U	0.092 U
SVOCs	2,4-Dinitrophenol	1200	120	1200	EPA, Industrial Soil	0.26 U	0.25 U	0.25 UJ	0.23 UJ	0.24 UJ	0.26 UJ	0.24 U	0.25 U	0.26 U
SVOCs	2,4-Dinitrotoluene	5.5	1.6	5.5	EPA, Industrial Soil	0.027 U	0.026 U	0.026 UJ	0.024 UJ	0.025 U	0.027 U	0.025 U	0.026 U	0.028 U
SVOCs	2,6-Dinitrotoluene	620	61	620	EPA, Industrial Soil	0.037 U	0.036 U	0.036 UJ	0.032 UJ	0.034 U	0.036 U	0.034 U	0.035 U	0.037 U
SVOCs	2-Chloronaphthalene	82000	6300	82000	EPA, Industrial Soil	0.016 U	0.015 U	0.015 UJ	0.013 UJ	0.014 U	0.015 U	0.014 U	0.015 U	0.016 U
SVOCs	2-Chlorophenol	5100	390	5100	EPA, Industrial Soil	0.13 U	0.13 U	0.13 UJ	0.11 UJ	0.12 U	0.13 UJ	0.12 U	0.13 U	0.13 U
SVOCs	2-Methylnaphthalene	4100	310	4100	EPA, Industrial Soil	0.023 U	0.022 U	0.048 J	0.02 UJ	0.021 U	0.22	0.021 U	0.15	0.033 J
SVOCs	2-Methylphenol (o-cresol)	---	---	---	---	0.13 U	0.13 U	0.13 UJ	0.11 UJ	0.12 U	0.13 UJ	0.12 U	0.13 U	0.13 U
SVOCs	2-Nitroaniline	6000	610	6000	EPA, Industrial Soil	0.031 U	0.03 U	0.03 UJ	0.027 UJ	0.028 U	0.03 U	0.029 U	0.03 U	0.031 U
SVOCs	2-Nitrophenol	---	---	---	---	0.14 U	0.14 U	0.14 UJ	0.12 UJ	0.13 U	0.14 UJ	0.13 U	0.14 U	0.14 U
SVOCs	3,3'-Dichlorobenzidine	3.8	1.1	3.8	EPA, Industrial Soil	0.33 U	0.32 U	0.32 UJ	0.29 UJ	0.3 R	0.33 U	0.31 U	0.32 U	0.33 U

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Surface Soil								
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	QC08-103008-FD (SS07 Duplicate)	SS08-103008	SS09-103008	SS10-103008	SS11-103008	SS12-103008	SS13-103008	SS14-103008	SS15-103008
SVOCs	3-Nitroaniline	---	---	---	---	0.038 U	0.037 U	0.037 UJ	0.033 UJ	0.035 UJ	0.037 U	0.035 U	0.037 U	0.038 U
SVOCs	4,6-Dinitro-2-methylphenol	---	---	---	---	0.085 U	0.081 U	0.082 UJ	0.073 UJ	0.077 UJ	0.083 UJ	0.078 U	0.081 U	0.085 U
SVOCs	4-Bromophenyl phenyl ether	---	---	---	---	0.012 U	0.011 U	0.012 UJ	0.01 UJ	0.011 U	0.012 U	0.011 U	0.011 U	0.012 U
SVOCs	4-Chloro-3-methylphenol	---	---	---	---	0.11 U	0.1 U	0.1 UJ	0.094 UJ	0.099 U	0.11 UJ	0.1 U	0.1 U	0.11 U
SVOCs	4-Chloroaniline	---	---	---	---	0.078 UJ	0.075 UJ	0.075 UJ	0.067 UJ	0.07 UJ	0.076 UJ	0.072 UJ	0.074 UJ	0.078 UJ
SVOCs	4-Chlorophenyl phenyl ether	---	---	---	---	0.037 U	0.036 U	0.036 UJ	0.032 UJ	0.034 U	0.036 U	0.034 U	0.035 U	0.037 U
SVOCs	4-Methylphenol (m/p-cresol)	---	---	---	---	0.13 U	0.13 U	0.13 UJ	0.11 UJ	0.12 U	0.13 UJ	0.12 U	0.13 U	0.13 U
SVOCs	4-Nitroaniline	86	24	86	EPA, Industrial Soil	0.037 U	0.036 U	0.036 UJ	0.032 UJ	0.034 U	0.036 U	0.034 U	0.035 U	0.037 U
SVOCs	4-Nitrophenol	---	---	---	---	0.39 U	0.38 U	0.38 UJ	0.34 UJ	0.36 U	0.38 UJ	0.36 U	0.38 U	0.39 U
SVOCs	Aniline	300	85	300	EPA, Industrial Soil	0.073 UJ	0.07 UJ	0.07 UJ	0.063 UJ	0.066 UJ	0.071 UJ	0.067 UJ	0.07 UJ	0.073 UJ
SVOCs	Benzoic acid	2500000	240000	2500000	EPA, Industrial Soil	0.35 UJ	0.33 UJ	0.33 UJ	0.3 UJ	0.31 UJ	0.34 UJ	0.32 UJ	0.33 UJ	0.35 UJ
SVOCs	Benzyl alcohol	62000	6100	62000	EPA, Industrial Soil	0.093 U	0.089 U	0.09 UJ	0.08 UJ	0.085 U	0.091 U	0.086 U	0.089 U	0.093 U
SVOCs	bis(2-chloroethoxy)methane	1800	180	1800	EPA, Industrial Soil	0.024 U	0.023 U	0.023 UJ	0.021 UJ	0.022 U	0.023 U	0.022 U	0.023 U	0.024 U
SVOCs	bis(2-chloroethyl)ether	1.0	0.21	1.0	EPA, Industrial Soil	0.017 U	0.016 U	0.016 UJ	0.014 UJ	0.015 U	0.016 U	0.015 U	0.016 U	0.017 U
SVOCs	Bis(2-chloroisopropyl) ether	---	---	---	---	0.013 U	0.013 U	0.013 UJ	0.011 UJ	0.012 U	0.013 U	0.012 U	0.013 U	0.013 U
SVOCs	bis(2-ethylhexyl)phthalate	120	35	120	EPA, Industrial Soil	0.033 U	0.032 U	0.032 UJ	0.029 UJ	0.03 U	0.033 U	0.031 U	0.032 U	0.033 U
SVOCs	Butylbenzylphthalate	910	260	910	EPA, Industrial Soil	0.029 U	0.028 U	0.028 UJ	0.025 UJ	0.026 U	0.028 U	0.026 U	0.027 U	0.029 U
SVOCs	Dibenzofuran	1000	78	1000	EPA, Industrial Soil	0.044 U	0.042 U	0.043 UJ	0.038 UJ	0.04 U	**0.062 J**	0.041 U	0.042 U	0.044 U
SVOCs	Diethylphthalate	490000	49000	490000	EPA, Industrial Soil	0.045 U	0.044 U	0.044 UJ	0.039 UJ	0.041 U	0.044 U	0.042 U	0.043 U	0.045 U
SVOCs	Dimethylphthalate	---	---	---	---	0.031 U	0.03 U	0.03 UJ	0.027 UJ	0.028 U	0.03 U	0.029 U	0.03 U	0.031 U
SVOCs	Di-n-butylphthalate	62000	6100	62000	EPA, Industrial Soil	0.17 B	0.16 B	0.17 B	0.14 B	0.15 B	0.17 B	0.15 B	0.16 B	0.17 B
SVOCs	Di-n-octylphthalate	---	---	---	---	0.047 U	0.045 U	0.045 UJ	0.04 UJ	0.042 U	0.045 U	0.043 U	0.045 U	0.047 U
SVOCs	Hexachlorobenzene	1.1	0.3	1.1	EPA, Industrial Soil	0.018 U	0.017 U	0.017 UJ	0.015 UJ	0.016 U	0.017 U	0.017 U	0.017 U	0.018 U
SVOCs	Hexachlorobutadiene	22	6.2	22	EPA, Industrial Soil	0.037 U	0.036 U	0.036 UJ	0.032 UJ	0.034 U	0.036 U	0.034 U	0.035 U	0.037 U
SVOCs	Hexachlorocyclopentadiene	3700	370	3700	EPA, Industrial Soil	0.031 U	0.03 U	0.03 UJ	0.027 UJ	0.028 UJ	0.03 U	0.029 U	0.03 U	0.031 U
SVOCs	Hexachloroethane	120	35	120	EPA, Industrial Soil	0.02 U	0.019 U	0.02 UJ	0.017 UJ	0.018 U	0.02 U	0.019 U	0.019 U	0.02 U
SVOCs	Isophorone	1800	510	1800	EPA, Industrial Soil	0.032 U	0.031 U	0.031 UJ	0.028 UJ	0.029 U	0.031 U	0.03 U	0.031 U	0.032 U
SVOCs	Nitrobenzene	24	4.8	24	EPA, Industrial Soil	0.048 U	0.046 U	0.046 UJ	0.041 UJ	0.043 U	0.047 U	0.044 U	0.046 U	0.048 U
SVOCs	*n-Nitrosodimethylamine*	*0.034*	*0.0023*	*0.034*	*EPA, Industrial Soil*	*0.17 UJ*	*0.16 UJ*	*0.16 UJ*	*0.14 UJ*	*0.15 UJ*	*0.16 UJ*	*0.15 UJ*	*0.16 UJ*	*0.17 UJ*
SVOCs	n-Nitroso-di-n-propylamine	0.25	0.069	0.25	EPA, Industrial Soil	0.036 U	0.034 U	0.035 UJ	0.031 UJ	0.033 U	0.035 U	0.033 U	0.034 U	0.036 U
SVOCs	n-Nitrosodiphenylamine	350	99	350	EPA, Industrial Soil	0.02 U	0.019 U	0.02 UJ	0.017 UJ	0.018 U	0.02 U	0.019 U	0.019 U	0.02 U
SVOCs	Pentachlorophenol	9	3	9	EPA, Industrial Soil	0.084 U	0.08 U	0.081 UJ	0.072 UJ	0.076 UJ	0.081 UJ	0.077 U	0.08 U	0.084 U
SVOCs	Phenols	180000	18000	180000	EPA, Industrial Soil	0.16 U	0.15 U	0.15 UJ	0.13 UJ	0.14 U	0.15 UJ	0.14 U	0.15 U	0.16 U
SVOCs	Pyridine	1000	78	1000	EPA, Industrial Soil	0.081 R	0.078 R	0.078 R	0.07 R	0.074 R	0.079 R	0.075 R	0.078 R	0.081 R
VOCs	1,1,1-Trichloroethane	38000	8700	38000	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	1,1,2,2-Tetrachloroethane	2.8	0.56	2.8	EPA, Industrial Soil	0.0013 UJ	0.0012 UJ	0.0011 UJ	0.0012 UJ	0.0013 UJ	0.0013 UJ	0.0011 UJ	0.0015 UJ	0.0012 UJ
VOCs	1,1,2-Trichloroethane	5.3	1.1	5.3	EPA, Industrial Soil	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	1,1-Dichloroethane	17	3.3	17	EPA, Industrial Soil	0.00035 U	0.00032 U	0.00031 U	0.00032 U	0.00036 U	0.00036 U	0.00031 U	0.0004 U	0.00033 U
VOCs	1,1-Dichloroethene	1100	240	1100	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	1,2,3-Trichlorobenzene	490	49	490	EPA, Industrial Soil	0.0019 UJ	0.0017 UJ	0.0017 UJ	0.0017 UJ	0.0019 UJ	0.0019 UJ	0.0017 UJ	0.0021 UJ	0.0018 UJ
VOCs	1,2,4-Trichlorobenzene	99	22	99	EPA, Industrial Soil	0.0019 UJ	0.0017 UJ	0.0017 UJ	0.0017 UJ	0.0019 UJ	0.0019 UJ	0.0017 UJ	0.0021 UJ	0.0018 UJ
VOCs	1,2-Dibromo-3-chloropropane	0.069	0.0054	0.069	EPA, Industrial Soil	0.0013 UJ	0.0012 UJ	0.0011 UJ	0.0012 UJ	0.0013 UJ	0.0013 UJ	0.0011 UJ	0.0015 UJ	0.0012 UJ
VOCs	1,2-Dibromoethane (EDB)	0.17	0.034	0.17	EPA, Industrial Soil	0.00035 U	0.00032 UJ	0.00031 UJ	0.00032 U	0.00036 UJ	0.00036 U	0.00031 U	0.0004 U	0.00033 U
VOCs	1,2-Dichlorobenzene	9800	1900	9800	EPA, Industrial Soil	0.0011 UJ	0.00096 UJ	0.00094 UJ	0.00095 UJ	0.0011 UJ	0.0011 UJ	0.00094 UJ	0.0012 UJ	0.00099 UJ
VOCs	1,2-Dichloroethane	2.2	0.43	2.2	EPA, Industrial Soil	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	1,2-Dichloropropane	4.5	0.89	4.5	EPA, Industrial Soil	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	1,3-Dichlorobenzene	---	---	---	---	0.0014 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0015 UJ	0.0014 UJ	0.0013 UJ	0.0016 UJ	0.0013 UJ
VOCs	1,4-Dichlorobenzene	12	2.4	12	EPA, Industrial Soil	0.0016 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0017 UJ	0.0017 UJ	0.0015 UJ	0.0019 UJ	0.0015 UJ
VOCs	2-Butanone (MEK)	200000	28000	200000	EPA, Industrial Soil	0.007 U	0.0064 U	0.0063 U	0.0064 U	0.0073 UJ	0.0072 U	**0.013 J**	0.008 U	0.0066 U
VOCs	2-Hexanone	1400	210	1400	EPA, Industrial Soil	0.0058 U	0.0053 UJ	0.0052 UJ	0.0053 U	0.0061 UJ	0.006 U	0.0052 U	0.0067 U	0.0055 U
VOCs	4-Methyl-2-pentanone (MIBK)	53000	5300	53000	EPA, Industrial Soil	0.0034 U	0.0031 U	0.003 U	0.0031 U	0.0035 UJ	0.0035 U	0.003 U	0.0039 U	0.0032 U
VOCs	Acetone	630000	61000	630000	EPA, Industrial Soil	0.007 U	0.0064 U	0.0063 U	0.0064 U	0.0073 UJ	0.0072 U	**0.03 J**	0.008 U	0.0066 U
VOCs	Benzene	5.4	1.1	5.4	EPA, Industrial Soil	0.00035 U	0.00032 U	0.00031 U	0.00032 U	0.00036 U	0.00036 U	0.00031 U	0.0004 U	0.00033 U
VOCs	Bromochloromethane	---	---	---	---	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	Bromodichloromethane	1.4	0.27	1.4	EPA, Industrial Soil	0.00047 U	0.00043 UJ	0.00042 UJ	0.00042 U	0.00049 U	0.00048 U	0.00042 U	0.00054 U	0.00044 U

TABLE 4-2
RI Sediment and Surface Soil Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

						Surface Soil								
Method Group	Analyte	EPA, Industrial Soil mg/kg	EPA, Residential Soil mg/kg	RI Screening Level mg/kg	Sample Location and Date>> / Screening Level Source	QC08-103008-FD (SS07 Duplicate)	SS08-103008	SS09-103008	SS10-103008	SS11-103008	SS12-103008	SS13-103008	SS14-103008	SS15-103008
VOCs	Bromoform	220	61	220	EPA, Industrial Soil	0.00082 U	0.00074 UJ	0.00073 UJ	0.00074 U	0.00085 UJ	0.00084 U	0.00073 U	0.00094 U	0.00077 U
VOCs	Bromomethane	32	7.3	32	EPA, Industrial Soil	0.0014 U	0.0013 U	0.0013 U	0.0013 U	0.0015 UJ	0.0014 U	0.0013 U	0.0016 U	0.0013 U
VOCs	Carbon disulfide	3700	820	3700	EPA, Industrial Soil	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.001 U	0.0013 U	0.0011 U
VOCs	Carbon tetrachloride	1.2	0.25	1.2	EPA, Industrial Soil	0.00082 U	0.00074 U	0.00073 U	0.00074 U	0.00085 U	0.00084 U	0.00073 U	0.00094 U	0.00077 U
VOCs	Chlorobenzene	1400	290	1400	EPA, Industrial Soil	0.00093 U	0.00085 UJ	0.00083 UJ	0.00085 U	0.00097 U	0.00096 U	0.00083 U	0.0011 U	0.00088 U
VOCs	Chloroethane	---	---	---	---	0.00047 U	0.00043 U	0.00042 U	0.00042 U	0.00049 U	0.00048 U	0.00042 U	0.00054 U	0.00044 U
VOCs	Chloroform	1.5	0.29	1.5	EPA, Industrial Soil	0.00047 U	0.00043 U	0.00042 U	0.00042 U	0.00049 U	0.00048 U	0.00042 U	0.00054 U	0.00044 U
VOCs	Chloromethane	500	120	500	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	cis-1,2-Dichloroethene	10000	780	10000	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	cis-1,3-Dichloropropene	---	---	---	---	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 UJ	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	Dibromochloromethane	3.3	0.68	3.3	EPA, Industrial Soil	0.00082 U	0.00074 U	0.00073 U	0.00074 U	0.00085 U	0.00084 U	0.00073 U	0.00094 U	0.00077 U
VOCs	Dichlorodifluoromethane	780	180	780	EPA, Industrial Soil	**0.0079 J**	**0.0049 J**	**0.0061 J**	**0.0017 J**	**0.0019 J**	**0.0076 J**	**0.0073 J**	**0.0095 J**	**0.0017 J**
VOCs	Ethylbenzene	27	5.4	27	EPA, Industrial Soil	0.00082 U	0.00074 UJ	0.00073 UJ	0.00074 U	0.00085 U	0.00084 U	0.00073 U	0.00094 U	0.00077 U
VOCs	Isopropylbenzene	---	---	---	---	0.0007 UJ	0.00064 UJ	0.00063 UJ	0.00064 UJ	0.00073 UJ	0.00072 UJ	0.00063 UJ	0.0008 UJ	0.00066 UJ
VOCs	m&p-Xylenes	17000	3400	17000	EPA, Industrial Soil	0.002 U	0.0018 UJ	0.0018 UJ	0.0018 U	0.0021 U	0.002 U	0.0018 U	0.0023 U	0.0019 U
VOCs	Methyl tert-butyl ether (MTBE)	220	43	220	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	Methylene chloride	53	11	53	EPA, Industrial Soil	0.0022 U	0.01 B	0.002 U	0.01 B	0.0023 U	0.0023 U	0.002 U	0.0025 U	0.011 B
VOCs	o-Xylene	19000	3800	19000	EPA, Industrial Soil	0.0012 U	0.0011 UJ	0.001 UJ	0.0011 U	0.0012 U	0.0012 U	0.001 U	0.0013 U	0.0011 U
VOCs	Styrene	36000	6300	36000	EPA, Industrial Soil	0.00058 U	0.00053 UJ	0.00052 UJ	0.00053 U	0.00061 UJ	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	Tetrachloroethene	2.6	0.55	2.6	EPA, Industrial Soil	0.0011 UJ	0.00096 UJ	0.00094 UJ	0.00095 UJ	0.0011 UJ	0.0011 UJ	0.00094 UJ	0.0012 UJ	0.00099 UJ
VOCs	Toluene	45000	5000	45000	EPA, Industrial Soil	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	trans-1,2-Dichloroethene	690	150	690	EPA, Industrial Soil	0.0007 U	0.00064 U	0.00063 U	0.00064 U	0.00073 U	0.00072 U	0.00063 U	0.0008 U	0.00066 U
VOCs	trans-1,3-Dichloropropene	---	---	---	---	0.00093 U	0.00085 U	0.00083 U	0.00085 U	0.00097 UJ	0.00096 U	0.00083 U	0.0011 U	0.00088 U
VOCs	Trichloroethene	14	2.8	14	EPA, Industrial Soil	0.00058 U	0.00053 U	0.00052 U	0.00053 U	0.00061 U	0.0006 U	0.00052 U	0.00067 U	0.00055 U
VOCs	Trichlorofluoromethane	3400	790	3400	EPA, Industrial Soil	0.0011 U	**0.0012 J**	0.00094 U	**0.0036 J**	**0.0041 J**	0.0011 U	0.00094 U	0.0012 U	**0.0041 J**
VOCs	Vinyl chloride	1.7	0.06	1.7	EPA, Industrial Soil	0.00082 U	0.00074 U	0.00073 U	0.00074 U	0.00085 U	0.00084 U	0.00073 U	0.00094 U	0.00077 U

EPA Screening values are December 2009 USEPA RSLs
Chromium III screening criteria used for chromium comparison
All data presented in milligrams per kilograms (mg/kg)
--- - criteria not established
Detections are shown in bold
Exceedances above the industrial screening criteria are shaded
Laboratory method detection limit listed for non-detects
Compounds in italics indicate that the method detection limit is higher than the mimimum screening criteria/ level.
U - Analyte analyzed but not detected
UJ - Analyte analyzed not detected, quantitation limit is estimated
R - Rejected for project use
J - Estimated concentration
B - Analyte qualified due to blank contamination

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Sample ID & Date>>	MW11															
MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	Screening Level Source	Nov-08		Nov-08 (Duplicate)		Jan-09		Jan-09 (Duplicate)		Apr-09		Apr-09 (Duplicate)		Jul-09		Jul-09 (Duplicate)	
Dissolved Metals	Aluminum	---	37	37	EPA, Tapwater	0.005	U	0.005	U	**0.0054**	**J**	0.005	U	0.007	U	0.007	U	0.007	U	0.007	U
Dissolved Metals	Antimony	0.006	0.015	0.006	EPA, MCL	0.0026	U	0.0026	U	0.0026	U	0.0026	U	0.003	U	0.003	U	0.003	U	0.0056	B
Dissolved Metals	Arsenic	0.01	0.000045	0.01	EPA, MCL	**0.0042**	**J**	**0.0041**	**J**	**0.0063**	**J**	**0.0086**		**0.0042**	**J**	**0.0067**	**J**	*0.01*	*B*	*0.01*	*B*
Dissolved Metals	Barium	2.0	7.3	2.0	EPA, MCL	**0.24**	**J**	**0.23**	**J**	**0.256**		**0.257**		**0.265**		**0.258**		**0.263**		**0.261**	
Dissolved Metals	Beryllium	0.004	0.073	0.004	EPA, MCL	0.00019	B	0.00018	UJ	0.00022	B	0.00018	U	0.00012	U	0.00012	U	0.00012	U	0.00012	U
Dissolved Metals	Cadmium	0.005	0.018	0.005	EPA, MCL	0.0003	U	0.0003	U	0.0003	U	0.0003	U	0.00016	U	0.00016	U	0.00016	U	0.00016	U
Dissolved Metals	Calcium	---	---	---	---	**25**	**J**	**24**	**J**	**27.1**		**28**		**28.9**		**28.3**		**28.4**		**28.2**	
Dissolved Metals	Chromium	0.1	---	0.1	EPA, MCL	0.004	U	0.004	U	0.004	U	0.004	U	**0.001**	**J**	0.001	U	0.001	U	0.001	U
Dissolved Metals	Cobalt	---	0.011	0.011	EPA, Tapwater	0.0008	U	0.0008	U	0.0008	U	0.0008	U	0.0003	U	0.0003	U	0.0003	U	0.0003	U
Dissolved Metals	Copper	1.3	1.5	1.3	EPA, MCL	0.0012	UJ	0.0012	UJ	0.0012	U	0.0012	U	0.0019	U	**0.0032**	**U**	0.0019	U	0.0019	U
Dissolved Metals	Iron	---	26	26	EPA, Tapwater	**0.017**	**J**	**0.011**	**J**	**0.209**		**0.231**		**0.163**		**0.163**		**0.165**		**0.162**	
Dissolved Metals	Lead	0.015	---	0.015	EPA, MCL	0.0014	U	0.0014	U	0.0014	U	0.0014	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U
Dissolved Metals	Magnesium	---	---	---	---	**20**	**J**	**20**	**J**	**17.4**		**18.1**		**22.2**		**21.8**		**22**		**22**	
Dissolved Metals	Manganese	---	0.88	0.88	EPA, Tapwater	**0.066**	**J**	**0.063**	**J**	**0.0487**		**0.0549**		**0.0443**		**0.0444**		**0.0335**		**0.0337**	
Dissolved Metals	Mercury	0.002	0.00057	0.002	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	0.00004	U	0.00004	U	0.00004	U	0.00004	U
Dissolved Metals	Nickel	---	0.73	0.73	EPA, Tapwater	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Dissolved Metals	Potassium	---	---	---	---	**3.7**		**3.8**		**3.73**		**3.98**		**3.65**		**3.76**		**3.27**		**3.31**	
Dissolved Metals	Selenium	0.05	0.18	0.05	EPA, MCL	0.004	U	0.004	U	0.004	U	0.004	U	0.0023	U	0.0023	U	0.0023	U	0.0023	U
Dissolved Metals	Silver	---	0.18	0.18	EPA, Tapwater	0.003	U	0.003	U	0.003	U	0.003	U	0.001	U	0.001	U	0.001	U	**0.001**	**J**
Dissolved Metals	Sodium	---	---	---	---	**69**		**69**		**69**		**72.7**		**69**		**68.9**		**59.3**	**J**	**59.1**	**J**
Dissolved Metals	Thallium	0.002	---	0.002	EPA, MCL	0.0013	UJ	0.0013	UJ	0.0013	U	0.0013	U	0.0015	U	0.0015	U	**0.0018**	**J**	0.0015	U
Dissolved Metals	Vanadium	---	0.18	0.18	EPA, Tapwater	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0009	U	0.0009	U	0.0009	U	0.0009	U
Dissolved Metals	Zinc	---	11.0	11	EPA, Tapwater	0.0019	U	0.0019	U	0.0019	U	0.0019	U	0.0016		**0.00061**	**J**	0.0005	U	**0.132**	
PAHs	Acenaphthene	---	2.2	2.2	EPA, Tapwater	0.0000052	U	0.0000052	UJ	0.0000052	U	0.0000053	U	0.0000051	U	0.0000051	U	0.0000051	U	0.0000051	U
PAHs	Acenaphthylene	---	---	---	---	0.0000041	U	0.0000041	UJ	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Anthracene	---	11	11	EPA, Tapwater	0.0000041	U	0.0000041	UJ	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Benzo(a)anthracene	---	0.000029	0.000029	EPA, Tapwater	0.0000041	U	0.0000041	UJ	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.000015	B	0.0000041	U
PAHs	*Benzo(a)pyrene*	*0.0002*	*0.0000029*	*0.0002*	*EPA, MCL*	*0.0000072*	*U*	*0.0000072*	*UJ*	*0.0000072*	*U*	*0.0000074*	*U*	*0.0000071*	*U*	*0.0000071*	*U*	*0.0000071*	*U*	*0.0000071*	*U*
PAHs	Benzo(b)fluoranthene	---	0.000029	0.000029	EPA, Tapwater	0.0000062	U	0.0000062	UJ	0.0000062	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000061	U	0.0000061	U
PAHs	Benzo(g,h,i)perylene	---	---	---	---	0.0000072	U	0.0000072	UJ	0.0000072	U	0.0000074	U	0.0000071	U	0.0000071	U	0.0000071	UJ	0.0000071	U
PAHs	Benzo(k)fluoranthene	---	0.00029	0.00029	EPA, Tapwater	0.0000062	U	0.0000062	UJ	0.0000062	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000061	U	0.0000061	U
PAHs	Chrysene	---	0.0029	0.0029	EPA, Tapwater	0.0000041	U	0.0000041	UJ	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	*Dibenzo(a,h)anthracene*	*---*	*0.0000029*	*0.0000029*	*EPA, Tapwater*	*0.0000052*	*U*	*0.0000052*	*UJ*	*0.0000052*	*U*	*0.0000053*	*U*	*0.0000051*	*U*	*0.0000051*	*U*	*0.0000051*	*UJ*	*0.0000051*	*U*
PAHs	Fluoranthene	---	1.5	1.5	EPA, Tapwater	0.0000052	U	0.0000052	UJ	**0.0000082**	**J**	**0.000011**	**J**	0.000015	B	0.0000051	U	0.0000051	U	0.0000051	U
PAHs	Fluorene	---	1.5	1.5	EPA, Tapwater	0.0000041	U	0.0000041	UJ	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Indeno(1,2,3-cd)pyrene	---	0.000029	0.000029	EPA, Tapwater	0.0000062	U	0.0000062	UJ	0.0000062	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000061	U	0.0000061	U
PAHs	Naphthalene	---	0.00014	0.00014	EPA, Tapwater	0.000037	B	0.000042	B	**0.000013**	**J**	**0.000014**	**J**	0.000021	B	0.000021	B	0.000021	B	0.000021	B
PAHs	Phenanthrene	---	---	---	---	0.0000041	U	0.0000041	UJ	0.0000041	U	**0.0000042**	**J**	0.000015	B	0.000015	B	0.0000041	U	0.0000041	U
PAHs	Pyrene	---	1.1	1.1	EPA, Tapwater	0.0000041	U	0.0000041	UJ	**0.0000082**	**J**	**0.000011**	**J**	0.000012	B	0.000012	B	0.0000041	U	0.0000041	U
SVOCs	1,2,4-Trichlorobenzene	0.07	0.0023	0.07	EPA, MCL	0.000071	U	0.000071	U	0.000072	U	0.000074	U	NS		NS		NS		NS	
SVOCs	*1,2-Diphenylhydrazine*	*---*	*0.000084*	*0.000084*	*EPA, Tapwater*	*0.00018*	*U*	*0.00018*	*U*	*0.00019*	*U*	*0.00019*	*U*	NS		NS		NS		NS	
SVOCs	2,4,5-Trichlorophenol	---	3.7	3.7	EPA, Tapwater	0.00081	U	0.0008	UJ	0.00081	UJ	0.00083	UJ	NS		NS		NS		NS	
SVOCs	2,4,6-Trichlorophenol	---	0.0061	0.0061	EPA, Tapwater	0.00088	U	0.00087	UJ	0.00089	UJ	0.00091	UJ	NS		NS		NS		NS	
SVOCs	2,4-Dichlorophenol	---	0.11	0.11	EPA, Tapwater	0.00062	U	0.00062	UJ	0.00063	UJ	0.00064	UJ	NS		NS		NS		NS	
SVOCs	2,4-Dimethylphenol	---	0.73	0.73	EPA, Tapwater	0.0012	U	0.0012	UJ	0.0012	UJ	0.0013	UJ	NS		NS		NS		NS	
SVOCs	2,4-Dinitrophenol	---	0.073	0.073	EPA, Tapwater	0.0016	U	0.0015	UJ	0.0016	UJ	0.0016	UJ	NS		NS		NS		NS	
SVOCs	2,4-Dinitrotoluene	---	0.00022	0.00022	EPA, Tapwater	0.00019	U	0.00019	U	0.0002	U	0.0002	U	NS		NS		NS		NS	
SVOCs	2,6-Dinitrotoluene	---	0.037	0.037	EPA, Tapwater	0.00012	U	0.00012	U	0.00012	U	0.00013	U	NS		NS		NS		NS	
SVOCs	2-Chloronaphthalene	---	2.9	2.9	EPA, Tapwater	0.0001	U	0.0001	U	0.0001	U	0.00011	U	NS		NS		NS		NS	
SVOCs	2-Chlorophenol	---	0.18	0.18	EPA, Tapwater	0.00069	U	0.00069	UJ	0.0007	UJ	0.00072	UJ	NS		NS		NS		NS	
SVOCs	2-Methylnaphthalene	---	0.15	0.15	EPA, Tapwater	0.00012	U	0.00012	U	0.0000052	U	0.0000053	U	NS		NS		NS		NS	
SVOCs	2-Methylphenol (o-cresol)	---	---	---	---	0.00089	U	0.00088	UJ	0.0009	UJ	0.00092	UJ	NS		NS		NS		NS	
SVOCs	2-Nitroaniline	---	0.37	0.37	EPA, Tapwater	0.00011	U	0.00011	U	0.00011	U	0.00012	U	NS		NS		NS		NS	

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Sample ID & Date>>	MW11											
MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	Screening Level Source	Nov-08		Nov-08 (Duplicate)		Jan-09		Jan-09 (Duplicate)		Apr-09	Apr-09 (Duplicate)	Jul-09	Jul-09 (Duplicate)
SVOCs	2-Nitrophenol	---	---	---	---	0.00061	U	0.00061	UJ	0.00062	UJ	0.00063	UJ	NS	NS	NS	NS
SVOCs	*3,3'-Dichlorobenzidine*	---	*0.00015*	*0.00015*	*EPA, Tapwater*	*0.003*	*U*	*0.003*	*U*	*0.0031*	*U*	*0.0031*	*U*	NS	NS	NS	NS
SVOCs	3-Nitroaniline	---	---	---	---	0.00021	U	0.00021	U	0.00022	U	0.00022	U	NS	NS	NS	NS
SVOCs	4,6-Dinitro-2-methylphenol	---	---	---	---	0.00095	U	0.00094	UJ	0.00096	UJ	0.00098	UJ	NS	NS	NS	NS
SVOCs	4-Bromophenyl phenyl ether	---	---	---	---	0.00015	U	0.00015	U	0.00015	U	0.00016	U	NS	NS	NS	NS
SVOCs	4-Chloro-3-methylphenol	---	---	---	---	0.0011	U	0.0011	UJ	0.0011	UJ	0.0012	UJ	NS	NS	NS	NS
SVOCs	4-Chloroaniline	---	---	---	---	0.00017	U	0.00017	U	0.00018	U	0.00018	U	NS	NS	NS	NS
SVOCs	4-Chlorophenyl phenyl ether	---	---	---	---	0.000082	U	0.000081	U	0.000082	U	0.000084	U	NS	NS	NS	NS
SVOCs	4-Methylphenol (m/p-cresol)	---	---	---	---	0.00068	U	0.00068	UJ	0.00069	UJ	0.00071	UJ	NS	NS	NS	NS
SVOCs	4-Nitroaniline	---	0.0034	0.0034	EPA, Tapwater	0.00047	UJ	0.00046	UJ	0.00047	U	0.00048	U	NS	NS	NS	NS
SVOCs	4-Nitrophenol	---	---	---	---	0.00063	UJ	0.00063	UJ	0.00064	UJ	0.00065	UJ	NS	NS	NS	NS
SVOCs	Aniline	---	0.012	0.012	EPA, Tapwater	0.00033	U	0.00032	U	0.00033	U	0.00034	U	NS	NS	NS	NS
SVOCs	Benzoic acid	---	150	150	EPA, Tapwater	0.012	U	0.012	UJ	0.012	UJ	0.012	UJ	NS	NS	NS	NS
SVOCs	Benzyl alcohol	---	3.7	3.7	EPA, Tapwater	0.00032	U	0.00031	U	**0.00058**	**J**	**0.00055**	**J**	NS	NS	NS	NS
SVOCs	bis(2-chloroethoxy)methane	---	0.11	0.11	EPA, Tapwater	0.000092	U	0.000091	U	0.000093	U	0.000095	U	NS	NS	NS	NS
SVOCs	*bis(2-chloroethyl)ether*	---	*0.000012*	*0.000012*	*EPA, Tapwater*	*0.0002*	*U*	*0.0002*	*U*	*0.00021*	*U*	*0.00021*	*U*	NS	NS	NS	NS
SVOCs	bis(2-chloroisopropyl) ether	---	---	---	---	0.000092	U	0.000091	U	0.000093	U	0.000095	U	NS	NS	NS	NS
SVOCs	bis(2-ethylhexyl)phthalate	0.006	0.0048	0.006	EPA, MCL	0.00062	UJ	**0.002**	**J**	0.00063	U	0.00064	U	NS	NS	NS	NS
SVOCs	Butylbenzylphthalate	---	0.035	0.035	EPA, Tapwater	0.00011	U	0.00011	U	0.00011	U	0.00012	U	NS	NS	NS	NS
SVOCs	Dibenzofuran	---	0.037	0.037	EPA, Tapwater	0.000082	U	0.000081	U	0.000082	U	0.000084	U	NS	NS	NS	NS
SVOCs	Diethylphthalate	---	29	29	EPA, Tapwater	0.00017	U	0.00017	U	0.00018	U	0.00018	U	NS	NS	NS	NS
SVOCs	Dimethylphthalate	---	---	---	---	0.000092	U	0.000091	U	0.000093	U	0.000095	U	NS	NS	NS	NS
SVOCs	Di-n-butylphthalate	---	---	---	---	0.0026	B	0.00076	UJ	0.00077	U	0.00079	U	NS	NS	NS	NS
SVOCs	Di-n-octylphthalate	---	---	---	---	0.00016	UJ	0.00016	UJ	0.00016	U	0.00017	U	NS	NS	NS	NS
SVOCs	*Hexachlorobenzene*	*0.001*	*0.000042*	*0.001*	*EPA, MCL*	*0.00022*	*U*	*0.00022*	*U*	*0.00023*	*U*	*0.00023*	*U*	NS	NS	NS	NS
SVOCs	Hexachlorobutadiene	---	0.00086	0.00086	EPA, Tapwater	0.00031	U	0.0003	U	0.00031	U	0.00032	U	NS	NS	NS	NS
SVOCs	Hexachlorocyclopentadiene	0.05	0.22	0.05	EPA, MCL	0.00012	U	0.00012	U	0.00012	U	0.00013	U	NS	NS	NS	NS
SVOCs	Hexachloroethane	---	0.0048	0.0048	EPA, Tapwater	0.000071	U	0.000071	U	0.000072	U	0.000074	U	NS	NS	NS	NS
SVOCs	Isophorone	---	0.071	0.071	EPA, Tapwater	0.00011	U	0.00011	U	0.00011	U	0.00012	U	NS	NS	NS	NS
SVOCs	Nitrobenzene	---	0.00012	0.00012	EPA, Tapwater	0.00015	U	0.00015	U	0.00015	U	0.00016	U	NS	NS	NS	NS
SVOCs	*n-Nitrosodimethylamine*	---	*0.00000042*	*0.00000042*	*EPA, Tapwater*	*0.00071*	*U*	*0.00071*	*U*	*0.00072*	*U*	*0.00074*	*U*	NS	NS	NS	NS
SVOCs	*n-Nitroso-di-n-propylamine*	---	*0.0000096*	*0.0000096*	*EPA, Tapwater*	*0.00018*	*U*	*0.00018*	*U*	*0.00019*	*U*	*0.00019*	*U*	NS	NS	NS	NS
SVOCs	n-Nitrosodiphenylamine	---	0.014	0.014	EPA, Tapwater	0.00019	U	0.00019	U	0.0002	U	0.0002	U	NS	NS	NS	NS
SVOCs	*Pentachlorophenol*	*0.001*	*0.00056*	*0.001*	*EPA, MCL*	*0.00091*	*U*	*0.0009*	*UJ*	*0.00092*	*UJ*	*0.00094*	*UJ*	NS	NS	NS	NS
SVOCs	Phenols	---	11.0	11.0	EPA, Tapwater	0.00032	U	0.00031	UJ	0.00032	UJ	0.00033	UJ	NS	NS	NS	NS
SVOCs	Pyridine	---	0.037	0.037	EPA, Tapwater	0.0018	UJ	0.0018	UJ	0.0018	R	0.0019	R	NS	NS	NS	NS
VOCs	1,1,1-Trichloroethane	0.2	9.1	0.2	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS	NS	NS	NS
VOCs	1,1,2,2-Tetrachloroethane	---	0.000067	0.000067	EPA, Tapwater	0.000019	U	0.000019	U	0.000019	U	0.000019	U	NS	NS	NS	NS
VOCs	1,1,2-Trichloroethane	0.005	0.00024	0.005	EPA, MCL	0.00006	U	0.00006	U	0.00006	U	0.00006	U	NS	NS	NS	NS
VOCs	1,1-Dichloroethane	---	0.0024	0.0024	EPA, Tapwater	0.00006	U	0.00006	U	0.00006	U	0.00006	U	NS	NS	NS	NS
VOCs	1,1-Dichloroethene	0.007	0.34	0.007	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS	NS	NS	NS
VOCs	1,2,3-Trichlorobenzene	---	0.029	0.029	EPA, Tapwater	0.00007	U	0.00007	U	0.00007	U	0.00007	U	NS	NS	NS	NS
VOCs	1,2,4-Trichlorobenzene	0.07	0.0023	0.07	EPA, MCL	0.00006	U	0.00006	U	0.00006	U	0.00006	U	NS	NS	NS	NS
VOCs	*1,2-Dibromo-3-chloropropane*	*0.0002*	*0.00000032*	*0.0002*	*EPA, MCL*	*0.00005*	*U*	*0.00005*	*U*	*0.00005*	*U*	*0.00005*	*U*	NS	NS	NS	NS
VOCs	*1,2-Dibromoethane (EDB)*	*0.00005*	*0.0000065*	*0.00005*	*EPA, MCL*	*0.00005*	*U*	*0.00005*	*U*	*0.00005*	*U*	*0.00005*	*U*	NS	NS	NS	NS
VOCs	1,2-Dichlorobenzene	0.6	0.37	0.6	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS	NS	NS	NS
VOCs	1,2-Dichloroethane	0.005	0.00015	0.005	EPA, MCL	0.00003	U	0.00003	U	0.00003	U	0.00003	U	NS	NS	NS	NS
VOCs	1,2-Dichloropropane	0.005	0.00039	0.005	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS	NS	NS	NS
VOCs	1,3-Dichlorobenzene	---	---	---	---	0.000027	U	0.000027	U	0.000027	U	0.000027	U	NS	NS	NS	NS
VOCs	1,4-Dichlorobenzene	0.075	0.00043	0.075	EPA, MCL	0.00004	U	0.00004	U	0.00004	U	0.00004	U	NS	NS	NS	NS
VOCs	2-Butanone (MEK)	---	7.1	7.1	EPA, Tapwater	0.0006	U	0.0006	U	0.0006	U	0.0006	U	NS	NS	NS	NS
VOCs	2-Hexanone	---	0.047	0.047	EPA, Tapwater	0.0016	U	0.0016	U	0.0016	U	0.0016	U	NS	NS	NS	NS
VOCs	4-Methyl-2-pentanone (MIBK)	---	2.0	2.0	EPA, Tapwater	0.0008	U	0.0008	U	0.0008	U	0.0008	U	NS	NS	NS	NS

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

					Sample ID & Date>>	MW11													
MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	Screening Level Source	Nov-08		Nov-08 (Duplicate)		Jan-09		Jan-09 (Duplicate)		Apr-09		Apr-09 (Duplicate)		Jul-09		Jul-09 (Duplicate)	
VOCs	Acetone	---	22	22	EPA, Tapwater	0.0052	B	0.0052	B	0.0015	U	0.0015	U	NS		NS		NS		NS	
VOCs	Benzene	0.005	0.00041	0.005	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS		NS		NS		NS	
VOCs	Bromochloromethane	---	---	---	---	0.000028	U	0.000028	U	0.000028	U	0.000028	U	NS		NS		NS		NS	
VOCs	Bromodichloromethane	---	0.00012	0.00012	EPA, Tapwater	0.00003	U	0.00003	U	0.00003	U	0.00003	U	NS		NS		NS		NS	
VOCs	Bromoform	---	0.0085	0.0085	EPA, Tapwater	0.00004	U	0.00004	U	0.00004	U	0.00004	U	NS		NS		NS		NS	
VOCs	Bromomethane	---	0.0087	0.0087	EPA, Tapwater	0.00007	U	0.00007	U	0.00007	U	0.00007	U	NS		NS		NS		NS	
VOCs	Carbon disulfide	---	1.0	1.0	EPA, Tapwater	0.00009	U	0.00009	U	0.00009	U	0.00009	U	NS		NS		NS		NS	
VOCs	Carbon tetrachloride	0.005	0.0002	0.005	EPA, MCL	0.000022	U	0.000022	U	0.000022	U	0.000022	U	NS		NS		NS		NS	
VOCs	Chlorobenzene	0.1	0.091	0.1	EPA, MCL	0.00004	U	0.00004	U	0.00004	U	0.00004	U	NS		NS		NS		NS	
VOCs	Chloroethane	---	---	---	---	0.00007	U	0.00007	U	0.00007	U	0.00007	U	NS		NS		NS		NS	
VOCs	Chloroform	---	0.00019	0.00019	EPA, Tapwater	0.000022	U	0.000022	U	0.000022	U	0.000022	U	NS		NS		NS		NS	
VOCs	Chloromethane	---	0.19	0.19	EPA, Tapwater	0.00011	B	0.00011	B	0.00094	B	0.001	B	NS		NS		NS		NS	
VOCs	cis-1,2-Dichloroethene	0.07	0.37	0.07	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS		NS		NS		NS	
VOCs	cis-1,3-Dichloropropene	---	---	---	---	0.000017	U	0.000017	U	0.000017	U	0.000017	U	NS		NS		NS		NS	
VOCs	Dibromochloromethane	---	0.00015	0.00015	EPA, Tapwater	0.000026	U	0.000026	U	0.000026	U	0.000026	U	NS		NS		NS		NS	
VOCs	Dichlorodifluoromethane	---	0.39	0.39	EPA, Tapwater	0.00003	U	0.00003	U	0.00003	U	0.00003	U	NS		NS		NS		NS	
VOCs	Ethylbenzene	0.7	0.0015	0.7	EPA, MCL	0.000024	U	0.000024	U	0.000024	U	0.000024	U	NS		NS		NS		NS	
VOCs	Isopropylbenzene	---	---	---	---	0.00004	U	0.00004	U	0.00004	U	0.00004	U	NS		NS		NS		NS	
VOCs	m&p-Xylenes	---	1.2	1.2	EPA, Tapwater	0.00008	U	0.00008	U	0.00008	U	0.00008	U	NS		NS		NS		NS	
VOCs	Methyl tert-butyl ether (MTBE)	---	0.012	0.012	EPA, Tapwater	0.00008	U	0.00008	U	0.00008	U	0.00008	U	NS		NS		NS		NS	
VOCs	Methylene chloride	0.005	0.0048	0.005	EPA, MCL	0.00018	R	0.00018	R	0.00018	UJ	0.00018	UJ	NS		NS		NS		NS	
VOCs	o-Xylene	---	1.2	1.2	EPA, Tapwater	0.000023	U	0.000023	U	0.000023	U	0.000023	U	NS		NS		NS		NS	
VOCs	Styrene	0.1	1.6	0.1	EPA, MCL	0.000022	U	0.000022	U	0.000022	U	0.000022	U	NS		NS		NS		NS	
VOCs	Tetrachloroethene	0.005	0.00011	0.005	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS		NS		NS		NS	
VOCs	Toluene	1.0	2.3	1.0	EPA, MCL	0.00006	B	**0.000063**	**J**	0.00006	U	0.00006	U	NS		NS		NS		NS	
VOCs	trans-1,2-Dichloroethene	0.1	0.11	0.1	EPA, MCL	0.00006	U	0.00006	U	0.00006	U	0.00006	U	NS		NS		NS		NS	
VOCs	trans-1,3-Dichloropropene	---	---	---	---	0.000017	U	0.000017	U	0.000017	U	0.000017	U	NS		NS		NS		NS	
VOCs	Trichloroethene	0.005	0.002	0.005	EPA, MCL	0.00005	U	0.00005	U	0.00005	U	0.00005	U	NS		NS		NS		NS	
VOCs	Trichlorofluoromethane	---	1.3	1.3	EPA, Tapwater	0.00006	U	0.00006	U	0.00006	U	0.00006	U	NS		NS		NS		NS	
VOCs	Vinyl chloride	0.002	0.000016	0.002	EPA, MCL	0.000013	U	0.000013	U	0.000013	U	0.000013	U	NS		NS		NS		NS	

EPA Screening values are December 2009 USEPA RSLs
All data presented in milligrams per liter (mg/L)
NS - Not Sampled. VOCs and SVOCs were removed from the sampling program in April 2009
--- - criteria not established
Detections are shown in bold
Exceedances above the minimum screening criteria are shaded
Laboratory method detection limit listed for non-detects
Compounds in italics indicate that the method detection limit is higher than the mimimum screening criteria/ level.
U - Analyte analyzed but not detected
UJ - Analyte analyzed not detected, quantitation limit is estimated
R - Rejected for project use
J - Estimated concentration
B - The analyte was detected in the associated method blank as well as in the samples and therefore, was qualified as non-detect at the concentration measured. The data is italicized because the concentration measured is above the tapwater screening criteria

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	MW12 Nov-08		MW12 Jan-09		MW12 Apr-09		MW12 Jul-09		MW13 Nov-08		MW13 Jan-09		MW13 Apr-09		MW13 Jul-09	
Dissolved Metals	Aluminum	---	37	37	0.005	U	0.005	U	0.007	UJ	0.007	U	0.005	U	**0.323**	**J**	**0.0119**	**J**	0.007	U
Dissolved Metals	Antimony	0.006	0.015	0.006	0.0026	U	**0.0078**	**J**	0.003	U	0.003	U	0.0026	U	0.0026	U	**0.0035**	**J**	0.003	U
Dissolved Metals	Arsenic	0.01	0.000045	0.01	*0.0022*	*U*	*0.0022*	*U*	*0.0031*	*U*	*0.0031*	*UJ*	**0.013**		**0.0182**	**J**	**0.0106**		*0.0139*	*B*
Dissolved Metals	Barium	2.0	7.3	2.0	**0.071**	**J**	**0.0697**		**0.0609**		**0.0667**		**0.47**	**J**	**0.616**		**0.513**		**0.473**	
Dissolved Metals	Beryllium	0.004	0.073	0.004	0.00018	U	0.00018	U	0.00012	U	0.00012	U	0.00018	U	0.00018	U	0.00012	U	0.00012	U
Dissolved Metals	Cadmium	0.005	0.018	0.005	0.0003	U	0.0003	U	0.00016	U	0.00016	U	0.0003	U	0.0003	U	0.00016	U	0.00016	U
Dissolved Metals	Calcium	---	---	---	**130**	**J**	**137**		**123**		**125**		**31**	**J**	**39.3**		**48.7**		**42.6**	
Dissolved Metals	Chromium	0.1	---	0.1	0.004	U	0.004	U	**0.0016**	**J**	0.001	U	0.004	U	0.004	U	0.001	U	0.001	U
Dissolved Metals	Cobalt	---	0.011	0.011	0.0008	U	0.0008	U	0.0003	U	0.0003	U	0.0008	U	0.0008	U	**0.00039**	**J**	0.0003	U
Dissolved Metals	Copper	1.3	1.5	1.3	**0.0012**	**J**	**0.0019**	**J**	0.0019	U	**0.0039**	**J**	0.0012	UJ	0.0012	U	0.0019	U	0.0019	U
Dissolved Metals	Iron	---	26	26	**0.008**	**U**	**0.0109**	**J**	0.008	U	**0.0271**		**0.069**	**J**	**0.709**	**J**	**0.454**		**0.463**	
Dissolved Metals	Lead	0.015	---	0.015	**0.0028**	**J**	0.0014	U	**0.0024**	**J**	**0.0029**	**J**	**0.0017**	**J**	**0.0016**	**J**	0.0015	U	0.0015	U
Dissolved Metals	Magnesium	---	---	---	**42**	**J**	**38**		**41.5**		**40.6**		**23**	**J**	**18.5**	**J**	**25.2**		**22.9**	
Dissolved Metals	Manganese	---	0.88	0.88	**0.054**	**J**	**0.0673**		**0.0596**		**0.0685**		**0.049**	**J**	**0.115**		**0.173**		**0.145**	
Dissolved Metals	Mercury	0.002	0.00057	0.002	0.00005	U	0.00005	U	0.00004	U	0.00004	U	0.00005	U	0.00005	U	0.00004	U	0.00004	U
Dissolved Metals	Nickel	---	0.73	0.73	0.001	B	0.0011	B	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U	0.001	U
Dissolved Metals	Potassium	---	---	---	**1.6**		**1.58**		**1.55**		**1.75**		**2.3**		**2.93**		**2.9**		**2.63**	
Dissolved Metals	Selenium	0.05	0.18	0.05	0.004	U	0.004	U	0.0023	U	0.0023	U	0.004	U	0.004	U	0.0023	U	0.0023	U
Dissolved Metals	Silver	---	0.18	0.18	0.003	U	**0.0048**	**J**	0.001	U	**0.0013**	**J**	0.003	U	0.003	U	0.001	U	0.001	U
Dissolved Metals	Sodium	---	---	---	**12**		**12.5**		**12**		**10.1**	**J**	**76**		**80.5**		**63.8**		**64.3**	**J**
Dissolved Metals	Thallium	0.002	---	0.002	0.0013	UJ	**0.0018**	**J**	0.0015	U	0.0015	U	0.0013	UJ	0.0013	U	0.0015	U	0.0015	U
Dissolved Metals	Vanadium	---	0.18	0.18	0.0015	U	0.0015	U	0.0009	U	0.0009	U	0.0015	U	0.0015	U	0.0009	U	0.0009	U
Dissolved Metals	Zinc	---	11.0	11	0.0019	U	**0.003**	**J**	**0.0011**	**J**	**0.0018**		0.0019	U	**0.0037**	**J**	0.00087	J	0.0005	U
PAHs	Acenaphthene	---	2.2	2.2	0.0000051	U	0.0000052	U	0.0000051	U	0.0000051	U	0.0000052	U	0.0000051	U	0.0000051	U	**0.0000052**	**J**
PAHs	Acenaphthylene	---	---	---	0.0000041	U	0.0000042	U	0.000004	U	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Anthracene	---	11	11	0.0000041	U	0.0000042	U	0.000004	U	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Benzo(a)anthracene	---	0.000029	0.000029	0.0000041	U	0.0000042	U	0.000004	U	0.000015	B	0.0000042	U	0.0000041	U	0.0000041	U	0.000015	B
PAHs	*Benzo(a)pyrene*	*0.0002*	*0.0000029*	*0.0002*	*0.0000071*	*U*	*0.0000073*	*U*	*0.0000071*	*U*	*0.0000071*	*U*	*0.0000073*	*U*	*0.0000071*	*U*	*0.0000071*	*U*	*0.0000072*	*U*
PAHs	Benzo(b)fluoranthene	---	0.000029	0.000029	0.0000061	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000063	U	0.0000061	U	0.000021	B	**0.0000091**	**J**
PAHs	Benzo(g,h,i)perylene	---	---	---	0.0000071	U	0.0000073	U	0.0000071	U	0.0000071	UJ	0.0000073	U	0.0000071	U	0.0000071	U	0.0000072	UJ
PAHs	Benzo(k)fluoranthene	---	0.00029	0.00029	0.0000061	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000062	U
PAHs	Chrysene	---	0.0029	0.0029	0.0000041	U	0.0000042	U	0.000004	U	0.000012	B	0.0000042	U	0.0000041	U	0.0000041	U	0.000012	B
PAHs	*Dibenzo(a,h)anthracene*	*---*	*0.0000029*	*0.0000029*	*0.0000051*	*U*	*0.0000052*	*U*	*0.0000051*	*U*	*0.0000051*	*UJ*	*0.0000052*	*U*	*0.0000051*	*U*	*0.0000051*	*U*	*0.0000052*	*UJ*
PAHs	Fluoranthene	---	1.5	1.5	0.0000051	U	**0.0000094**	**J**	0.0000051	U	**0.0000072**	**J**	0.0000052	U	**0.0000092**	**J**	0.000015	B	**0.0000072**	**J**
PAHs	Fluorene	---	1.5	1.5	0.0000041	U	0.0000042	U	0.000004	U	0.0000041	U	0.0000042	U	0.0000041	U	0.0000041	U	0.0000041	U
PAHs	Indeno(1,2,3-cd)pyrene	---	0.000029	0.000029	0.0000061	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000063	U	0.0000061	U	0.0000061	U	0.0000062	UJ
PAHs	Naphthalene	---	0.00014	0.00014	0.000021	B	0.0000063	U	0.000021	B	0.000021	B	0.000028	B	**0.000013**	**J**	0.000021	B	0.000024	B
PAHs	Phenanthrene	---	---	---	**0.000012**	**J**	**0.0000052**	**J**	0.000015	B	0.0000041	U	0.0000042	U	**0.000015**	**J**	0.000019	B	**0.000017**	
PAHs	Pyrene	---	1.1	1.1	**0.0000083**	**J**	**0.000011**	**J**	0.000004	U	0.000012	B	0.0000042	U	**0.000011**	**J**	0.000012	B	0.000012	B
SVOCs	1,2,4-Trichlorobenzene	0.07	0.0023	0.07	0.000072	U	0.000073	U	NS		NS		0.000071	U	0.000071	U	NS		NS	
SVOCs	*1,2-Diphenylhydrazine*	*---*	*0.000084*	*0.000084*	*0.00019*	*U*	*0.00019*	*U*	NS		NS		*0.00018*	*U*	*0.00018*	*U*	NS		NS	
SVOCs	2,4,5-Trichlorophenol	---	3.7	3.7	0.00081	U	0.00082	U	NS		NS		0.00081	U	0.00081	UJ	NS		NS	
SVOCs	2,4,6-Trichlorophenol	---	0.0061	0.0061	0.00089	U	0.0009	U	NS		NS		0.00088	U	0.00088	UJ	NS		NS	
SVOCs	2,4-Dichlorophenol	---	0.11	0.11	0.00063	U	0.00064	U	NS		NS		0.00062	U	0.00062	UJ	NS		NS	
SVOCs	2,4-Dimethylphenol	---	0.73	0.73	0.0012	U	0.0012	U	NS		NS		0.0012	U	0.0012	UJ	NS		NS	
SVOCs	2,4-Dinitrophenol	---	0.073	0.073	0.0016	U	0.0016	U	NS		NS		0.0016	U	0.0016	UJ	NS		NS	
SVOCs	2,4-Dinitrotoluene	---	0.00022	0.00022	0.0002	U	0.0002	U	NS		NS		0.00019	U	0.00019	U	NS		NS	
SVOCs	2,6-Dinitrotoluene	---	0.037	0.037	0.00012	U	0.00013	U	NS		NS		0.00012	U	0.00012	U	NS		NS	
SVOCs	2-Chloronaphthalene	---	2.9	2.9	0.0001	U	0.0001	U	NS		NS		0.0001	U	0.0001	U	NS		NS	
SVOCs	2-Chlorophenol	---	0.18	0.18	0.0007	U	0.00071	U	NS		NS		0.00069	U	0.00069	UJ	NS		NS	
SVOCs	2-Methylnaphthalene	---	0.15	0.15	0.00012	U	0.0000052	U	NS		NS		0.00012	U	**0.000022**		NS		NS	
SVOCs	2-Methylphenol (o-cresol)	---	---	---	0.0009	U	0.00091	U	NS		NS		0.00089	U	0.00089	UJ	NS		NS	
SVOCs	2-Nitroaniline	---	0.37	0.37	0.00011	U	0.00011	U	NS		NS		0.00011	U	0.00011	U	NS		NS	

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	MW12 Nov-08		MW12 Jan-09		MW12 Apr-09	MW12 Jul-09	MW13 Nov-08		MW13 Jan-09		MW13 Apr-09	MW13 Jul-09
SVOCs	2-Nitrophenol	---	---	---	0.00062	U	0.00063	U	NS	NS	0.00061	U	0.00061	UJ	NS	NS
SVOCs	*3,3'-Dichlorobenzidine*	---	*0.00015*	*0.00015*	*0.0031*	*U*	*0.0031*	*U*	NS	NS	*0.003*	*U*	*0.003*	*U*	NS	NS
SVOCs	3-Nitroaniline	---	---	---	0.00022	U	0.00022	U	NS	NS	0.00021	U	0.00021	U	NS	NS
SVOCs	4,6-Dinitro-2-methylphenol	---	---	---	0.00096	U	0.00097	U	NS	NS	0.00095	U	0.00095	UJ	NS	NS
SVOCs	4-Bromophenyl phenyl ether	---	---	---	0.00015	U	0.00016	U	NS	NS	0.00015	U	0.00015	U	NS	NS
SVOCs	4-Chloro-3-methylphenol	---	---	---	0.0011	U	0.0012	U	NS	NS	0.0011	U	0.0011	UJ	NS	NS
SVOCs	4-Chloroaniline	---	---	---	0.00018	U	0.00018	U	NS	NS	0.00017	U	0.00017	U	NS	NS
SVOCs	4-Chlorophenyl phenyl ether	---	---	---	0.000082	U	0.000083	U	NS	NS	0.000082	U	0.000082	U	NS	NS
SVOCs	4-Methylphenol (m/p-cresol)	---	---	---	0.00069	U	0.0007	U	NS	NS	0.00068	U	0.00068	UJ	NS	NS
SVOCs	4-Nitroaniline	---	0.0034	0.0034	0.00047	UJ	0.00048	U	NS	NS	0.00047	UJ	0.00047	U	NS	NS
SVOCs	4-Nitrophenol	---	---	---	0.00064	UJ	0.00065	U	NS	NS	0.00063	UJ	0.00063	UJ	NS	NS
SVOCs	Aniline	---	0.012	0.012	0.00033	U	0.00033	U	NS	NS	0.00033	U	0.00033	UJ	NS	NS
SVOCs	Benzoic acid	---	150	150	0.012	U	0.012	U	NS	NS	0.012	U	0.012	UJ	NS	NS
SVOCs	Benzyl alcohol	---	3.7	3.7	0.00032	U	0.00032	U	NS	NS	0.00032	U	0.00032	UJ	NS	NS
SVOCs	bis(2-chloroethoxy)methane	---	0.11	0.11	0.000093	U	0.000094	U	NS	NS	0.000092	U	0.000092	U	NS	NS
SVOCs	*bis(2-chloroethyl)ether*	---	*0.000012*	*0.000012*	*0.00021*	*U*	*0.00021*	*U*	NS	NS	*0.0002*	*U*	*0.0002*	*U*	NS	NS
SVOCs	bis(2-chloroisopropyl) ether	---	---	---	0.000093	U	0.000094	U	NS	NS	0.000092	U	0.000092	U	NS	NS
SVOCs	bis(2-ethylhexyl)phthalate	0.006	0.0048	0.006	0.00063	U	**0.0037**		NS	NS	**0.0007**	**J**	0.00062	U	NS	NS
SVOCs	Butylbenzylphthalate	---	0.035	0.035	0.00011	U	0.00011	U	NS	NS	0.00011	U	0.00011	U	NS	NS
SVOCs	Dibenzofuran	---	0.037	0.037	0.000082	U	0.000083	U	NS	NS	0.000082	U	0.000082	U	NS	NS
SVOCs	Diethylphthalate	---	29	29	0.00018	U	0.00018	U	NS	NS	0.001	B	0.00017	U	NS	NS
SVOCs	Dimethylphthalate	---	---	---	0.000093	U	0.000094	U	NS	NS	0.000092	U	0.000092	U	NS	NS
SVOCs	Di-n-butylphthalate	---	---	---	0.00077	U	0.00078	U	NS	NS	0.0026	B	0.00077	U	NS	NS
SVOCs	Di-n-octylphthalate	---	---	---	0.00016	UJ	**0.0006**	**J**	NS	NS	0.00016	UJ	0.00016	U	NS	NS
SVOCs	*Hexachlorobenzene*	*0.001*	*0.000042*	*0.001*	*0.00023*	*U*	*0.00023*	*U*	NS	NS	*0.00022*	*U*	*0.00022*	*U*	NS	NS
SVOCs	Hexachlorobutadiene	---	0.00086	0.00086	0.00031	U	0.00031	U	NS	NS	0.00031	U	0.00031	U	NS	NS
SVOCs	Hexachlorocyclopentadiene	0.05	0.22	0.05	0.00012	U	0.00013	U	NS	NS	0.00012	U	0.00012	U	NS	NS
SVOCs	Hexachloroethane	---	0.0048	0.0048	0.000072	U	0.000073	U	NS	NS	0.000071	U	0.000071	U	NS	NS
SVOCs	Isophorone	---	0.071	0.071	0.00011	U	0.00011	U	NS	NS	0.00011	U	0.00011	U	NS	NS
SVOCs	Nitrobenzene	---	0.00012	0.00012	0.00015	U	0.00016	U	NS	NS	0.00015	U	0.00015	U	NS	NS
SVOCs	*n-Nitrosodimethylamine*	---	*0.00000042*	*0.00000042*	*0.00072*	*U*	*0.00073*	*U*	NS	NS	*0.00071*	*U*	*0.00071*	*U*	NS	NS
SVOCs	*n-Nitroso-di-n-propylamine*	---	*0.0000096*	*0.0000096*	*0.00019*	*U*	*0.00019*	*U*	NS	NS	*0.00018*	*U*	*0.00018*	*U*	NS	NS
SVOCs	n-Nitrosodiphenylamine	---	0.014	0.014	0.0002	U	0.0002	U	NS	NS	0.00019	U	0.00019	U	NS	NS
SVOCs	*Pentachlorophenol*	*0.001*	*0.00056*	*0.001*	*0.00092*	*U*	*0.00093*	*U*	NS	NS	*0.00091*	*U*	*0.00091*	*UJ*	NS	NS
SVOCs	Phenols	---	11.0	11.0	0.00032	U	0.00032	U	NS	NS	0.00032	U	0.00032	UJ	NS	NS
SVOCs	Pyridine	---	0.037	0.037	0.0018	R	0.0018	R	NS	NS	0.0018	UJ	0.0018	R	NS	NS
VOCs	1,1,1-Trichloroethane	0.2	9.1	0.2	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	1,1,2,2-Tetrachloroethane	---	0.000067	0.000067	0.000019	U	0.000019	U	NS	NS	0.000019	U	0.000019	U	NS	NS
VOCs	1,1,2-Trichloroethane	0.005	0.00024	0.005	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	1,1-Dichloroethane	---	0.0024	0.0024	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	1,1-Dichloroethene	0.007	0.34	0.007	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	1,2,3-Trichlorobenzene	---	0.029	0.029	0.00007	U	0.00007	U	NS	NS	0.00007	U	0.00007	U	NS	NS
VOCs	1,2,4-Trichlorobenzene	0.07	0.0023	0.07	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	*1,2-Dibromo-3-chloropropane*	*0.0002*	*0.00000032*	*0.0002*	*0.00005*	*U*	*0.00005*	*U*	NS	NS	*0.00005*	*U*	*0.00005*	*U*	NS	NS
VOCs	*1,2-Dibromoethane (EDB)*	*0.00005*	*0.0000065*	*0.00005*	*0.00005*	*U*	*0.00005*	*U*	NS	NS	*0.00005*	*U*	*0.00005*	*U*	NS	NS
VOCs	1,2-Dichlorobenzene	0.6	0.37	0.6	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	1,2-Dichloroethane	0.005	0.00015	0.005	0.00003	U	0.00003	U	NS	NS	0.00003	U	0.00003	U	NS	NS
VOCs	1,2-Dichloropropane	0.005	0.00039	0.005	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	1,3-Dichlorobenzene	---	---	---	0.000027	U	0.000027	U	NS	NS	0.000027	U	0.000027	U	NS	NS
VOCs	1,4-Dichlorobenzene	0.075	0.00043	0.075	0.00004	U	0.00004	U	NS	NS	0.00004	U	0.00004	U	NS	NS
VOCs	2-Butanone (MEK)	---	7.1	7.1	0.0006	U	0.0006	U	NS	NS	0.0006	U	0.0006	U	NS	NS
VOCs	2-Hexanone	---	0.047	0.047	0.0016	U	0.0016	U	NS	NS	0.0016	U	0.0016	U	NS	NS
VOCs	4-Methyl-2-pentanone (MIBK)	---	2.0	2.0	0.0008	U	0.0008	U	NS	NS	0.0008	U	0.0008	U	NS	NS

TABLE 4-3
Quarterly Groundwater Analytical Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

MethodGroup	Analyte	EPA, MCL mg/L	EPA, Tapwater mg/L	RI Screening Level mg/L	MW12 Nov-08		MW12 Jan-09		MW12 Apr-09	MW12 Jul-09	MW13 Nov-08		MW13 Jan-09		MW13 Apr-09	MW13 Jul-09
VOCs	Acetone	---	22	22	0.0015	U	0.0015	U	NS	NS	0.0052	B	0.0015	U	NS	NS
VOCs	Benzene	0.005	0.00041	0.005	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	Bromochloromethane	---	---	---	0.000028	U	0.000028	U	NS	NS	0.000028	U	0.000028	U	NS	NS
VOCs	Bromodichloromethane	---	0.00012	0.00012	0.00003	U	0.00003	U	NS	NS	0.00003	U	0.00003	U	NS	NS
VOCs	Bromoform	---	0.0085	0.0085	0.00004	U	0.00004	U	NS	NS	0.00004	U	0.00004	U	NS	NS
VOCs	Bromomethane	---	0.0087	0.0087	0.00007	U	0.00007	U	NS	NS	0.00007	U	0.00007	U	NS	NS
VOCs	Carbon disulfide	---	1.0	1.0	0.00009	U	0.00009	U	NS	NS	0.00009	U	0.00009	U	NS	NS
VOCs	Carbon tetrachloride	0.005	0.0002	0.005	0.000022	U	0.000022	U	NS	NS	0.000022	U	0.000022	U	NS	NS
VOCs	Chlorobenzene	0.1	0.091	0.1	0.00004	U	0.00004	U	NS	NS	0.00004	U	0.00004	U	NS	NS
VOCs	Chloroethane	---	---	---	0.00007	U	0.00007	U	NS	NS	0.00007	U	0.00007	U	NS	NS
VOCs	Chloroform	---	0.00019	0.00019	0.000022	U	0.000022	U	NS	NS	0.000022	U	0.000022	U	NS	NS
VOCs	Chloromethane	---	0.19	0.19	0.00031	B	0.00067	B	NS	NS	0.0002	B	0.00047	B	NS	NS
VOCs	cis-1,2-Dichloroethene	0.07	0.37	0.07	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	cis-1,3-Dichloropropene	---	---	---	0.000017	U	0.000017	U	NS	NS	0.000017	U	0.000017	U	NS	NS
VOCs	Dibromochloromethane	---	0.00015	0.00015	0.000026	U	0.000026	U	NS	NS	0.000026	U	0.000026	U	NS	NS
VOCs	Dichlorodifluoromethane	---	0.39	0.39	0.00003	U	0.00003	U	NS	NS	0.00003	U	0.00003	U	NS	NS
VOCs	Ethylbenzene	0.7	0.0015	0.7	0.000024	U	0.000024	U	NS	NS	0.000024	U	0.000024	U	NS	NS
VOCs	Isopropylbenzene	---	---	---	0.00004	U	0.00004	U	NS	NS	0.00004	U	0.00004	U	NS	NS
VOCs	m&p-Xylenes	---	1.2	1.2	0.00008	U	0.00008	U	NS	NS	0.00008	U	0.00008	U	NS	NS
VOCs	Methyl tert-butyl ether (MTBE)	---	0.012	0.012	0.00008	U	0.00008	U	NS	NS	0.00008	U	0.00008	U	NS	NS
VOCs	Methylene chloride	0.005	0.0048	0.005	0.00018	R	0.00018	UJ	NS	NS	0.00018	R	0.00018	UJ	NS	NS
VOCs	o-Xylene	---	1.2	1.2	0.000023	U	0.000023	U	NS	NS	0.000023	U	0.000023	U	NS	NS
VOCs	Styrene	0.1	1.6	0.1	0.000022	U	0.000022	U	NS	NS	0.000022	U	0.000022	UJ	NS	NS
VOCs	Tetrachloroethene	0.005	0.00011	0.005	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	Toluene	1.0	2.3	1.0	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	trans-1,2-Dichloroethene	0.1	0.11	0.1	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	trans-1,3-Dichloropropene	---	---	---	0.000017	U	0.000017	U	NS	NS	0.000017	U	0.000017	U	NS	NS
VOCs	Trichloroethene	0.005	0.002	0.005	0.00005	U	0.00005	U	NS	NS	0.00005	U	0.00005	U	NS	NS
VOCs	Trichlorofluoromethane	---	1.3	1.3	0.00006	U	0.00006	U	NS	NS	0.00006	U	0.00006	U	NS	NS
VOCs	Vinyl chloride	0.002	0.000016	0.002	0.000013	U	0.000013	U	NS	NS	0.000013	U	0.000013	U	NS	NS

EPA Screening values are December 2009 USEPA RSLs
All data presented in milligrams per liter (mg/L)
NS - Not Sampled. VOCs and SVOCs were removed from the sampling program in April 2009
--- - criteria not established
Detections are shown in bold
Exceedances above the minimum screening criteria are shaded
Laboratory method detection limit listed for non-detects
Compounds in italics indicate that the method detection limit is higher than the mimimum screening criteria/ level.
U - Analyte analyzed but not detected
UJ - Analyte analyzed not detected, quantitation limit is estimated
R - Rejected for project use
J - Estimated concentration
B - The analyte was detected in the associated method blank as well as in the samples and therefore, was qualified as non-detect at the concentration measured. The data is italicized because the concentration measured is above the tapwater screening criteria

TABLE 5-1
Chemical and Physical Properties of Representative Chemicals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Chemical	Water Solubility[a] (mg/L)	Vapor Pressure [b] (mm Hg)	Molecular Weight (g/mole)	Specific Gravity	Log K_{ow}	K_{OC} (mL/g)	Henry's Law Constant (atm-m^2/mole)[c]
Organic							
Benzo(a)anthracene	0.0094 @ 24°C	5x10^{-09} @ 20°C	228.29	1.274 @ 20/4 °C	5.61	176,900	0.000012 (UT)
Benzo(b)fluoranthene	0.0015	5.0x10^{-7} @ 20°C	252.3	NA	6.57	589,400	6.57x10^{-7}
Benzo(a)pyrene	0.00162	5.6 x 10^{-9} @ 20°C	252.3	1.351 (UT)	5.98	587,400	4.57 X 10^{-7}
Dibenzo(a,h)anthracene	0.00249	1 x 10^{-10} @ 20°C	278.35	1.282 (UT)	5.97	1,912,000	1.41 X 10^{-7}
indeno(1,2,3-cd)pyrene	0.00019	1.4 x 10^{-10} @ 20°C	276.34	NA	6.54	1,951,000	3.48 X 10^{-7}
Metals							
Antimony	Insoluble	1x10^{00} @886°C	121.75	6.684	NA	NA	NA
Arsenic	Insoluble	1.0x10^{00}@372°C	75	5.727@14°C	NA	NA	NA
Cobalt	Insoluble	3.0x10^{01} @ 2375°C	58.9332	8.9 (UT)	NA	NA	NA
Lead	Insoluble	1.0 mm Hg @ 980 °C	207.2	11.35	NA	NA	NA
Mercury	0.06	1.0x10^{02} @ 260°C	201	13.6@20°C	NA	NA	0.0114

Note:
NA=Not Applicable or Not Available
[a]Water Solubility in mg/L at 25°C, unless otherwise noted
[b]Vapor Pressure in mm Hg at 25°C, unless otherwise noted
[c]Henry's Law Constant in atm-m^3/mole at 25°C, unless otherwise noted
UT= unspecified reference temperature
All data were obtained from U.S. EPA's Regional Screening Levels Chemical-specific Parameters Table (May 2010) and EPA's Soil Screening Guidance: Technical Background Document, July 1996

TABLE 6-1
Summary of Background Concentrations for HHRA
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CAS Number	Analyte	Background value (mg/kg)	Source
7429-90-5	Aluminum	9.99E+03	1
7440-38-2	Arsenic	1.20E+01	2
7440-39-3	Barium	4.69E+02	2
7440-41-7	Beryllium	1.00E+00	2
7440-47-3	Chromium	5.50E+01	2
7440-48-4	Cobalt	1.30E+01	2
7440-50-8	Copper	2.80E+01	2
7439-89-6	Iron	2.20E+04	1
7439-92-1	Lead	2.30E+01	2
7439-96-5	Manganese	4.35E+02	1
7440-02-0	Nickel	2.50E+01	2
7782-49-2	Selenium	6.00E-01	2
7440-62-2	Vanadium	2.34E+01	1
7440-66-6	Zinc	6.90E+01	2
83-32-9	Acenaphthene	2.90E-03	1
120-12-7	Anthracene	5.50E-03	1
100-52-7	Benzaldehyde	2.40E-02	1
56-55-3	Benzo(a)anthracene	7.97E-03	1
50-32-8	Benzo(a)pyrene	7.86E-03	1
205-99-2	Benzo(b)fluoranthene	9.99E-03	1
191-24-2	Benzo(g,h,i)perylene	6.04E-03	1
207-08-9	Benzo(k)fluoranthene	7.28E-03	1
117-81-7	bis(2-Ethylhexyl)phthalate	1.21E-01	1
85-68-7	Butylbenzylphthalate	5.00E-02	1
218-01-9	Chrysene	1.13E-02	1
53-70-3	Dibenz(a,h)anthracene	3.70E-03	1
206-44-0	Fluoranthene	1.51E-02	1
86-73-7	Fluorene	3.40E-03	1
193-39-5	Indeno(1,2,3-cd)pyrene	4.81E-03	1
91-57-6	2-Methylnaphthalene	5.50E-02	1
91-20-3	Naphthalene	7.39E-03	1
85-01-8	Phenanthrene	1.17E-02	1
108-95-2	Phenol	5.20E-02	1
129-00-0	Pyrene	1.46E-02	1
1746-01-6	2,3,7,8-TCDD TEQ	4.57E-06	1

Sources:

[1] Mean detected background concentration for surface soil (0-0.5 feet below ground surface).
Final Remedial Investigation Report for Wilkins Air Force Station, Pioneer Area of Concern (Plexus, 2006).

[2] Mean reported background concentration for Ohio.
Guidance for Developing Ecological Screening Levels (USEPA 2005).

TABLE 6-2
Summary of Data Quantitatively Evaluated in HHRA
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Medium	Date of Sampling	Sample Location	Sample	Beginning Depth (feet bgs)	Ending Depth (feet bgs)	Parameters/Notes
soil and sediment data)	8/29/2000	SB09_SI	SB09_SI	2	3	VOCs, SVOCs, Pest/PCBs
	8/29/2000	SB10_SI	SB10_SI	2	3	VOCs, SVOCs, Pest/PCBs
	8/22/2000	SB11_SI	SB11_SI	2	4	VOCs, SVOCs, Pest/PCBs
	8/22/2000	SB12_SI	SB12_SI	2	4	VOCs, SVOCs, Pest/PCBs
	8/22/2000	SB112_SI	SB12_SI	2	4	SB12_SI Duplicate: VOCs, SVOCs, Pest/PCBs
	8/29/2000	SB13_SI	SB13_SI	2	3	VOCs, SVOCs, Pest/PCBs
	8/22/2000	SS09_SI	SS09_SI	0.8	0.8	VOCs, SVOCs, Pest/PCBs
	8/29/2000	SS10_SI	SS10_SI	0	0.5	VOCs, SVOCs, Pest/PCBs
	8/13/2000	SS15_SI	SS15_SI	0	0.5	VOCs, SVOCs, Pest/PCBs
	8/13/2000	SS16_SI	SS16_SI	0	0.5	VOCs, SVOCs, Pest/PCBs
	10/30/2008	SS-01	SS01-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-02	SS02-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	QC-09-FD	QC-09-103008-FD	0	0.5	SS-02 Duplicate; VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-03	SS03-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-04	SS04-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-05	SS05-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-06	SS06-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-07	SS07-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	QC-08-FD	QC08-103008-FD	0	0.5	SS-07 Duplicate; VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-08	SS08-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-09	SS09-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-10	SS10-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-11	SS11-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-12	SS12-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-13	SS13-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-14	SS14-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/30/2008	SS-15	SS15-103008	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-01	SD01-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-02	SD02-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-03	SD03-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-04	SD04-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals

TABLE 6-2
Summary of Data Quantitatively Evaluated in HHRA
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Medium	Date of Sampling	Sample Location	Sample	Beginning Depth (feet bgs)	Ending Depth (feet bgs)	Parameters/Notes
	10/29/2008	SD-05	SD05-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-06	SD06-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	QC-14-FD	QC14-102908-FD	0	0.5	SD-06 Duplicate; VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-07	SD07-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
	10/29/2008	SD-08	SD08-102908	0	0.5	VOCs, SVOCs, PAHs, and Metals
Groundwater	1/27/2009	MW-11	MW11-012709	--	--	VOCs, SVOCs
	1/27/2009	MW-11	QC03-012709-FD	--	--	VOCs, SVOCs
	7/29/2009	MW-11	MW11-072909	--	--	PAHs, Dissolved Metals
	7/29/2009	MW-11	QC03-072909-FD	--	--	MW-11 Duplicate; PAHs, Dissolved Metals
	1/28/2009	MW-12	MW12-012809	--	--	VOCs, SVOCs
	7/29/2009	MW-12	MW12-072909	--	--	PAHs, Dissolved Metals
	1/27/2009	MW-13	MW13-012709	--	--	VOCs, SVOCs
	7/29/2009	MW-13	MW13-072909	--	--	PAHs, Dissolved Metals

PAHs - Polynuclear aromatic hydrocarbons

Pest/PCBs - Pesticides/polychlorinated biphenyls

SVOCs - Semi-volatile organic constituents

VOCs - Volatile organic constituents

TABLE 6-3
Summary of COPCs
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Surface Soil
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene[1]
Chrysene[1]
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene
n-Nitrosodimethylamine
Aluminum
Arsenic
Chromium
Cobalt
Iron
Manganese
Mercury
Air
Chromium
Surface Soil and Subsuface Soil Combined
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene[1]
Chrysene[1]
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene
n-Nitrosodimethylamine
Aluminum
Antimony
Arsenic
Cadmium
Chromium
Cobalt
Iron
Lead
Manganese
Mercury
Vanadium
Air
Chromium

TABLE 6-3
Summary of COPCs
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Groundwater
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane
1,2-Diphenylhydrazine
3,3'-Dichlorobenzidine
4,6-Dinitro-2-methylphenol
4-Nitrophenol
Benzo(a)anthracene[1]
Benzo(a)pyrene
Benzo(b)fluoranthene[1]
Benzo(k)fluoranthene
bis(2-Chloroethyl)ether
Chrysene
Dibenz(a,h)anthracene[1]
Hexachlorobenzene
Indeno(1,2,3-cd)pyrene[1]
n-Nitrosodimethylamine
n-Nitroso-di-n-propylamine
Arsenic
Chromium
Manganese
Air
1,2-Dibromo-3-chloropropane
1,2-Dibromoethane

Notes:

[1] Chemical not identified as COPC based on maximum concentration, but identified as a COPC since chemical from same class (carcinogenic PAH) identified as a COPC.

[2] Non-detect chemical that was not identified as COPC based on maximum concentration, but identified as a COPC based on half the reporting limit.

TABLE 6-4
Summary of RME Cancer Risks and Hazard Indices
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
Current/Future Industrial Worker	Surface Soil	Ingestion	9.4E-06			n-Nitrosodimethylamine, Arsenic	4.7E-01	
		Dermal Contact	3.8E-06			n-Nitrosodimethylamine, Arsenic	2.8E-02	
		Inhalation	6.2E-08				2.1E-05	
	All Media	Total	1.3E-05			n-Nitrosodimethylamine, Arsenic	5.0E-01	
Current/Future Tespasser/Visitor Adult	Surface Soil	Ingestion	1.3E-06				6.5E-02	
		Dermal Contact	5.1E-07				4.0E-03	
		Inhalation	2.1E-09				7.3E-07	
	All Media	Total	1.8E-06				6.9E-02	
Current/Future Trespasser/Visitor Youth	Surface Soil	Ingestion	1.6E-06				2.0E-01	
		Dermal Contact	4.1E-07				7.7E-03	
		Inhalation	8.7E-10				7.3E-07	
	All Media	Total	2.0E-06			Arsenic	2.1E-01	
Future Resident Adult	Surface Soil	Ingestion	NA				6.5E-01	
		Dermal Contact	NA				2.4E-02	
		Inhalation	NA				8.7E-05	
	All Media	Total	NA				6.8E-01	
Future Resident Child	Surface Soil	Ingestion	NA				6.1E+00	Cobalt
		Dermal Contact	NA				1.6E-01	
		Inhalation	NA				8.7E-05	
	All Media	Total	NA				6.3E+00	Cobalt
Future Resident Child/Adult	Surface Soil	Ingestion	4.2E-05		n-Nitrosodimethylamine, Arsenic	Benzo(a)pyrene	NA	

TABLE 6-4
Summary of RME Cancer Risks and Hazard Indices
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
		Dermal Contact	8.2E-06			Benzo(a)pyrene, n-Nitrosodimethylamine, Arsenic	NA	
		Inhalation	3.1E-07				NA	
	All Media	Total	5.0E-05		n-Nitrosodimethylamine, Arsenic	Benzo(a)pyrene	NA	
Future Resident Adult	Soil*	Ingestion	NA				6.6E-01	
		Dermal Contact	NA				3.1E-02	
		Inhalation	NA				2.3E-04	
	All Media	Total	NA				6.9E-01	
Future Resident Child	Soil*	Ingestion	NA				6.1E+00	Cobalt
		Dermal Contact	NA				2.0E-01	
		Inhalation	NA				2.3E-04	
		Total	NA				6.3E+00	Cobalt

TABLE 6-4
Summary of RME Cancer Risks and Hazard Indices
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
Future Resident Child/Adult	Soil*	Ingestion	5.0E-05		n-Nitrosodimethylamine, Arsenic	Benzo(a)pyrene, Dibenz(a,h)anthracene	NA	
		Dermal Contact	1.1E-05			Benzo(a)pyrene, n-Nitrosodimethylamine, Arsenic	NA	
		Inhalation	8.4E-07				NA	
	All Media	Total	6.2E-05		n-Nitrosodimethylamine, Arsenic	Benzo(a)pyrene	NA	
Future Construction Worker	Soil*	Ingestion	1.5E-06				8.3E-02	
		Dermal Contact	3.0E-07				2.5E-04	
		Inhalation	6.6E-09				5.5E-05	
		Total	1.8E-06				8.3E-02	
	Groundwater	Ingestion	NA				NA	
		Dermal Contact	6.6E-07				2.3E-08	
		Inhalation	3.2E-11				3.6E-12	
		Total	6.6E-07				2.3E-08	
	All Media	Total	2.4E-06				8.3E-02	

Soil* - surface soil and subsurface soil combined.
NA = Not available/not applicable

TABLE 7-1
Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Survival, growth, and reproduction of terrestrial soil invertebrate communities	Are site-related constituent concentrations in surface soils sufficient to adversely affect soil invertebrate communities?	Comparison of constituent concentrations in surface soils with soil screening values	Soil invertebrates (earthworms)
Survival, growth, and reproduction of terrestrial plant communities	Are site-related constituent concentrations in surface soils sufficient to adversely affect terrestrial plant communities?	Comparison of constituent concentrations in surface soils with soil screening values	Terrestrial plants
Survival, growth, and reproduction of avian terrestrial hervivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume terrestrial plants and soil invertebrates from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Mourning dove
Survival, growth, and reproduction of avian terrestrial insectivore/omnivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume terrestrial plants and soil invertebrates from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	American robin
Survival, growth, and reproduction of avian terrestrial carnivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume small mammals from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Red-tailed hawk
Survival, growth, and reproduction of mammalian terrestrial herbivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume soil invertebrates from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Deer mouse
Survival, growth, and reproduction of mammalian terrestrial invertivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume soil invertebrates from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Short-tailed Shrew
Survival, growth, and reproduction of mammalian terrestrial carnivore populations	Are site-related constituent concentrations in surface soils sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume terrestrial plants and soil invertebrates from the site?	Comparison of modeled dietary intakes using surface soil concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Red fox

TABLE 7-2
Comparison of Surface Soil Concentrations to Background Concentrations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Inorganic Chemical Detected in Surface Soil	Maximum Detected Concentration (mg/kg)	Background Concentration[1,2] (mg/kg)	Ratio of Maximum Detected Soil Concentrations to Background
Aluminum	12,600	9990	**1.3**
Antimony	1	NA	**--**
Arsenic	17	12	**1.4**
Barium	150	469	0.3
Beryllium	1	1	**1.3**
Cadmium	2	NA	**--**
Calcium[3]	246,000	NA	**--**
Chromium, total	17	55	0.3
Cobalt	229	13	**17.6**
Copper	52	28	**1.9**
Iron	25,100	22000	**1.1**
Lead	57	23	**2.5**
Magnesium[3]	66,100	NA	**--**
Manganese	1,310	435	**3.0**
Mercury	6	NA	**--**
Nickel	27	25	**1.1**
Potassium[3]	2,100	NA	**--**
Selenium	1	0.6	**2.0**
Silver	1	NA	**--**
Sodium[3]	255	NA	**--**
Thallium	273	NA	**--**
Vanadium	29	23.4	**1.3**
Zinc	146	69	**2.1**

[1] For aluminum, iron, manganese, and vanadium, used mean reported background concentration for Ohio. *Guidance for Developing Ecological Screening Levels* (USEPA 2005a).

[2] For arsenic, barium, beryllium, chromium, cobalt, copper, lead, nickel, selenium, and zinc, used mean detected background concentration for surface soil (0-0.5 feet below ground surface). *Final Remedial Investigation Report for Wilkins Air Force Station, Pioneer Area of Concern* (Plexus 2006).

[3] Macronutrient: Not considered to be a constituent of potential concern.

Notes:
NA = not available.

TABLE 7-3
Soil Screening Values -- Direct Exposure
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Inorganics (mg/kg)		
Aluminum	50.0	Efroymson et al., 1997c; microbe benchmark
Antimony	78.0	USEPA 2005b
Arsenic	18.0	USEPA 2005c
Barium	330	USEPA 2005d
Beryllium	40.0	USEPA 2005e
Cadmium	32.0	USEPA 2005f
Calcium	NSV	--
Chromium, total	0.40	Efroymson et al. 1997b
Cobalt	13.0	USEPA 2005g
Copper	70.0	USEPA 2007b
Cyanide	1.3	EPA Region 5, 2003; ESL based on meadow vole
Iron	NSV	--
Lead	120	USEPA 2005h
Magnesium	NSV	--
Manganese	220	USEPA 2007c
Mercury	0.10	Efroymson et al. 1997b
Nickel	38.00	USEPA 2007d
Potassium	NSV	--
Selenium	0.52	USEPA 2007e
Silver	560	USEPA 2006
Sodium	NSV	--
Thallium	1.00	Efroymson et al. 1997c
Vanadium	2.00	Efroymson et al. 1997c
Zinc	120	USEPA 2007f
Pesticide/Polychlorinated Biphenyls (mg/kg)		
Aldrin	0.0033	EPA Region 5, 2003; ESL based on masked shrew
Chlordane	0.22	EPA Region 5, 2003; ESL for total chlordane based on plant exposure
DDD, p,p'-	0.76	EPA Region 5, 2003; ESL based on masked shrew
DDE, p,p'-	0.60	EPA Region 5, 2003; ESL based on masked shrew
DDT, p,p'-	0.0035	EPA Region 5, 2003; ESL based on masked shrew
Dieldrin	0.0024	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan A	0.12	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan B	0.12	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan sulfate	0.036	EPA Region 5, 2003; ESL based on masked shrew
Endrin	0.010	EPA Region 5, 2003; ESL based on masked shrew
Endrin aldehyde	0.011	EPA Region 5, 2003; ESL based on masked shrew
Endrin ketone	NSV	--
Heptachlor	0.0060	EPA Region 5, 2003; ESL based on masked shrew
Heptachlor epoxide	0.15	EPA Region 5, 2003; ESL based on masked shrew
Hexachlorocyclohexane, alpha-	NSV	--
Hexachlorocyclohexane, beta-	NSV	--
Hexachlorocyclohexane, delta-	NSV	--
Hexachlorocyclohexane, gamma- (Lindane)	NSV	--
Methoxychlor	0.020	EPA Region 5, 2003; ESL based on masked shrew
PCB 1016	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1221	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1232	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1242	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1248	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1254	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
PCB 1260	0.037	Efroymson et al., 1997b; shrew NOAEL-based PRG for total PCBs
Toxaphene	0.12	EPA Region 5, 2003; ESL based on masked shrew
Semivolatile Organic Compounds (mg/kg)		
Acenaphthene	20.0	Efroymson et al., 1997b; plant benchmark
Acenaphthylene	682	EPA Region 5, 2003; ESL based on masked shrew
Aniline	0.057	EPA Region 5, 2003; ESL based on meadow vole
Anthracene	1,480	EPA Region 5, 2003; ESL based on masked shrew

TABLE 7-3
Soil Screening Values -- Direct Exposure
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Benz(a)anthracene	5.21	EPA Region 5, 2003; ESL based on masked shrew
Benzo(a)pyrene	1.52	EPA Region 5, 2003; ESL based on masked shrew
Benzo(b)fluoranthene	59.8	EPA Region 5, 2003; ESL based on masked shrew
Benzo(ghi)perylene	119	EPA Region 5, 2003; ESL based on masked shrew
Benzo(k)fluoranthene	148	EPA Region 5, 2003; ESL based on masked shrew
Benzoic acid	NSV	--
Benzyl alcohol	NSV	--
Bis(2-chloroethoxy) methane	0.30	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-chloroethyl) ether	23.7	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-chloroisopropyl) ether	19.4	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-ethylhexyl) phthalate	0.93	EPA Region 5, 2003; ESL based on masked shrew
Bromophenyl phenyl ether, 4-	NSV	--
Butylbenzyl phthalate	NSV	--
Carbazole	NSV	--
Chloroaniline, 4-	20.0	Efroymson et al., 1997b; Plant PRG for 3-Chloroaniline
Chloronaphthalene, 2-	NSV	--
Chlorophenol, 2-	7.00	Efroymson et al., 1997b; Earthworm PRG for 2-chlorophenol
Chlorophenyl phenyl ether, 4-	NSV	--
Chrysene	4.73	EPA Region 5, 2003; ESL based on masked shrew
Dibenz(ah)anthracene	18.4	EPA Region 5, 2003; ESL based on masked shrew
Dibenzofuran	NSV	--
Dichlorobenzene, 1,2-	20.0	Efroymson et al., 1997b; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzene, 1,3-	20.0	Efroymson et al., 1997b; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzene, 1,4-	20.0	Efroymson et al., 1997b; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzidine, 3,3'-	0.65	--
Dichlorophenol, 2,4-	20.0	Efroymson et al., 1997b; Earthworm, plant PRG for 3,4-dichlorophenol
Diethylene glycol, monobutyl ether	NSV	--
Diethyl phthalate	100	Efroymson et al., 1997b; Plant PRG
Dimethyl phthalate	734	EPA Region 5, 2003; ESL based on masked shrew
Dimethylphenol, 2,4-	0.010	EPA Region 5, 2003; ESL based on masked shrew
Diphenylhydrazine, 1,2-	NSV	--
Di-n-butyl phthalate	0.15	EPA Region 5, 2003; ESL based on masked shrew
Dinitro-2-methylphenol, 4,6-	NSV	--
Dinitrophenol, 2,4-	20.0	Efroymson et al., 1997b; Plant PRG
Dinitrotoluene, 2,4-	1.28	EPA Region 5, 2003; ESL for total chlordane based on plant exposure
Dinitrotoluene, 2,6-	0.033	EPA Region 5, 2003; ESL for total chlordane based on plant exposure
Di-n-octyl phthalate	NSV	--
Fluoranthene	122	EPA Region 5, 2003; ESL based on masked shrew
Fluorene	30.0	Efroymson et al., 1997c; earthworm benchmark
Hexachlorobenzene	NSV	--
Hexachlorobutadiene	NSV	--
Hexachlorocyclopentadiene	NSV	--
Hexachloroethane	NSV	--
Indeno(1,2,3-cd)pyrene	109	EPA Region 5, 2003; ESL based on masked shrew
Isophorone	NSV	--
Methylnaphthalene, 2-	3.24	EPA Region 5, 2003; ESL based on masked shrew
Methylphenol, 2-	NSV	--
Methylphenol, 4-	NSV	--
Methylphenol, 4-chloro-3-	NSV	--
Naphthalene	0.099	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 2-	74.1	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 3-	3.16	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 4-	21.9	EPA Region 5, 2003; ESL based on masked shrew
Nitrobenzene	1.31	EPA Region 5, 2003; ESL for total chlordane based on plant exposure
Nitrophenol, 2-	1.60	EPA Region 5, 2003; ESL based on masked shrew
Nitrophenol, 4-	7.00	Efroymson et al., 1997b; Earthworm PRG
Nitrosodimethylamine, N-	0.000032	EPA Region 5, 2003; ESL based on meadow vole
Nitrosodi-N-propylamine, N-	NSV	--

TABLE 7-3
Soil Screening Values -- Direct Exposure
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Nitrosodiphenylamine, N-	0.55	EPA Region 5, 2003; ESL based on masked shrew
Pentachlorophenol	3.00	Efroymson et al., 1997b; Plant PRG
Phenanthrene	45.7	EPA Region 5, 2003; ESL based on masked shrew
Phenol	30.0	Efroymson et al., 1997b; Earthworm PRG
Pyrene	45.7	EPA Region 5, 2003; ESL based on masked shrew
Trichlorobenzene, 1,2,3-	20.0	Efroymson et al., 1997b; Earthworm PRG
Trichlorobenzene, 1,2,4-	20.0	Efroymson et al., 1997b; Earthworm PRG
Trichlorophenol, 2,4,5-	9.00	Efroymson et al., 1997b; Earthworm PRG
Trichlorophenol, 2,4,6-	4.00	Efroymson et al., 1997b; Plant PRG
Total Low Molecular Weight PAHs	29	USEPA 2007f
Total High Molecular Weight PAHs	18	USEPA 2007f
Volatile Organic Compounds (MG/KG)		
Acetone	2.50	EPA Region 5, 2003; ESL based on masked shrew
Benzene	0.26	EPA Region 5, 2003; ESL based on masked shrew
Bromochloromethane	NSV	--
Bromodichloromethane	0.54	EPA Region 5, 2003; ESL based on masked shrew
Bromoform	15.9	EPA Region 5, 2003; ESL based on masked shrew
Bromomethane	NSV	--
Carbon disulfide	0.094	EPA Region 5, 2003; ESL based on masked shrew
Carbon tetrachloride	2.98	EPA Region 5, 2003; ESL based on masked shrew
Chlorobenzene	40.0	Efroymson et al., 1997a; Earthworm PRG
Chloroethane	NSV	--
Chloroform	1.19	EPA Region 5, 2003; ESL based on masked shrew
Chloromethane	NSV	--
Chlorotoluene, 2-	NSV	--
Chlorotoluene, 4-	NSV	--
Dibromochloromethane	2.05	EPA Region 5, 2003; ESL based on masked shrew
Dibromochloropropane	0.035	EPA Region 5, 2003; ESL based on masked shrew
Dichlorodifluoromethane	39.5	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethane, 1,1-	20.1	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethane, 1,2-	21.2	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethene, 1,1-	8.28	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethene, 1,2-, cis-	0.78	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloroethene (trans) used as surrogate)
Dichloroethene, 1,2-, trans-	0.78	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethenes, 1,2-, total	NSV	--
Dichloropropane, 1,2-	32.7	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropane, 1,3-	32.7	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropane, 2,2-	32.7	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropene, 1,1-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropene, 1,3-, cis-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropene, 1,3-, trans-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Ethylbenzene	5.16	EPA Region 5, 2003; ESL based on masked shrew
Ethylene dibromide	NSV	--
Isopropylbenzene	NSV	--
Isopropyltoluene, 4-	NSV	--
Methyl ethyl ketone	89.6	EPA Region 5, 2003; ESL based on masked shrew
Methyl isobutyl ketone	NSV	--
Methyl n-butyl ketone	NSV	--
Methyl tert-butyl ether	NSV	--
Methylene bromide	65.0	EPA Region 5, 2003; ESL based on masked shrew
Methylene chloride	4.05	EPA Region 5, 2003; ESL based on masked shrew
Propylbenzene, 1-	NSV	--
Styrene	4.69	EPA Region 5, 2003; ESL based on masked shrew
Tetrachloroethane, 1,1,1,2-	0.13	EPA Region 5, 2003; ESL based on masked shrew
Tetrachloroethane, 1,1,2,2-	0.13	EPA Region 5, 2003; ESL based on masked shrew

TABLE 7-3
Soil Screening Values -- Direct Exposure
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Tetrachloroethene	9.92	EPA Region 5, 2003; ESL based on masked shrew
Toluene	5.45	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethane, 1,1,1-	29.8	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethane, 1,1,2-	28.6	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethene	12.4	EPA Region 5, 2003; ESL based on masked shrew
Trichlorofluoromethane	16.4	EPA Region 5, 2003; ESL based on masked shrew
Trichloropropane, 1,2,3-	3.36	EPA Region 5, 2003; ESL based on masked shrew
Trimethylbenzene, 1,2,4-	NSV	--
Trimethylbenzene, 1,3,5-	NSV	--
Vinyl chloride	0.65	EPA Region 5, 2003; ESL based on masked shrew
Xylene, 1,2-	NSV	--
Xylene, 1,3- and/or 1,4-	NSV	--
Xylenes, total	10.0	EPA Region 5, 2003; ESL based on masked shrew
Dioxin/Furans (mg/kg)		
TCDD-TEQ	3.15E-07	Efroymson et al., 1997b; shrew NOAEL-based PRG

Notes:
[1] See Section 9 of the text for complete reference citation.

TABLE 7-4
Soil Screening Values -- Food Web Exposures
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Inorganics (mg/kg)		
Aluminum	NSV	--
Antimony	0.27	USEPA 2005b
Arsenic	18.0	USEPA 2005c
Beryllium	21.0	USEPA 2005e
Cadmium	0.36	USEPA 2005f
Calcium	NSV	--
Cobalt	120	USEPA 2005g
Copper	28.0	USEPA 2007b
Cyanide	NSV	--
Iron	NSV	--
Lead	11.0	USEPA 2005h
Magnesium	NSV	--
Manganese	4,000	USEPA 2007c
Mercury	0.10	EPA Region 5, 2003; ESL
Nickel	130.00	USEPA 2007d
Potassium	NSV	--
Selenium	0.63	USEPA 2007e
Silver	4.20	USEPA 2006
Sodium	NSV	--
Thallium	0.057	EPA Region 5, 2003; ESL
Vanadium	7.800	USEPA 2005
Zinc	46.0	USEPA 2007f
Pesticide/Polychlorinated Biphenyls (mg/kg)		
Aldrin	0.0033	EPA Region 5, 2003; ESL
Chlordane	0.22	EPA Region 5, 2003; ESL for total chlordane based on plant exposure
DDD, p,p'-	0.76	EPA Region 5, 2003; ESL based on masked shrew
DDE, p,p'-	0.60	EPA Region 5, 2003; ESL based on masked shrew
DDT, p,p'-	0.0035	EPA Region 5, 2003; ESL based on masked shrew
Dieldrin	0.0024	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan A	0.12	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan B	0.12	EPA Region 5, 2003; ESL based on masked shrew
Endosulfan sulfate	0.036	EPA Region 5, 2003; ESL based on masked shrew
Endrin	0.010	EPA Region 5, 2003; ESL based on masked shrew
Endrin aldehyde	0.011	EPA Region 5, 2003; ESL based on masked shrew
Endrin ketone	NSV	--
Heptachlor	0.0060	EPA Region 5, 2003; ESL based on masked shrew
Heptachlor epoxide	0.15	
Hexachlorocyclohexane, alpha-	NSV	--
Hexachlorocyclohexane, beta-	NSV	--
Hexachlorocyclohexane, delta-	NSV	--
Hexachlorocyclohexane, gamma- (Lindan	NSV	--
Methoxychlor	0.020	EPA Region 5, 2003; ESL based on masked shrew
PCB 1016	0.00033	EPA Region 5, 2003; ESL based on masked shrew
PCB 1221	0.00033	EPA Region 5, 2003; ESL based on masked shrew
PCB 1232	0.00033	EPA Region 5, 2003; ESL based on masked shrew
PCB 1242	0.00033	EPA Region 5, 2003; ESL based on masked shrew
PCB 1248	0.00033	EPA Region 5, 2003; ESL based on masked shrew

TABLE 7-4
Soil Screening Values -- Food Web Exposures
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
PCB 1254	0.00033	EPA Region 5, 2003; ESL based on masked shrew
PCB 1260	0.00033	EPA Region 5, 2003; ESL based on masked shrew
Toxaphene	0.12	EPA Region 5, 2003; ESL based on masked shrew
Semivolatile Organic Compounds (mg/kg)		
Acenaphthene	682	EPA Region 5, 2003; ESL based on masked shrew
Acenaphthylene	682	EPA Region 5, 2003; ESL based on masked shrew
Anthracene	1,480	EPA Region 5, 2003; ESL based on masked shrew
Aniline	0.057	EPA Region 5, 2003; ESL based on meadow vole
Benz(a)anthracene	5.21	EPA Region 5, 2003; ESL based on masked shrew
Benzo(a)pyrene	1.52	EPA Region 5, 2003; ESL based on masked shrew
Benzo(b)fluoranthene	59.8	EPA Region 5, 2003; ESL based on masked shrew
Benzo(ghi)perylene	119	EPA Region 5, 2003; ESL based on masked shrew
Benzo(k)fluoranthene	148	EPA Region 5, 2003; ESL based on masked shrew
Benzoic acid	NSV	--
Benzyl alcohol	NSV	--
Bis(2-chloroethoxy) methane	0.30	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-chloroethyl) ether	23.7	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-chloroisopropyl) ether	19.4	EPA Region 5, 2003; ESL based on masked shrew
Bis(2-ethylhexyl) phthalate	0.93	EPA Region 5, 2003; ESL based on masked shrew
Bromophenyl phenyl ether, 4-	NSV	--
Butylbenzyl phthalate	NSV	--
Carbazole	NSV	--
Chloroaniline, 4-	1.10	EPA Region 5, 2003; ESL based on masked shrew
Chloronaphthalene, 2-	0.012	EPA Region 5, 2003; ESL based on masked shrew
Chlorophenol, 2-	0.24	EPA Region 5, 2003; ESL based on masked shrew
Chlorophenyl phenyl ether, 4-	NSV	--
Chrysene	4.73	EPA Region 5, 2003; ESL based on masked shrew
Dibenz(ah)anthracene	18.4	EPA Region 5, 2003; ESL based on masked shrew
Dibenzofuran	NSV	--
Dichlorobenzene, 1,2-	2.96	EPA Region 5, 2003; ESL based on masked shrew
Dichlorobenzene, 1,3-	37.7	EPA Region 5, 2003; ESL based on masked shrew
Dichlorobenzene, 1,4-	0.55	EPA Region 5, 2003; ESL based on masked shrew
Dichlorobenzidine, 3,3'-	0.65	EPA Region 5, 2003; ESL based on masked shrew
Dichlorophenol, 2,4-	87.5	EPA Region 5, 2003; ESL based on masked shrew
Diethylene glycol, monobutyl ether	NSV	--
Diethyl phthalate	24.8	EPA Region 5, 2003; ESL based on masked shrew
Dimethyl phthalate	734	EPA Region 5, 2003; ESL based on masked shrew
Dimethylphenol, 2,4-	0.010	EPA Region 5, 2003; ESL based on masked shrew
Di-n-butyl phthalate	0.15	EPA Region 5, 2003; ESL based on masked shrew
Dinitro-2-methylphenol, 4,6-	NSV	--
Dinitrophenol, 2,4-	0.069	EPA Region 5, 2003; ESL based on masked shrew
Diphenylhydrazine, 1,2-		
Dinitrotoluene, 2,4-	1.28	EPA Region 5, 2003; ESL based on masked shrew
Dinitrotoluene, 2,6-	0.033	EPA Region 5, 2003; ESL based on masked shrew
Di-n-octyl phthalate	NSV	--
Diphenylhydrazine, 1,2-	NSV	--
Fluoranthene	122	EPA Region 5, 2003; ESL based on masked shrew
Fluorene	122	EPA Region 5, 2003; ESL based on masked shrew
Hexachlorobenzene	0.20	EPA Region 5, 2003; ESL based on masked shrew

TABLE 7-4
Soil Screening Values -- Food Web Exposures
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Hexachlorobutadiene	NSV	--
Hexachlorocyclopentadiene	NSV	--
Hexachloroethane	NSV	--
Indeno(1,2,3-cd)pyrene	109	EPA Region 5, 2003; ESL based on masked shrew
Isophorone	NSV	--
Methylnaphthalene, 2-	3.24	EPA Region 5, 2003; ESL based on masked shrew
Methylphenol, 2-	NSV	--
Methylphenol, 4-	NSV	--
Methylphenol, 4-chloro-3-	NSV	--
Naphthalene	0.099	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 2-	74.1	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 3-	3.16	EPA Region 5, 2003; ESL based on masked shrew
Nitroaniline, 4-	21.9	EPA Region 5, 2003; ESL based on masked shrew
Nitrobenzene	1.31	EPA Region 5, 2003; ESL based on masked shrew
Nitrophenol, 2-	1.60	EPA Region 5, 2003; ESL based on masked shrew (2-nitrophenol used as surrogate)
Nitrophenol, 4-	1.60	EPA Region 5, 2003; ESL based on masked shrew
Nitrosodimethylamine, N	0.000032	EPA Region 5, 2003; ESL based on meadow vole
Nitrosodi-N-propylamine, N-	NSV	--
Nitrosodiphenylamine, N-	0.55	EPA Region 5, 2003; ESL based on masked shrew
Pentachlorophenol	0.12	EPA Region 5, 2003; ESL based on masked shrew
Phenanthrene	45.7	EPA Region 5, 2003; ESL based on masked shrew
Phenol	1,200	EPA Region 5, 2003; ESL based on masked shrew
Pyrene	45.7	EPA Region 5, 2003; ESL based on masked shrew
Trichlorobenzene, 1,2,3-	11.1	EPA Region 5, 2003; ESL based on masked shrew (1,2,4-Trichlorobenzene used as surrogate
Trichlorobenzene, 1,2,4-	11.1	EPA Region 5, 2003; ESL based on masked shrew
Trichlorophenol, 2,4,5-	14.1	EPA Region 5, 2003; ESL based on masked shrew
Trichlorophenol, 2,4,6-	9.94	EPA Region 5, 2003; ESL based on masked shrew
Total Low Molecular Weight PAHs	100	USEPA 2007e
Total High Molecular Weight PAHs	1.1	USEPA 2007e
Volatile Organic Compounds (mg/kg)		
Acetone	2.50	EPA Region 5, 2003; ESL based on masked shrew
Benzene	0.26	EPA Region 5, 2003; ESL based on masked shrew
Bromochloromethane	NSV	--
Bromodichloromethane	0.54	EPA Region 5, 2003; ESL based on masked shrew
Bromoform	15.9	EPA Region 5, 2003; ESL based on masked shrew
Bromomethane	NSV	--
Carbon disulfide	0.094	EPA Region 5, 2003; ESL based on masked shrew
Carbon tetrachloride	2.98	EPA Region 5, 2003; ESL based on masked shrew
Chlorobenzene	13.1	EPA Region 5, 2003; ESL based on masked shrew
Chloroethane	NSV	--
Chloroform	1.19	EPA Region 5, 2003; ESL based on masked shrew
Chloromethane	NSV	--
Chlorotoluene, 2-	NSV	--
Chlorotoluene, 4-	NSV	--
Dibromochloromethane	2.05	EPA Region 5, 2003; ESL based on masked shrew
Dibromochloropropane	0.035	EPA Region 5, 2003; ESL based on masked shrew
Dichlorodifluoromethane	39.5	EPA Region 5, 2003; ESL based on masked shrew

TABLE 7-4
Soil Screening Values -- Food Web Exposures
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Analyte Name	Screening Value	Reference[1]
Dichloroethane, 1,1-	20.1	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethane, 1,2-	21.2	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethene, 1,1-	8.28	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethene, 1,2-, cis-	0.78	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloroethene (trans) used as surrogate)
Dichloroethene, 1,2-, trans-	0.78	EPA Region 5, 2003; ESL based on masked shrew
Dichloroethenes, 1,2-, total	NSV	--
Dichloropropane, 1,2-	32.7	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropane, 1,3-	32.7	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropane, 2,2-	32.7	EPA Region 5, 2003; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropene, 1,1-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropene, 1,3-, cis-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Dichloropropene, 1,3-, trans-	0.40	EPA Region 5, 2003; ESL based on masked shrew
Ethylbenzene	5.16	EPA Region 5, 2003; ESL based on masked shrew
Ethylene dibromide	NSV	--
Isopropylbenzene	NSV	--
Isopropyltoluene, 4-	NSV	--
Methyl ethyl ketone	89.6	EPA Region 5, 2003; ESL based on masked shrew
Methyl isobutyl ketone	NSV	--
Methyl n-butyl ketone	NSV	--
Methyl tert-butyl ether	NSV	--
Methylene bromide	65.0	EPA Region 5, 2003; ESL based on masked shrew
Methylene chloride	4.05	EPA Region 5, 2003; ESL based on masked shrew
Propylbenzene, 1-	NSV	--
Styrene	4.69	EPA Region 5, 2003; ESL based on masked shrew
Tetrachloroethane, 1,1,1,2-	0.13	EPA Region 5, 2003; ESL based on masked shrew
Tetrachloroethane, 1,1,2,2-	0.13	EPA Region 5, 2003; ESL based on masked shrew
Tetrachloroethene	9.92	EPA Region 5, 2003; ESL based on masked shrew
Toluene	5.45	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethane, 1,1,1-	29.8	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethane, 1,1,2-	28.6	EPA Region 5, 2003; ESL based on masked shrew
Trichloroethene	12.4	EPA Region 5, 2003; ESL based on masked shrew
Trichlorofluoromethane	16.4	EPA Region 5, 2003; ESL based on masked shrew
Trichloropropane, 1,2,3-	3.36	EPA Region 5, 2003; ESL based on masked shrew
Trimethylbenzene, 1,2,4-	NSV	--
Trimethylbenzene, 1,3,5-	NSV	--
Vinyl chloride	0.65	EPA Region 5, 2003; ESL based on masked shrew
Xylene, 1,2-	NSV	--
Xylene, 1,3- and/or 1,4-	NSV	--
Xylenes, total	10.0	EPA Region 5, 2003; ESL based on masked shrew

Notes:
[1] See Section 9 of the text for complete reference citation.

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (mg/kg)							
Aluminum	-- - --	27 / 27	12,600	SD06-102908	50.0	27 / 27	**252**
Antimony	0.18 - 12.0	10 / 27	0.91	SS16_SI	78.0	0 / 27	< 1
Arsenic	-- - --	27 / 27	17.0	SS16_SI	18.0	0 / 27	< 1
Beryllium	0.0041 - 0.51	22 / 27	1.30	SS12-103008	40.0	0 / 27	< 1
Cadmium	0.43 - 2.30	24 / 27	1.90	SS03-103008	32.0	0 / 27	< 1
Calcium [2]	-- - --	27 / 27	246,000	SS02-103008	NSV	-- / --	NSV
Cobalt	5.20 - 5.20	26 / 27	229	SS04-103008	13.0	3 / 27	**18**
Copper	-- - --	27 / 27	52.0	SS16_SI	70.0	0 / 27	< 1
Iron	-- - --	27 / 27	25,100	SS07-103008	NSV	-- / --	NSV
Lead	-- - --	27 / 27	57.0	SD01-102908	120	0 / 27	< 1
Magnesium [2]	-- - --	27 / 27	66,100	SS02-103008	NSV	-- / --	NSV
Manganese	-- - --	27 / 27	1,310	SS07-103008	220	17 / 27	**6**
Mercury	0.050 - 0.050	26 / 27	6.10	SS09_SI	0.10	19 / 27	**61**
Nickel	-- - --	27 / 27	27.2	SD05-102908	38.0	0 / 27	< 1
Potassium [2]	-- - --	27 / 27	2,100	SS10_SI	NSV	-- / --	NSV
Selenium	0.41 - 34.0	12 / 27	1.20	SS07-103008	0.52	10 / 27	**2**
Silver	0.031 - 2.30	12 / 27	0.86	SD01-102908	560	0 / 27	< 1
Sodium [2]	71.0 - 580	23 / 27	255	SS11-103008	NSV	-- / --	NSV
Thallium	0.54 - 250	8 / 27	273	SS09-103008	1.00	8 / 27	**273**
Vanadium	-- - --	27 / 27	29.3	SD05-102908	2.00	27 / 27	**15**
Zinc	-- - --	27 / 27	146	SS07-103008	120	2 / 27	**1**
Pesticide/Polychlorinated Biphenyls (mg/kg)							
DDD, p,p'-	0.020 - 0.19	1 / 4	0.0090	SS16_SI	0.76	0 / 4	< 1
DDE, p,p'-	0.020 - 0.19	1 / 4	0.023	SS16_SI	0.60	0 / 4	< 1
DDT, p,p'-	0.020 - 0.039	2 / 4	0.019	SS10_SI	0.0035	2 / 4	**5**
Hexachlorocyclohexane, beta-	0.020 - 0.19	1 / 4	0.0035	SS09_SI	NSV	-- / --	NSV

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (mg/kg)							
Methylnaphthalene, 2-	0.020 - 0.38	10 / 27	0.70	SS16_SI	3.24	0 / 27	< 1
Benzoic acid	0.30 - 0.36	1 / 23	0.44	SS01-103008	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.029 - 0.40	4 / 27	0.062	SD05-102908	0.93	0 / 27	< 1
Dibenzofuran	0.038 - 0.38	4 / 27	0.16	SS16_SI	NSV	-- / --	NSV
Diethyl phthalate	0.039 - 0.40	1 / 27	0.17	SS10_SI	100	0 / 27	< 1
Di-n-butyl phthalate	0.047 - 0.40	6 / 27	0.17	SD06-102908	0.15	1 / 27	**1**
Carbazole	0.37 - 0.40	1 / 4	0.083	SS09_SI	NSV	-- / --	NSV
Diethylene glycol, monobutyl ether	-- - --	1 / 1	1.40	SS10_SI	NSV	-- / --	NSV
Acenaphthene	0.0017 - 4.50	21 / 27	0.073	SS11-103008	20.0	0 / 27	< 1
Acenaphthylene	0.0014 - 0.40	4 / 27	0.0031	SD01-102908	682	0 / 27	< 1
Anthracene	0.0018 - 2.20	22 / 27	0.12	SS11-103008	1,480	0 / 27	< 1
Benz(a)anthracene	0.023 - 0.023	26 / 27	0.47	SS10_SI	5.21	0 / 27	< 1
Benzo(a)pyrene	0.012 - 0.012	26 / 27	0.62	SS10_SI	1.52	0 / 27	< 1
Benzo(b)fluoranthene	0.012 - 0.012	26 / 27	0.55	SS10_SI	59.8	0 / 27	< 1
Benzo(ghi)perylene	0.023 - 0.25	25 / 27	0.22	SS09_SI	119	0 / 27	< 1
Benzo(k)fluoranthene	0.0018 - 0.012	25 / 27	0.20	SS10_SI	148	0 / 27	< 1
Chrysene	0.012 - 0.012	26 / 27	0.52	SS10_SI	4.73	0 / 27	< 1
Dibenz(ah)anthracene	0.0017 - 0.22	22 / 27	0.034	SS11-103008	18.4	0 / 27	< 1
Fluoranthene	0.023 - 0.25	24 / 26	1.60	SS09_SI	122	0 / 26	< 1
Fluorene	0.0018 - 1.20	23 / 27	0.12	SS10_SI	30.0	0 / 27	< 1
Indeno(1,2,3-cd)pyrene	0.023 - 0.25	25 / 27	0.89	SS10_SI	109	0 / 27	< 1
Naphthalene	0.12 - 2.20	24 / 27	0.37	SS16_SI	0.099	4 / 27	**4**
Phenanthrene	0.12 - 0.12	26 / 27	1.20	SS10_SI	45.7	0 / 27	< 1
Pyrene	0.023 - 0.023	26 / 27	2.00	SS10_SI	45.7	0 / 27	< 1
Total Low Molecular Weight PAHs	-- - --	26 / 27	6.14	SS10_SI	29.0	0 / 27	< 1
Total High Molecular Weight PAHs	-- - --	26 / 27	5.54	SS10_SI	18.0	0 / 27	< 1

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Volatile Organic Compounds (mg/kg)							
Methyl ethyl ketone	0.0022 - 0.0083	1 / 27	0.013	SS13-103008	89.6	0 / 27	< 1
Acetone	0.0054 - 0.022	1 / 20	0.030	SS13-103008	2.50	0 / 20	< 1
Carbon disulfide	7.40E-04 - 0.0014	1 / 27	0.0012	SS04-103008	0.094	0 / 27	< 1
Chloroform	3.60E-04 - 0.0011	1 / 27	0.0080	SS09_SI	1.19	0 / 27	< 1
Dichlorodifluoromethane	7.90E-04 - 0.0011	15 / 23	0.012	SS02-103008	39.5	0 / 23	< 1
Methylene chloride	0.0017 - 0.020	1 / 22	0.0015	SS10_SI	4.05	0 / 22	< 1
Toluene	5.90E-04 - 0.0022	1 / 27	0.0026	SS01-103008	5.45	0 / 27	< 1
Trichlorofluoromethane	8.20E-04 - 0.0012	7 / 23	0.0041	SS11-103008	16.4	0 / 23	< 1
Non-Detected Constituents							
Inorganics (mg/kg)							
Cyanide	0.33 - 1.20	0 / 4	--	--	1.33	-- / --	< 1
Pesticide/Polychlorinated Biphenyls (mg/kg)							
Aldrin	0.020 - 0.19	0 / 4	--	--	0.0033	-- / --	**57**
Hexachlorocyclohexane, alpha-	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Chlordane	0.020 - 0.19	0 / 4	--	--	0.22	-- / --	< 1
Hexachlorocyclohexane, delta-	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.020 - 0.19	0 / 4	--	--	0.0024	-- / --	**80**
Endosulfan A	0.020 - 0.19	0 / 4	--	--	0.12	-- / --	**2**
Endosulfan B	0.020 - 0.19	0 / 4	--	--	0.12	-- / --	**2**
Endosulfan sulfate	0.020 - 0.19	0 / 4	--	--	0.036	-- / --	**5**
Endrin aldehyde	0.020 - 0.19	0 / 4	--	--	0.011	-- / --	**18**
Endrin ketone	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Endrin	0.020 - 0.19	0 / 4	--	--	0.010	-- / --	**19**
Hexachlorocyclohexane, gamma- (Lindane)	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Heptachlor epoxide	0.020 - 0.19	0 / 4	--	--	0.15	-- / --	**1**
Heptachlor	0.020 - 0.19	0 / 4	--	--	0.0060	-- / --	**32**
Methoxychlor	0.020 - 0.19	0 / 4	--	--	0.020	-- / --	**10**
Toxaphene	0.078 - 0.75	0 / 4	--	--	0.12	-- / --	**6**

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
PCB 1016	0.037 - 0.040	0 / 4	--	--	0.037	-- / --	**1**
PCB 1221	0.075 - 0.082	0 / 4	--	--	0.037	-- / --	**2**
PCB 1232	0.037 - 0.040	0 / 4	--	--	0.037	-- / --	**1**
PCB 1242	0.075 - 0.082	0 / 4	--	--	0.037	-- / --	**2**
PCB 1248	0.037 - 0.040	0 / 4	--	--	0.037	-- / --	**1**
PCB 1254	0.075 - 0.082	0 / 4	--	--	0.037	-- / --	**2**
PCB 1260	0.037 - 0.040	0 / 4	--	--	0.037	-- / --	**1**
Semivolatile Organic Compounds (mg/kg)							
Trichlorobenzene, 1,2,4-	0.016 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Diphenylhydrazine, 1,2-	0.033 - 0.040	0 / 23	--	--	NSV	-- / --	NSV
Trichlorophenol, 2,4,5-	0.11 - 0.40	0 / 27	--	--	4.00	-- / --	< 1
Trichlorophenol, 2,4,6-	0.078 - 0.095	0 / 23	--	--	4.00	-- / --	< 1
Dichlorophenol, 2,4-	0.096 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Dimethylphenol, 2,4-	0.079 - 0.40	0 / 27	--	--	0.010	-- / --	**40**
Dinitrophenol, 2,4-	0.23 - 1.80	0 / 25	--	--	20.0	-- / --	< 1
Dinitrotoluene, 2,4-	0.024 - 0.40	0 / 27	--	--	1.28	-- / --	< 1
Dinitrotoluene, 2,6-	0.032 - 0.40	0 / 27	--	--	0.033	-- / --	**12**
Chloronaphthalene, 2-	0.013 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Chlorophenol, 2-	0.11 - 0.40	0 / 27	--	--	7.00	-- / --	< 1
Methylphenol, 2-	0.11 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.027 - 2.00	0 / 27	--	--	74.1	-- / --	< 1
Nitrophenol, 2-	0.12 - 0.40	0 / 27	--	--	1.60	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.29 - 2.00	0 / 26	--	--	0.65	-- / --	**3**
Nitroaniline, 3-	0.033 - 2.00	0 / 27	--	--	3.16	-- / --	< 1
Dinitro-2-methylphenol, 4,6-	0.073 - 2.00	0 / 27	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.010 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.094 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.067 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Chlorophenyl phenyl ether, 4-	0.032 - 0.40	0 / 27	--	--	NSV	-- / --	NSV

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Methylphenol, 4-	0.11 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	0.032 - 2.00	0 / 27	--	--	21.9	-- / --	< 1
Nitrophenol, 4-	0.34 - 2.00	0 / 27	--	--	7.00	-- / --	< 1
Aniline	0.063 - 0.076	0 / 22	--	--	0.0568	-- / --	**1**
Benzyl alcohol	0.080 - 0.098	0 / 22	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.021 - 0.40	0 / 27	--	--	0.30	-- / --	**1**
Bis(2-chloroethyl) ether	0.014 - 0.40	0 / 27	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.011 - 0.014	0 / 23	--	--	19.4	-- / --	< 1
Butylbenzyl phthalate	0.025 - 0.40	0 / 27	--	--	0.24	-- / --	**2**
Dimethyl phthalate	0.027 - 0.40	0 / 27	--	--	734	-- / --	< 1
Di-n-octyl phthalate	0.040 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Hexachlorobenzene	0.015 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Hexachlorobutadiene	0.032 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.027 - 2.00	0 / 26	--	--	NSV	-- / --	NSV
Hexachloroethane	0.017 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Isophorone	0.028 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitrobenzene	0.041 - 0.40	0 / 27	--	--	1.31	-- / --	< 1
Nitrosodimethylamine, N-	0.14 - 0.18	0 / 23	--	--	0.0000321	-- / --	**5607**
Nitrosodi-N-propylamine, N-	0.031 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.017 - 0.40	0 / 27	--	--	0.55	-- / --	< 1
Pentachlorophenol	0.072 - 0.40	0 / 27	--	--	3.00	-- / --	< 1
Phenol	0.13 - 0.40	0 / 27	--	--	30.0	-- / --	< 1
Volatile Organic Compounds (mg/kg)							
Trichloroethane, 1,1,1-	4.50E-04 - 0.0011	0 / 27	--	--	29.8	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0010 - 0.0022	0 / 27	--	--	0.13	-- / --	< 1
Trichloroethane, 1,1,2-	5.40E-04 - 0.0022	0 / 27	--	--	28.6	-- / --	< 1
Dichloroethane, 1,1-	2.70E-04 - 0.0011	0 / 27	--	--	20.1	-- / --	< 1
Dichloroethene, 1,1-	4.50E-04 - 0.0033	0 / 27	--	--	8.28	-- / --	< 1
Trichlorobenzene, 1,2,3-	0.0015 - 0.0022	0 / 23	--	--	20.0	-- / --	< 1

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Trichlorobenzene, 1,2,4-	0.0015 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Dibromochloropropane	0.0010 - 0.0015	0 / 23	--	--	0.035	-- / --	< 1
Ethylene dibromide	2.70E-04 - 4.10E-04	0 / 23	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	8.20E-04 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Dichloroethane, 1,2-	5.40E-04 - 0.0011	0 / 27	--	--	21.2	-- / --	< 1
Dichloropropane, 1,2-	5.40E-04 - 0.0011	0 / 27	--	--	32.7	-- / --	< 1
Dichlorobenzene, 1,3-	0.0011 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Dichlorobenzene, 1,4-	0.0013 - 0.40	0 / 27	--	--	20.0	-- / --	< 1
Methyl n-butyl ketone	0.0015 - 0.0069	0 / 27	--	--	NSV	-- / --	NSV
Methyl isobutyl ketone	0.0015 - 0.0040	0 / 27	--	--	NSV	-- / --	NSV
Benzene	2.70E-04 - 0.0011	0 / 27	--	--	0.26	-- / --	< 1
Bromochloromethane	5.40E-04 - 8.30E-04	0 / 23	--	--	NSV	-- / --	NSV
Bromodichloromethane	3.60E-04 - 0.0011	0 / 27	--	--	0.54	-- / --	< 1
Bromoform	6.30E-04 - 0.0011	0 / 27	--	--	15.9	-- / --	< 1
Bromomethane	0.0011 - 0.0022	0 / 27	--	--	NSV	-- / --	NSV
Carbon tetrachloride	6.30E-04 - 0.0011	0 / 27	--	--	2.98	-- / --	< 1
Chlorobenzene	7.30E-04 - 0.0011	0 / 27	--	--	40.0	-- / --	< 1
Chloroethane	3.60E-04 - 0.0022	0 / 27	--	--	NSV	-- / --	NSV
Chloromethane	4.50E-04 - 0.0011	0 / 27	--	--	NSV	-- / --	NSV
Dichloroethene, 1,2-, cis-	4.50E-04 - 6.90E-04	0 / 23	--	--	0.78	-- / --	< 1
Dichloropropene, 1,3-, cis-	5.40E-04 - 0.0011	0 / 27	--	--	0.40	-- / --	< 1
Dibromochloromethane	6.30E-04 - 0.0011	0 / 27	--	--	2.05	-- / --	< 1
Ethylbenzene	6.30E-04 - 0.0011	0 / 27	--	--	5.16	-- / --	< 1
Isopropylbenzene	5.40E-04 - 8.30E-04	0 / 23	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.0015 - 0.0023	0 / 23	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	4.50E-04 - 6.90E-04	0 / 23	--	--	NSV	-- / --	NSV
Xylene, 1,2-	9.10E-04 - 0.0014	0 / 23	--	--	NSV	-- / --	NSV
Styrene	4.50E-04 - 0.0011	0 / 27	--	--	4.69	-- / --	< 1
Tetrachloroethene	7.40E-04 - 0.0012	0 / 27	--	--	9.92	-- / --	< 1

TABLE 7-5
Screening Statistics for Direct Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichloroethene, 1,2-, trans-	5.40E-04 - 8.30E-04	0 / 23	--	--	0.78	-- / --	< 1
Dichloropropene, 1,3-, trans-	7.30E-04 - 0.0011	0 / 27	--	--	0.40	-- / --	< 1
Trichloroethene	4.50E-04 - 0.0011	0 / 27	--	--	12.4	-- / --	< 1
Vinyl chloride	6.30E-04 - 0.0011	0 / 27	--	--	0.65	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0015 - 0.0022	0 / 4	--	--	NSV	-- / --	NSV
Xylenes, total	0.0022 - 0.0033	0 / 4	--	--	10.0	-- / --	< 1

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (mg/kg)							
Aluminum	-- - --	27 / 27	12,600	SD06-102908	NSV	-- / --	NSV
Antimony	0.18 - 12.0	10 / 27	0.91	SS16_SI	0.27	5 / 27	**3**
Arsenic	-- - --	27 / 27	17.0	SS16_SI	18	0 / 27	< 1
Beryllium	0.0041 - 0.51	22 / 27	1.30	SS12-103008	21	0 / 27	< 1
Cadmium	0.43 - 2.30	24 / 27	1.90	SS03-103008	0.36	17 / 27	**5**
Calcium [2]	-- - --	27 / 27	246,000	SS02-103008	NSV	-- / --	NSV
Cobalt	5.20 - 5.20	26 / 27	229	SS04-103008	120	3 / 27	**2**
Copper	-- - --	27 / 27	52.0	SS16_SI	28	6 / 27	**2**
Iron	-- - --	27 / 27	25,100	SS07-103008	NSV	-- / --	NSV
Lead	-- - --	27 / 27	57.0	SD01-102908	11	19 / 27	**5**
Magnesium [2]	-- - --	27 / 27	66,100	SS02-103008	NSV	-- / --	NSV
Manganese	-- - --	27 / 27	1,310	SS07-103008	4000	0 / 27	< 1
Mercury	0.050 - 0.050	26 / 27	6.10	SS09_SI	0.1	19 / 27	**61**
Nickel	-- - --	27 / 27	27.2	SD05-102908	130	0 / 27	< 1
Potassium [2]	-- - --	27 / 27	2,100	SS10_SI	NSV	-- / --	NSV
Selenium	0.41 - 34.0	12 / 27	1.20	SS07-103008	0.63	8 / 27	**2**
Silver	0.031 - 2.30	12 / 27	0.86	SD01-102908	4.2	0 / 27	< 1
Sodium [2]	71.0 - 580	23 / 27	255	SS11-103008	NSV	-- / --	NSV
Thallium	0.54 - 250	8 / 27	273	SS09-103008	0.0569	8 / 27	**4,798**
Vanadium	-- - --	27 / 27	29.3	SD05-102908	7.8	25 / 27	**4**
Zinc	-- - --	27 / 27	146	SS07-103008	46	20 / 27	**3**
Pesticide/Polychlorinated Biphenyls (mg/kg)							
DDD, p,p'-	0.020 - 0.19	1 / 4	0.0090	SS16_SI	0.75815	0 / 4	< 1
DDE, p,p'-	0.020 - 0.19	1 / 4	0.023	SS16_SI	0.59587	0 / 4	< 1
DDT, p,p'-	0.020 - 0.039	2 / 4	0.019	SS10_SI	0.0035	2 / 4	**5**
Hexachlorocyclohexane, beta-	0.020 - 0.19	1 / 4	0.0035	SS09_SI	NSV	-- / --	NSV

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (mg/kg)							
Methylnaphthalene, 2-	0.020 - 0.38	10 / 27	0.70	SS16_SI	3.24	0 / 27	< 1
Benzoic acid	0.30 - 0.36	1 / 23	0.44	SS01-103008	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.029 - 0.40	4 / 27	0.062	SD05-102908	0.925	0 / 27	< 1
Dibenzofuran	0.038 - 0.38	4 / 27	0.16	SS16_SI	NSV	-- / --	NSV
Diethyl phthalate	0.039 - 0.40	1 / 27	0.17	SS10_SI	24.8	0 / 27	< 1
Di-n-butyl phthalate	0.047 - 0.40	6 / 27	0.17	SD06-102908	0.15	1 / 27	**1**
Carbazole	0.37 - 0.40	1 / 4	0.083	SS09_SI	NSV	-- / --	NSV
Diethylene glycol, monobutyl ether	-- - --	1 / 1	1.40	SS10_SI	NSV	-- / --	NSV
Acenaphthene	0.0017 - 4.50	21 / 27	0.073	SS11-103008	682	0 / 27	< 1
Acenaphthylene	0.0014 - 0.40	4 / 27	0.0031	SD01-102908	682	0 / 27	< 1
Anthracene	0.0018 - 2.20	22 / 27	0.12	SS11-103008	1480	0 / 27	< 1
Benz(a)anthracene	0.023 - 0.023	26 / 27	0.47	SS10_SI	5.21	0 / 27	< 1
Benzo(a)pyrene	0.012 - 0.012	26 / 27	0.62	SS10_SI	1.52	0 / 27	< 1
Benzo(b)fluoranthene	0.012 - 0.012	26 / 27	0.55	SS10_SI	59.8	0 / 27	< 1
Benzo(ghi)perylene	0.023 - 0.25	25 / 27	0.22	SS09_SI	119	0 / 27	< 1
Benzo(k)fluoranthene	0.0018 - 0.012	25 / 27	0.20	SS10_SI	148	0 / 27	< 1
Chrysene	0.012 - 0.012	26 / 27	0.52	SS10_SI	4.73	0 / 27	< 1
Dibenz(ah)anthracene	0.0017 - 0.22	22 / 27	0.034	SS11-103008	18.4	0 / 27	< 1
Fluoranthene	0.023 - 0.25	24 / 26	1.60	SS09_SI	122	0 / 26	< 1
Fluorene	0.0018 - 1.20	23 / 27	0.12	SS10_SI	122	0 / 27	< 1
Indeno(1,2,3-cd)pyrene	0.023 - 0.25	25 / 27	0.89	SS10_SI	109	0 / 27	< 1
Naphthalene	0.12 - 2.20	24 / 27	0.37	SS16_SI	0.09939	4 / 27	**4**
Phenanthrene	0.12 - 0.12	26 / 27	1.20	SS10_SI	45.7	0 / 27	< 1
Pyrene	0.023 - 0.023	26 / 27	2.00	SS10_SI	45.7	0 / 27	< 1
Total Low Molecular Weight PAHs	-- - --	26 / 27	6.14	SS10_SI	100	0 / 27	< 1
Total High Molecular Weight PAHs	-- - --	26 / 27	5.54	SS10_SI	1.1	13 / 27	**5**

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Volatile Organic Compounds (mg/kg)							
Methyl ethyl ketone	0.0022 - 0.0083	1 / 27	0.013	SS13-103008	89.6	0 / 27	< 1
Acetone	0.0054 - 0.022	1 / 20	0.030	SS13-103008	2.5	0 / 20	< 1
Carbon disulfide	7.40E-04 - 0.0014	1 / 27	0.0012	SS04-103008	0.0941	0 / 27	< 1
Chloroform	3.60E-04 - 0.0011	1 / 27	0.0080	SS09_SI	1.19	0 / 27	< 1
Dichlorodifluoromethane	7.90E-04 - 0.0011	15 / 23	0.012	SS02-103008	39.5	0 / 23	< 1
Methylene chloride	0.0017 - 0.020	1 / 22	0.0015	SS10_SI	4.05	0 / 22	< 1
Toluene	5.90E-04 - 0.0022	1 / 27	0.0026	SS01-103008	5.45	0 / 27	< 1
Trichlorofluoromethane	8.20E-04 - 0.0012	7 / 23	0.0041	SS11-103008	16.4	0 / 23	< 1
Non-Detected Constituents							
Inorganics (mg/kg)							
Cyanide	0.33 - 1.20	0 / 4	--	--	NSV	-- / --	NSV
Pesticide/Polychlorinated Biphenyls (mg/kg)							
Aldrin	0.020 - 0.19	0 / 4	--	--	0.00332	-- / --	**57**
Hexachlorocyclohexane, alpha-	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Chlordane	0.020 - 0.19	0 / 4	--	--	0.224	-- / --	< 1
Hexachlorocyclohexane, delta-	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.020 - 0.19	0 / 4	--	--	0.00238	-- / --	**80**
Endosulfan A	0.020 - 0.19	0 / 4	--	--	0.119	-- / --	**2**
Endosulfan B	0.020 - 0.19	0 / 4	--	--	0.119	-- / --	**2**
Endosulfan sulfate	0.020 - 0.19	0 / 4	--	--	0.0358	-- / --	**5**
Endrin aldehyde	0.020 - 0.19	0 / 4	--	--	0.0105	-- / --	**18**
Endrin ketone	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Endrin	0.020 - 0.19	0 / 4	--	--	0.0101	-- / --	**19**
Hexachlorocyclohexane, gamma- (Lindane)	0.020 - 0.19	0 / 4	--	--	NSV	-- / --	NSV
Heptachlor epoxide	0.020 - 0.19	0 / 4	--	--	0.152	-- / --	**1**
Heptachlor	0.020 - 0.19	0 / 4	--	--	0.00598	-- / --	**32**
Methoxychlor	0.020 - 0.19	0 / 4	--	--	0.0199	-- / --	**10**
Toxaphene	0.078 - 0.75	0 / 4	--	--	0.119	-- / --	**6**

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
PCB 1016	0.037 - 0.040	0 / 4	--	--	0.000332	-- / --	**120**
PCB 1221	0.075 - 0.082	0 / 4	--	--	0.000332	-- / --	**247**
PCB 1232	0.037 - 0.040	0 / 4	--	--	0.000332	-- / --	**120**
PCB 1242	0.075 - 0.082	0 / 4	--	--	0.000332	-- / --	**247**
PCB 1248	0.037 - 0.040	0 / 4	--	--	0.000332	-- / --	**120**
PCB 1254	0.075 - 0.082	0 / 4	--	--	0.000332	-- / --	**247**
PCB 1260	0.037 - 0.040	0 / 4	--	--	0.000332	-- / --	**120**
Semivolatile Organic Compounds (mg/kg)							
Trichlorobenzene, 1,2,4-	0.016 - 0.40	0 / 27	--	--	11.1	-- / --	< 1
Diphenylhydrazine, 1,2-	0.033 - 0.040	0 / 23	--	--	NSV	-- / --	NSV
Trichlorophenol, 2,4,5-	0.11 - 0.40	0 / 27	--	--	14.1	-- / --	< 1
Trichlorophenol, 2,4,6-	0.078 - 0.095	0 / 23	--	--	9.94	-- / --	< 1
Dichlorophenol, 2,4-	0.096 - 0.40	0 / 27	--	--	87.5	-- / --	< 1
Dimethylphenol, 2,4-	0.079 - 0.40	0 / 27	--	--	0.01	-- / --	**40**
Dinitrophenol, 2,4-	0.23 - 1.80	0 / 25	--	--	0.069	-- / --	**26**
Dinitrotoluene, 2,4-	0.024 - 0.40	0 / 27	--	--	1.28	-- / --	< 1
Dinitrotoluene, 2,6-	0.032 - 0.40	0 / 27	--	--	0.0328	-- / --	**12**
Chloronaphthalene, 2-	0.013 - 0.40	0 / 27	--	--	0.0122	-- / --	**33**
Chlorophenol, 2-	0.11 - 0.40	0 / 27	--	--	0.243	-- / --	**2**
Methylphenol, 2-	0.11 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.027 - 2.00	0 / 27	--	--	74.1	-- / --	< 1
Nitrophenol, 2-	0.12 - 0.40	0 / 27	--	--	1.6	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.29 - 2.00	0 / 26	--	--	0.646	-- / --	**3**
Nitroaniline, 3-	0.033 - 2.00	0 / 27	--	--	3.16	-- / --	< 1
Dinitro-2-methylphenol, 4,6-	0.073 - 2.00	0 / 27	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.010 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.094 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.067 - 0.40	0 / 27	--	--	1.1	-- / --	< 1
Chlorophenyl phenyl ether, 4-	0.032 - 0.40	0 / 27	--	--	NSV	-- / --	NSV

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Methylphenol, 4-	0.11 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	0.032 - 2.00	0 / 27	--	--	21.9	-- / --	< 1
Nitrophenol, 4-	0.34 - 2.00	0 / 27	--	--	1.6	-- / --	**1**
Aniline	0.063 - 0.076	0 / 22	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.080 - 0.098	0 / 22	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.021 - 0.40	0 / 27	--	--	0.302	-- / --	**1**
Bis(2-chloroethyl) ether	0.014 - 0.40	0 / 27	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.011 - 0.014	0 / 23	--	--	19.4	-- / --	< 1
Butylbenzyl phthalate	0.025 - 0.40	0 / 27	--	--	NSV	-- / --	**NSV**
Dimethyl phthalate	0.027 - 0.40	0 / 27	--	--	734	-- / --	< 1
Di-n-octyl phthalate	0.040 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Hexachlorobenzene	0.015 - 0.40	0 / 27	--	--	0.199	-- / --	**2**
Hexachlorobutadiene	0.032 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.027 - 2.00	0 / 26	--	--	NSV	-- / --	NSV
Hexachloroethane	0.017 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Isophorone	0.028 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitrobenzene	0.041 - 0.40	0 / 27	--	--	1.31	-- / --	< 1
Nitrosodimethylamine, N-	0.14 - 0.18	0 / 23	--	--	NSV	-- / --	NSV
Nitrosodi-N-propylamine, N-	0.031 - 0.40	0 / 27	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.017 - 0.40	0 / 27	--	--	0.545	-- / --	< 1
Pentachlorophenol	0.072 - 0.40	0 / 27	--	--	0.119	-- / --	**3**
Phenol	0.13 - 0.40	0 / 27	--	--	1200	-- / --	< 1
Volatile Organic Compounds (mg/kg)							
Trichloroethane, 1,1,1-	4.50E-04 - 0.0011	0 / 27	--	--	29.8	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0010 - 0.0022	0 / 27	--	--	0.127	-- / --	< 1
Trichloroethane, 1,1,2-	5.40E-04 - 0.0022	0 / 27	--	--	28.6	-- / --	< 1
Dichloroethane, 1,1-	2.70E-04 - 0.0011	0 / 27	--	--	20.1	-- / --	< 1
Dichloroethene, 1,1-	4.50E-04 - 0.0033	0 / 27	--	--	8.28	-- / --	< 1
Trichlorobenzene, 1,2,3-	0.0015 - 0.0022	0 / 23	--	--	11.1	-- / --	< 1

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Trichlorobenzene, 1,2,4-	0.0015 - 0.40	0 / 27	--	--	11.1	-- / --	< 1
Dibromochloropropane	0.0010 - 0.0015	0 / 23	--	--	0.0352	-- / --	< 1
Ethylene dibromide	2.70E-04 - 4.10E-04	0 / 23	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	8.20E-04 - 0.40	0 / 27	--	--	2.96	-- / --	< 1
Dichloroethane, 1,2-	5.40E-04 - 0.0011	0 / 27	--	--	21.2	-- / --	< 1
Dichloropropane, 1,2-	5.40E-04 - 0.0011	0 / 27	--	--	32.7	-- / --	< 1
Dichlorobenzene, 1,3-	0.0011 - 0.40	0 / 27	--	--	37.7	-- / --	< 1
Dichlorobenzene, 1,4-	0.0013 - 0.40	0 / 27	--	--	0.546	-- / --	< 1
Methyl n-butyl ketone	0.0015 - 0.0069	0 / 27	--	--	NSV	-- / --	NSV
Methyl isobutyl ketone	0.0015 - 0.0040	0 / 27	--	--	NSV	-- / --	NSV
Benzene	2.70E-04 - 0.0011	0 / 27	--	--	0.255	-- / --	< 1
Bromochloromethane	5.40E-04 - 8.30E-04	0 / 23	--	--	NSV	-- / --	NSV
Bromodichloromethane	3.60E-04 - 0.0011	0 / 27	--	--	0.54	-- / --	< 1
Bromoform	6.30E-04 - 0.0011	0 / 27	--	--	15.9	-- / --	< 1
Bromomethane	0.0011 - 0.0022	0 / 27	--	--	NSV	-- / --	NSV
Carbon tetrachloride	6.30E-04 - 0.0011	0 / 27	--	--	2.98	-- / --	< 1
Chlorobenzene	7.30E-04 - 0.0011	0 / 27	--	--	13.1	-- / --	< 1
Chloroethane	3.60E-04 - 0.0022	0 / 27	--	--	NSV	-- / --	NSV
Chloromethane	4.50E-04 - 0.0011	0 / 27	--	--	NSV	-- / --	NSV
Dichloroethene, 1,2-, cis-	4.50E-04 - 6.90E-04	0 / 23	--	--	0.784	-- / --	< 1
Dichloropropene, 1,3-, cis-	5.40E-04 - 0.0011	0 / 27	--	--	0.398	-- / --	< 1
Dibromochloromethane	6.30E-04 - 0.0011	0 / 27	--	--	2.05	-- / --	< 1
Ethylbenzene	6.30E-04 - 0.0011	0 / 27	--	--	5.16	-- / --	< 1
Isopropylbenzene	5.40E-04 - 8.30E-04	0 / 23	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.0015 - 0.0023	0 / 23	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	4.50E-04 - 6.90E-04	0 / 23	--	--	NSV	-- / --	NSV
Xylene, 1,2-	9.10E-04 - 0.0014	0 / 23	--	--	NSV	-- / --	NSV
Styrene	4.50E-04 - 0.0011	0 / 27	--	--	4.69	-- / --	< 1
Tetrachloroethene	7.40E-04 - 0.0012	0 / 27	--	--	9.92	-- / --	< 1

TABLE 7-6
Screening Statistics for Food Web Exposures -- Soil (Step 2)
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichloroethene, 1,2-, trans-	5.40E-04 - 8.30E-04	0 / 23	--	--	0.784	-- / --	< 1
Dichloropropene, 1,3-, trans-	7.30E-04 - 0.0011	0 / 27	--	--	0.398	-- / --	< 1
Trichloroethene	4.50E-04 - 0.0011	0 / 27	--	--	12.4	-- / --	< 1
Vinyl chloride	6.30E-04 - 0.0011	0 / 27	--	--	0.646	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0015 - 0.0022	0 / 4	--	--	NSV	-- / --	NSV
Xylenes, total	0.0022 - 0.0033	0 / 4	--	--	10	-- / --	< 1

TABLE 7-7
Screening Statistics - Soil - Direct Exposures - Step 3
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Arithmetic Mean Hazard Quotient[1]	95% UCL Hazard Quotient[1]
Inorganics (mg/kg)										
Aluminum	-- - --	27 / 27	12,600	SD06-102908	8037	10650	50.0	27 / 27	**161**	**213**
Cobalt	5.20 - 5.20	26 / 27	229	SS04-103008	28.54	102.8	13.0	3 / 27	**2**	**8**
Iron	-- - --	27 / 27	25,100	SS07-103008	17226	22429	NSV	-- / --	NSV	NSV
Manganese	-- - --	27 / 27	1,310	SS07-103008	341.8	444.1	220	17 / 27	**2**	**2.0**
Mercury	0.050 - 0.050	26 / 27	6.10	SS09_SI	0.88	3.921	0.10	19 / 27	**9**	**39**
Selenium	0.41 - 34.0	12 / 27	1.20	SS07-103008	0.723	0.674	0.52	10 / 27	**1**	**1.3**
Thallium	0.54 - 250	8 / 27	273	SS09-103008	70.74	164.8	1.00	8 / 27	**71**	**165**
Vanadium	-- - --	27 / 27	29.3	SD05-102908	20.35	22.34	2.00	27 / 27	**10**	**11**
Zinc	-- - --	27 / 27	146	SS07-103008	67.18	78.43	120	2 / 27	< 1	< 1
Pesticide/Polychlorinated Biphenyls (mg/kg)										
DDT, p,p'-	0.020 - 0.039	2 / 4	0.019	SS10_SI	0.0155	--	0.0035	2 / 4	**4**	**5**
Hexachlorocyclohexane, beta-	0.020 - 0.19	1 / 4	0.0035	SS09_SI	0.0035	--	NSV	-- / --	NSV	NSV
Semivolatile Organic Compounds (mg/kg)										
Benzoic acid	0.30 - 0.36	1 / 23	0.44	SS01-103008	0.44	0.201	NSV	-- / --	NSV	NSV
Dibenzofuran	0.038 - 0.38	4 / 27	0.16	SS16_SI	0.0848	0.0639	NSV	-- / --	NSV	NSV
Di-n-butyl phthalate	0.047 - 0.40	6 / 27	0.17	SD06-102908	0.096	0.0945	0.15	1 / 27	< 1	< 1
Carbazole	0.37 - 0.40	1 / 4	0.083	SS09_SI	0.083	--[2]	NSV	-- / --	NSV	NSV
Diethylene glycol, monobutyl ether	-- - --	1 / 1	1.40	SS10_SI	1.4	--	NSV	-- / --	NSV	NSV
Naphthalene	0.12 - 2.20	24 / 27	0.37	SS16_SI	0.0401	0.137	0.099	4 / 27	< 1	**1.4**

Notes:
[1]HQs greater than 1 are in bold
NSV = No Screening Value

TABLE 7-8
Screening Statistics -- Food Web Exposures Soil -- Step 3
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Arithmetic Mean Hazard Quotient[1]	95% UCL Hazard Quotient[1]
Inorganics (mg/kg)										
Aluminum	-- - --	27 / 27	12,600	SD06-102908	8037	10650	NSV	-- / --	NSV	NSV
Antimony	0.18 - 12.0	10 / 27	0.91	SS16_SI	0.382	0.319	0.27	5 / 27	**1**	**1**
Cadmium	0.43 - 2.30	24 / 27	1.90	SS03-103008	0.527	0.642	0.36	17 / 27	**1**	**2**
Cobalt	5.20 - 5.20	26 / 27	229	SS04-103008	28.54	102.8	120	3 / 27	< 1	< 1
Copper	-- - --	27 / 27	52.0	SS16_SI	21.76	25.35	28	6 / 27	< 1	< 1
Iron	-- - --	27 / 27	25,100	SS07-103008	17226	22429	NSV	-- / --	NSV	NSV
Lead	-- - --	27 / 27	57.0	SD01-102908	21.77	28.78	11	19 / 27	**2**	**3**
Mercury	0.050 - 0.050	26 / 27	6.10	SS09_SI	0.88	3.921	0.1	19 / 27	**9**	**39**
Selenium	0.41 - 34.0	12 / 27	1.20	SS07-103008	0.723	0.674	0.63	8 / 27	**1**	**1**
Thallium	0.54 - 250	8 / 27	273	SS09-103008	70.74	164.8	0.0569	8 / 27	**1,243**	**2,896**
Vanadium	-- - --	27 / 27	29.3	SD05-102908	20.35	22.34	7.8	25 / 27	**3**	**3**
Zinc	-- - --	27 / 27	146	SS07-103008	67.18	78.43	46	20 / 27	**1**	**2**
Pesticide/Polychlorinated Biphenyls (mg/kg)										
DDT, p,p'-	0.020 - 0.039	2 / 4	0.019	SS10_SI	0.0155	--[2]	0.0035	2 / 4	**4**	**5**
Hexachlorocyclohexane, beta-	0.020 - 0.19	1 / 4	0.0035	SS09_SI	0.0035	--	NSV	-- / --	NSV	NSV
Semivolatile Organic Compounds (mg/kg)										
Benzoic acid	0.30 - 0.36	1 / 23	0.44	SS01-103008	0.44	0.201	NSV	-- / --	NSV	NSV
Dibenzofuran	0.038 - 0.38	4 / 27	0.16	SS16_SI	0.0848	0.0639	NSV	-- / --	NSV	NSV
Di-n-butyl phthalate	0.047 - 0.40	6 / 27	0.17	SD06-102908	0.096	0.0945	NSV	-- / --	NSV	NSV
Carbazole	0.37 - 0.40	1 / 4	0.083	SS09_SI	0.083	--	NSV	-- / --	NSV	NSV
Diethylene glycol, monobutyl ether	-- - --	1 / 1	1.40	SS10_SI	1.4	--	NSV	-- / --	NSV	NSV
Naphthalene	0.12 - 2.20	24 / 27	0.37	SS16_SI	0.0401	0.137	0.09939	2 / 15	< 1	**1**
Total High Molecular Weight PAHs	-- - --	26 / 27	5.54	SS10_SI	1.354	1.968	1.1	13 / 27	**1**	**2**

Notes:
[1] HQs greater than 1 are in bold.
[2] A 95% UCL was not calculated because of the small sample size (< 8 samples).
NSV = No Screening Value

TABLE 7-9
Soil Bioconcentration Factors For Plants and Soil Invertebrates - Step 3
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
Chemical	Value	Reference[1]	Value	Reference[1]
Inorganics				
Aluminum	0.004	Baes et al. 1984	0.039	Sample et al. 1998a
Antimony	0.200	Baes et al. 1984	0.063	Helmke et al. 1979
Cadmium	0.514	Bechtel Jacobs 1998a	7.660	Sample et al. 1998a
Cobalt	0.020	Baes et al. 1984	0.113	Sample et al. 1998a
Copper	0.123	Bechtel Jacobs 1998a	0.468	Sample et al. 1998a
Lead	0.038	Bechtel Jacobs 1998a	0.307	Sample et al. 1998a
Mercury	0.344	Bechtel Jacobs 1998a	1.186	Sample et al. 1998a
Selenium	0.567	Bechtel Jacobs 1998a	0.982	Sample et al. 1998a
Thallium	0.004	Baes et al. 1984	1.000	--
Vanadium	0.006	Baes et al. 1984	0.039	Sample et al. 1998a
Zinc	0.358	Bechtel Jacobs 1998a	2.482	Sample et al. 1998a
Pesticides/PCBs				
4,4'-DDT	0.0065	Travis and Arms 1988	0.70	Menzie et al. 1992
Hexachlorocyclohexane, beta-	0.2431	Travis and Arms 1988	1.00	--
Semivolatile Organics				
Carbazole	0.3258	Travis and Arms 1988	1.00	--
Dibenzofuran	0.1447	Travis and Arms 1988	1.00	--
Di-n-butylphthalate	0.0838	Travis and Arms 1988	1.00	--
Naphthalene	0.4425	Travis and Arms 1988	0.21	Beyer and Stafford 1993

Notes:
[1] See Section 9 of the text for complete reference citation.

TABLE 7-10
Soil Bioaccumulation Factors For Small Mammals - Step 3
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Soil-Mouse BAF (dry weight)		Soil-Shrew BAF (dry weight)	
Chemical	**Value**	**Reference[1]**	**Value**	**Reference[1]**
Inorganics				
Aluminum	0.062	Sample et al. 1998b	0.026	Sample et al. 1998b
Antimony	--	see text	--	see text
Cadmium	0.144	Sample et al. 1998b	2.212	Sample et al. 1998b
Cobalt	0.016	Sample et al. 1998b	0.025	Sample et al. 1998b
Copper	0.111	Sample et al. 1998b	0.502	Sample et al. 1998b
Lead	0.055	Sample et al. 1998b	0.148	Sample et al. 1998b
Mercury	0.054	Sample et al. 1998b	0.067	Sample et al. 1998b
Selenium	0.258	Sample et al. 1998b	0.273	Sample et al. 1998b
Thallium	0.112	Sample et al. 1998b	0.112	Sample et al. 1998b
Vanadium				
Zinc	0.509	Sample et al. 1998b	0.862	Sample et al. 1998b
Pesticides/PCBs				
4,4'-DDT	--	see text	--	see text
Hexachlorocyclohexane, beta-	--	see text	--	see text
Semivolatile Organics				
Carbazole	--	see text	--	see text
Dibenzofuran	--	see text	--	see text
Di-n-butylphthalate	--	see text	--	see text
Naphthalene	--	see text	--	see text

Notes:
[1] See Section 9 of the text for complete reference citation.

TABLE 7-11

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 3

Shelby Horizons AOC Remedial Investigation

Former Wilkins Air Station, Shelby, Ohio

	Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate		Dietary Composition (percent)				Soil Ingestion (percent)	
Receptor	Value	Reference	Value	Reference[1]	Value	Reference[1]	Terr. Plants	Soil Invert.	Small Mammals	Reference[1]	Value	Reference[1]
Birds												
Mourning dove	0.127	Tomlinson et al. 1994	0.0148	allometric equation	0.0151	allometric equation	95.0	0	0	Tomlinson et al. 1994	5.0	Assumed based on diet
American robin	0.077	USEPA 1993a	0.011	allometric equation	0.01	Levey and Karasov 1989	51.9	43.5	0	Martin et al. 1951	4.6	Sample and Suter 1994
Red-tailed hawk	1.13	Sample and Suter 1994	0.064	allometric equation	0.04	Sample and Suter 1994	0	0	100	USEPA 1993a; Sample and Suter 1994	0	Sample and Suter 1994
Mammals												
Deer mouse	0.017	Silva and Downing 1995	0.0030	USEPA 1993d	0.0005	USEPA 1993d	53.0	45.0	0	Martin et al. 1951	2.0	Beyer et al. 1994
Short-tailed shrew	0.017	USEPA 1993d	0.0038	USEPA 1993d	0.0015	USEPA 1993d	4.7	82.3	0	USEPA 1993d; Sample and Suter 1994	13.0	Sample and Suter 1994
Red fox	4.06	Silva and Downing 1995	0.3494	allometric equation	0.1231	Sample and Suter 1994	7.0	2.8	87.4	USEPA 1993d	2.8	Beyer et al. 1994

Notes:

[1] See Section 9 of the text for complete reference citation.

TABLE 7-12

Uncertainty Factors Applied to Ingestion-Based Screening Values

Shelby Horizons AOC Remedial Investigation

Former Wilkins Air Station, Shelby, Ohio

Convert From	Convert To	Uncertainty Factor
Chronic NOAEL	Chronic NOAEL	1
Chronic LOAEL	Chronic NOAEL	5
Subchronic NOAEL	Chronic NOAEL	10
Subchronic LOAEL	Chronic NOAEL	20
Acute NOAEL	Chronic NOAEL	30
Acute LOAEL	Chronic NOAEL	50
LD50	Chronic NOAEL	100

Notes:

Uncertainty factors from: Wentsel. R.S. et al. 1996.

Durations are defined as follows (USEPA, August 1999; Sample et al. 1996):

- Acute: <14 days
- Subchronic: 14 - 90 days
- Chronic: >90 days or during critical life stage

See report Section 9 for complete references.

TABLE 7-13
Ingestion Screening Values for Mammals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor: Deer Mouse	Receptor: Red Fox	Receptor: Short-tailed Shrew
Inorganics											
Aluminum	mouse	0.03	3 generations (390 days)	oral in water/diet	reproduction	245	49.0	ATSDR 2008	X	X	X
Antimony	mouse	0.03	lifetime	oral in water	lifespan/longevity	1.25	0.25	Sample et al. 1996	X	X	X
Cadmium	rat	0.303	6 weeks	oral (gavage)	reproduction	10	1.00	Sample et al. 1996	X		X
Cadmium	dog	10	3 months	oral in diet	reproduction	3.75	0.75	ATSDR 1999a		X	
Cobalt	rat	0.35	69 days	oral in diet	reproduction	20.0	5.00	ATSDR 2004a	X	X	X
Copper	mouse	0.03	1 month + GD 0-19	oral in diet	developmental	104	78.0	ATSDR 2004b	X		X
Copper	mink	1.00	357 days	oral in diet	reproduction	15.1	11.7	Sample et al. 1996		X	
Iron	--	--	--	--	--	NA	NA	--	X	X	X
Lead	rat	0.35	3 generations	oral in diet	reproduction	80.0	8.00	Sample et al. 1996	X	X	X
Mercury	rat	0.35	3 generations	oral in diet	reproduction	0.07	0.0	Sample et al. 1996	X		X
Mercury	mink	1	93 days	oral in diet	survival/weight loss	0.07	0.0	Sample et al. 1996		X	
Selenium	rat	0.35	1 year	oral in water	reproduction	0.33	0.20	Sample et al. 1996	X	X	X
Thallium	rat	0.365	60 days	oral in water	reproduction	0.185	0.037	Sample et al. 1996	X	X	X
Vanadium	rat	0.26	60 days + gest/lact	oral (gavage)	reproduction	2.1	0.42	Sample et al. 1996	X	X	X
Zinc	rat	0.35	GD 1-16	oral in diet	reproduction	320	160	Sample et al. 1996	X		X
Zinc	mink	1.00	25 weeks	oral	reproduction	104	20.8	ATSDR 2005		X	
Pesticides/PCBs											
4,4'-DDT	rat	0.35	2 years	oral in diet	reproduction	4.00	0.80	Sample et al. 1996	X		X
4,4'-DDT	dog	10.0	2 generations	oral in diet	reproduction	5.00	1.00	ATSDR 2002		X	
Hexachlorocyclohexane, beta-	rat	0.35	4 generations	oral in diet	reproduction	3.2	1.60	Sample et al. 1996	X	X	X
Semivolatile Organics											
Carbazole	--	--	--	--	--	NA	NA	--	X	X	X
Dibenzofuran	--	--	--	--	--	NA	NA	--	X	X	X
Di-n-butylphthalate	mouse	0.03	105 days	oral in diet	reproduction	1,833	550	Sample et al. 1996	X	X	X
Naphthalene	mouse	0.03	13 weeks	oral (gavage)	reproduction	1,000	200	ATSDR 1995	X	X	X

Notes:
[1] See Section 9 of the text for complete reference citation.

TABLE 7-14
Ingestion Screening Values for Birds
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor: Mourning Dove	Receptor: American Robin	Receptor: Red-Tailed Hawk
Inorganics											
Aluminum	ringed dove	0.155	4 months	oral in diet	reproduction	549	110	Sample et al. 1996	X	X	X
Antimony	--	--	--	--	--	NA	NA	--	X	X	X
Cadmium	mallard	1.15	90 days	oral in diet	reproduction	20.0	1.45	Sample et al. 1996	X	X	X
Cobalt	--	--	--	--	--	NA	NA	--	X	X	X
Copper	chicken (chicks)	0.534	10 weeks	oral in diet	growth/survival	61.7	47.0	Sample et al. 1996	X	X	X
Iron	--	--	--	--	--	NA	NA	--	X	X	X
Lead	Japanese quail	0.15	12 weeks	oral in diet	reproduction	11.3	1.13	Sample et al. 1996		X	
Lead	American kestrel	0.13	7 months	oral in diet	reproduction	19.3	3.85	Sample et al. 1996	X		X
Mercury	red-tailed hawk	1.1	12 weeks	oral in diet	survival/neurological	0	0.05	USEPA 1999b	X		X
Mercury	Japanese quail	0.15	1 year	oral in diet	reproduction	0	0.05	Sample et al. 1996		X	
Selenium	screech owl	0.20	13.7 weeks	oral in diet	reproduction	1.50	0.44	Sample et al. 1996	X	X	X
Thallium	European starling	0.082	acute	oral	survival	1.75	0.35	USEPA 1999	X	X	X
Vanadium	mallard	1.170	12 weeks	oral in diet	growth/survival	57	11.4	Sample et al. 1996	X	X	X
Zinc	chicken	1.94	44 weeks	oral in diet	reproduction	131	14.5	Sample et al. 1996	X	X	X
Pesticides/PCBs											
4,4'-DDT	Japanese quail	0.11	3 generations	oral in diet	reproduction	5.00	0.50	USEPA 1995	X	X	
4,4'-DDT	barn owl	0.47	2 years	oral in diet	reproduction	0.40	0.08	Blus 1996			X
Hexachlorocyclohexane, beta-	Japanese quail	0.15	90 days	oral in diet	reproduction	2.25	0.56	Sample et al. 1996	X	X	X
Semivolatile Organics											
Carbazole	--	--	--	--	--	NA	NA	--	X	X	X
Dibenzofuran	--	--	--	--	--	NA	NA	--	X	X	X
Di-n-butylphthalate	ringed dove	0.16	4 weeks	oral in diet	reproduction	1.1	0.22	Sample et al. 1996	X	X	X
Naphthalene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X

TABLE 7-15
Summary of Hazard Quotients for Food Web Exposures Soil -- Step 3
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Short-tailed shrew			Deer mouse			Red fox			American robin			Mourning dove			Red-tailed hawk		
Chemical	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics																		
Aluminum	**3.1**	<1	**1.4**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Antimony	<1	<1	<1	<1	<1	<1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	**19.5**	**5.6**	**10.4**	**4.4**	**1.3**	**2.3**	<1	<1	<1	**4.1**	<1	**1.7**	**3.5**	<1	**1.4**	<1	<1	<1
Selenium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thallium	**375.7**	**75.1**	**168.0**	**64.0**	**12.8**	**28.6**	**20.9**	**4.2**	**9.3**	**16.3**	**3.3**	**7.3**	**3.0**	<1	**1.4**	**1.7**	<1	<1
Vanadium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pesticides/PCBs																		
DDT, p,p'-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorocyclohexane, beta-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Semivolatile Organics																		
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Notes:
[1] HQs greater than 1 are in bold.

TABLE 7-16
Attributes for Judging Measures of Effects
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Category/Attribute	Description
I. Relationship between Measure of Effect and Assessment Endpoint	
Degree of Association	The extent to which the measure of effect is representative of, correlated with, or applicable to the assessment endpoint; in particular, with respect to similarity of effect, target organ, mechanism of action, and level of ecological organization.
Stressor/Response	The ability of an endpoint to demonstrate effects from chronic exposure to the stressor and to correlate the effects with the degree of exposure, susceptibility, and magnitude of effect.
Utility of Measure	The ability to judge results of the study against well-accepted standards, criteria, or objective measures (e.g., sediment quality criteria and toxicity thresholds). As such, the attribute describes the applicability, certainty, and scientific basis of the measure, as well as the sensitivity of a benchmark in detecting environmental harm.
II. Data Quality	
Quality of Data	The degree to which data quality objectives (DQOs) and other recognized characteristics of high quality studies are met. The appropriateness of data collection and analysis practices, as well as the implementation of the experimental design and the minimization of confounding factors strongly influence the data quality.
III. Study Design	
Site-specificity	The extent to which chemical and/or biological data, media, species, environmental conditions, and habitat types used in the study reflect the site of interest.
Stressor-specificity	The degree to which the measure of effect is associated with the specific stressor(s) of concern. Some measures of effects respond to a broad range of stressors, complicating interpretation of results, while others are more specific to a particular stressor.
Sensitivity	The ability to detect a response in the measure of effect, expressed as a percentage of the total possible variability that the endpoint is able to detect. Additionally, this attribute reflects the ability of the measure of effect to discriminate between responses to a stressor and those resulting from natural or design variability and uncertainty.
Spatial Representativeness	The degree of compatibility or overlap between the study area and locations of measurements or samples, stressors, ecological receptors, and potential exposure points.
Temporal Representativeness	The compatibility or overlap between when data were collected or the period for which data are representative and the period during which effects of concern would be likely to be detected. Also linked to this attribute is the number of measurement or sampling events and the expected variability over time.
Quantitativeness	The degree to which numbers can be used to describe the magnitude of response to the stressor. Some measure of effects yield qualitative or hierarchical results, while others are more quantitative. In addition, this attribute encompasses the extent to which biological significance can be interpreted from statistical significance.
Use of a Standard Method	The extent to which the study follows protocols recommended by a recognized scientific authority (e.g., study designs or chemical measures published in the Code of Federal Regulations, developed by ASTM, or repeatedly published in the peer-reviewed scientific literature). This attribute also reflects the suitability and applicability of the method to the endpoint and the site, as well as any modifications made to the method.

TABLE 7-17
Score Definitions
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Score/Definitions		
Attribute Category	**Low**	**Medium**	**High**
I. Relationship between Measurement and Assessment Endpoint	Assessment endpoint is measured only indirectly. A weak correlation exists between the measurement and assessment endpoint. Endpoint response to stressor not demonstrated previously but is expected to occur based upon observations of similar stressors. Measure developed by investigator, has limited applicability, weak scientific basis, and relatively insensitive benchmark.	Endpoints linked by the effect, target organ, and mechanism of action evaluated are not the same, or levels of ecological organization differ; or all of the above criteria are met but the assessment endpoint is not directly measured. Endpoint response to stressor has been noted, but not necessarily proven or has a statistically significant correlation Measure ranges from a personal index with limited applicability or a weak scientific basis or relatively insensitive benchmark to a well-accepted measure developed by a third party with moderate certainty, and scientific basis, and the benchmark is moderately sensitive.	Assessment endpoint is measured directly A statistically significant correlation exists Measure was developed by a third party, is well accepted, and has very high levels of certainty and applicability, strong scientific basis, and is sensitive.
II. Data Quality	Three or more DQOs not met; or DQOs just meet the needs of the risk assessment; or No documentation exists for not meeting DQOs and not discussion of that impact on the risk assessment provided	One to two DQOs are not met; DQOs meet the risk assessment needs or are rigorous and comprehensive; and reasons for not meeting DQOs and the impact on the risk assessment are provided.	DQOs are rigorous and comprehensive All DQOs were met
III. Study Design	Only one or two of the following is derived from or reflects the site: data, media, species, environmental conditions, benchmark, and habitat type Measure of effect responds in the expected manner to various non-related stressors. Only changes greater than 1,000 times can be detected.	Three to five of the following is derived from or reflects the site: data, media, species, environmental conditions, benchmark, and habitat type Measure of effect responds in the expected manner to closely related stressors. Changes between 2 and 1,000 times can be detected The locations of two to four of the following are overlapped spatially: study area, sampling/measurement site, stressors, receptors, and points of potential exposure	Data, media, species, environmental conditions, benchmark, and habitat type are derived from or reflect the site conditions Particular stressor is known to be the only site-related stressor that the measure of effect responds in the expected manner. Changes of less than 2 times can be detected

TABLE 7-17
Score Definitions
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Score/Definitions		
Attribute Category	**Low**	**Medium**	**High**
III. Study Design (cont.)	Only two of the following are spatially overlapped, but only to a limited extent: study area, sampling/ measurement site, stressors, receptors, and points of potential exposures. Measurements were collected during a season when effects are not expected to be most observable and a single sampling or measurement event is conducted and there is high variability in the parameter over time. Results are qualitative and subjective. Method not previously published and is not an impact assessment, field survey, toxicity test, benchmark approach, toxicity quotient or tissue residue analysis.	Ranges from measurements collected during a season different from when effects would be most observable or a single sampling or measurement was collected that also has high variability to measurements collected during the same period that effects would be most observable during two sampling or measurement events and have moderate variability. Results range from qualitative but objective to quantitative, can be tested for statistical significance, but do not reflect biological significance Ranges from the method being an impact assessment, field survey, toxicity test, benchmark approach, toxicity quotient, or tissue residue analysis, but the application has not been published or standardized to a standard method that is directly applicable to the measure of effect, but needs slight modifications or the methodology published in two peer-reviewed studies.	At least five of the following are spatially overlapped: study area, sampling/measurement site, stressors, receptors, and points of potential exposures. Measurements were collected during the same periods that effects would be expected to be most observable and at least two sampling events are conducted and variability is low; or multiple sampling events are conducted and variability is moderate to high. Results are quantitative and can be tested for statistical significance. A standard method exists that was developed to test a measure of effect such as this with no modifications necessary or the methodology was used in three or more peer-reviewed studies.

TABLE 7-18
Measure of Effect Weighting
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Category/Attribute	Attribute Weighting Factor	Measure of effect Scoring	
		Modeled Exposure and Effects	**Rationale**
I. Relationship between Measurement and Assessment Endpoints			
Degree of Association	High	Medium	Exposure models were species-specific, but effects data were benchmark values for surrogate mammalian species
Stressor/Response	High	Medium	Exposure modeling was species and chemical-specific, but benchmarks instead of site-specific toxicity studies were used
Utility of Measure	High	Medium	Modeled exposure and effects procedures used are standardized and widely accepted, the primary limitation is lack of receptor-specific effects data
II. Data Quality			
Quality of data	High	High	Exposure and effect data were gathered primarily from peer reviewed scientific literature
III. Study Design			
Site-specificity	High	Medium	Media concentrations used in exposure models were site-specific, but other exposure parameters were literature-based
Stressor-specificity	High	High	Modeled exposure and effects were specific to each of the COPECs
Sensitivity	High	N/A	Modeled exposure and effects do not compare potential effects associated with other stressors
Spatial representativeness	High	Medium	Modeled exposures relied on abiotic media data collected throughout the Lockbourne landfill, but may not reflect all potential exposures to target species
Temporal representativeness	High	High	Model exposure and effects lines of evidence spanned critical life stages and in general tissue data used was collected when exposure was expected to be high
Quantitativeness	High	Medium	Exposure and effects modeling is quantitative but does not propagate uncertainty associated with modeling procedures
Use of a standard method	Medium	Medium	Generally accepted exposure and effects modeling procedures were followed.
Total Score	---	Medium-High	---

* Adapted from scaling presented in Menzie et al., 1996

TABLE 7-19
Scoring Sheet for Evidence of Harm and Magnitude: Habitat: Terrestrial
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

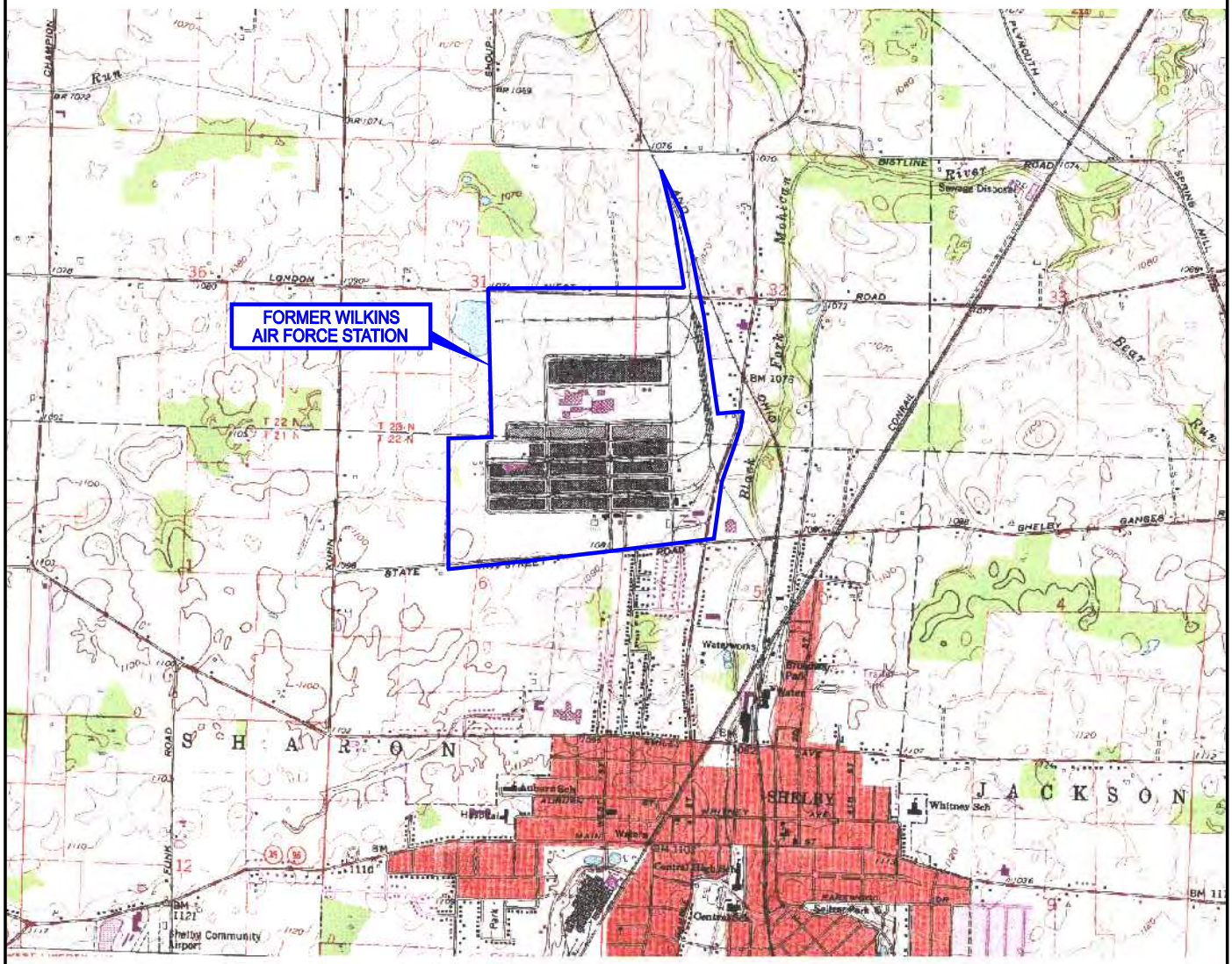
Measures of Effects (Target Receptor)	**Weighting Score (high, medium or low)**	**Evidence of Harm (Yes/No/Undetermined)**	**Magnitude (High/Low)**
Lower-Trophic Terrestrial	Medium-High	Yes	High
American Robin	Medium-High	Yes	Low
Mourning Dove	Medium-High	Yes	Low
Red-tailed Hawk	Medium-High	Yes	Low
Deer Mouse	Medium-High	Yes	High
Short-tailed Shrew	Medium-High	Yes	High
Red Fox	Medium-High	Yes	Low

Adapted from: Menzie et al., 1996.

TABLE 7-20
Ecological Risk Assessment COPEC Summary
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

	Direct Exposures	Food Web Exposures	
COPEC	**Surface Soil**	**Terrestrial (Mammals)**	**Terrestrial (Avian)**
Inorganics			
Aluminum	X		
Antimony			
Cadmium			
Cobalt	X		
Copper			
Iron			
Lead			
Manganese	X		
Mercury	X	X	X
Selenium	X		
Thallium	X	X	X
Vanadium	X		
Pesticide/Polychlorinated Biphenyls			
DDT, p,p'-	X		
Semivolatile Organic Compounds			
Naphthalene	X		

Figures



Shelby, Ohio
USGS Quadrangle, 7.5 minute series

North

0 1/4 1/2 1

Approximate scale in miles

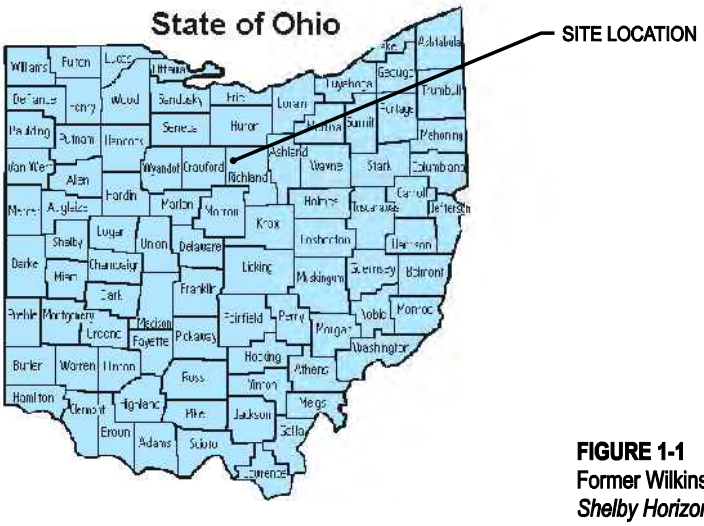
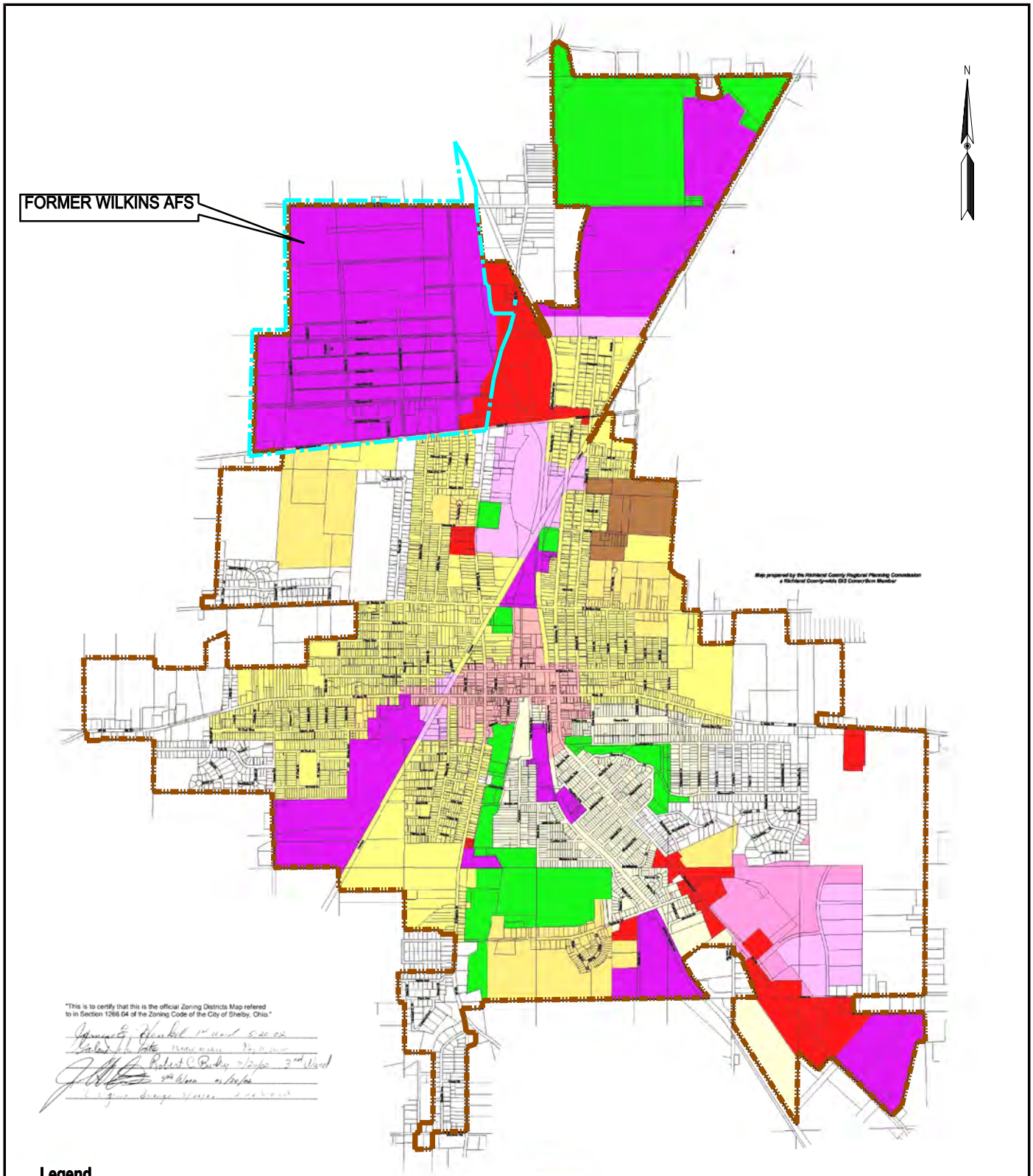


FIGURE 1-1
Former Wilkins Air Force Station Site Location Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

shelby_figure_1-1.dgn



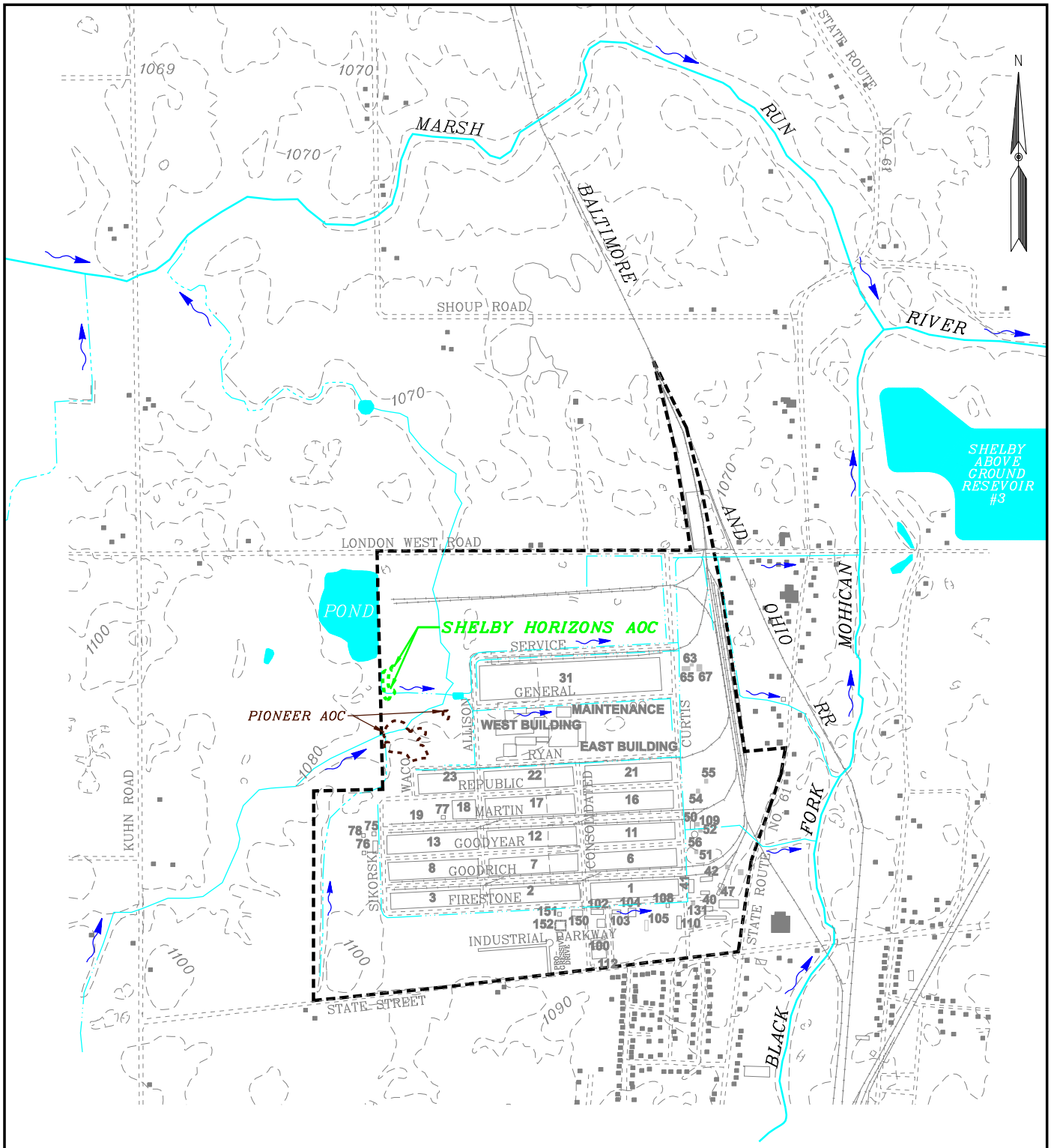
Legend

- CD CONSERVATION DISTRICT
- R-1 RESIDENTAL - SINGLE FAMILY
- R-1A RESIDENTAL - SINGLE FAMILY, SMALL LOT
- R-2 RESIDENTAL - SINGLE AND TWO FAMILY
- R-2A RESIDENTAL - SINGLE & TWO FAMILY DWELLINGS & TOWNHOMES UP TO SIX UNITS
- R-3 RESIDENTAL - SINGLE, TWO FAMILY & MULTIPLE FAMILY
- MHP MOBILE HOME PARK
- OS-1 OFFICE SERVICE
- B-1 NEIGHBORHOOD BUSINESS
- B-2 CENTRAL BUSINESS
- B-3 HIGHWAY BUSINESS
- I-1 LIGHT INDUSTRY
- I-2 HEAVY INDUSTRY
- UNZONED
- CORPORATION LIMIT
- FORMER WILKINS AFS EXTENT

FIGURE 1-2
City of Shelby Zoning District Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

shelby_figure_1-2.dgn



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

LEGEND

- FORMER WILKINS AFS APPROXIMATE PROPERTY BOUNDRY
- CONTOURS
- RAILROAD
- INTERMITANT DRAINAGE DITCH
- STREAM/RIVER
- SHELBY HORIZONS AOC
- PIONEER AOC
- EXISTING BUILDINGS
- DIRECTIONAL FLOW ARROW
- APPROXIMATE EXTENT OF PIONEER AOC
- INTERMITTENT RETENTION POND

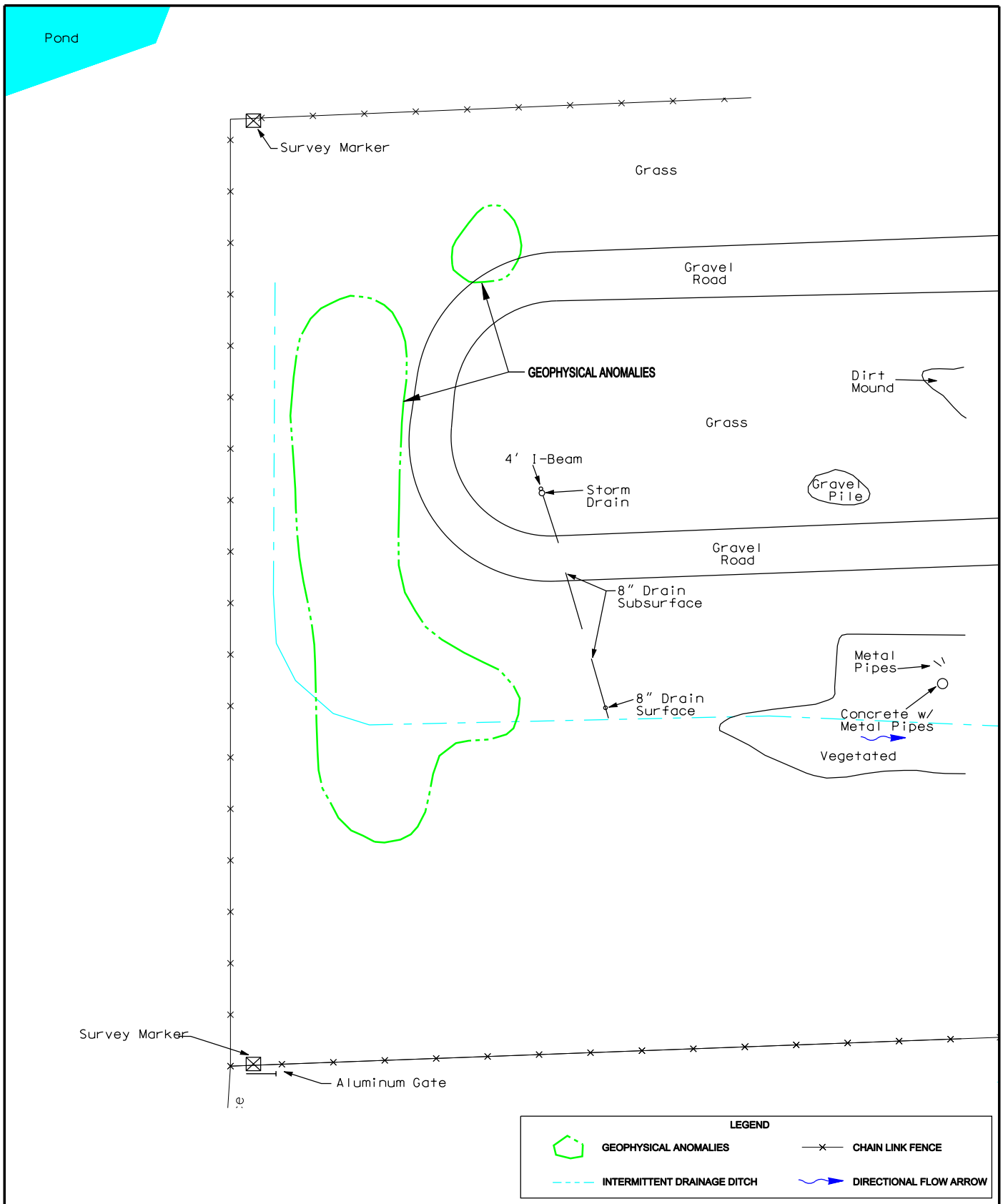
North

0 800 1600
Approximate scale in feet

FIGURE 1-3
Site Layout and Shelby Horizons AOC Location
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

shelby_figure_2-1.dgn



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80
Approximate scale in feet

FIGURE 1-4
Shelby Horizons Anomalies
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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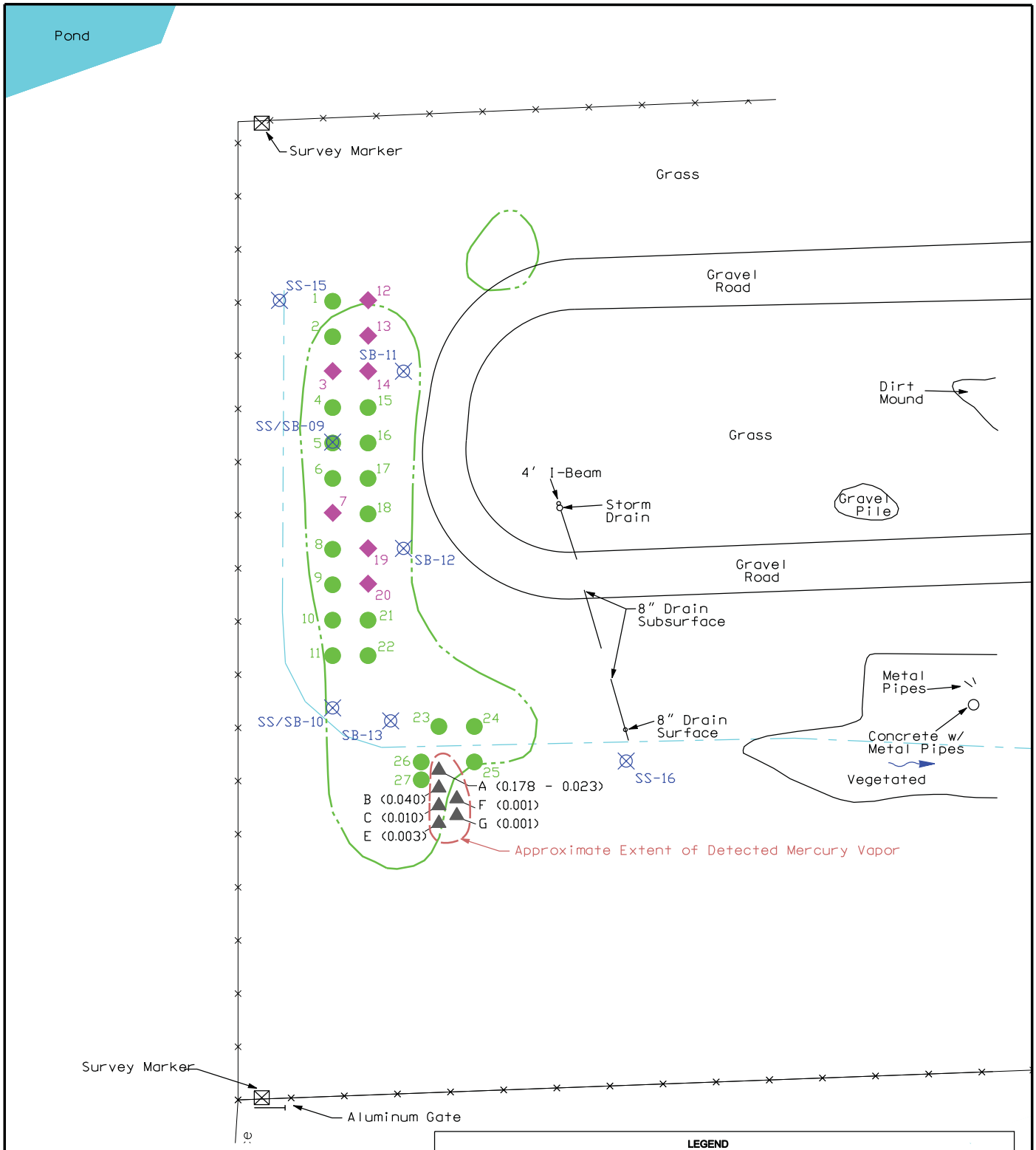
Shelby_Figure-2-5.dgn



NOTES:

1. Plexus SI mercury vapor screening location D is not plotted due to incorrect coordinates obtained during the SI.

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

LEGEND

- GEOPHYSICAL ANOMALIES
- PLEXUS SI MERCURY VAPOR SCREENING LOCATION AND DETECTED RESULTS (mg/m3)
- PLEXUS SI MERCURY VAPOR SCREENING LOCATION (NON DETECT)
- DIRECTIONAL FLOW ARROW
- PLEXUS SI MERCURY VAPOR SCREENING LOCATION (SAMPLE UNATAINABLE)
- PLEXUS SOIL SAMPLE
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- AREA OF MERCURY VAPOR DETECTION

North

0 40 80
Approximate scale in feet

FIGURE 1-5
Plexus SI Sampling Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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Shelby_Figure-1-5.dgn

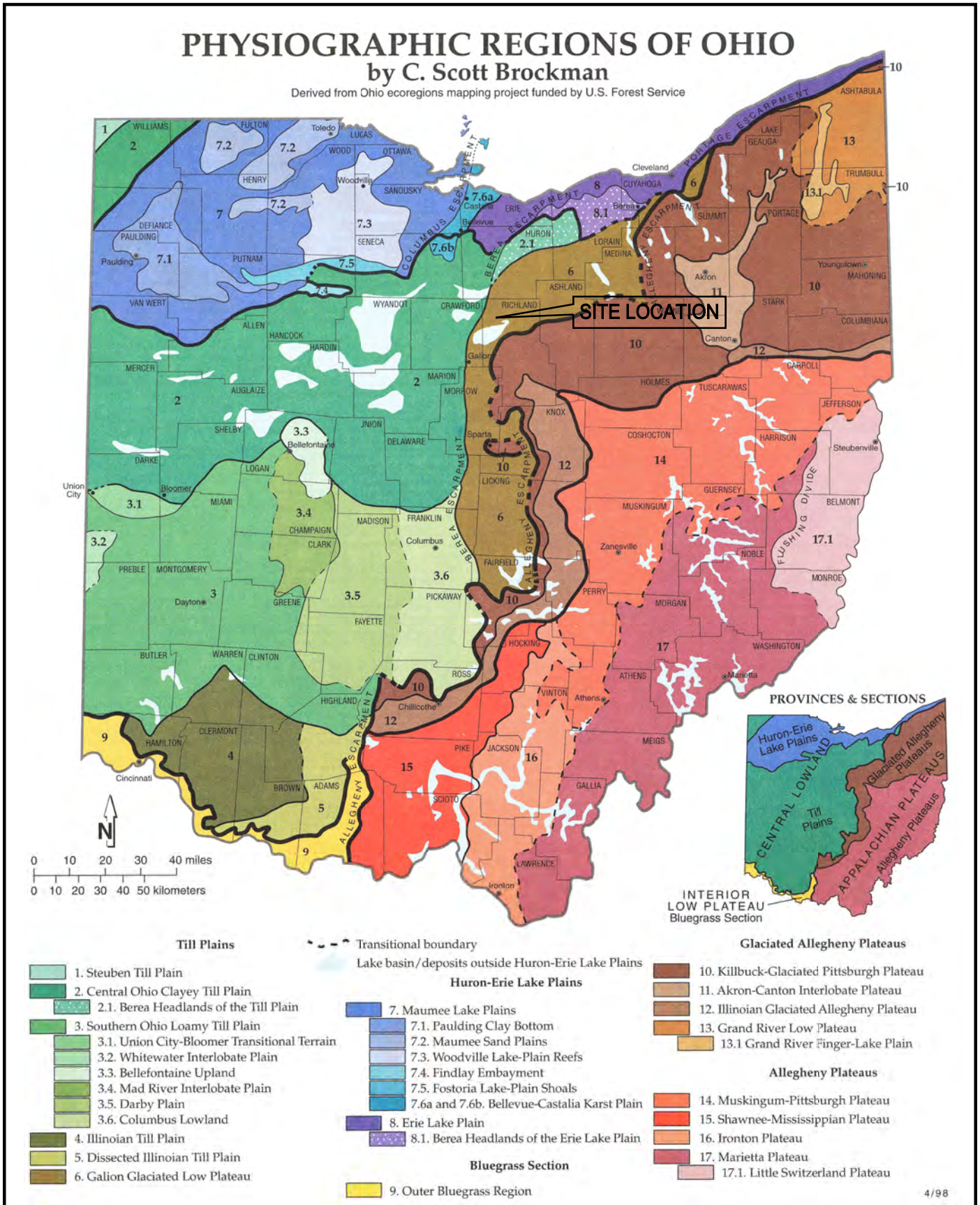

FIGURE 2-1
Physiographic Regions of Ohio
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station
Shelby, OH

Source: Ohio ecoregions mapping project (C. Scott Brockman)

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Shelby_Figures.dgn

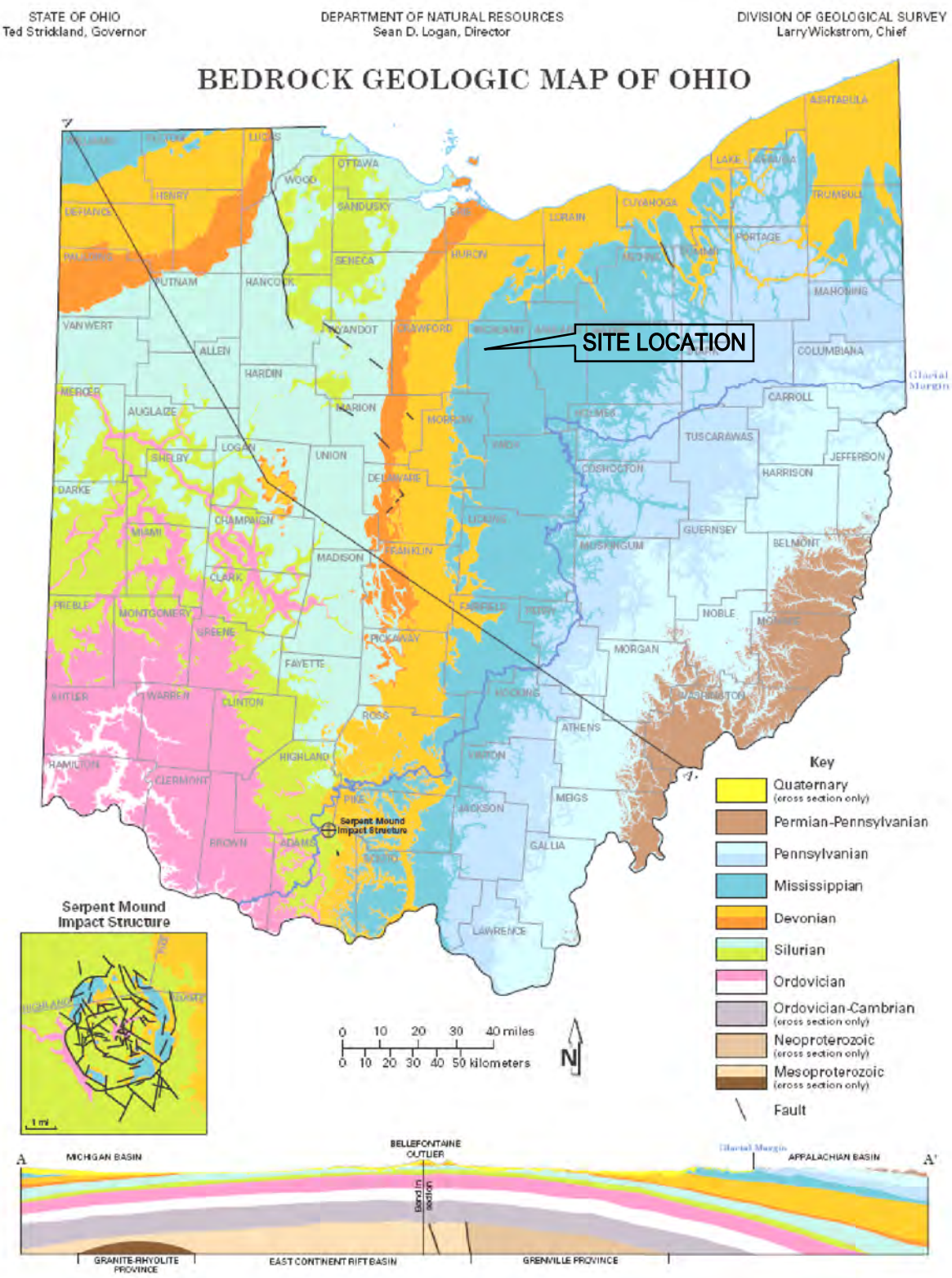


FIGURE 2-2
Bedrock Geological Map of Ohio
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station
Shelby, OH

CH2MHILL

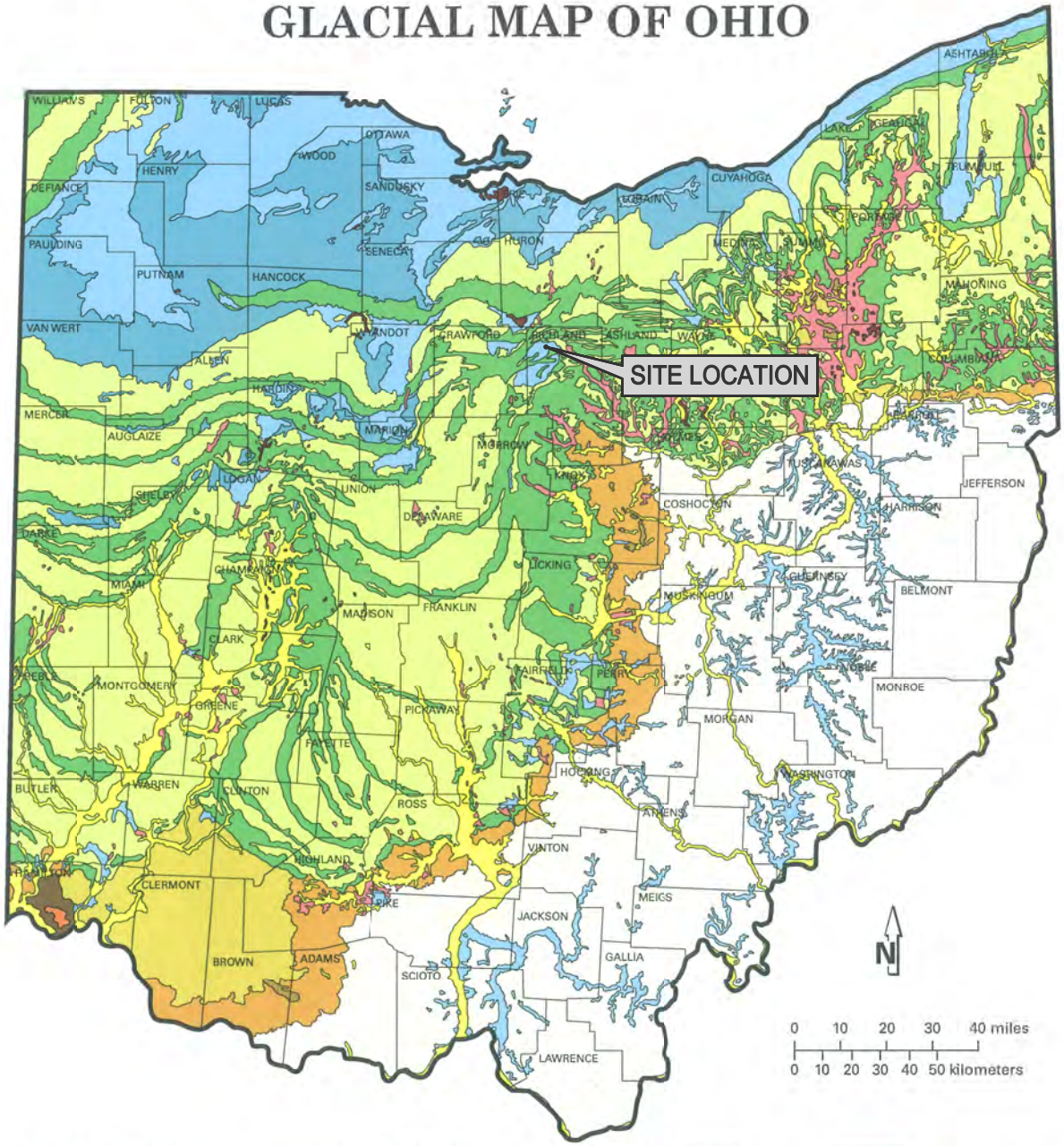
Shelby_Figures.dgn

STATE OF OHIO
Ted Strickland, Governor

DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

GLACIAL MAP OF OHIO



WISCONSINAN (14,000 to 24,000 years old)	ILLINOIAN (130,000 to 300,000 years old)	PRE-ILLINOIAN (older than 300,000 years)	
Ground moraine	Ground moraine	Ground moraine	Kames and eskers
Wave-planed ground moraine	Dissected ground moraine	Dissected ground moraine	Outwash
Ridge moraine	Hummocky moraine		Lake deposits
			Peat
			Colluvium

Recommended citation: Ohio Division of Geological Survey, 2005, Glacial map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,000,000.

FIGURE 2-3
Glacial Map of Ohio
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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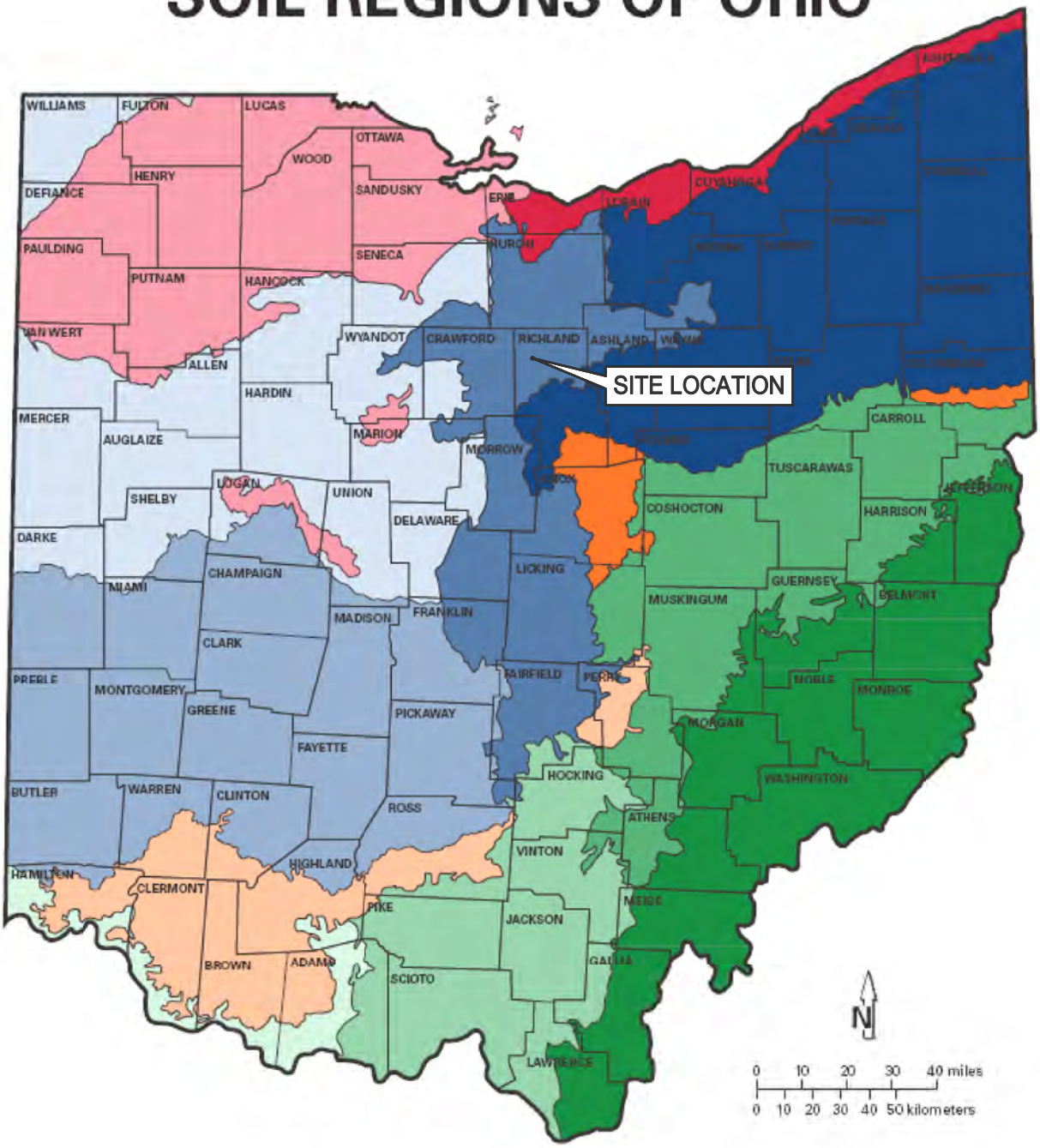
shelby_figure_2-03.dgn

SOIL REGIONS OF OHIO



LEGEND*

1 Hoytville-Nappanee-Paulding-Toledo

2 Conotton-Conneaut-Allis

3 Blount-Pewamo-Glynwood

4 Miamian-Kokomo-Eldean

5 Bennington-Cardington-Centerburg

6 Mahoning-Canfield-Rittman-Chili

7 Clermont-Rossmoyne-Avonburg-Cincinnati

8 Westmoreland-Homewood-Loudonville

9 Eden-Bratton-Brushcreek

10 Shelocta-Brownsville-Latham-Steinsburg

11 Coshocton-Westmoreland-Berks

12 Gilpin-Upshur-Lowell-Guernsey

*Soil regions are identified by the names of the soil series that are common in that region

FIGURE 2-4
Soil Regions of Ohio
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Source: ODNR Division of Soil and Water Resources
https://dnr.state.oh.us/tabid/9073/default.aspx

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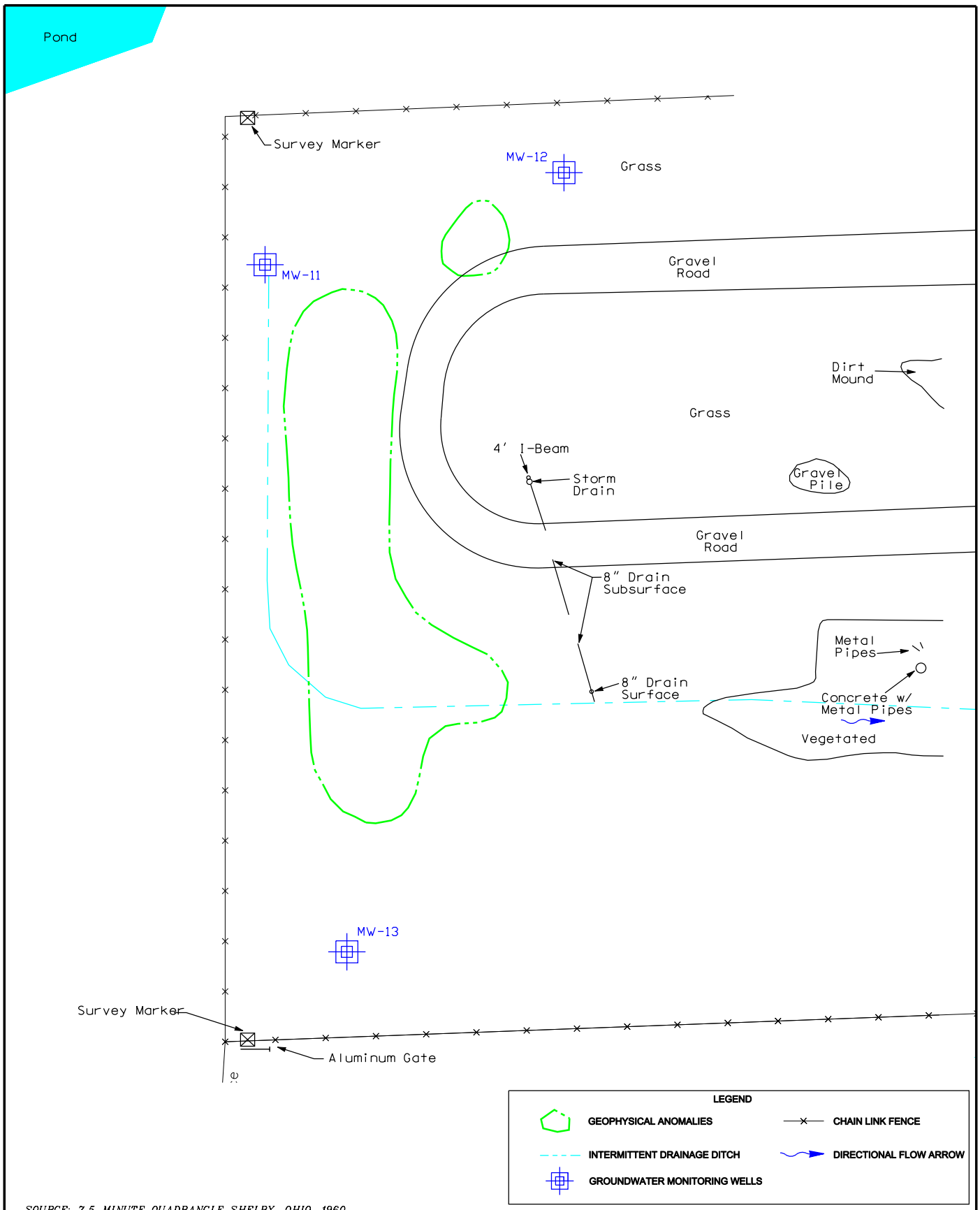
Shelby_Figures.dgn 2-5



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80
Approximate scale in feet

FIGURE 2-5
Monitoring Well Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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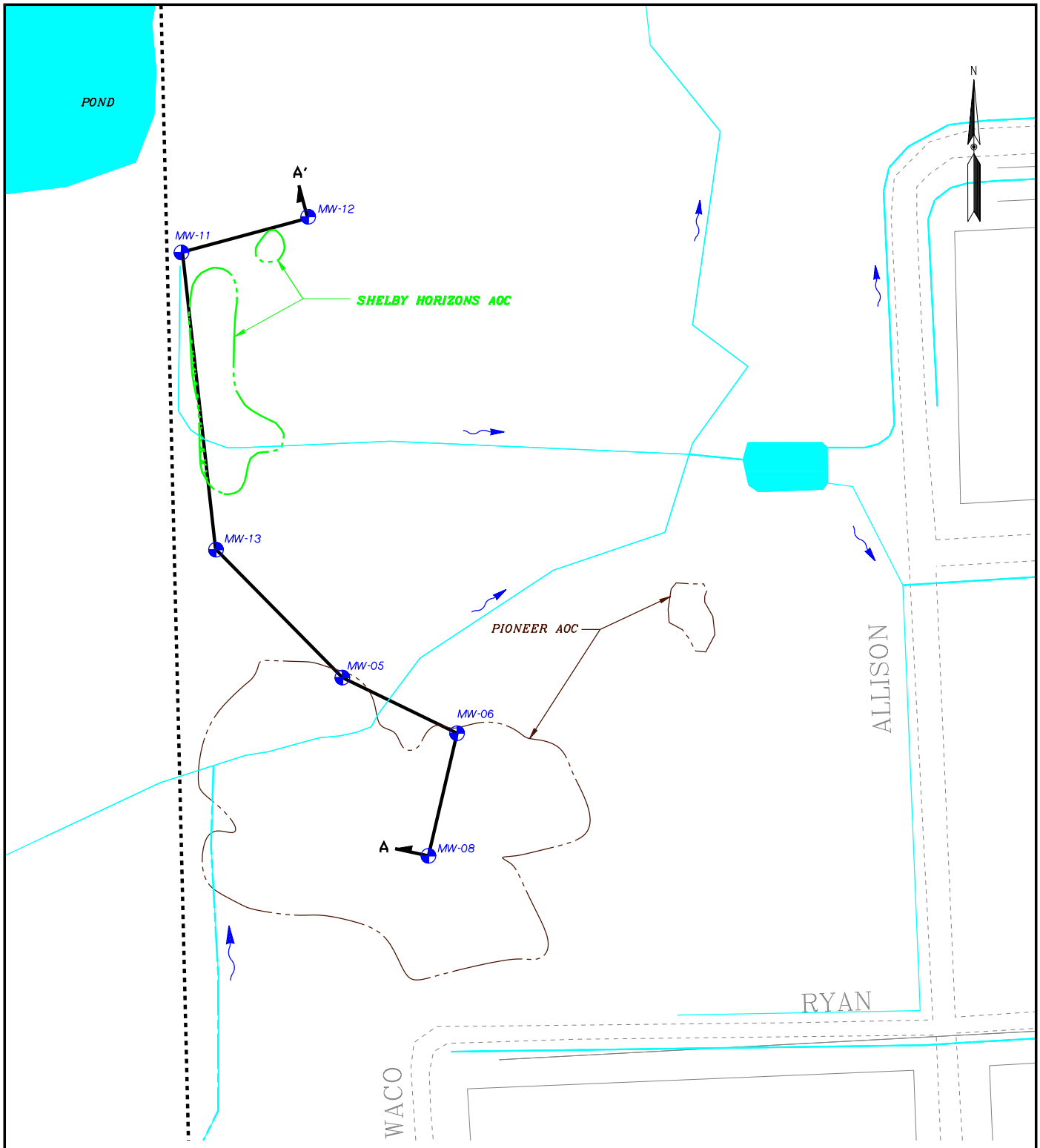
Shelby_Figure-2-5.dgn



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

LEGEND

- FORMER WILKINS AFS APPROXIMATE PROPERTY BOUNDRY
- RAILROAD
- DIRECTIONAL FLOW ARROW
- INTERMITTENT DRAINAGE DITCH
- SHELBY HORIZONS AOC
- EXISTING BUILDINGS
- APPROXIMATE EXTENT OF PIONEER AOC

North

0 100 200
Approximate scale in feet

FIGURE 2-6
Cross Section Location Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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shelby_figure_2-06.dgn

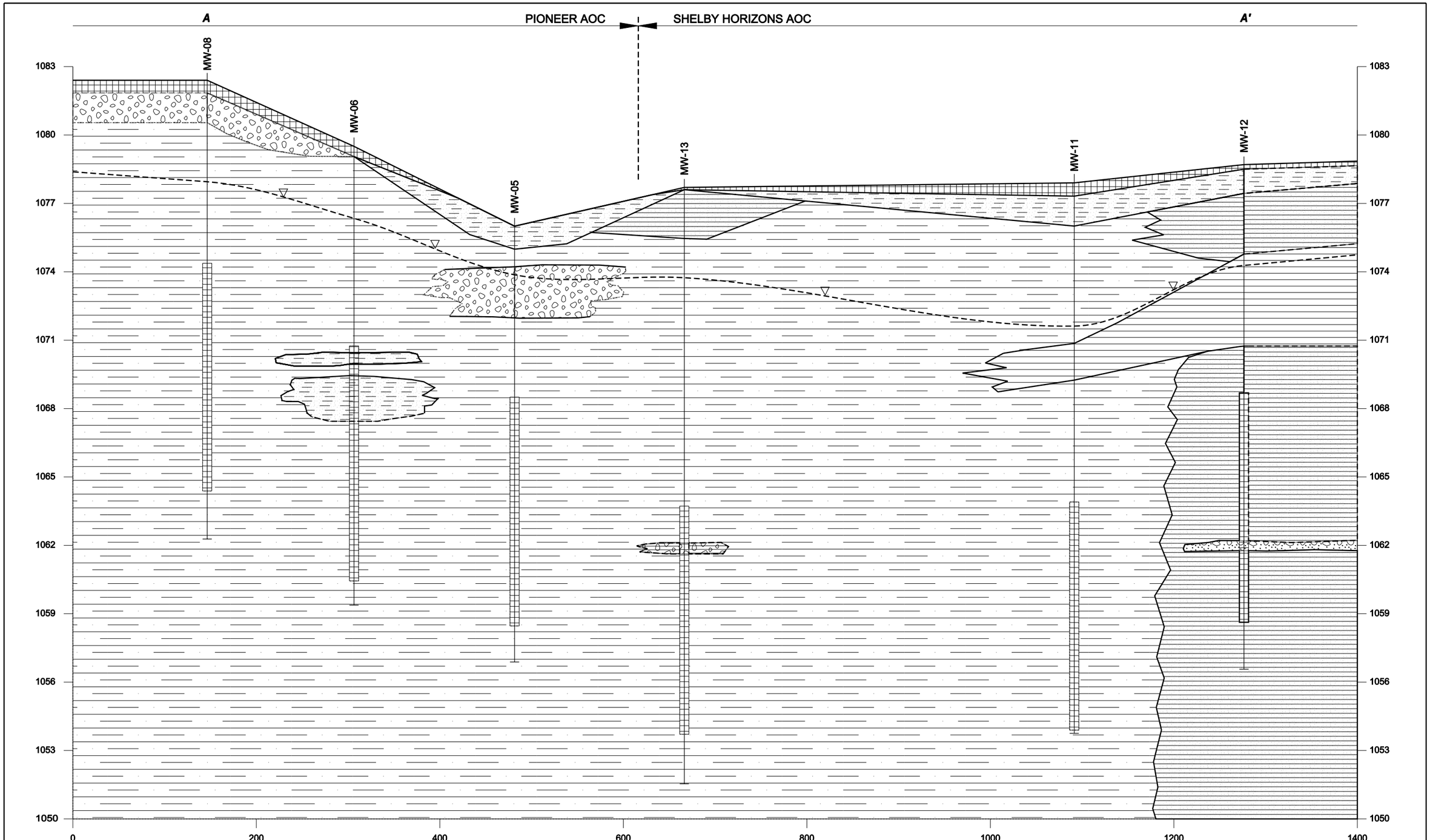

FIGURE 2-7
Cross Section A-A'
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station
Shelby, OH

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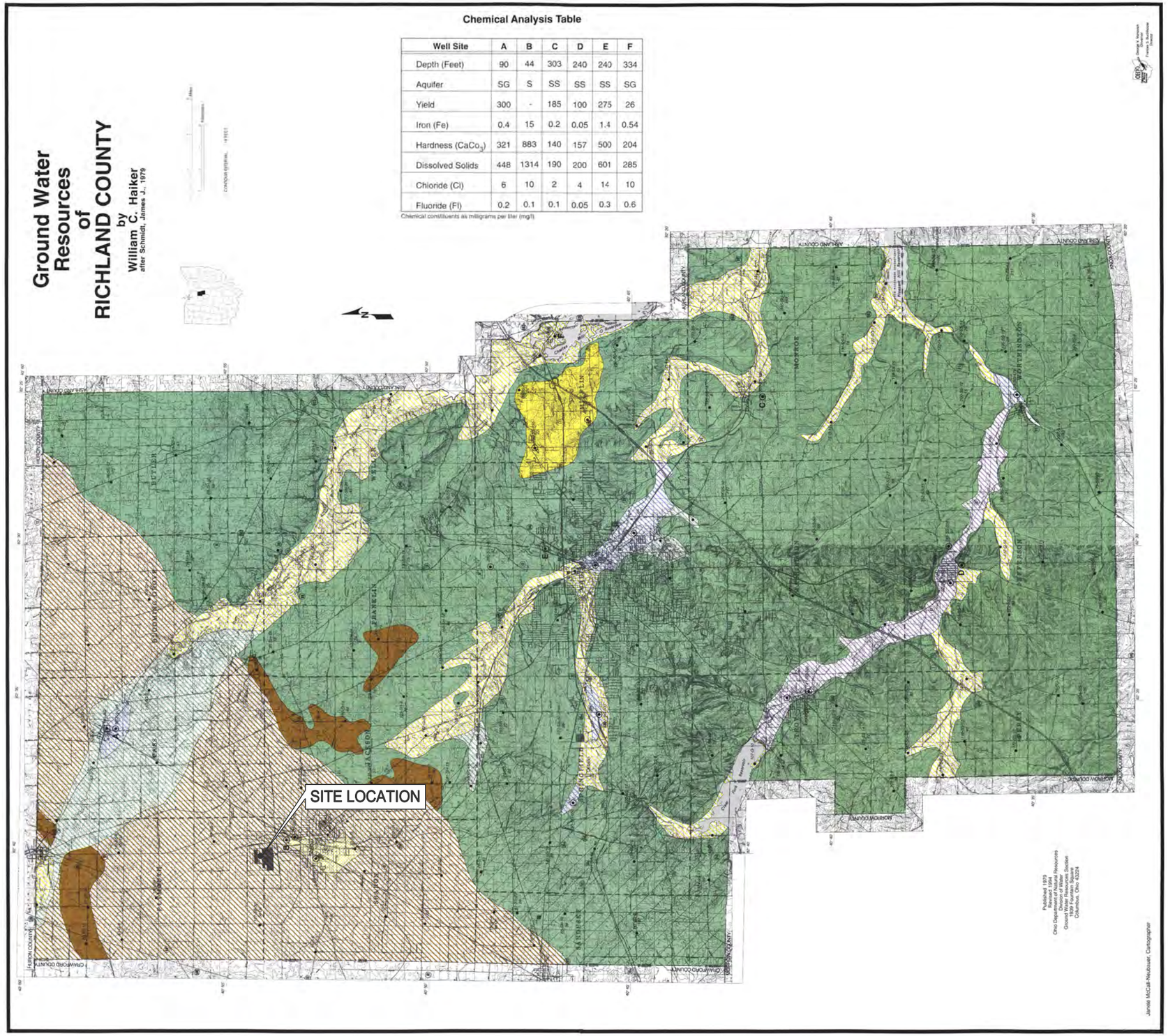
SHELBY_FIGURES.DGN 2-7



Chemical Analysis Table

Well Site	A	B	C	D	E	F
Depth (Feet)	90	44	303	240	240	334
Aquifer	SG	S	SS	SS	SS	SG
Yield	300	-	185	100	275	26
Iron (Fe)	0.4	15	0.2	0.05	1.4	0.54
Hardness ($CaCo_3$)	321	883	140	157	500	204
Dissolved Solids	448	1314	190	200	601	285
Chloride (Cl)	6	10	2	4	14	10
Fluoride (Fl)	0.2	0.1	0.1	0.05	0.3	0.6

Chemical constituents as milligrams per liter (mg/l)

Well Yields

AREAS IN WHICH YIELDS OF MORE THAN 500 GALLONS PER MINUTE MAY BE DEVELOPED

Good potential area for the development of municipal and industrial ground water supplies. Thick permeable deposits of coarse sand and gravel yield 500 to more than 1500 gallons per minute at depths of 65 to 150 feet.

AREAS IN WHICH YIELDS OF 100 TO 500 GALLONS PER MINUTE MAY BE DEVELOPED

Sustained yields of 100 to 500 gallons per minute may be developed from permeable sand and gravel deposits encountered at depths of 125 to 300 feet. Extensive test drilling may be necessary to locate the more permeable deposits which partially fill ancestral drainage channels.

AREAS IN WHICH YIELDS OF 25 TO 100 GALLONS PER MINUTE MAY BE DEVELOPED

Ground water is obtained from the sandstone bedrock. Sustained yields of 50 gallons per minute are possible from wells less than 200 feet deep. Greater yields of up to 200 gallons per minute may be possible from large diameter wells at depths of 250 to 400 feet.

Properly screened and developed wells may yield up to 75 gallons per minute from sand and gravel deposits at depths of 65 to 200 feet. Test drilling may be necessary to locate areas suitable for industrial and small public water supplies.

Shallow sand and gravel deposits less than 50 feet deep may potentially yield up to 100 gallons per minute from larger diameter wells. Deposits may be fine-grained and therefore wells must be screened and properly developed to attain maximum yields.

AREAS IN WHICH YIELDS OF 10 TO 25 GALLONS PER MINUTE MAY BE DEVELOPED

Yields of 10 to 25 gallons per minute are generally available from sandstone and shale formations of the Cuyahoga Group at depths of up to 275 feet. Industrial and municipal supplies of more than 200 gallons per minute have been reported for properly completed large diameter wells at depths of up to 400 feet.

Thin to thick lenses of sand and gravel interbedded in layers of till may yield up to 20 gallons per minute at depths of less than 200 feet. If water-bearing deposits are not encountered, wells may be developed in the underlying sandstone and shale bedrock, although dry wells are noted.

AREAS IN WHICH YIELDS OF 3 TO 10 GALLONS PER MINUTE MAY BE DEVELOPED

Shale and shaly-sandstone bedrock is capable of yielding 3 to 10 gallons per minute at depths of less than 200 feet. An occasional dry well is possible.

Relatively shallow wells drilled into thin, fine-grained glacial deposits may yield 3 to 10 gallons per minute from properly developed wells less than 100 feet deep. Deeper drilling into the underlying shale and sandstone bedrock yields minimal supplies of brackish water. Oil is sometimes reported from wells in Plymouth Township. Dry wells are not uncommon.

Numerous sandstone and shale wells less than 125 feet have been deepened to 200 to 250 feet to re-develop adequate supplies.

County Line

Township Line

Incorporated City Limit

Well Site Symbols

WELL INFORMATION
(SEE NOTE)

DEPTH (ft.) Total depth of well in feet.
AQUIFER TYPE Water-bearing formation
YIELD (gpm) Amount of water a well produces in gallons per minute.
WELL SITE Approximate well location
75-SS-20
26
DEPTH TO BEDROCK (ft.) Depth to bedrock in feet.

WELL TYPES
- Well Site
- Municipal-Industrial Well
- Observation Well Site *
- A Chemical Analyses

AQUIFER TYPES
- S – Sand
- G – Gravel
- SG – Sand & Gravel
- SS – Sandstone
- SH – Shale

*Observation well sites indicate the location of wells used to collect ground water level information. These wells are part of the state observation well network. Hydrographs of the water levels recorded in these and other State observation wells can be obtained through ODNR–Division of Water.

FIGURE 2-8
Site Location and Groundwater Resources
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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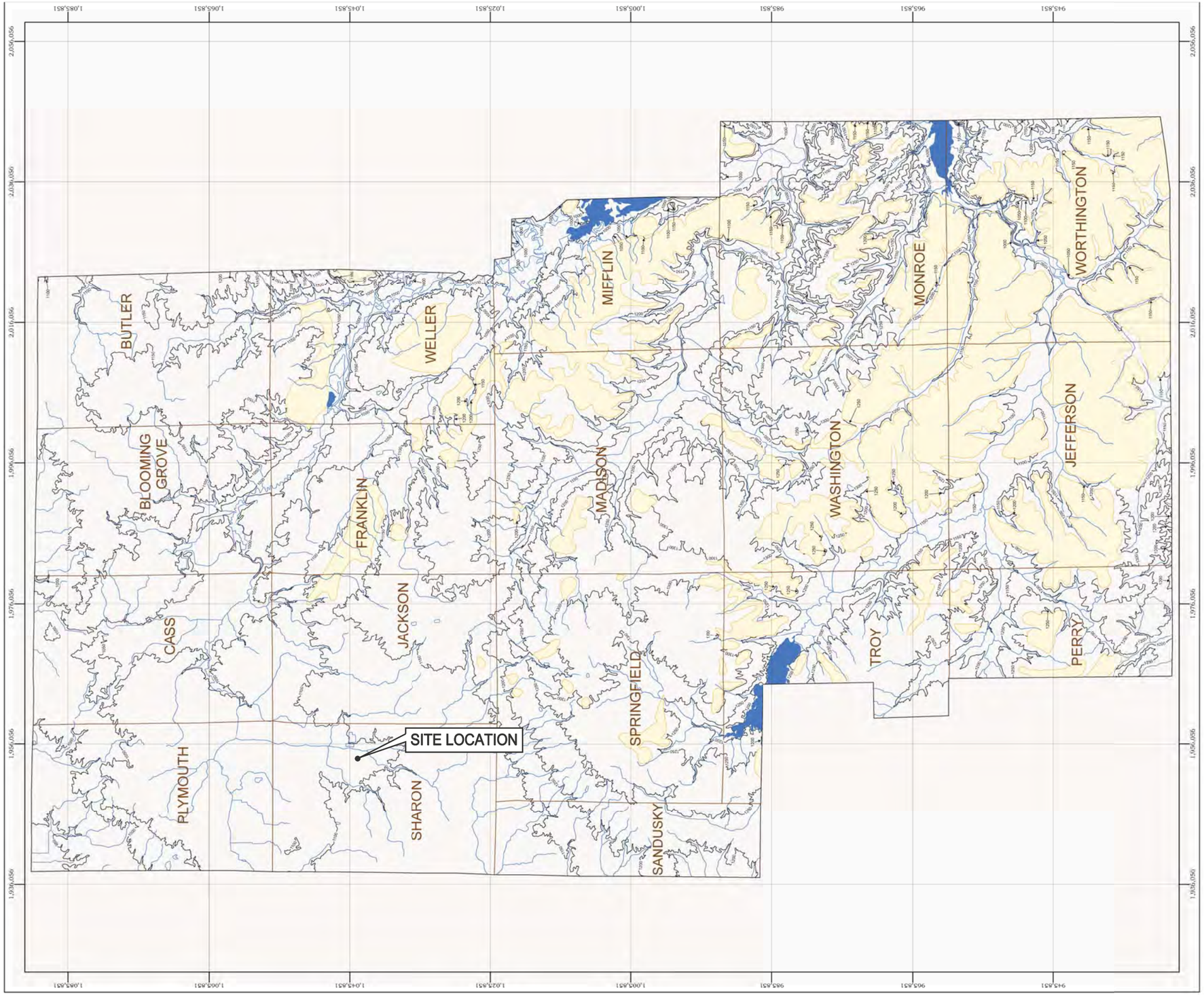
SHELBY_FIGURE2-9.DGN

SHELBY_FIGURES.DGN 2-8



Potentiometric Surface of the Unconsolidated Aquifers in Richland County

by
Kathy Sprowls
Ohio Department of Natural Resources
Division of Water

This map shows the elevation of the ground water level that was measured from individual water wells completed in the unconsolidated (sand and gravel) aquifers within Richland County.

Ground water potentiometric surface (water level) maps indicate the elevation and general direction of ground water flow. Ground water flows from areas of higher head elevations to lower head elevations in a direction perpendicular to the contour lines. This map only depicts the horizontal gradient.

These maps could be used to determine ground water recharge and discharge areas, as input data into ground water modeling programs, and to locate monitoring wells in the correct locations to satisfy compliance monitoring. These maps could also be used to assist in preparing water resource plans, to assist in preparing technical studies, the mapping of stress areas, and in possible ground water diversion issues. Since these maps were created from existing data collected over a fifty-year period, field verification of the ground water flow direction should be conducted before any site specific work is conducted.

Legend

- –800– Ground Water Elevation, in feet
- Roads
- Streams
- Lakes
- Townships
- No Aquifer / No Data - Areas of thin (<25 ft) of glacial drift

Contour interval is 50 feet. Contour elevations are measured from Mean Sea Level.

Black grid represents the State Plane South Coordinate System (NAD27, feet).

N

0 1 2 3 4 5
Miles

0 1 2 4 6 8
Kilometers

Disclaimer

This map was created using static water level readings from water well records collected over a 50 (+/-) year period. The Division of Water has technically reviewed this map but disclaims any responsibility or liability for interpretations or decisions based thereon. In no event shall the Division of Water have any liability whatsoever for payment of any kind, including but not limited to, any loss of profits arising out of use of or reliance on the maps.

Ohio Department of Natural Resources
Division of Water
Ground Water Resources Section
2045 Morse Rd., Bldg. B-2
Columbus Ohio 43229
www.dnr.state.oh.us

December, 2005

Cartography by Nicholas Booth and Michael Angle

FIGURE 2-9
Site Location and Unconsolidated Aquifer Potentiometric Surface Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Shelby_Figure2-9.dgn

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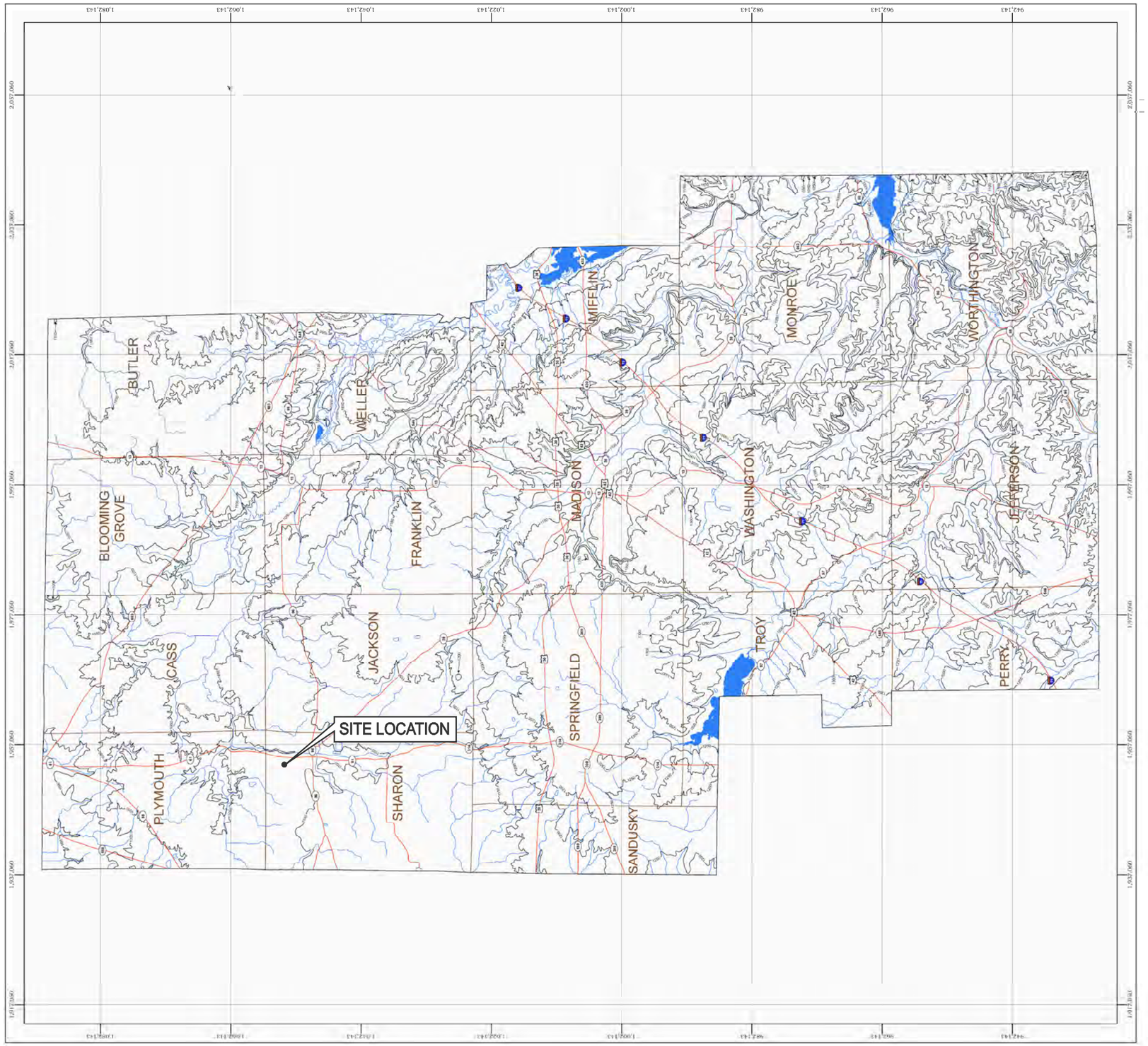

Potentiometric Surface of the Consolidated Aquifers in Richland County

by
Kathy Sprowls
Ohio Department of Natural Resources
Division of Water

This map shows the elevation of the ground water level that was measured from individual water wells completed in the Consolidated (Bedrock) aquifers within Richland County.

Ground water potentiometric surface (water level) maps indicate the elevation and general direction of ground water flow. Ground water flows from areas of higher head elevations to lower head elevations in a direction perpendicular to the contour lines. This map only depicts the horizontal gradient.

These maps could be used to determine ground water recharge and discharge areas, as input data into ground water modeling programs, and to locate monitoring wells in the correct locations to satisfy compliance monitoring. These maps could also be used to assist in preparing water resource plans, to assist in preparing technical studies, the mapping of stress areas, and in possible ground water diversion issues. Since these maps were created from existing data collected over a fifty-year period, field verification of the ground water flow direction should be conducted before any site specific work is conducted.

Legend

- –800– Ground Water Elevation, in feet
- Roads
- Streams
- Lakes
- Townships

Contour interval is 50 feet. Contour elevations are measured from Mean Sea Level.

Black grid represents the State Plane South Coordinate System (NAD27, feet).

N

0 1 2 3 4 5 Miles

0 1 2 4 6 8 Kilometers

Disclaimer

This map was created using static water level readings from water well records collected over a 50 (+/-) year period. The Division of Water has technically reviewed this map but disclaims any responsibility or liability for interpretations or decisions based thereon. In no event shall the Division of Water have any liability whatsoever for payment of any kind, including but not limited to, any loss of profits arising out of use of or reliance on the maps.

Ohio Department of Natural Resources
Division of Water
Ground Water Resources Section
2045 Morse Rd, Bldg. D-2
Columbus Ohio 43229
www.dnr.state.oh.us

December 2006

Cartography by Nicholas Booth and Michael Angle

FIGURE 2-10
Site Location and Consolidated Aquifer Potentiometric Surface Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Shelby_Figure2-9.dgn

Shelby_Figure2-10.dgn

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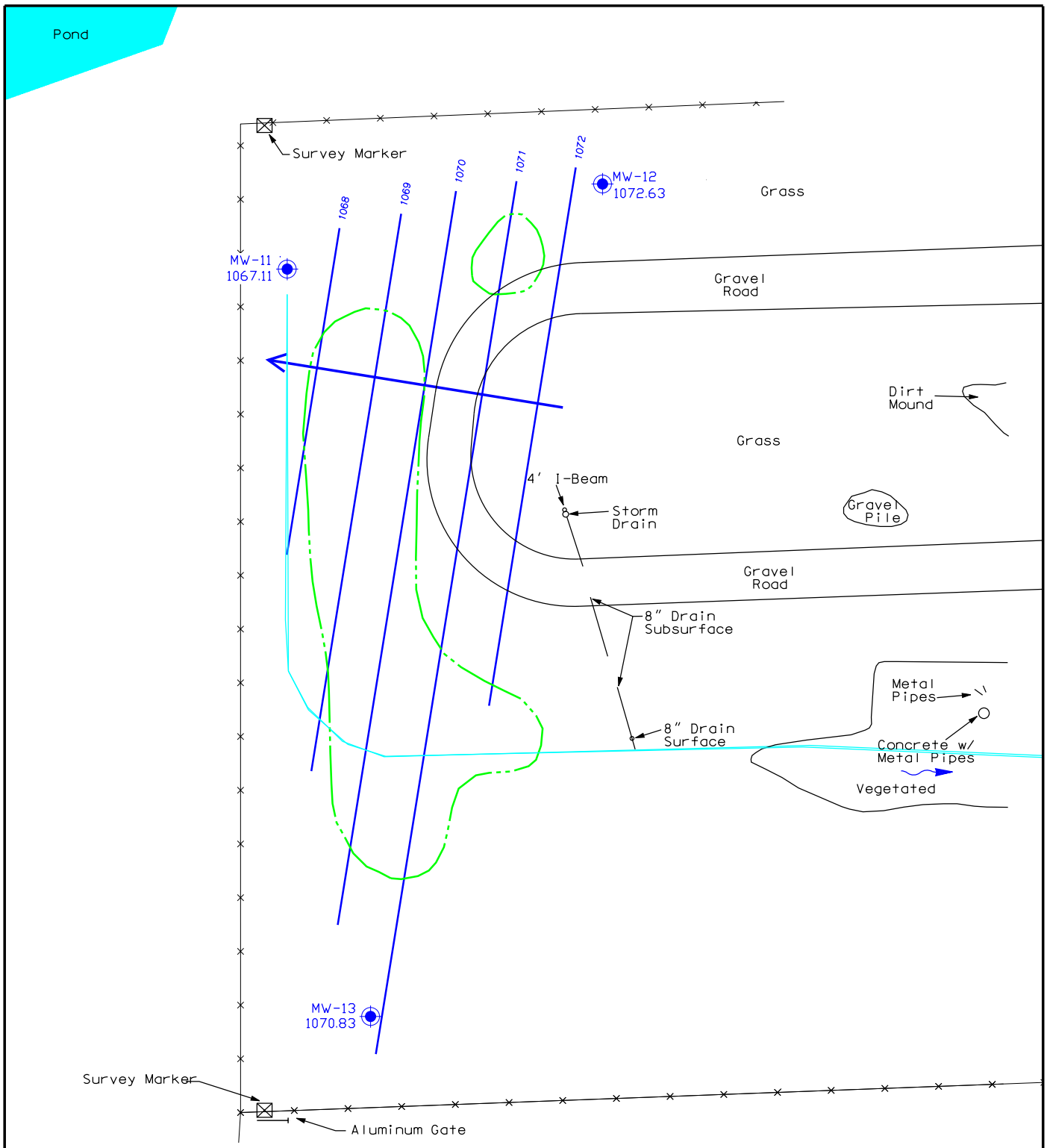

LEGEND

- GEOPHYSICAL ANOMALIES
- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATIONS
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- GENERALIZED GROUNDWATER FLOW DIRECTION

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

Approximate scale in feet

FIGURE 2-11
November 2008 Potentiometric Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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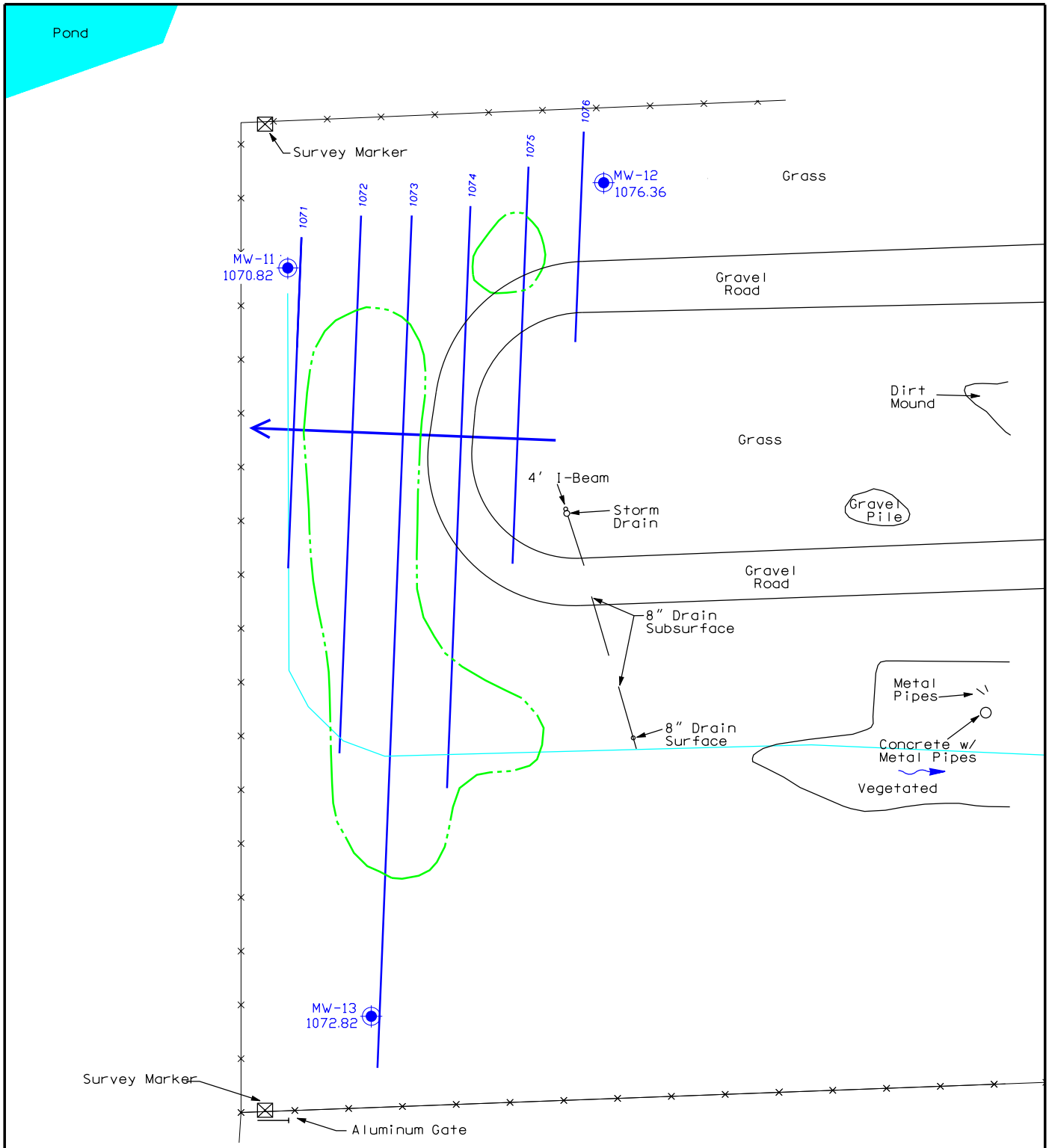
Shelby_Figure-2-11.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATIONS
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- GENERALIZED GROUNDWATER FLOW DIRECTION

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

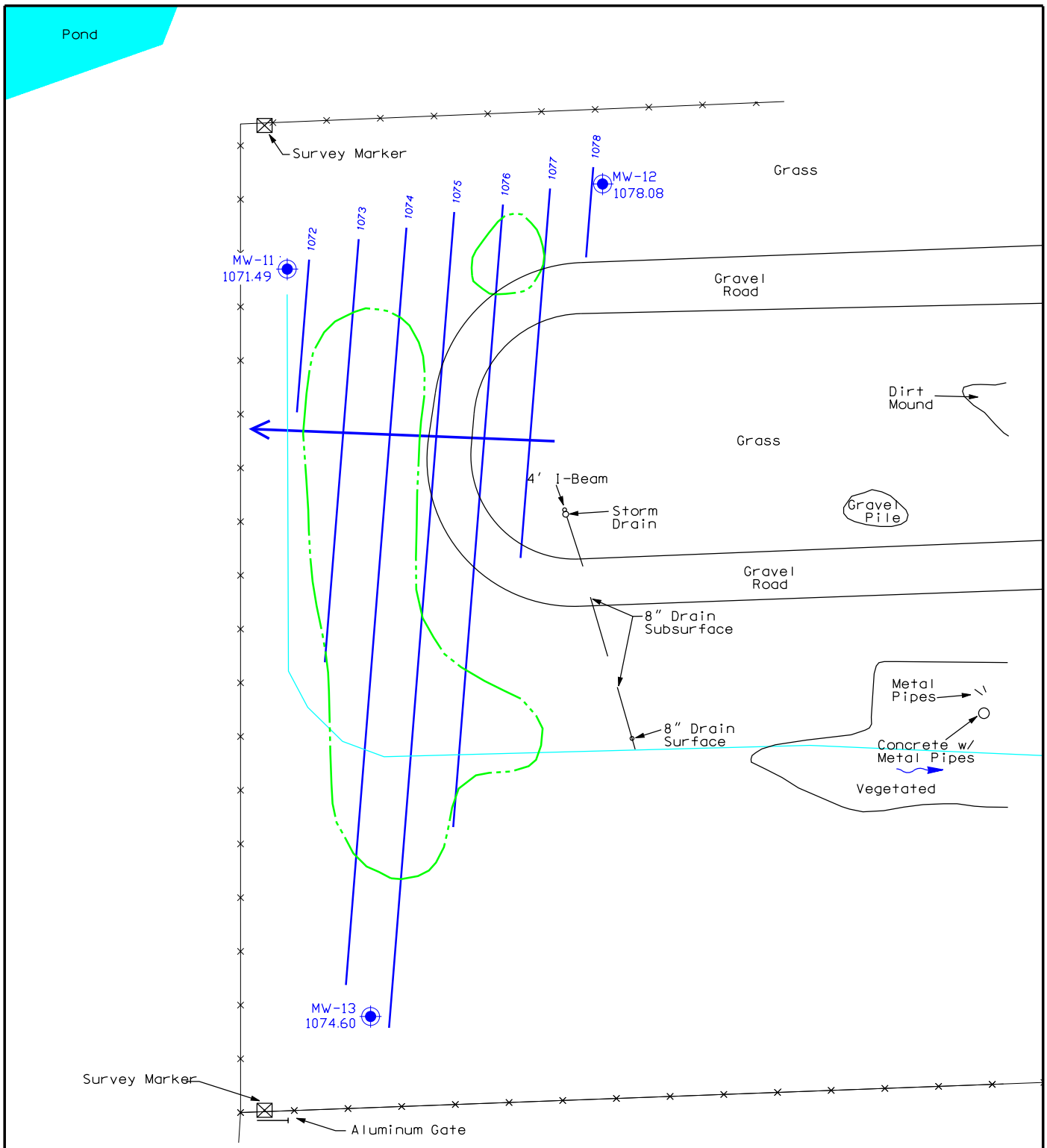
0 40 80

Approximate scale in feet

FIGURE 2-12
Januuary 2009 Potentiometric Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-2-12.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATIONS
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- GENERALIZED GROUNDWATER FLOW DIRECTION

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

Approximate scale in feet

FIGURE 2-13
April 2009 Potentiometric Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

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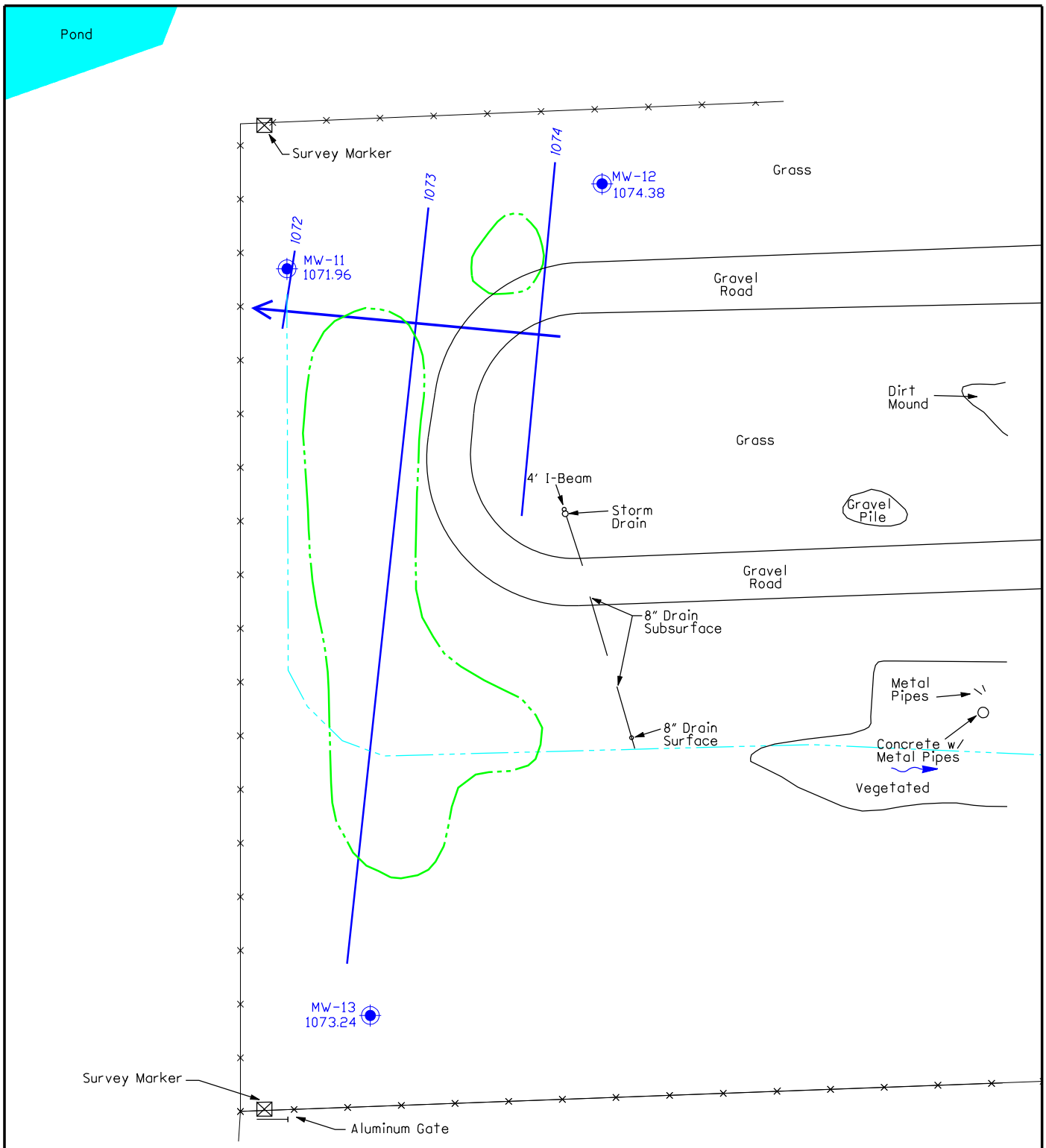
Shelby_Figure-2-13.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- GROUNDWATER MONITORING WELL
- GROUNDWATER ELEVATIONS
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- GENERALIZED GROUNDWATER FLOW DIRECTION

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

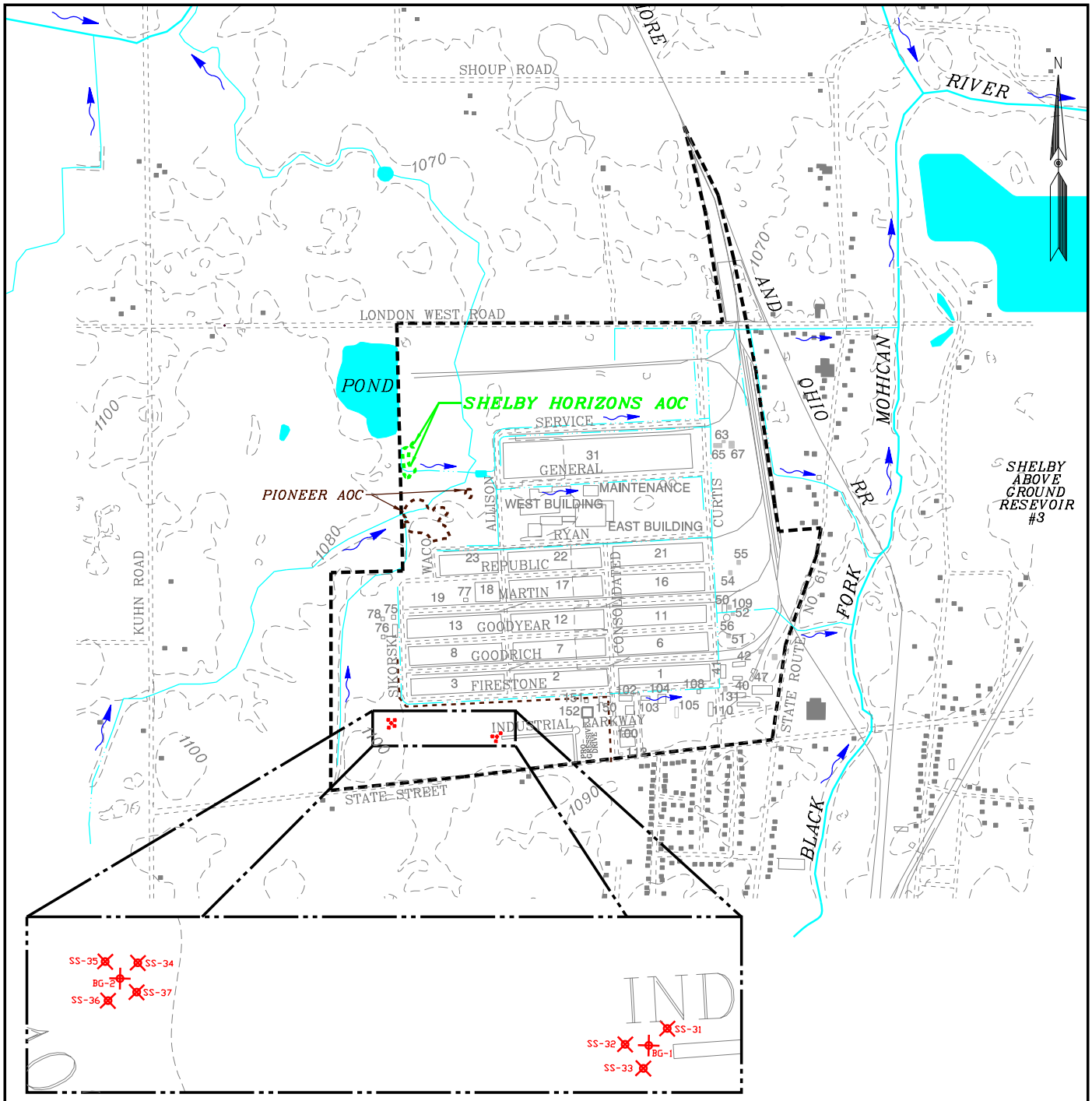
North

0 40 80
Approximate scale in feet

FIGURE 2-14
July 2009 Potentiometric Map
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-2-14.dgn



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

LEGEND

- FORMER WILKINS AFS APPROXIMATE PROPERTY BOUNDRY
- CONTOURS
- RAILROAD
- INTERMITANT DRAINAGE DITCH
- STREAM/RIVER
- BACKGROUND SAMPLE LOCATIONS
- SHELBY HORIZONS AOC
- PIONEER AOC
- EXISTING BUILDINGS
- DIRECTIONAL FLOW ARROW
- APPROXIMATE EXTENT OF PIONEER AOC
- INTERMITTENT RETENTION POND

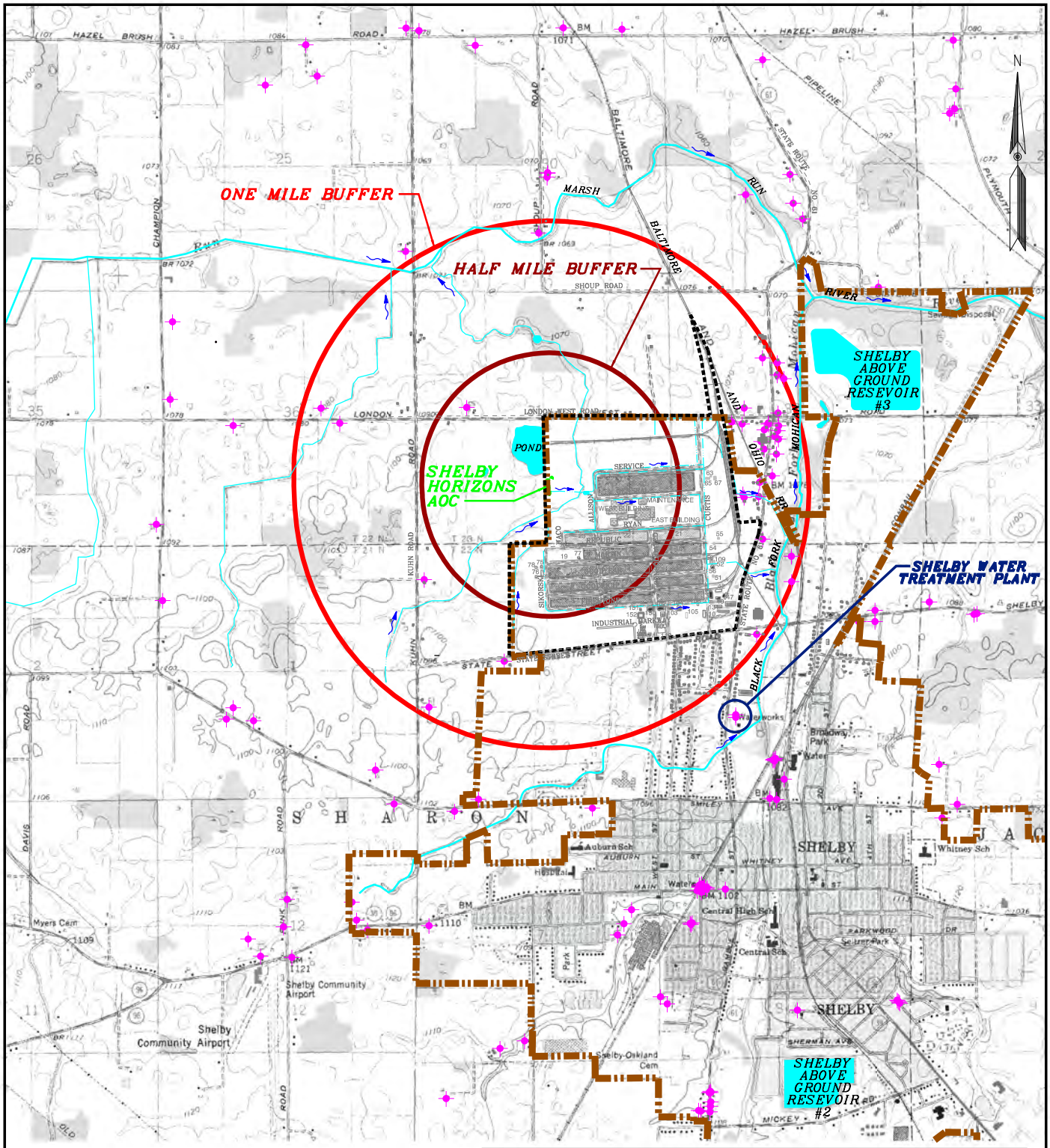
North

0 800 1600
Approximate scale in feet

FIGURE 2-15
Wilkins AFS Background Sample Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

shelby_figure_2-15.dgn



NOTES:
1. ODNR listed wells were located from the Ohio DNR well logs.

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 1500 3000
Approximate scale in feet

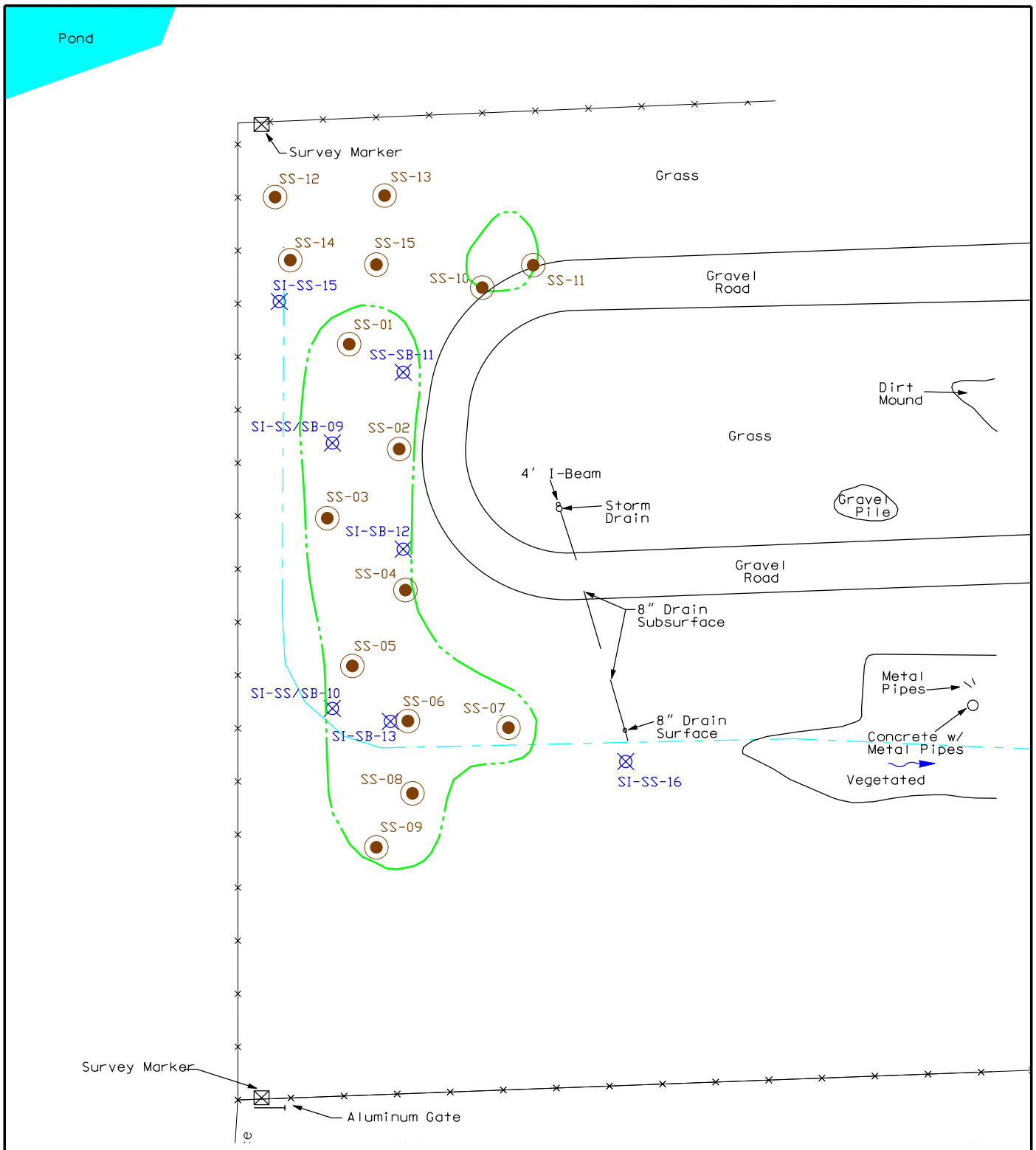
LEGEND

- FORMER WILKINS AFS APPROXIMATE PROPERTY BOUNDRY
- CONTOURS
- RAILROAD
- INTERMITANT DRAINAGE DITCH
- STREAM/RIVER
- CITY LIMITS
- SHELBY HORIZONS AOC
- EXISTING BUILDINGS
- DIRECTIONAL FLOW ARROW
- INTERMITTENT RETENTION POND
- ODNR Listed Wells

FIGURE 2-16
ODNR Listed Wells Within 1 Mile of Shelby Horizons AOC
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

shelby_figure_2-15.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- RI SURFACE SOIL SAMPLE
- PLEXUS SI SOIL SAMPLE (SS/SB INDICATES A LOCATION WHERE BOTH SURFACE SOIL AND SUBSURFACE SOIL BORING SAMPLES WERE COLLECTED)
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- DIRECTIONAL FLOW ARROW

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

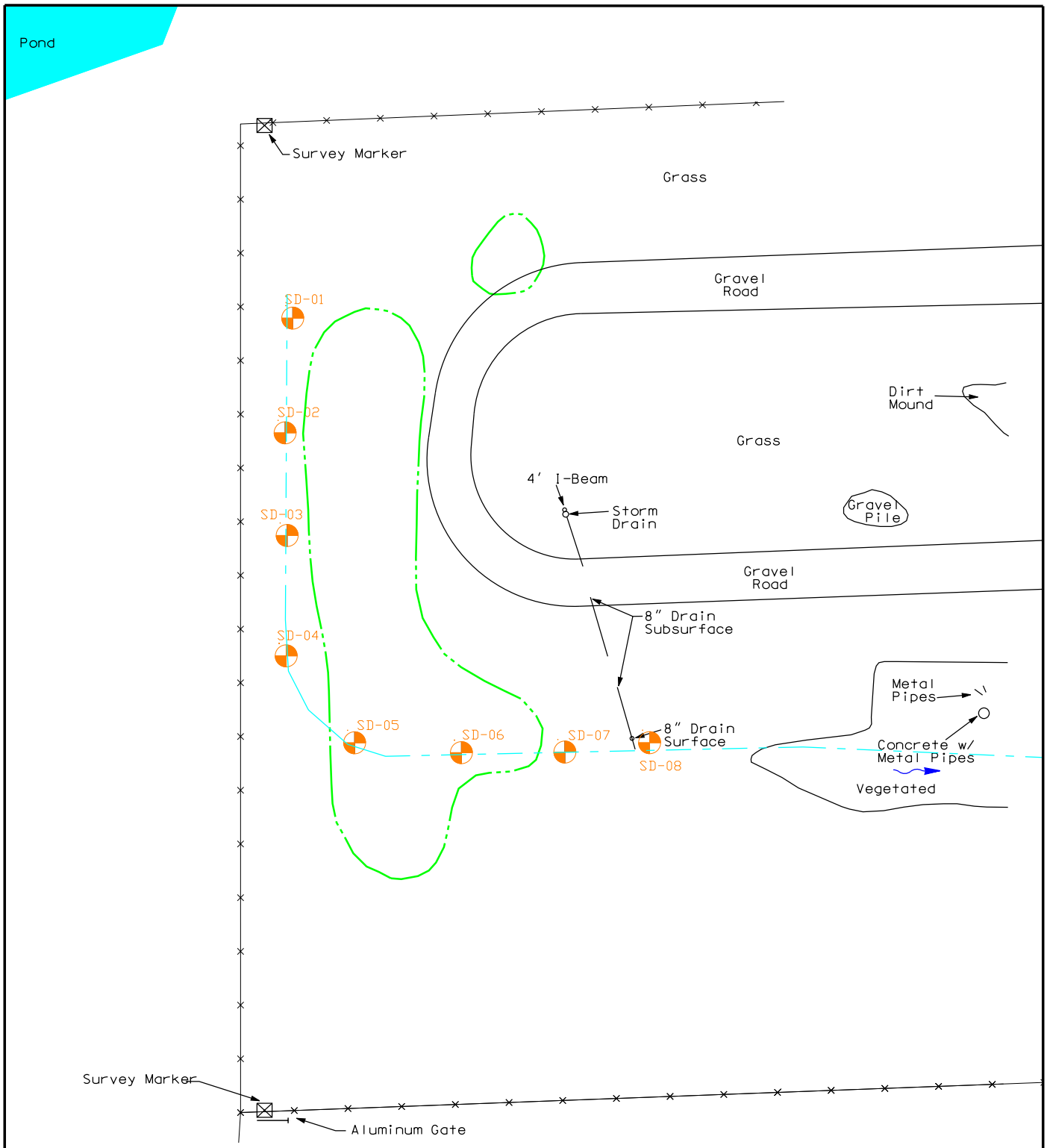
Approximate scale in feet

FIGURE 3-1

Soil Sampling Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-3-1.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- RI Drainage Ditch Surface Soil/ Sediment Sampling Locations
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

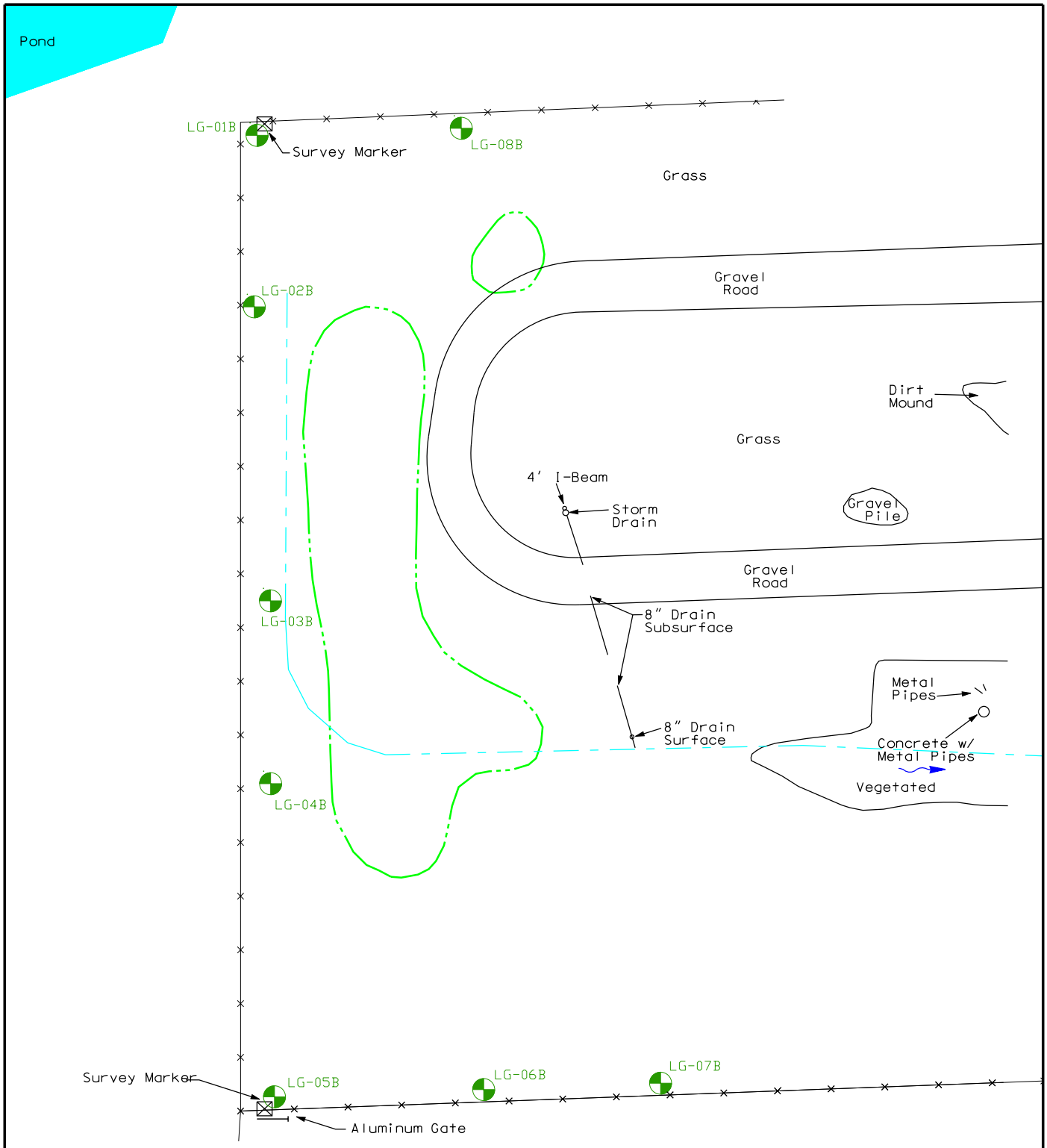
North

0 40 80
Approximate scale in feet

FIGURE 3-2
Drainage Ditch Surface Soil/ Sediment Sampling Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-3-2.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- LANDFILL GAS SURVEY LOCATION
- DIRECTIONAL FLOW ARROW
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

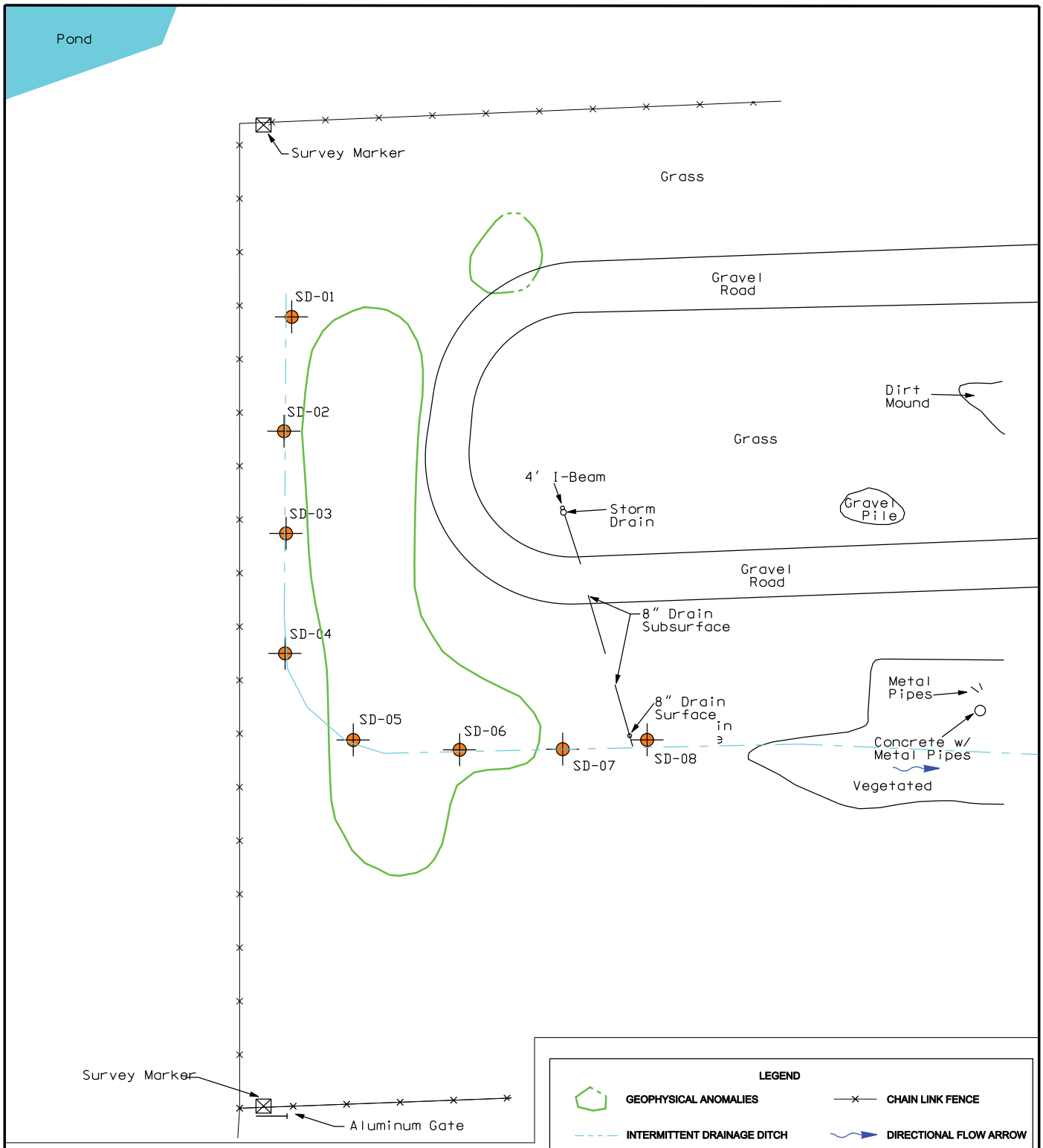
North

0 40 80
Approximate scale in feet

FIGURE 3-3
Landfill Gas Survey Locations
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-3-3.dgn



LEGEND

GEOPHYSICAL ANOMALIES

CHAIN LINK FENCE

INTERMITTENT DRAINAGE DITCH

DIRECTIONAL FLOW ARROW

SOIL SAMPLE COLOR CODING

Arsenic

RI SURFACE SOIL SAMPLE

NOTES:

1. RI Screening levels for sediment are the December 2009 USEPA Industrial soil RSLs (Regional Screening Levels).

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

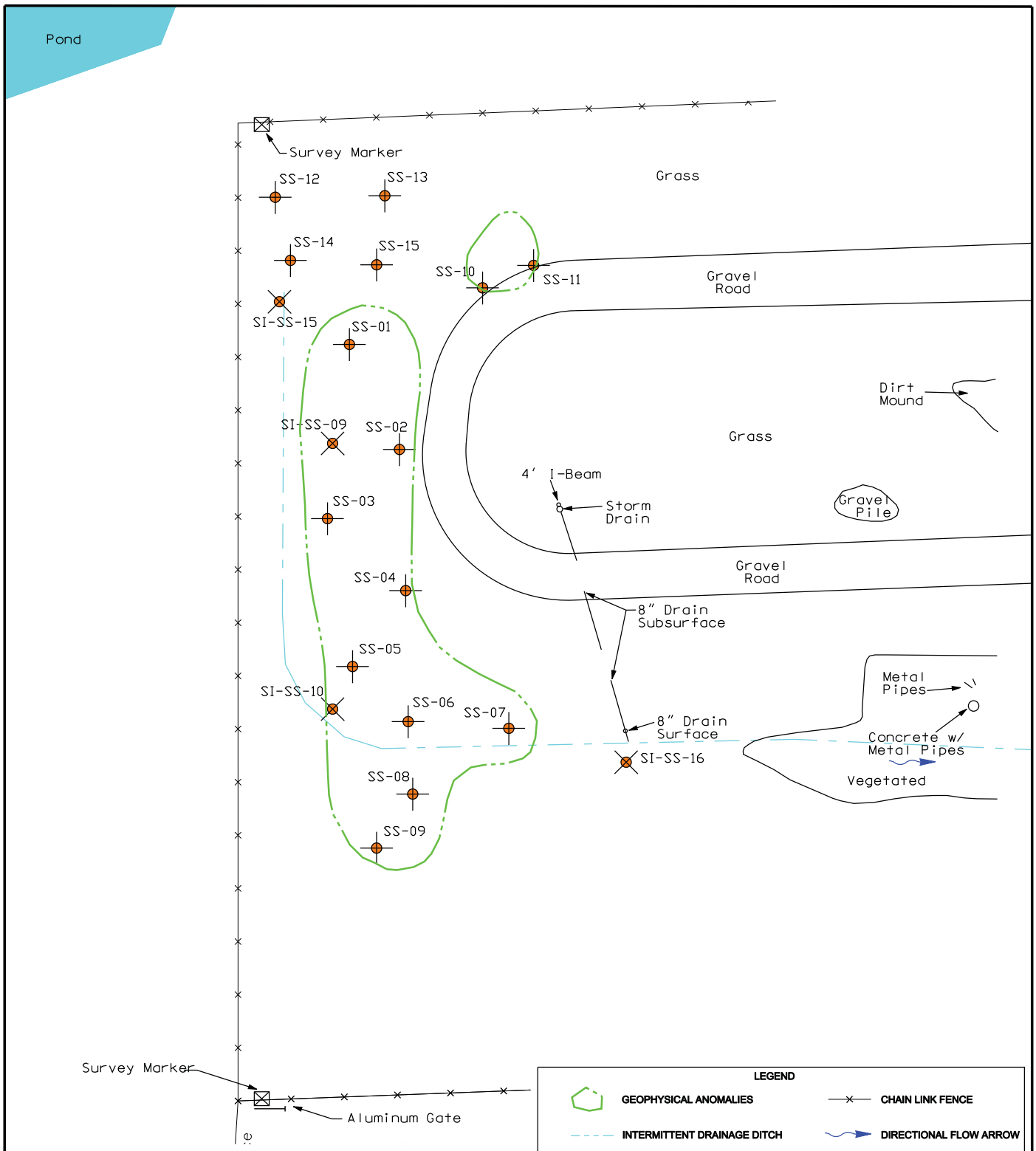
Approximate scale in feet

FIGURE 4-1

Sediment Sampling Locations in Excess of Industrial Screening Levels for Metals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-3.dgn



LEGEND

GEOPHYSICAL ANOMALIES

CHAIN LINK FENCE

INTERMITTENT DRAINAGE DITCH

DIRECTIONAL FLOW ARROW

SOIL SAMPLE COLOR CODING

Arsenic

Arsenic

PLEXUS SI SOIL SAMPLE

RI SURFACE SOIL SAMPLE

NOTES:

1. RI Screening levels for surface soil are the December 2009 USEPA Industrial RSLs (Regional Screening Levels).

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

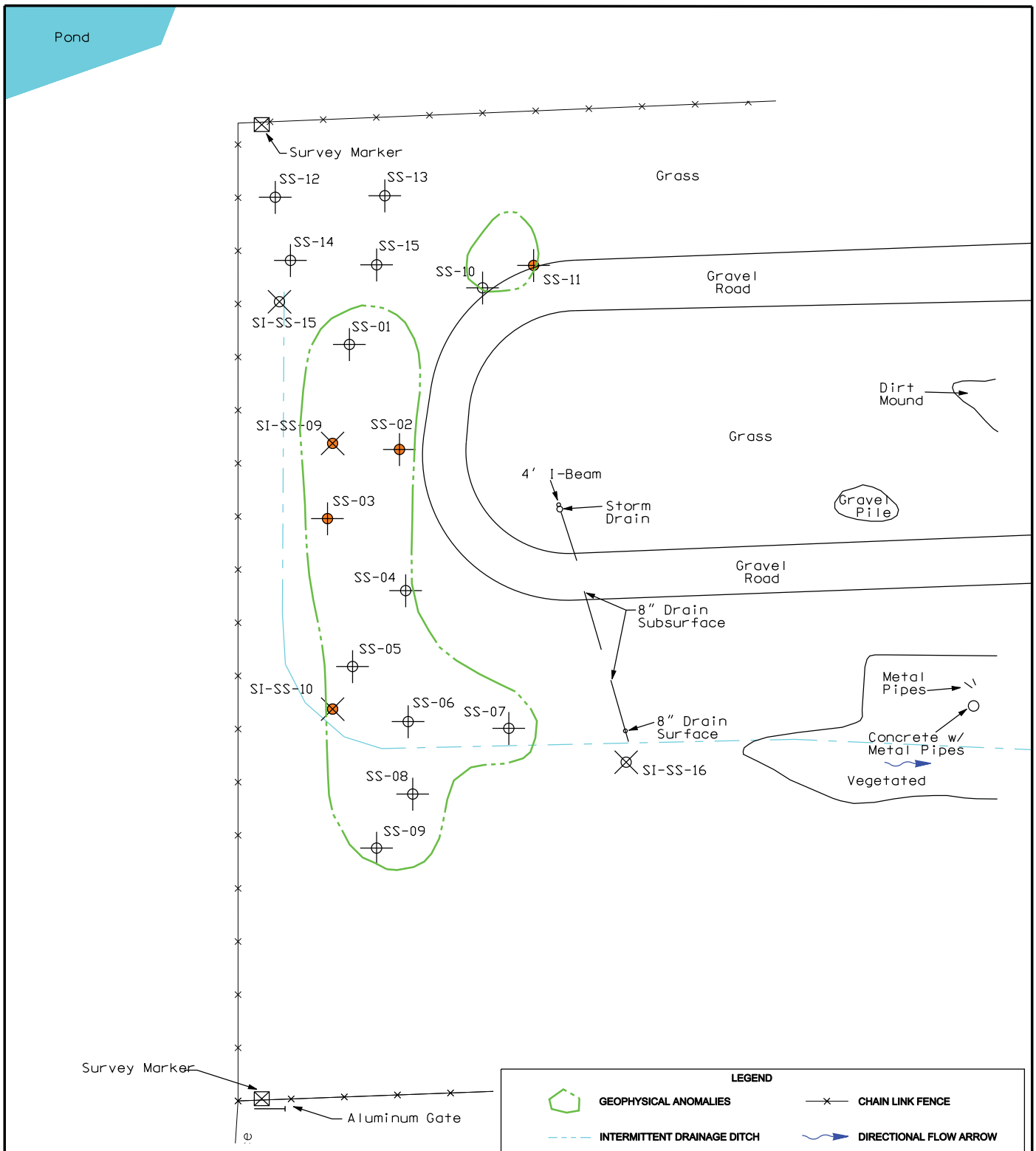
Approximate scale in feet

FIGURE 4-2

Surface Soil Sampling Locations in Excess of Industrial Screening Levels for Metals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-1.dgn



LEGEND

- GEOPHYSICAL ANOMALIES
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH
- DIRECTIONAL FLOW ARROW

SURFACE SOIL SAMPLE COLOR CODING

- Benzo(a)pyrene — PLEXUS SI SOIL SAMPLE
- Benzo(a)pyrene — RI SURFACE SOIL SAMPLE

NOTES:

1. RI Screening levels for surface soil are the December 2009 USEPA Industrial RSLs (Regional Screening Levels).

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

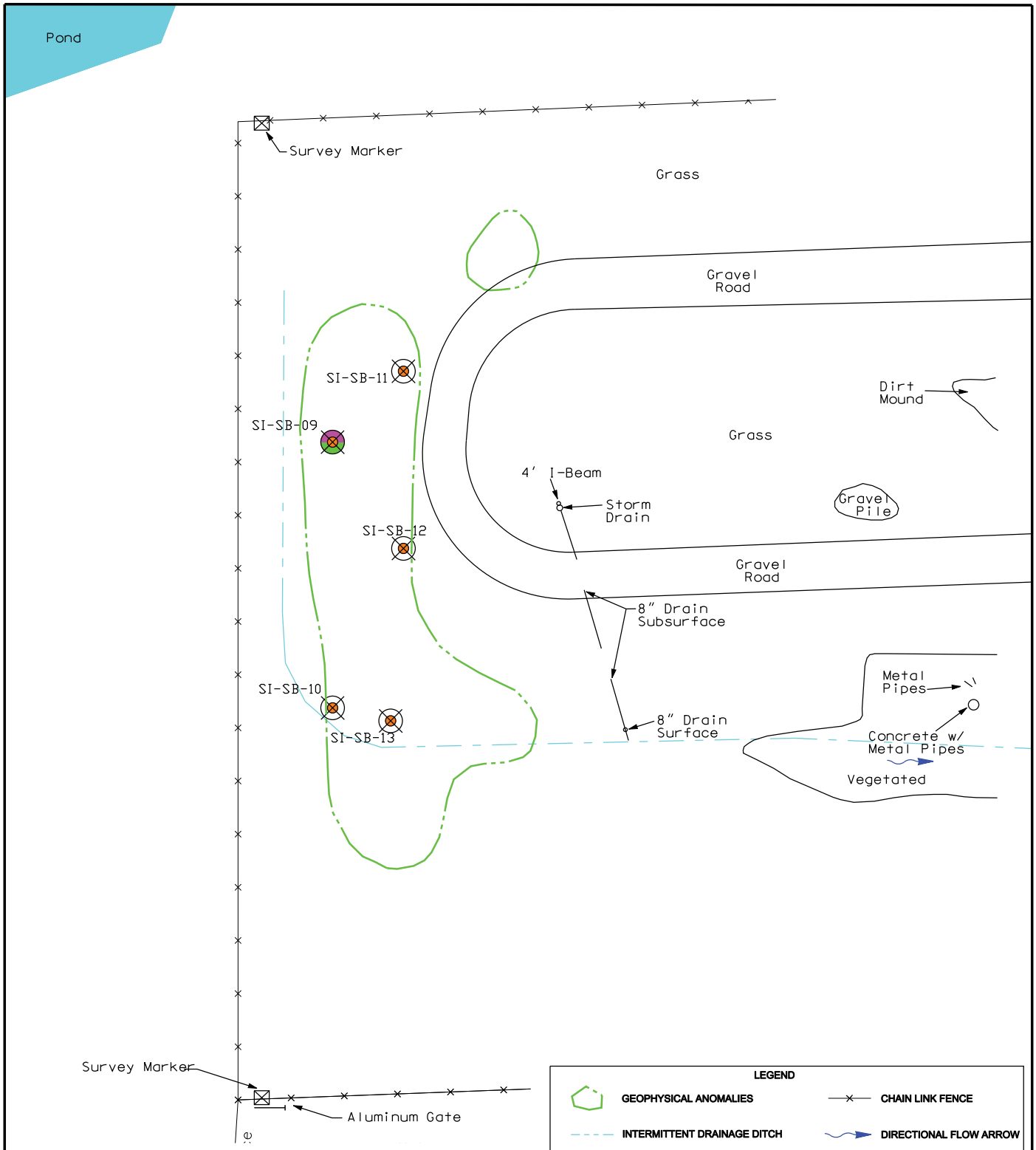
Approximate scale in feet

FIGURE 4-3

Surface Soil Sampling Locations in Excess of Industrial Screening Levels for PAHs
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-2.dgn



LEGEND

GEOPHYSICAL ANOMALIES

CHAIN LINK FENCE

INTERMITTENT DRAINAGE DITCH

DIRECTIONAL FLOW ARROW

SUBSURFACE SOIL SAMPLE COLOR CODING

Arsenic

Mercury

Lead

PLEXUS SI SUBSURFACE SOIL SAMPLE

NOTES:

1. RI Screening levels for subsurface soil are December 2009 USEPA Industrial RSLs (Regional Screening Levels).

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

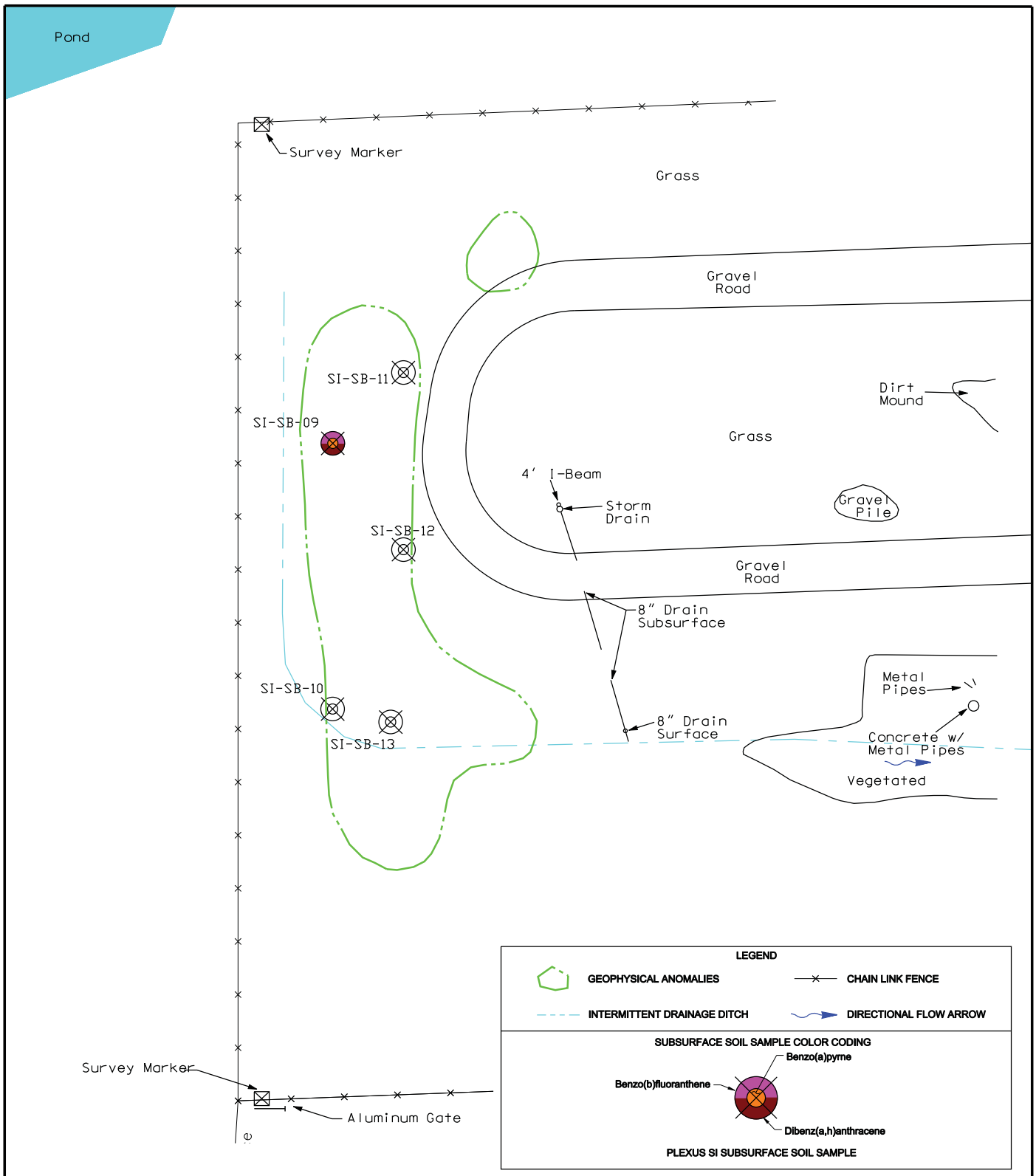
Approximate scale in feet

FIGURE 4-4

Subsurface Soil Sampling Locations in Excess of Industrial Screening Levels for Metals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-4.dgn



NOTES:

1. RI Screening levels for subsurface soil are the December 2009 USEPA Industrial RSLs (Regional Screening Levels).

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

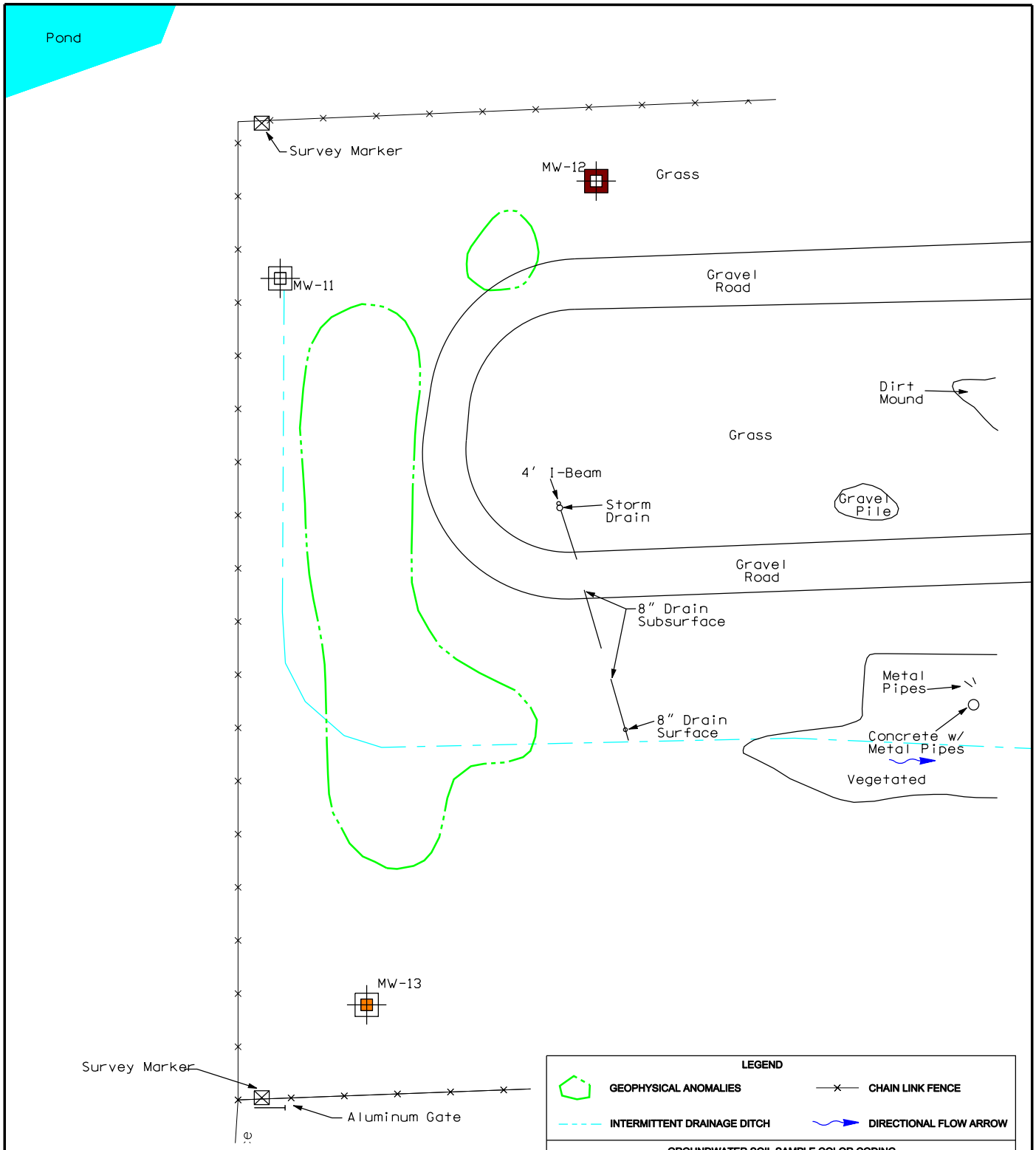
Approximate scale in feet

FIGURE 4-5

Subsurface Soil Sampling Locations in Excess of Industrial Screening Levels for PAHs
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-5.dgn



LEGEND

GEOPHYSICAL ANOMALIES

CHAIN LINK FENCE

INTERMITTENT DRAINAGE DITCH

DIRECTIONAL FLOW ARROW

GROUNDWATER SOIL SAMPLE COLOR CODING

Antimony

Arsenic

RI MONITORING WELL

NOTES:

1. RI Screening levels for groundwater are the EPA MCL or EPA Tapwater if no MCL exists.

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982). BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952. BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80

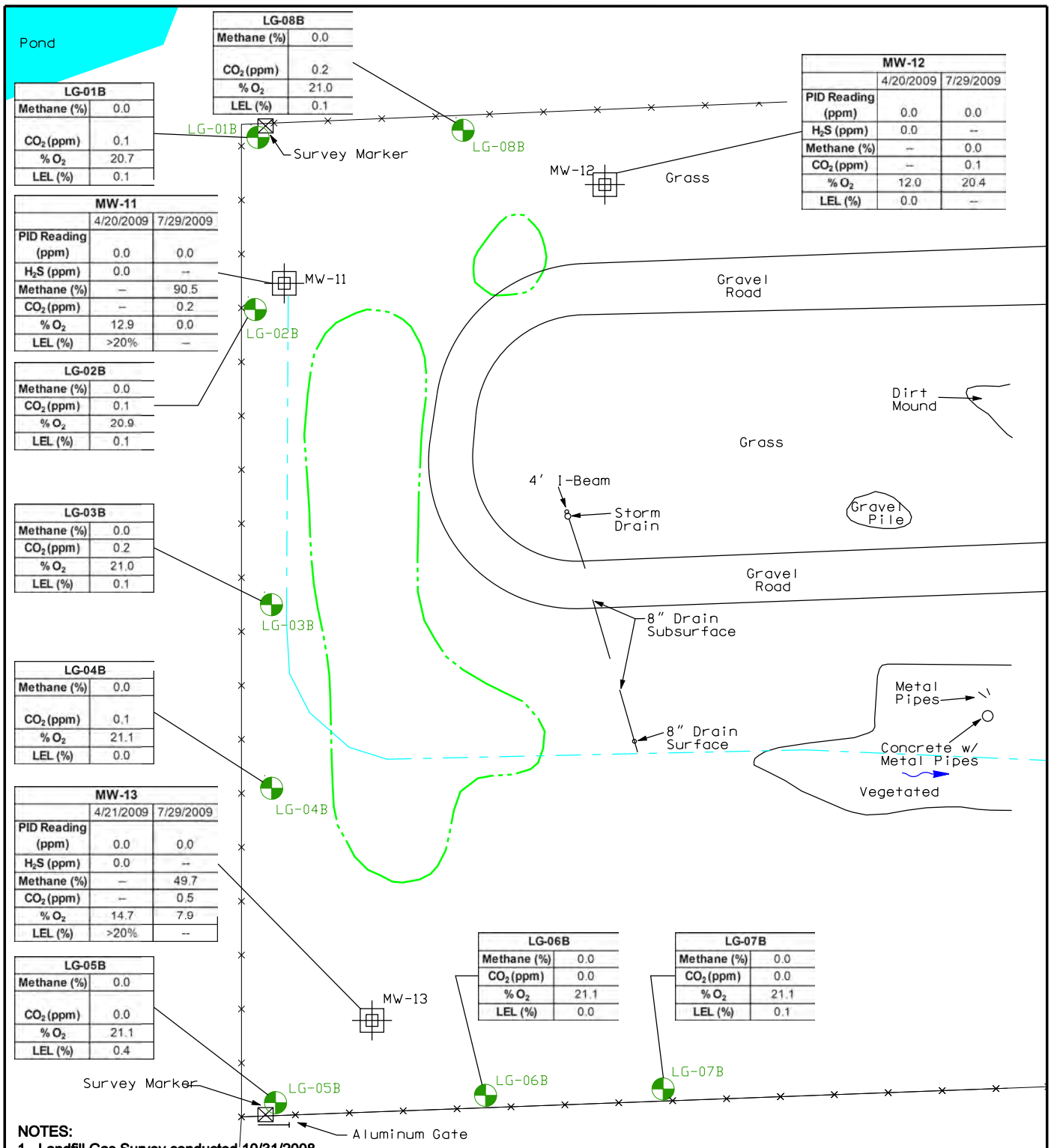
Approximate scale in feet

FIGURE 4-6

Groundwater Sampling Locations in Excess of RI Screening Levels For Metals
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-1.dgn



NOTES:

1. Landfill Gas Survey conducted 10/31/2008.
2. Down well readings were only collected in April and July 2009
3. -- - Indicates reading not available/ not collected
4. LEL - lower explosive limit
5. H2S - hydrogen sulfide
6. O2 Oxygen
7. CO2 - carbon dioxide
8. ppm - parts per million

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

FIGURE 4-7
Landfill Gas Survey and Downwell Air Quality Monitoring Results
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

CH2MHILL

Shelby_Figure-4-7.dgn

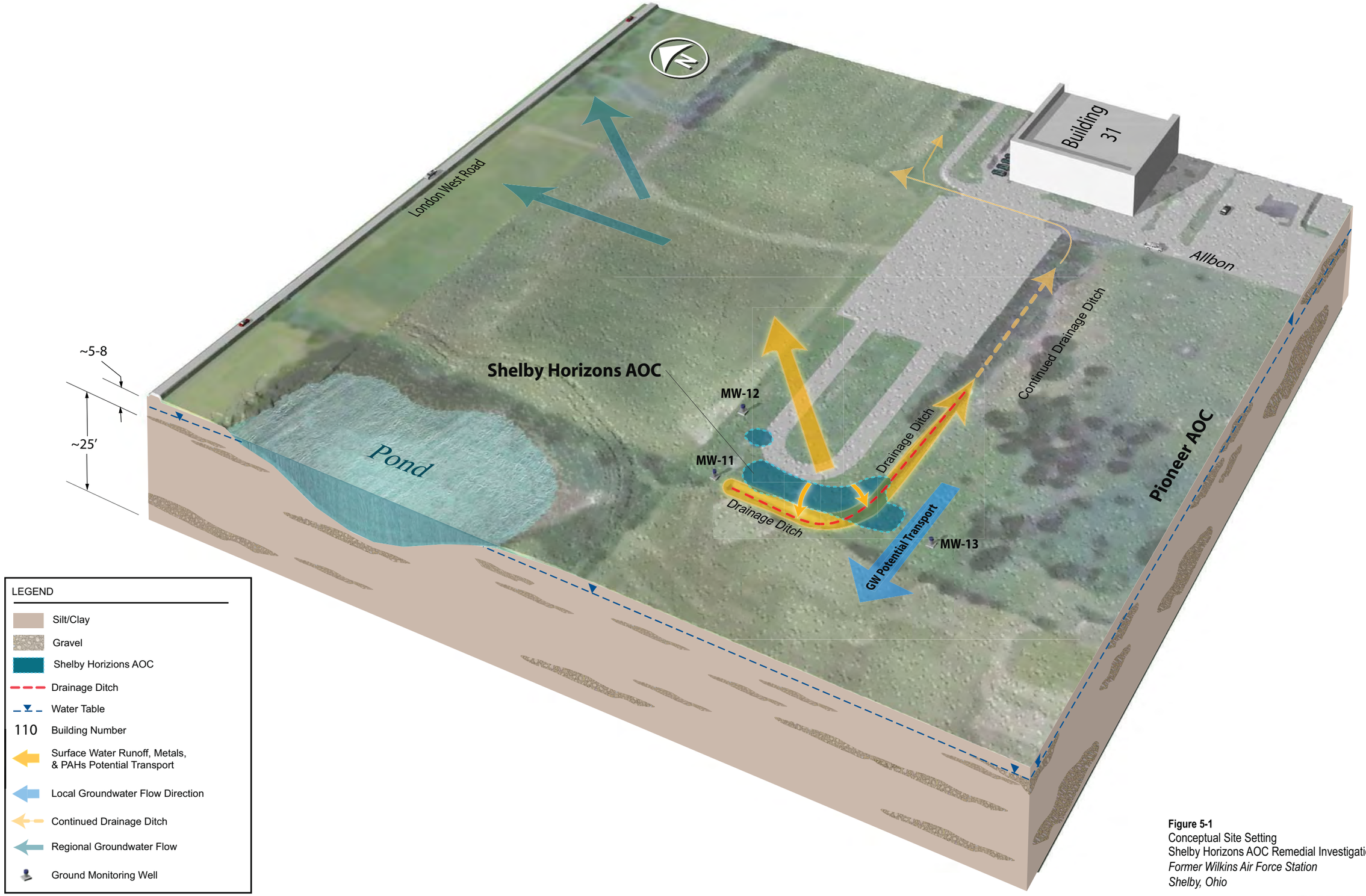
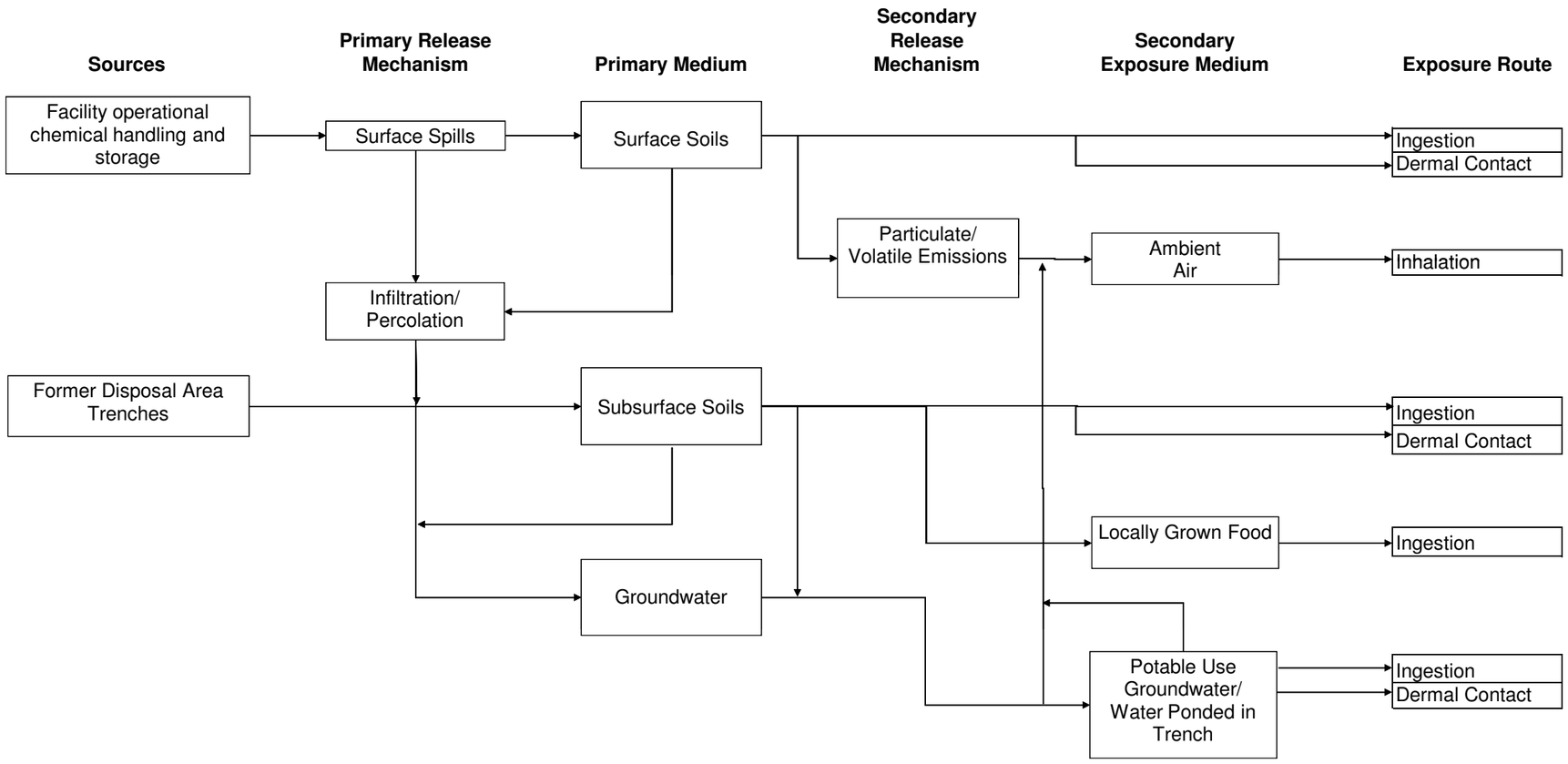


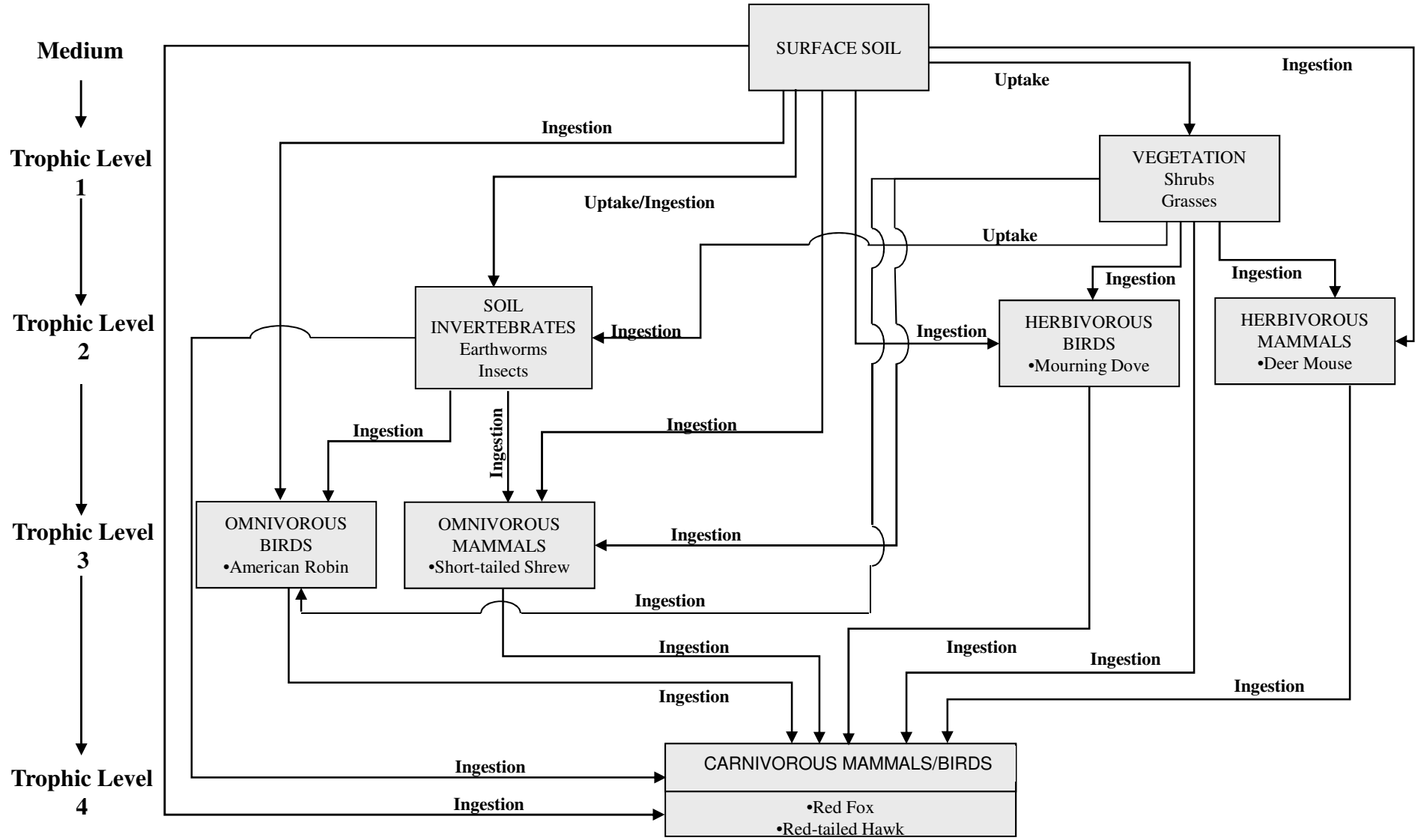
Figure 5-1
Conceptual Site Setting
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Force Station
Shelby, Ohio



Potential Human Receptors			
Industrial Worker	Construction Worker	Trespasser	Resident
+	+	+	+
+	+	+	+
+	+	+	+
-	+[1]	-	+[1]
-	+[1]	-	+[1]
-[2]	-[2]	-[2]	-[2]
-	-[3]	-	-
-	+	-	-

+ Potentially complete exposure pathways
- Incomplete pathway
[1] Exposure is assumed to be total soil (combined surface soil and subsurface soil)
-[2] Assumes land use will remain industrial in the future
-[3] Potentially complete pathway with insignificant contribution to risk estimates
Assumed exposure to water ponded in trench is limited to construction worker scenario only.

FIGURE 6-1
Conceptual Site Model Human Health Exposure Pathways
Shelby Horizons AOC Remedial Investigation
Former Wilkins AFB, Shelby, Ohio



LEGEND

• Representative species

→ Pathway evaluated for at least one species in feeding guild

▭ Feeding guild evaluated

FIGURE 7-1
Terrestrial Ecosystem Conceptual Site Model
Shelby Horizons AOC Remedial Investigation
Former Wilkins AFB, Shelby, Ohio

Appendix A

Soil Boring Logs and Well Completion Diagrams (provided on the attached CD)

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-11 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (451191.7 N, 1919856.1 E)

ELEVATION : 1077.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/28/08 10:30 END : 10/28/08 12:15 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1077.69		0.95/2.0		**Topsoil** 0.0-0.5' - organics with roots **Silt (ML)** 0.6-2.0' - 10YR 3/1, dry to slightly damp, medium stiff, trace clay and sand		0		
	2.0	1.0/2.0		**Silty Clay (CL)** 2.0-4.0' - 10YR 4/2, with with brown-gray mottling, moist, stiff, poorly sorted, trace sand, organics		0		
	4.0	1.3/2.0		**Silty Clay (CL)** 4.0-6.0' - 10YR 4/3, with with 10YR 5/4 mottling, moist, stiff to very stiff, poorly sorted, trace gravel, organic staining		0		2" PVC Bentonite Quick Grout
5 1072.69	6.0	1.6/2.0		**Silty Clay (CL)** 6.0-7.0' - 10YR 4/4, damp to moist, stiff, poorly sorted, trace gravel **Clay (CL)** 7.0-7.6' - 10YR 4/2, moist to wet, medium stiff to stiff, poorly sorted, trace silt		0		
	8.0	1.4/2.0		7.6-8.0' - no recovery **Clay (CL)** 8.0-8.6' - 10YR 4/2, wet, medium stiff to stiff, poorly sorted, trace silt, poorly sorted **Silty Clay (CL)** 8.6-10.0' - 10YR 4/2, moist to wet, stiff to very stiff, poorly sorted, trace gravel and cobbles		0		
10 1067.69	10.0	1.6/2.0		**Silty Clay (CL)** 10.0-12.0' - 10YR 4/2, wet, stiff to very stiff, poorly sorted, trace gravel and cobbles		0		Sodium Bentonite Seal
	12.0	1.5/2.0		**Silty Clay (CL)** 12.0-14.0' - 10YR 4/2, wet, stiff to very stiff, poorly sorted, trace gravel and cobbles, with small gravel lens at bottom		0		#5 Sand
15 1062.69	14.0	1.5/2.0		**Silty Clay (CL)** 14.0-16.0' - 10YR 4/2 to 10YR 3/2, wet, stiff, poorly sorted, trace gravel		0		
	16.0	1.9/2.0		**Silty Clay (CL)** 16.0-18.0' - 10YR 4/2 to 10YR 3/2, wet, stiff to very stiff, poorly sorted, trace gravel		0		
20	18.0	1.7/2.0		**Silty Clay (CL)** 18.0-20.0' - 10YR 4/2 to 10YR 3/2, wet, stiff to very stiff, poorly sorted, trace gravel		0		2" PVC with 0.010" slots
	20.0							

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-11 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (451191.7 N, 1919856.1 E)

ELEVATION : 1077.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/28/08 10:30 END : 10/28/08 12:15 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1057.69	20.0	2.0/2.0		**Silty Clay (CL)** 20.0-22.0' - 10YR 4/2 to 10YR 3/2, wet, stiff, poorly sorted, trace gravel, 2" thick wet sand and gravel lens at 21'		0		
	22.0	1.6/2.0		**Silty Clay (CL)** 22.0-24.0' - 10YR 4/2, wet, stiff, poorly sorted, increasing plasticity		0		
	24.0			Bottom of Boring at 24.0 ft below ground surface				
25 / 1052.69								
30 / 1047.69								
35 / 1042.69								
40								

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-12 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (451242.1 N, 1920034.3 E)

ELEVATION : 1078.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/28/08 14:35 END : 10/28/28 16:10 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1078.65				**Topsoil** 0.0-0.2' - organics				
		1.8/2.0		**Sandy Silt (SM)** 0.2-1.2' - 10YR 5/4, dense, poorly sorted		0		
	2.0			**Sandy Clay (SC)** 1.2-2.0' - 10YR 5/4, with with mottling, dense to very dense, poorly sorted, trace orgaincs (roots)				
		1.3/2.0		**Clayey Sand (SC)** 2.0-4.0' - 10YR 5/4, poorly sorted, density increasing with depth, dry to damp		0		Bentonite Quick Grout
	4.0							2" PVC
5 / 1073.65		1.6/2.0		**Clay (CL)** 4.0-6.0' - 10YR 5/3, moist, stiff, dense, poorly sorted, trace gravel with cobbles up to 1/2"		0		
	6.0							
		1.8/2.0		**Clay (CL)** 6.0-8.0' - 10YR 4/3, moist, stiff, dense, poorly sorted, trace gravel with cobbles up to 1/2"		0		Sodium Bentonite Seal
	8.0							
		1.6/2.0		**Clayey Sand (SC)** 8.0-8.5' - 10YR 4/2, moist, dense, poorly sorted, trace gravel				
10 / 1068.65	10.0			**Clayey Sand with Gravel (SC)** 8.5-9.0' - 10YR 4/3, loose to medium dense, poorly sorted		0		
		1.6/2.0		**Clayey Sand (SC)** 9.0-10.0' - 10YR 4/1, moist, dense, poorly sorted, trace gravel			wet fat clay with sand, high plasticity cuttings at 12'	
	12.0			**Clay with Sand (CL)** 10.0-12.0' - 10YR 4/1, moist, stiff, poorly sorted, trace gravel, angular fragments 1/2"		0		
		0.6/2.0		**Clay with Sand (CL)** 12.0-14.0' - 10YR 4/1, moist, stiff, poorly sorted, trace gravel, angular fragments 1/2"		0	wet fat clay with sand, high plasticity cuttings, rock size of split spoon	#5 Sand
	14.0							
15 / 1063.65		1.4/2.0		**Sandy Clay (CL)** 14.0-16.0' - 10YR 3/2, moist to wet, medium stiff to stiff, poorly sorted, trace gravel		0		2" PVC with 0.010" slots
	16.0							
		1.4/2.0		**Sandy Clay (CL)** 16.0-16.5' - 10YR 3/2, moist to wet, medium stiff to stiff, poorly sorted, trace gravel				
	18.0			**Sand and Gravel (SP)** 16.5-16.8' - 10YR 3/2, wet, loose, poorly sorted, little clay		0		
		0.0/2.0		**Sandy Clay (CL)** 16.8-18.0' - 10YR 3/2, moist, stiff to very stiff, poorly sorted, few angular cobbles up to 1" 18.0-20.0' - no recovery				
20	20.0							

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-12 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (451242.1 N, 1920034.3 E)

ELEVATION : 1078.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/28/08 14:35 END : 10/28/28 16:10 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1058.65	20.0	1.3/2.0		**sandy clay, poorly sorted (CL)** 20.0-22.0' - 10YR 3/2, wet, stiff to very stiff, poorly sorted, trace gravel and angular cobbles up to 1/2"		0		
	22.0			Bottom of Boring at 22.0 ft below ground surface				
25 1053.65								
30 1048.65								
35 1043.65								
40								

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-13 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (450773.7 N, 1919904.4 E)

ELEVATION : 1077.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/30/08 08:50 END : 10/30/08 11:00 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1077.69				**Topsoil** 0.0-0.1' - orgaincs (grass)				
	2.0	1.4/2.0		**Clayey Sand/Silt (SC)** 0.1-2.0' - 10YR 4/3, with with mottling, dry to damp, dense, poorly sorted, few organics, black wood debris in bottom 1/2"				
	4.0	1.3/2.0		**Clayey Silt (CL)** 2.0-4.0' - 10YR 4/3, damp, stiff, poorly sorted, trace gravel and sand		0		2" PVC
5 / 1072.69	6.0	1.2/2.0		**Silty Clay (CL)** 4.0-6.0' - 10YR 4/4, with with 10YR 4/2 mottling, moist to wet, medium stiff to stiff, poorly sorted, trace gravel		0		Bentonite Quick Grout
	8.0	1.1/2.0		**Silty Clay with Sand (CL)** 6.0-8.0' - 10YR 4/2, moist to wet, medium stiff to stiff, poorly sorted, trace gravel, approximately 1/2" sand lens at 6.5' and 7.1'		0		
10 / 1067.69	10.0	1.5/2.0		**Silty Clay (CL)** 8.0-10.0' - 10YR 4/1, moist to wet, stiff, trace gravel - angular up to 1"		0		
	12.0	1.3/2.0		**Silty Clay (CL)** 10.0-12.0' - 10YR 4/2, moist to wet, medium stiff to stiff, trace gravel - angular up to 1/2"		0		Sodium Bentonite Seal
	14.0	1.1/2.0		**Silty Clay (CL)** 12.0-14.0' - 10YR 4/2, wet, soft to medium stiff, trace gravel - angular up to 1/2"		0		#5 Sand
15 / 1062.69	16.0	1.3/2.0		**Silty Clay (CL)** 14.0-15.5' - 10YR 4/2, wet, soft to medium stiff, medium stiff at bottom, trace gravel - angular up to 1/2"		0		
	18.0	1.9/2.0		**Clay with Gravel (CL)** 15.5-16.0' - 10YR 4/2, damp, loose, angular fragments up to 1" **Silty Clay (CL)** 16.0-18.0' - 10YR 4/1, moist, stiff, poorly sorted, trace gravel, angular gravel fragments		0		
20	20.0	1.8/2.0		**Silty Clay (CL)** 18.0-20.0' - 10YR 4/1, moist, stiff, poorly sorted, some fine sand, trace gravel, angular fragments		0	thin less than 1/2" loose, medium sand at 19'	2" PVC with 0.010" slots

PROJECT NUMBER:	BORING NUMBER:
352798.01.FI.SH.01	MW-13 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : USACE Shelby Horizons AOC - Former Wilkins AFS LOCATION : Shelby, OH (450773.7 N, 1919904.4 E)

ELEVATION : 1077.7 ft DRILLING CONTRACTOR : Belasco Drilling Services, Inc.

DRILLING METHOD AND EQUIPMENT : Split Spoon

WATER LEVELS : --- START : 10/30/08 08:50 END : 10/30/08 11:00 LOGGER : R. Clennon

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	SAMPLER (TYPE)	SOIL DESCRIPTION: DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	GRAPHIC LOG	PID (ppm)	COMMENTS	WELL DIAGRAM
1057.69	20.0	0.5 / 2.0		**Silty Clay (CL)** 20.0-20.5' - 10YR 4/2, medium stiff, poorly sorted, little fine sand 20.5-22.0' - no recovery		0		
	22.0	0.9 / 2.0		**Silty Clay (CL)** 22.0-22.9' - 10YR 4/2, moist to wet, stiff, poorly sorted, at bottom - soft to medium 22.9-24.0' - no recovery		0		
	24.0	1.4 / 2.0		**Silty Clay (CL)** 24.0-25.4' - 10YR 4/2, moist to wet, stiff, poorly sorted, bottom 0.2' - soft, wet with sand 25.4-26.0' - no recovery		0		
25 / 1052.69	26.0			Bottom of Boring at 26.0 ft below ground surface				
30 / 1047.69								
35 / 1042.69								
40								

Appendix B

ODNR Well Log Search (provided on the attached CD)

TABLE B-1
ODNR Well Logs within 1 Mile of Shelby Horizons AOC
Shelby Horizons AOC Remedial Investigation
Former Wilkins Air Station, Shelby, Ohio

Well Log Number	House No.	Street Name	Owner's First Name	Owner's Last Name	County	Township	Latitude	Longitude	Horiz Y	Horiz X	Total Depth	Case Length	Screen Length	Screen Slot Size	Screen Diameter	Test Rate	Static Water Level	Aquifer Type
50234			61	V F WAR	RICHLAND	PLYMOUTH	40.904104	-82.661064	1057870.22	1955434.32	65	0				0		SHALE
50235			61 W	WAR	RICHLAND	PLYMOUTH	40.903918	-82.660971	1057802.49	1955460.02	57	0						GRAVEL AND CLAY
104563		LONDON	RAYMOND	MESSERSMITH	RICHLAND	PLYMOUTH	40.908241	-82.661912	1059378.49	1955202.42	49	52				20	5.5	SAND
136954			61 W	POLLOCK	RICHLAND	PLYMOUTH	40.906691	-82.659463	1058812.33	1955878.69	34	16				2	14	GRAVEL
136954			61 W	POLLOCK	RICHLAND	PLYMOUTH	40.906691	-82.659463	1058812.33	1955878.69	34	34				2	14	GRAVEL
157231			61 WOODROW	SHAW	RICHLAND	PLYMOUTH	40.905152	-82.658848	1058251.15	1956047.78	20	20				7	8	GRAVEL
160721		SHELBY PLYMOUTH		V.F.W.	RICHLAND	PLYMOUTH	40.904788	-82.659798	1058119.08	1955784.7	160	68				9	19	SANDSTONE
171142		SHOUP	MABLE	SHOUP	RICHLAND	PLYMOUTH	40.922472	-82.675858	1064572.06	1951356.73	33	33				15	10	SAND
177301		LONDON W	LEO	TUCKER	RICHLAND	PLYMOUTH	40.90904	-82.681937	1059680.22	1949666.48	121	70				5	16.5	BEREA
184765		SHOUP	ADEN	MC FARLAND	RICHLAND	PLYMOUTH	40.922255	-82.675901	1064493.03	1951344.73	35	35				10	8	SAND AND GRAVEL
232154			61 ROBERT	UTZ	RICHLAND	PLYMOUTH	40.910731	-82.657975	1060283.87	1956292.75	40	40				5	5	SAND AND GRAVEL
263205		KUHN	FLOYD	WINELY	RICHLAND	SHARON	40.899164	-82.685129	1056082.91	1948776.43	122	87				4	20	ROCK
263216			61 RICHARD	HARTGE	RICHLAND	PLYMOUTH	40.903959	-82.659861	1057816.98	1955766.72	72	66				7	14	SHALE
285264			61 CHESTER	JOSE	RICHLAND	PLYMOUTH	40.908182	-82.659148	1059355.52	1955966.69	44	44					8	SAND AND GRAVEL
293601			61 CLYDE	BELL	RICHLAND	PLYMOUTH	40.910941	-82.658478	1060360.89	1956153.69	40	38				8	4	SAND
293625		STATE ST	ARTHUR	CONKLIN	RICHLAND	SHARON	40.8945	-82.679068	1054379.45	1950449.12	152	79				1	40	SILTSTONE
293644		STATE ST	FRED	GRAUER	RICHLAND	SHARON	40.896067	-82.660002	1054940.99	1955722.88	164	77				4	6	SHALE
320006			61 EUGENE	HALL	RICHLAND	PLYMOUTH	40.907263	-82.658375	1059020.42	1956179.78	66	54				1	20	SHALE
320010			61 C	WILLIAMS	RICHLAND	PLYMOUTH	40.907411	-82.65864	1059074.43	1956106.76	42	40				3	9	SAND
365354			61 FRED	BARKER	RICHLAND	PLYMOUTH	40.907124	-82.659688	1058970.38	1955816.66	48	46				5	8	SAND AND GRAVEL
365391			61 HAROLD	FORALTER	RICHLAND	PLYMOUTH	40.911636	-82.65848	1060613.98	1956153.67	42	40				8	8	SAND AND GRAVEL
424750		LONDON WEST	T	WILLIAM	RICHLAND	PLYMOUTH	40.909038	-82.660977	1059668.61	1955461.49	50	50				20	4	SAND
425224		LONDON WEST	W	BARKER	RICHLAND	PLYMOUTH	40.908127	-82.661134	1059336.49	1955417.49	60	53				3	8	SHALE
440555			61 CHESTER	JOSE	RICHLAND	PLYMOUTH	40.908116	-82.659133	1059331.52	1955970.69	40	38					5	SAND AND GRAVEL
442094			61 GEORGE	SANDS	RICHLAND	PLYMOUTH	40.901525	-82.659563	1056929.68	1955847.79	17	17				3	11	GRAVEL
485242		LONDON WEST/SR 61	RALPH	PHILLIPS	RICHLAND	PLYMOUTH	40.908029	-82.65837	1059299.52	1956181.76	34	33				10	9	SHALE
507835		SHOUP	BOB	ELLIS	RICHLAND	PLYMOUTH	40.922507	-82.675865	1064585.06	1951354.72	36	31				6	11	SAND
522005			61 HAROLD	BRICKER	RICHLAND	PLYMOUTH	40.911917	-82.659599	1060717	1955844.56	65	52					9.5	SHALE
596917		61/LONDON WEST	CLAIR	OEHLHOF	RICHLAND	PLYMOUTH	40.908759	-82.658408	1059565.61	1956171.75	26	24				6	13.5	SAND
637967			61 EUGENE	HALL	RICHLAND	PLYMOUTH	40.907746	-82.658438	1059196.48	1956162.76	45	27				15	9	CLAY & SHALE
637968			61 RALPH	PHILLIPS	RICHLAND	PLYMOUTH	40.906407	-82.658525	1058708.31	1956137.78	36	36				12	8	SAND AND GRAVEL
660741			61 CARL	WEBER	RICHLAND	PLYMOUTH	40.907794	-82.659451	1059214.47	1955882.67	40	40				9	13	GRAVEL AND SAND
962394	4279	SHOUP	BRIAN	DAY	RICHLAND	PLYMOUTH	40.91905	-82.67653	1063325.37	1951168.47	62							SHALE
2016193	11	STATE		ARCELOR MITTAL	RICHLAND	SHARON	40.89909	-82.65737			18	8	10	0.01	2		0	FILL MATERIAL
2016211	11	STATE		ARCELOR MITTAL	RICHLAND	SHARON	40.90055	-82.65738			23	8	15	0.01	2		0	FILL MATERIAL
2020202		WEST OF SERVICE RD		WILKENS AIR FORCE BASE	RICHLAND	PLYMOUTH	40.905311	-82.676597			24	17	10	0.01	2		24	CLAY
2020203		WEST OF SERVICE RD		WILKENS AIR FORCE BASE	RICHLAND	PLYMOUTH	40.905358	-82.676047			20	13	10	0.01	2		20	SILT & CLAY
2020204		WEST OF SERVICE RD		WILKENS AIR FORCE BASE	RICHLAND	PLYMOUTH	40.903825	-82.676917			24	17	10	0.01	2		24	GRAVEL AND CLAY
2028094	5046	KUHN	PHILIP	CROWENS	RICHLAND	SHARON	40.89185	-82.68475			160	73	5	0.05	5	4	40	SANDSTONE
2028094	5046	KUHN	PHILIP	CROWENS	RICHLAND	SHARON	40.89185	-82.68475			160		5	0.05	5	4	40	SANDSTONE
9970257				CITY OF SHELBY	RICHLAND	SHARON	40.891451	-82.661569	1053259.25	1955286.28	43	0						SAND AND GRAVEL
9970258				CITY OF SHELBY	RICHLAND	SHARON	40.891308	-82.66157	1053207.2	1955285.9	44	0						SAND AND CLAY

Notes:
Information received from Ohio Department of Natural Resources water well log search function at http://ohiodnr.com/water/maptechs/wellogs/appNew/Default.aspx

Appendix C
Site Photos
(provided on the attached CD)

APPENDIX C

Site Photographs

Photograph #1: View of Shelby Horizons AOC looking north.

Photograph #2: View of Shelby Horizons AOC looking north; drainage ditch visible in foreground.

Photograph #3: View of Shelby Horizons AOC looking west; drainage ditch visible along the south and west side of the site.

Photograph #4: View of semi-trailer parking area at Shelby Horizon AOC looking southeast.

All photos are from the Plexus, 2001 SI

Appendix D
Field Logs
(provided on the attached CD)

Exhibit 5.3.3-3

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
352798	MW-11	SHEET 1 OF 1

WELL DEVELOPMENT LOG

11/10/08

PROJECT: Shelby Horizons AOC-Former Wilkins AFS LOCATION: Shelby, OH
Development Contractor: CH2M HILL
START Time: 1230 END Time: 1350 LOGGER: L. Raterink/M. Gonzalez

Diameter of Well (inches) & Type: 2" PVC
Depth of Well (feet): (SCREEN INTERVAL) 27.16
Depth to Water (ft) at START: 13.84
Water Column Height (feet): 13.32
Gallons per Foot: 0.163
One Well Volume (gallons): 2.17
Ten Well Volumes (gallons): 21.63

Development Method: Submersible pump
Surge Block Used: Pump casing
Screen Interval Surged: 17.16 - 27.16

Water Quality Meter (Manufacturer/Model/Serial #):
~~Horiba U-10 : s/n 13430~~ LR
YSI multimeter Pine # 606065

Maximum Drawdown During Pumping: ~3' N/A for air lift
Average Discharge Rate & Range: 300 mL/min
Total Quantity of Water Discharged: 15.0 gal
Disposition of Discharge Water: 55 gal drum

Dia. (in)	Gal./Ft.	Dia. (in)	Gal./Ft.
1"	0.041	5"	1.02
1.25"	0.06	6"	1.469
2"	0.163	8"	2.611
3"	0.367	10"	4.08
4"	0.653		

Time	Water Volume Discharged (gal)	Discharge Rate (gpm) mL/min	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (ms/cm)	Remarks (color, odor, sheen, sediment, etc.)
1248	1.0 gal	400	142	10.76	8.09	0.496	Milk cloudy
1254	3.5 gal	400	77.4	10.95	8.10	0.487	clearing up
1301	4.5 gal	300	51.6	10.08	8.07	0.494	" "
1318	5.5 gal	300	30.4	6.90	8.10	0.494	" "
1343	7.5 gal	300	21.5	6.38	8.14	0.489	" "

Comments: Note: Discharged an additional 8 gallons to remove fine silts from bottom of Well.

Exhibit 5.3.3-3

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
352798	MW-12	SHEET 1 OF 1

WELL DEVELOPMENT LOG

11/10/08

PROJECT: Shelby Horizons ACC - Former Wilkins AFS LOCATION: Shelby, OH
Development Contractor: CH2M HILL
START Time: 1355 END Time: 1535 LOGGER: LRaterink/MGonzalez

Diameter of Well (inches) & Type: 2" PVC
Depth of Well (feet): (SCREEN INTERVAL) 22.96
Depth to Water (ft) at START: 9.22
Water Column Height (feet): 13.74
Gallons per Foot: 0.163
One Well Volume (gallons): 2.24
Ten Well Volumes (gallons): 22.40

Development Method: submersible pump
Surge Block Used: pump casing
Screen Interval Surged: 12.96 - 22.96

Water Quality Meter (Manufacturer/Model/Serial #):
~~Horiba U-10 : s/n 13430~~
YSI multimeter Pine #66665

Maximum Drawdown During Pumping: 2.9' N/A for air lift
Average Discharge Rate & Range: 300 mL/min
Total Quantity of Water Discharged: 16.5 gal
Disposition of Discharge Water: 55 gal drum

Dia. (in)	Gal./Ft.	Dia. (in)	Gal./Ft.
1"	0.041	5"	1.02
1.25"	0.06	6"	1.469
2"	0.163	8"	2.611
3"	0.367	10"	4.08
4"	0.653		

Time	Water Volume Discharged (gal)	Discharge Rate (gpm)	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (ms/cm)	Remarks (color, odor, sheen, sediment, etc.)
1405	0.00	300	>1000	9.85	7.24	0.750	brown, sediment
1420	2.75	300	>1000	10.13	7.17	0.778	clearing up
1436	4.50	300	568	10.49	7.16	0.780	" "
1452	6.75	300	112	11.46	7.14	0.775	" "
1505	8.00	300	69.2	11.69	7.19	0.788	" "
1515	10.00	300	55.0	10.83	7.18	0.751	" "
1532	12.50	300	45.0	12.15	7.19	0.785	

Comments: Note: Discharged an additional 4 gallons to remove fine silts from bottom of well.

Exhibit 5.3.3-3

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
352798	MW-13	SHEET 1 OF 1

WELL DEVELOPMENT LOG

11/10/08

PROJECT: Shelby Horizons AOC - Former Wilkins AFS LOCATION: Shelby, OH

Development Contractor: CH2M HILL

START Time: 1047 END Time: LOGGER: L. Raterink / M. Gamble

Diameter of Well (inches) & Type: 2" PVC

Depth of Well (feet): (SCREEN INTERVAL) 26.57

Depth to Water (ft) at START: 9.68

Water Column Height (feet): 16.89

Gallons per Foot: 0.163

One Well Volume (gallons): 2.75

Ten Well Volumes (gallons): 27.50

Development Method: Submersible Pump

Surge Block Used: Pump casing

Screen Interval Surged: 16.57 - 26.57

Water Quality Meter (Manufacturer/Model/Serial #):

~~Horiba U-10; s/n 13430~~ MGC

YSI 6.50 multimeter Pine #66645 JK

Maximum Drawdown During Pumping: 16.89 N/A for air lift

Average Discharge Rate & Range: 300 ml/min

Total Quantity of Water Discharged: 13 gals.

Disposition of Discharge Water: 55 gal drum

Dia. (in)	Gal./Ft.	Dia. (in)	Gal./Ft.
1"	0.041	5"	1.02
1.25"	0.06	6"	1.469
2"	0.163	8"	2.611
3"	0.367	10"	4.08
4"	0.653		

Time	Water Volume Discharged (gal)	Discharge Rate ~~(gpm)~~ gal/hour	Turbidity (NTU)	Temperature (°C)	pH (Std. Units)	Conductivity (ms/cm)	Remarks (color, odor, sheen, sediment, etc.)
1110	3.0 gal	250-650	>1000	3.92	7.97	0.578	[illegible] sediment
1111	5.0 gal	250-650	>1000	11.65	7.93	0.549	" "
1115	7.5 gal	250-650	>1000	11.47	7.95	0.545	" "
1122	10.0 gal	250-650	>1000	11.65	7.87	0.561	clearing up
1600	11.5 gal	250-650	>1000	11.76	7.90	0.545	
1612	13.5 gal	250-650	>1000	11.94	7.91	0.553	[illegible] cloudy

Comments: 1125 ran out of water - removed 10.0 gal

1615 - Called technical expert after well went dry without a reduction in turbidity. D. Buchanan, technical expert says development is sufficient if tomorrow, 11/11/08 during sampling, turbidity goes below 50 NTU.

* Turbidity below 50 NTU during sampling. MGC 11/11/08

NJO:\Taurus\Jackson Steel\Forms\Well Development.xls

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-11

Project Number: 352798 Sample Number: MW11-111208

Site Name: Shelby Horizons ACC Site Location: Shelby, CH

Personnel: M. Gonzalez and L. Raterink

Equipment Used: YSI 650 Multimeter, Mini RAE, LaMotte 2020 turbidimeter Calibrated meters: (Y) N

Sampling Method: Peristaltic / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 11.46 Date: 11/12/08 Time: 0906 Well Diameter: 2" PVC

Total well depth (ft): 27.16 Water column height (ft): 15.70

Well Volume (i.e. 2" well 0.17 gal/ft and 1" well 0.041): gallons 2.67 x 3 = 8.00 gallons

Date	Time	pH +/- 0.2	Conductivity (us/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
11/12/08	0911	7.87	0.602	3.25	11.35	194.8	3.22	0.05	12.00
	0916	7.93	0.602	3.11	12.19	187.0	1.84	0.15	12.54
	0921	7.92	0.602	6.75	12.37	180.2	1.24	0.20	12.86
	0926	7.94	0.600	7.82	12.85	173.5	1.13	0.30	13.28
	0931	7.93	0.599	5.77	12.82	165.5	0.76	0.50	13.82
	0936	7.93	0.602	6.44	12.65	160.4	0.68	0.70	14.23
	0941	7.94	0.600	5.85	12.70	156.1	0.64	1.00	14.49
	0946	7.95	0.601	6.70	12.65	151.5	0.67	1.20	14.74
	0951	7.95	0.600	6.92	12.88	146.3	0.72	1.25	14.95
	0956	7.96	0.601	6.19	13.20	140.8	0.67	1.40	15.19
	1001	7.93	0.602	5.67	13.08	137.5	0.66	1.50	15.35
	1006	7.91	0.605	5.80	12.80	134.0	0.64	1.60	15.52
	SAMPLE TIMES								
	MW11-111208			1006					
	QC03-111208-FD								
Sample									

Total Purge Time: 3.0 hours Total Purge Volume: 2.0 gal

Analyses: VOC, SVOC, PAH, TAL Metals Date Shipped: 11/12/08 Laboratory: CT Laboratories

Notes: Bubbles present in the line

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-12

Project Number: 352798 Sample Number: MW12-111108

Site Name: Shelby Horizons Arc Site Location: Shelby, OH

Personnel: M. Gonzalez and L. Raterink

Equipment Used: YSI Multimeter, Mini Rae, LaMotte 2020 turbidimeter Calibrated meters: Y / N

Sampling Method: Peristaltic / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 9.32 Date: 11/11/08 Time: 1538 Well Diameter: 2" PVC

Total well depth (ft): 22.96 Water column height (ft): 13.64

Well Volume (i.e. 2" well 0.17 gal/ft and 1" well 0.041): gallons 2.32 x 3 = 6.96 gallons

Date	Time	pH +/- 0.2	Conductivity (us/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
11/11/08	1543	7.11	1.026	42.3	10.37	44.6	12.39	0.0	9.60
11/11/08	1545	7.07	1.026	7.35	10.10	70.5	6.59	0.25	9.76
11/11/08	1553	7.05	1.027	5.15	10.27	76.4	6.43	0.40	9.82
11/11/08	1558	7.04	1.031	2.63	10.42	81.2	6.16	0.50	9.92
11/11/08	1603	7.04	1.031	2.74	10.56	84.7	5.38	0.65	10.01
11/11/08	1608	7.03	1.035	2.35	10.54	87.4	5.00	0.80	10.05
11/11/08	1613	7.03	1.034	2.31	10.54	89.1	4.79	1.00	10.07
	SAMPLE TIMES								
	MW12-111108 — 1615								
	GCC1-111108-MS- 1655								
	GCC2-111108-MSD - 1735								
Sample									

Total Purge Time: 2.5 hours Total Purge Volume: 1.5 gal

Analyses: VOC, SVOC, PAH, TAL Metals Date Shipped: 11/11/08 Laboratory: CT Laboratories

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-13

Project Number: 352798 Sample Number: MW13-111108

Site Name: Shelby Horizons ACC Site Location: Shelby, OH

Personnel: L. Roberink, M. Gonzalez

Equipment Used: YSI Multimeter, LaMotte 2020 turbidimeter Calibrated meters: Y / N

Sampling Method: Peristaltic / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 10.69 Date: 11/11/08 Time: 1345 Well Diameter: 2" PVC

Total well depth (ft): 26.57 Water column height (ft): 15.88

Well Volume (i.e. 2" well 0.17 gal/ft and 1" well 0.041): gallons 2.70 x 3 = 8.10 gallons

Date	Time	pH +/- 0.2	Conductivity (us/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
11/11/08	1352	7.52	0.725	37.6	10.27	190.0	1.50	0.2	10.98
11/11/08	1357	7.47	0.732	32.7	11.12	143.7	1.15	0.35	11.18
11/11/08	1402	7.49	0.733	25.3	11.21	141.1	1.15	0.40	11.18
11/11/08	1407	7.49	0.742	16.3	10.71	125.3	1.07	0.50	11.18
11/11/08	1412	7.69	0.740	64.3	10.66	74.1	0.84	0.60	11.20
11/11/08	1417	7.70	0.735	39.3	10.78	52.2	0.81	0.75	11.21
11/11/08	1422	7.69	0.741	33.5	10.62	38.1	0.78	0.85	11.22
11/11/08	1427	7.71	0.740	32.5	10.40	27.6	0.62	1.00	11.23
11/11/08	1432	7.71	0.733	27.5	10.46	12.2	0.74	1.15	11.25
11/11/08	1437	7.72	0.739	24.2	10.50	-2.9	0.62	1.25	11.25
	1440	VOC,	SVOC,	Sample.					
	1446	SVOC,							
	1503	PAH							
	1520	TAL							
Sample									

Total Purge Time: 1 hr 40 min Total Purge Volume: 1.5 gal

Analyses: VOC, SVOC, PAH, TAL Metals Date Shipped: 11/11/08 Laboratory: CT Laboratories

Notes: initial water level 1' lower than yesterday

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

Water Level Measurements
Former Wilkins AFB
Shelby Ohio

Date: 11/10/08

Team Members: M. Gonzála
L. Ratcrink

Well ID	Measured Depth to Water (feet)	Measured Well Depth (feet)	Time	Notes/ Comments
Pioneer			~~0921~~	
MW05	6.97	20.29	0921	Well plug not operating correctly
MW06	9.00	22.06	0926	
MW08	8.38	22.27	0932	
BG01	3.80	19.88	0858	
BG02	5.92	19.98	0910	slight pressure
Shelby Horizons		~~26.16~~ 27.16	~~0810~~	~~Air pressure noted~~
MW11	13.86	27.16	0810	Air pressure noted
MW12	9.22	22.96	0830	Gray silt inside well
MW13	9.68	26.57	0805	

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-11

Project Number: 352798.01.FI.SH.01

Sample Number: ~~MW-11~~ MW11-012709

Site Name: Shelby Horizons AOC - Former Wilkins AFS

Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae

Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 7.94 Date: 1/27/09 Time: 1515 Well Diameter: 2" PVC

Total well depth (ft): 27.16 Water column height (ft): 19.22

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 3.27 x 3 = 9.80 gallons

Date	Time	pH +/- 0.2	Conductivity (µs/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
1/27/09	1521	8.42	0.557	4.0	7.85	32.6	8.12	0.0	8.75
1/27/09	1526	8.23	0.583	2.0	7.39	8.7	1.43	0.30	9.37
1/27/09	1532	8.17	0.575	1.4	7.74	-27.8	0.52	0.60	10.36
1/27/09	1537	8.13	0.577	1.1	7.68	-54.6	0.47	0.70	11.21
1/27/09	1542	8.13	0.576	1.2	7.69	-60.9	0.37	1.00	11.89
1/27/09	1547	8.13	0.575	1.4	7.82	-82.6	0.37	1.40	12.77
1/27/09	1553	8.12	0.575	1.2	7.77	-90.2	0.37	1.65	13.47
1/27/09	1558	8.15	0.573	1.6	7.90	-92.8	0.30	1.80	13.81
1/27/09	1603	8.12	0.575	1.8	7.80	-104.0	0.31	2.10	14.39
1/27/09	1609	8.12	0.574	2.2	7.82	-110.7	0.27	2.30	14.89
1/27/09	1614	8.12	0.572	2.4	8.07	-120.8	0.29	2.50	15.21
1/27/09	1619	8.15	0.572	3.1	8.22	-118.1	0.30	2.75	15.62
	SAMPLE COLLECTED AT: 1620								
	DUPLICATE COLLECTED: QC03-012709-FD								
					Sample				

Total Purge Time: 1 hr 5 min Total Purge Volume: 2.75 gal

Analyses: Metals, SVOCs, PAHs, VOCs

Date Shipped: 1/28/09

Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-12

Project Number: 352798.01.FI.SH.01

Sample Number: mw12-012809

Site Name: Shelby Horizons AOC - Former Wilkins AFS

Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae

Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 5.51

Date: 1/28/09

Time: 1030

Well Diameter: 2" PVC

Total well depth (ft): 22.72

Water column height (ft): 17.21

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 2.93 x 3 = 8.78 gallons

Date	Time	pH +/- 0.2	Conductivity (µs/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
1/28/09	1045	7.27	0.993	7.8	3.17	96.4	0.75	0.0	6.42
1/28/09	1050	7.26	0.992	6.9	2.70	72.3	0.61	0.2	6.43
1/28/09	1055	7.26	0.992	5.1	2.58	51.4	0.63	0.4	6.44
1/28/09	1100	7.26	0.987	4.0	2.32	42.8	0.68	0.6	6.45
1/28/09	1105	7.26	0.996	3.3	1.91	37.3	0.65	0.8	6.46
1/28/09	1110	7.27	0.991	3.0	1.91	35.3	0.66	1.0	6.48
	SAMPLED AT: 1110								
Sample									

Total Purge Time: 1 hr 40 min

Total Purge Volume: 1.0 gal

Analyses: Metals, SVOCs, PAHs, VOCs

Date Shipped: 01/28/09

Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: mw-13

Project Number: 352798.01.FI.SH.01

Sample Number: MW13-012709

Site Name: Shelby Horizons AOC - Former Wilkins AFS

Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae

Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): ~~7.69~~ 7.71

Date: 1-27-09

Time: 1013

Well Diameter: 2" PVC

Total well depth (ft): 26.57

Water column height (ft): 18.86

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 3.20 x 3 = 9.6 gallons

Date	Time	pH +/- 0.2	Conductivity (mS/cm) +/- 5%	Turbidity (NTU) +/- 10%*	Temp +/- 1 C°	ORP +/- 20 mV	DO +/- 0.5 mg/L	Volume Removed (gallons)	Depth (feet)
1/27/09	1025	8.50	0.752	28.7	6.30	-73.7	3.13	0.00	~~7.80~~ 7.60
1/27/09	1030	8.07	0.723	31.9	6.47	-79.7	1.22	0.25	7.87
1/27/09	1037	7.85	0.703	40.6	6.89	-62.8	1.06	0.50	8.03
1/27/09	1042	7.82	0.695	44.8	6.72	-55.9	0.64	0.75	8.06
1/27/09	1049	7.78	0.685	56.0	6.63	-53.0	0.60	1.00	8.18
1/27/09	1055	7.77	0.681	59.8	6.95	-57.3	0.49	1.25	8.28
1/27/09	1100	7.77	0.684	60.6	6.44	-55.2	0.56	1.45	8.35
	SAMPLE TIME:								
			1110	MW13-012709					
			1145	QC01-012709-MS					
			1210	QC02-012709-MSD					
Sample									

Total Purge Time: 2 hrs 15 min

Total Purge Volume: 1.85

Analyses: Metals, SVOCs, PAHs, VOCs

Date Shipped: 1/27/09

Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

TABLE
Measured Groundwater Elevations
Shelby Area of Concern
Former Wilkins Air Force Station - Shelby, Ohio

Well Name	Top of Casing Elevation (ft)	Northing	Easting	Depth to Water (ft)	Total Depth (ft)	PID
MW-11				10.15	27.16	—
MW-12				5.49	22.72	—
MW-13				7.69	26.57	—
DTW Measurements Taken By: M. González / L. Raterink					*Date:* 1/26/09	

MW-12 had a soft bottom

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-11

Project Number: 352798.01.FI.SH.04 Sample Number:

Site Name: Shelby Horizons AOC - Former Wilkins AFS Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 7.36 Date: 7/29/09 Time: 1052 Well Diameter: 2" PVC

Total well depth (ft): Water column height (ft):

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons x 3 = gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
	1054	8.05	0.96	0.618	88.6	17.66	13.6	0.0	7.93
	1059	8.06	0.40	0.611	-2.9	16.99	11.8	0.10	8.47
	1104	8.06	0.20	0.608	-34.1	16.72	2.64	0.30	8.93
	1109	8.07	0.06	0.607	-53.6	16.35	15.7	0.50	9.35
	1114	8.07	0.04	0.604	-69.2	15.99	5.60	0.70	9.78
	1119	8.07	0.00	0.604	-74.9	15.97	13.4	0.85	10.09
	1124	8.07	0.02	0.605	-85.6	15.90	3.46	1.00	10.50
	1129	8.07	0.03	0.607	-88.2	16.11	6.62	1.15	10.91
	1134	8.07	0.04	0.606	-96.1	16.10	6.37	1.25	11.27
	1139	8.07	0.02	0.606	-102.2	16.00	8.67	1.35	11.61
	1144	8.07	0.03	0.605	-102.9	16.18	10.3	1.50	11.90
			SAMPLE TIME: 1145						
			DUPLICATE COLLECTED						
Sample									

Total Purge Time: Total Purge Volume:

Analyses: Metals, PAHs Date Shipped: 7/29/09 Laboratory: CT Laboratories - Baraboo, WI

Notes: COLLECTED DUP (FD) SAMPLE

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-12

Project Number: 352798.01.FI.SH.04 Sample Number:

Site Name: Shelby Horizons AOC - Former Wilkins AFS Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 7.46 Date: 7/29/09 Time: 1338 Well Diameter: 2" PVC

Total well depth (ft): Water column height (ft):

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons x 3 = gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
	1342	7.10	1.43	0.949	79.8	18.05	6.62	0.0	7.87
	1347	7.03	0.45	0.940	55.4	17.34	4.28	0.25	8.09
	1352	7.02	0.24	0.933	52.2	17.27	3.33	0.50	8.20
	1357	7.02	0.05	0.928	53.3	17.31	2.18	0.60	8.27
	1402	7.03	0.06	0.921	55.4	17.18	3.44	0.80	8.32
	1407	7.03	0.01	0.918	57.5	17.18	4.14	1.00	8.36
	1409: Collect Sample								
Sample									

Total Purge Time: Total Purge Volume:

Analyses: Metals, PAHs Date Shipped: Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-13

Project Number: 352798.01.FI.SH.04 Sample Number: MW13-072909

Site Name: Shelby Horizons AOC - Former Wilkins AFS Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 7.10 Date: 7/29/09 Time: 0908 Well Diameter: 2" PVC

Total well depth (ft): Water column height (ft):

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons x 3 = gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
	0910	7.66	0.49	0.726	-100.5	17.81	120	0.0	7.42
	0915	7.68	0.02	0.703	-113.0	17.25	56.3	0.15	7.61
	0920	7.70	0.14	0.694	-119.1	16.81	59.3	0.25	6.69
	0925	7.72	0.03	0.691	-122.9	16.86	52.5	0.45	6.74
	0930	7.73	-0.04	0.689	-124.5	16.66	52.9	0.55	6.76
	0935	7.73	-0.01	0.690	-124.6	16.68	44.3	0.70	6.80
		SAMPLE TIME:		0937					
	MS	SAMPLE TIME:		0957					
	MSD	SAMPLE TIME:		1017					
Sample									

Total Purge Time: Total Purge Volume:

Analyses: Metals, PAHs Date Shipped: 7/29/09 Laboratory: CT Laboratories - Baraboo, WI

Notes: Collected MS and MSD Samples

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

TABLE
Measured Groundwater Elevations
Shelby Area of Concern
Former Wilkins Air Force Station - Shelby, Ohio

Well Name	Top of Casing Elevation (ft)	Approximate Northing	Approximate Easting	Depth to Water (ft)	Total Depth (ft)	PID
MW-11	—	451198.27	1919853.47	9.01	27.19	0.0
MW-12	—	451245.80	1920029.61	7.47	22.64	0.0
MW-13	—	450780.88	1919900.04	7.27	26.60	0.0
DTW Measurements Taken By: L. Katerink / M. Gonzalez					*Date:* 7/27/09	

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-11

Project Number: 352798.01.FI.SH.01 Sample Number: MW11-042009

Site Name: Shelby Horizons AOC - Former Wilkins AFS Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 6.80 Date: 4/20/09 Time: 1615 Well Diameter: 2" PVC

Total well depth (ft): 27.18 Water column height (ft): 20.38

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 3.46 x 3 = 10.39 gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
4/20/09	1619	7.99	0.23	0.620	50.0	9.28	12.1	0.10	8.30
4/20/09	1624	8.03	0.22	0.609	31.2	9.22	10.4	0.50	8.66
4/20/09	1629	8.04	0.18	0.607	19.5	9.20	9.71	0.57	8.75
4/20/09	1635	8.06	0.19	0.599	-0.1	9.18	8.67	0.75	9.35
4/20/09	1640	8.06	0.18	0.597	-11.5	9.19	9.40	0.90	9.79
4/20/09	1645	8.07	0.16	0.596	-20.3	9.23	8.26	1.05	10.12
4/20/09	1650	8.07	0.16	0.595	-31.0	9.15	8.39	1.20	10.53
4/20/09	1655	8.07	0.17	0.595	-44.0	9.19	7.53	1.30	10.92
4/20/09	1700	8.07	0.16	0.594	-55.3	9.18	6.65	1.45	11.26
4/20/09	1705	8.07	0.15	0.594	-65.9	9.21	6.44	1.60	11.67
4/20/09	1710	8.07	0.16	0.594	-76.7	9.31	5.84	1.75	11.91
4/20/09	1715	8.07	0.15	0.594	-79.8	9.36	5.93	1.87	12.15
4/20/09	1720	8.07	0.16	0.594	-79.6	9.31	5.95	2.05	12.41
4/20/09	1725	8.07	0.14	0.594	-79.8	9.36	—	2.25	12.68
	SAMPLE TIME: 1727 MW11-042009								
	DUPLICATE: — QC03-042009-FD								
Sample									

Total Purge Time: 1 hr 35 min Total Purge Volume: 2.25 gal

Analyses: Metals, PAHs Date Shipped: 4/21/09 Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-12

Project Number: 352798.01.FI.SH.01

Sample Number: MW12-042009

Site Name: Shelby Horizons AOC - Former Wilkins AFS

Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae

Calibrated meters: (Y) / N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 3.67 Date: 4/20/09 Time: 1435/1445 (at well / start purge) Well Diameter: 2" PVC

Total well depth (ft): 22.65 Water column height (ft): 18.98

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 3.22 x 3 = 9.67 gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
4/20/09	1450	6.80	1.13	0.958	154.9	9.84	109	0.0	4.03
4/20/09	1455	6.82	0.40	0.946	145.5	9.36	28.1	0.15	4.34
4/20/09	1500	6.89	0.26	0.945	140.2	9.25	11.7	0.30	4.45
4/20/09	1505	6.93	0.25	0.943	136.4	9.13	8.22	0.50	4.50
4/20/09	1510	6.95	0.23	0.947	133.0	9.11	5.58	0.70	4.51
4/20/09	1515	6.98	0.23	0.943	130.5	9.03	5.47	0.90	4.51
4/20/09	1520	6.99	0.22	0.942	128.2	8.98	5.56	1.1	4.51
	SAMPLE TIME: 1523 MW12-042009								
	MS: 1535 QC01-042009-MS								
	MSD: 1548 QC02-042009-MSD								
Sample									

Total Purge Time: 1hr 5min Total Purge Volume: 1.2 gal.

Analyses: Metals, PAHs Date Shipped: 4/21/09 Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

CH2MHILL

Groundwater Monitoring Well Purging and Sampling

Well: MW-13

Project Number: 352798.01.FI.SH.01

Sample Number: MW13-042109

Site Name: Shelby Horizons AOC - Former Wilkins AFS

Site Location: Shelby, OH

Personnel: M. González and L. Raterink

Equipment Used: YSI Multimeter, HACH Turbidimeter, MultiRae

Calibrated meters: (Y) N

Sampling Method: (Peristaltic) / Submersible / Bladder / Bailer / Other

Initial Water Level (ft): 5.30 Date: 4/21/09 Time: 910 Well Diameter: 2" PVC

Total well depth (ft): 26.57 Water column height (ft): 21.27

Well Volume (i.e. 2" well (0.17 gal/ft) and 1" well 0.041): gallons 3.62 x 3 = 10.85 gallons

Date	Time	pH +/- 0.2	DO +/- 0.5 mg/L	Conductivity (ms/cm) +/- 5%	ORP +/- 20 mV	Temp +/- 1 C°	Turbidity (NTU) +/- 10%*	Volume Removed (gallons)	Depth (feet)
4/21/09	915	7.23	4.39	0.725	124.8	9.51	359	0.0	5.65
4/21/09	920	7.40	3.93	0.718	38.8	9.34	260	0.25	6.75
4/21/09	925	7.50	3.55	0.716	-24.7	9.13	264	0.45	6.86
4/21/09	930	7.55	3.38	0.716	-56.2	8.70	236	0.60	6.93
4/21/09	935	7.58	3.06	0.714	-80.8	8.62	212	0.75	7.03
4/21/09	940	7.60	2.80	0.714	-94.2	8.57	182	0.80	7.16
4/21/09	945	7.62	2.64	0.713	-104.3	8.48	202	1.00	7.21
4/21/09	950	7.63	2.31	0.713	-112.2	8.48	173	1.12	7.23
4/21/09	955	7.64	1.98	0.713	-117.7	8.65	140	1.25	7.30
4/21/09	1000	7.65	1.84	0.713	-122.3	8.39	112	1.45	7.31
4/21/09	1005	7.65	1.62	0.713	-125.0	8.15	100	1.60	7.33
	SAMPLE TIME: 1003								
Sample									

Total Purge Time: 1hr 5min Total Purge Volume: 1.6 gal

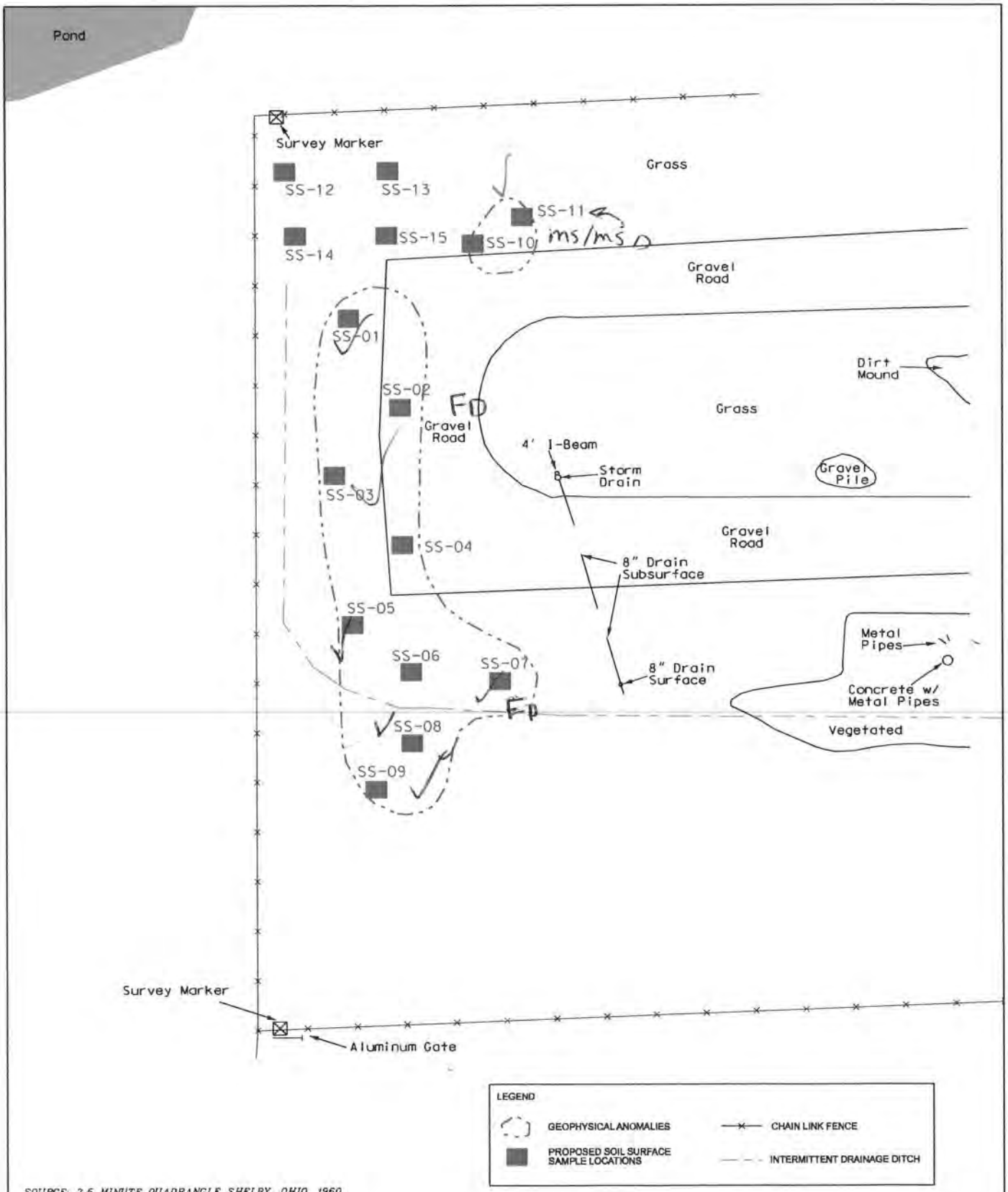
Analyses: Metals, PAHs Date Shipped: 4/21/09 Laboratory: CT Laboratories - Baraboo, WI

Notes:

* If the plan calls for metals analysis, field filtering will be conducted if turbidity is over 10 NTU.

TABLE
Measured Groundwater Elevations
Shelby Area of Concern
Former Wilkins Air Force Station - Shelby, Ohio

Well Name	Top of Casing Elevation (ft)	Approximate Northing	Approximate Easting	Depth to Water (ft)	Total Depth (ft)	PID	
MW-11		451198.27	1919853.47	9.48	27.18	0.0	bubbling
MW-12		451245.80	1920029.61	3.77	22.65	0.0	
MW-13		450780.88	1919900.04	5.91	26.57	0.0	bubbling
DTW Measurements Taken By: M. González					*Date:* 4/20/09		



LEGEND

- GEOPHYSICAL ANOMALIES
- PROPOSED SOIL SURFACE SAMPLE LOCATIONS
- CHAIN LINK FENCE
- INTERMITTENT DRAINAGE DITCH

SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

North

0 40 80
Approximate scale in feet

FIGURE 3-2
Proposed Surface Soil Sampling Locations
Shelby Horizons AOC Remedial Investigation

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mw-11 DTW 1940 (TOC
DTB 2712

mw-12 8.88 DTW - TOC
23.53 DTB - TOC

mw13 DTW 14.24'
DTB 26.58' (TOC)

TABLE
Soil Sample Locations
Shelby Area of Concern
Former Wilkins Air Force Station - Shelby, Ohio

	Approximate Coordinates		Actual Coordinates				
Location	Northing	Easting	Northing	Easting	Sample ID	Sample Time	Comments
SS-01	451151.37	1919891.14	451154.41	1919890.28 ✓	SS01-103008	1505	
SS-02	451097.59	1919921.95	~~1919920.28~~	1919918.54 ✓	SS02-103008	1600	FD
SS-03	451056.69	1919882.17	451056.07	1919897.92 ✓	SS03-103008	1410	
SS-04	451014.68	1919923.07	~~451078.~~	~~1919920.~~ ✓	SS04-103008	1420	
SS-05	450966.50	1919892.82	450972.56	1919892.07 ✓	SS05-103008	1350	
SS-06	450937.93	1919928.11	450941.46	1919923.45 ✓	SS06-103008	1355	
SS-07	450932.32	1919981.38	450937.66	1919980.28 ✓	SS07-103008	1315	FD Collected
SS-08	450894.79	1919928.67	450900.55	1919926.03	SS08-103008	1215	
SS-09	450866.78	1919906.82	450870.05	1919905.63	SS09-103008	1130	
SS-10	451196.09	1919966.24	451186.37	1919965.46 ✓	SS10-103008	1645	
SS-11	451212.23	1919995.75	~~1919965.~~	✓	SS11-103008	1545	MS/MSD
SS-12	451239.42	1919853.09	451237.52	1919848.43 ✓	SS12-103008	1715	
SS-13	451239.89	1919914.96	451238.38	1919910.28 ✓	SS13-103008	1620	
SS-14	451200.67	1919859.20	451201.98	1919857.18	SS14-103008	1745	
SS-15	451204.13	1919914.02	~~451201~~	1919905.66 ✓	SS15-103008	1650	
QC-06-MS	Not Specified				QC06-103008-MS	1545	At SS-11
QC-07-MSD	Not Specified				QC07-103008-MSD	1545	SS-11
QC-08-FD	Not Specified				QC08-103008-FD		Collected on SS-07
QC-09-FD	Not Specified				QC09-103008-FD		" " SS-02
QC-10-EB	18 ok Not Applicable						
QC-11-TB	Not Applicable						
Measurements Taken By:				*Date:*			

mw12 N: 451248.80
E 1920029.61

mw11 N: 451198.27
E 1919853.47

mw13 N: 450980.88
E: 1919900.04

SS02: 451095.12 (N)

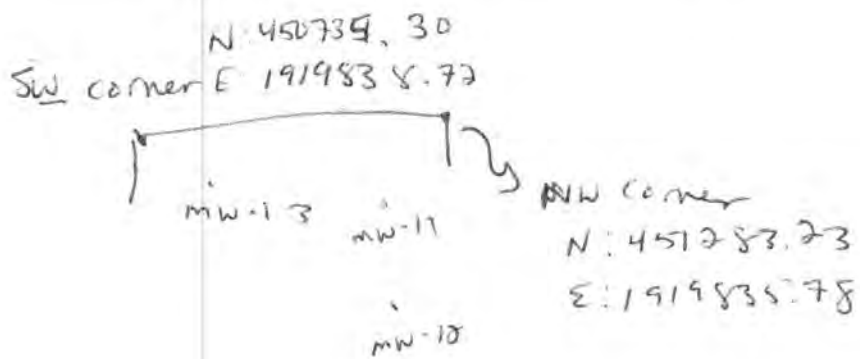
SS04: 451015.42 1919922.06

*SS11: N: 451199.05 1919994.27 - Location under semi trailer - 3' N. of actual location coordinates

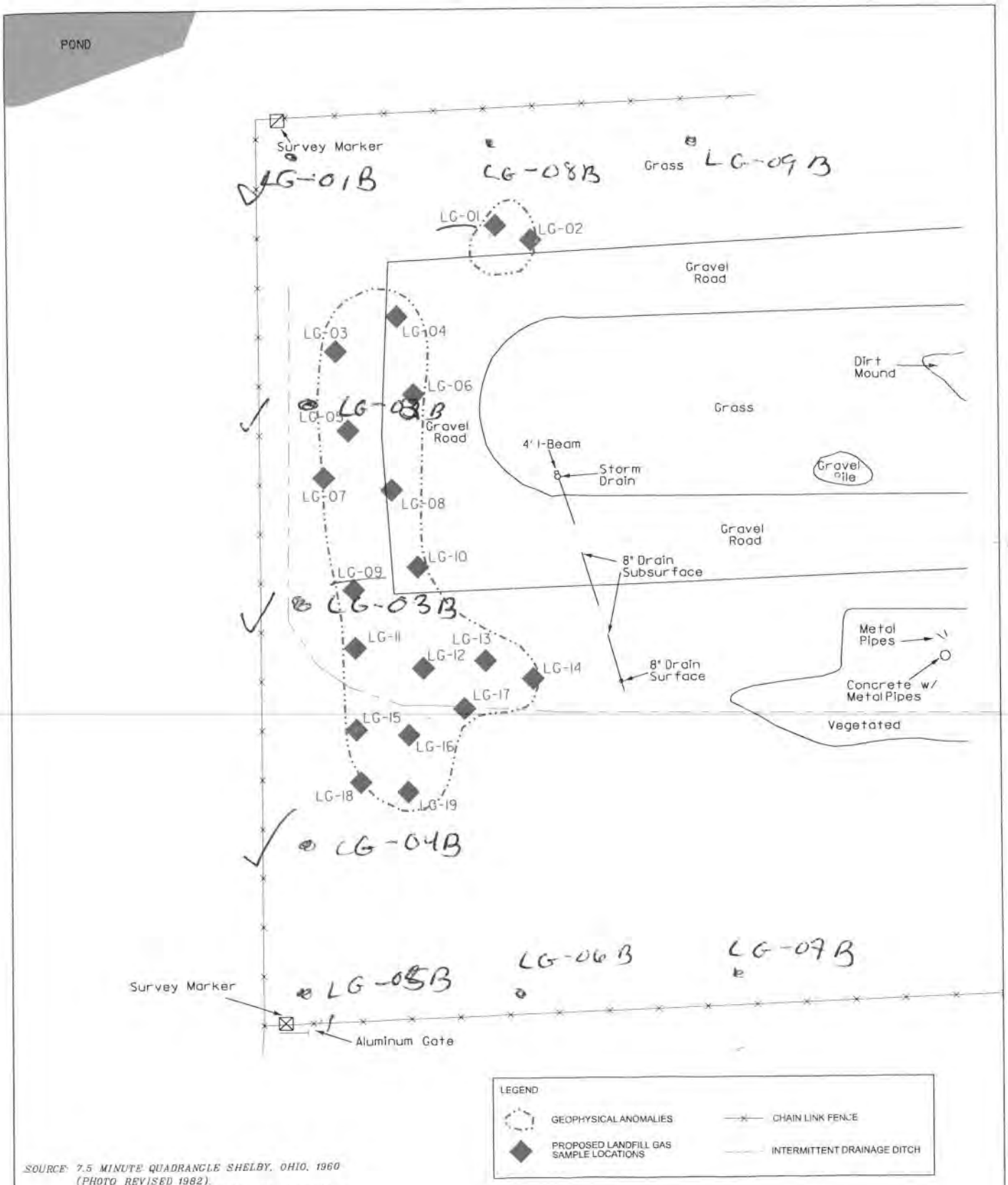
SS15 N: 451199.37 1919905.66

TABLE
Drainage Ditch Sample Locations
Shelby Area of Concern
Former Wilkins Air Force Station - Shelby, Ohio

	Approximate Coordinates		Actual Coordinates				
Location	Northing	Easting	Northing	Easting	Sample ID	Sample Time	Comments
SD-01	451175.23	1919854.47	451170.95	1919856.56	SD01-102908	1015	collected in ~~ch~~ "interval
SD-02	451108.92	1919852.44	451[illegible].87	1919852.30	SD02-102908	1050	
SD-03	451042.60	1919851.08	451049.55	1919853.44	SD03-102908	1130	
SD-04	450978.34	1919850.39	450982.32	1919852.89	SD04-102908	1205	~~ms/msd~~ collected
SD-05	450929.68	1919885.26	450933.79	1919891.13	SD05-102908	1230	~~FD collected~~
SD-06	450915.19	1919947.44	450928.28	1919950.78	SD06-102908	1300	FD collected
SD-07	450912.93	1920005.07	450928.62	1920008.56	SD07-102908	1400	
SD-08	450909.51	1920054.98	450933.84	1920055.90	SD08-102908	1430	
QC-12-MS	Not Specified					1205	SD-04
QC-13-MSD	Not Specified					1205	SD-04
QC-14-FD	Not Specified					~~1230~~ 1300	~~SD-05~~ SD-06
QC-15-EB	Not Applicable						
QC-16-TB	Not Applicable						
Measurements Taken By:				*Date:*			



STATE OF OHIO
Brillas
5802
222
ATL



SOURCE: 7.5 MINUTE QUADRANGLE SHELBY, OHIO, 1960 (PHOTO REVISED 1982).
BASIC LAYOUT, DRAINAGE SYSTEM, WILKINS AF SPECIALIZED DEPOT, FEBRUARY 13, 1952.
BASIC LAYOUT PLAN, SHELBY AIR FORCE DEPOT, WILKINS AIR FORCE STATION.

FIGURE 2-4
Proposed Landfill Gas Sample Locations
Shelby Horizons AOC Remedial Investigation Work Plan

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shelby_figure-2_4.dgn

Attachment 1.
Explosive Gas Monitoring Punch Bar Station Report

Sanitary Landfill: Shelby Horizons A.O.C. Location (County): Richland Co.

Tested By: L. Raterink, R. Clennon, M. González Date: 10-31-2008

Gas Instrument Type: Gem 2000 / MiniRAE Model No.: Gem 2000 / MiniRAE 2000

Last Calibrated: 10.31.08 Calibration Gas: Multi / Isobutylene Detection Limit: _____

Sampling Method: _____

Barometric Pressure: _____ Relative Humidity: _____ Outside Air Temperature: _____

Soil Conditions: _____

Test Method (Punch Bar/Other): _____

Station Designation/ Location	Time	Explosive Gas % Volume or % LEL (circle one)	Threshold Limit	% Gas is higher/lower than threshold	Punchbar hole depth
N: 451272.15 E: 1919836.64 LG-01B	1200	CH4: 00.0 CO2: 0.1	MiniRae: 0.1 ppm	reading @ 1'	O_2: 20.7% ~~CH4 77.9~~
N: 451176.39 E: 1919835.09 LG-02B	1208	CH4: 00.0 O2: 20.9% CO2: 00.1 MR:	0.1 ppm	reading @ 1'	
N: 451042.20 E: 1919844.12 LG-03B	1215	CH4: 00.0 O2: 21.0 CO2: 00.2 MR:	0.1 ppm	reading @ 1'	
N: 450900.01 E: 1919849.24 LG-04B	1223	CH4: 00.0 O2: 21.1 CO2: 00.1 MR	0.0 ppm	reading @ 1'	
N: 450735.23 E: 1919846.36 LG-05B	1228	CH4: 00.0 O2: 21.1 CO2: 00.0 MR:	0.4 ppm		Reading 1/2'
N: 450739.26 E: 1919963.22 LG-06B	1233	CH4: 00.0 O2: 21.1 CO2: 00.0 MR	0.0 ppm	reading 1'	
N: 450743.83 E: 1920062.03 LG-07B	1235	CH4: 00.0 O2: 21.1 CO2: 00.0 MR	0.1 ppm	reading 1'	
N: 451246.01 E: 1919950.73 LG-08B	1242	CH4: 00.0 O2: 21.0 CO2: 00.2 MR	0.1 ppm	reading 1'	hole 1'1/2'
		CH4: O2: CO2: MR:			

LG 06 E: 1919963.22

Punchbar hole abandonment method: _____

Comments: Ambient Readings on Mini Rae of 0.1 ppm

Appendix E

Analytical Laboratory Reports and Data Evaluation Reports (provided on the attached CD)

Former Wilkins Air Force Station
Shelby Horizons Landfill Groundwater Investigation
Data Quality Evaluation Report

Introduction

The object of the data quality evaluation (DQE) report is to assess the quality of analytical results for samples collected during the groundwater investigation at the former Wilkins Air Force Station Shelby Horizons Landfill in Shelby, Ohio. Samples were collected and analyzed in an effort to assess the presence of contaminants in groundwater at the former Air Force station and to determine if remedial action is required. Individual method requirements and guidelines from the *Final Quality Assurance Project Plan* (QAPP) *Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station* (March 2007) were used as the basis for the assessment. This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers 12 groundwater samples, 4 field duplicates (FD), 1 equipment blank (EB) and 4 trip blanks (TB). Table 1 lists the samples and collection dates. Samples were collected November 11, 2008, and January 27 through July 29, 2009. The sample results were reported in four sample delivery groups: 70211, 71268, 72585 and 74424. The analyses were performed by CT Laboratories located in Baraboo, Wisconsin.

Six methods were used to analyze the environmental samples. Samples were collected and shipped by overnight carrier to the laboratory for analysis. The samples were analyzed for one or more of the analytes and methods listed in Table 2.

TABLE 2
Samples Associated with DQE of Water Samples

SampleID	Sample Date and Time	Sample Type
QC05-111108-TB	11/11/2008 00:00	TB
QC04-111108-EB	11/11/2008 11:45	EB
MW13-111108	11/11/2008 14:40	N
MW12-111108	11/11/2008 16:15	N
QC03-111208-FD	11/12/2008 00:00	FD
QC05-111208-TB	11/12/2008 00:00	TB
MW11-111208	11/12/2008 10:06	N
QC03-012709-FD	01/27/2009 00:00	FD
QC05-012709-TB	01/27/2009 00:00	TB
QC05-012809-TB	01/27/2009 00:00	TB
MW13-012709	01/27/2009 12:10	N
MW11-012709	01/27/2009 16:20	N
MW12-012809	01/28/2009 11:10	N
MW11-042009	04/20/2009 00:00	N
MW12-042009	04/20/2009 00:00	N
QC03-042009-FD	04/20/2009 00:00	FD
MW13-042109	04/21/2009 00:00	N
QC03-072909-FD	07/29/2009 00:00	FD
MW13-072909	07/29/2009 09:37	N
MW11-072909	07/29/2009 11:45	N
MW12-072909	07/29/2009 14:09	N

Data validation was patterned after the USEPA Contract Laboratory National Functional Guidelines (NFG) for Inorganic Data Review (2004) and the USEPA Contract Laboratory NFG for Organic Data Review (1999), following the calibration and quality control requirements specified in the QAPP and the Louisville Army Corps Guidelines.

All data were validated per the following Level III validation requirements:

TABLE 2
Analytical Parameters

Parameter	Prep/Analytical Method
Volatile organic compounds (VOC)	SW5030/ 8260B
Semivolatile organic compounds (SVOC)	SW3510C, 3520C/ 8270C
Polynuclear aromatic hydrocarbons (PAH)	SW3520C/ 8270C-PAH
Mercury	SW3010A, 3015/7470A
Metals	SW3005A, 3010A, 3015/6010B/ 6010-NaK

- A review of the data set narrative to identify issues that the lab reported in the data deliverable
- A check of sample integrity (sample collection, preservation, and holding times)
- An evaluation of basic quality control (QC) measurements used to assess the accuracy, precision and representativeness of data including QC blanks, laboratory control samples (LCS), matrix spikes/matrix spike duplicates (MS/MSD), surrogate recovery when applicable, and field or laboratory duplicate results
- A review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations
- Evaluation of calibration and quality control summary results against the project requirements
- Other method specific QC requirements

In addition, 10 percent of the data collected in November underwent further validation to verify analyte identification and to check initial calibrations and calculations.

Data flags were assigned as specified in the QAPP. The flags and the reasons for them were entered into the electronic database. Multiple flags were routinely applied to specific sample method/matrix/analyte combinations, but there is only one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts. The data flags were:

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

R The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte could not be verified.

B The analyte was detected in the associated method or field blank and also in the samples.

U The analyte was analyzed for but was not detected at concentrations above the reported sample quantitation limit.

UJ The analyte was not detected above the reported sample quantitation limit. The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Findings

The overall summaries of the data validation findings are contained in the following sections and summarized in Table 3.

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
MW11-111208	6010B	Beryllium	0.00019	mg/L	B	MB
MW11-111208	6010B	Copper	0.0012	mg/L	UJ	MRL < LCL
MW11-111208	6010B	Iron	0.017	mg/L	J	MRL > UCL
MW11-111208	6010B	Magnesium	20	mg/L	J	MRL > UCL
MW11-111208	6010B	Thallium	0.0013	mg/L	UJ	MRL < LCL
MW11-012709	6010B	Beryllium	0.00022	mg/L	B	MB
MW11-111208	8260B	Acetone	5.2	µg/L	B	EB, TB, MRL > UCL (J)
MW11-111208	8260B	Chloromethane	0.11	µg/L	B	EB
MW11-111208	8260B	Methylene chloride	0.18	µg/L	R	MRL < LCL
MW11-111208	8260B	Toluene	0.06	µg/L	B	EB
MW11-111208	8270C	4-Nitroaniline	0.47	µg/L	UJ	MRL < LCL
MW11-111208	8270C	4-Nitrophenol	0.63	µg/L	UJ	MRL < LCL
MW11-111208	8270C	Di-n-butyl phthalate	2.6	µg/L	B	MB
MW11-111208	8270C	Di-n-octyl phthalate	0.16	µg/L	UJ	MRL < LCL
MW11-111208	8270C	Pyridine	1.8	µg/L	UJ	LCS < LCL, MRL < LCL
MW11-111208	8270C-PAH	Naphthalene	0.037	µg/L	B	MB, EB
MW11-012709	8260B	Chloromethane	0.94	µg/L	B	TB
MW11-012709	8260B	Methylene chloride	0.18	µg/L	UJ	CCV < LCL
MW11-012709	8270C	2,4,5-Trichlorophenol	0.81	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2,4,6-Trichlorophenol	0.89	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2,4-Dichlorophenol	0.63	µg/L	UJ	Sur < LCL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
MW11-012709	8270C	2,4-Dimethylphenol	1.2	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2,4-Dinitrophenol	1.6	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2-Chlorophenol	0.7	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2-Methyl-4,6-dinitrophenol	0.96	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2-Methylphenol	0.9	µg/L	UJ	Sur < LCL
MW11-012709	8270C	2-Nitrophenol	0.62	µg/L	UJ	Sur < LCL
MW11-012709	8270C	4-Chloro-3-methylphenol	1.1	µg/L	UJ	Sur < LCL
MW11-012709	8270C	4-Methylphenol	0.69	µg/L	UJ	Sur < LCL
MW11-012709	8270C	4-Nitrophenol	0.64	µg/L	UJ	Sur < LCL
MW11-012709	8270C	Benzoic acid	12	µg/L	UJ	Sur < LCL
MW11-012709	8270C	Benzyl alcohol	0.58	µg/L	J	Sur < LCL
MW11-012709	8270C	Pentachlorophenol	0.92	µg/L	UJ	Sur < LCL
MW11-012709	8270C	Phenol	0.32	µg/L	UJ	Sur < LCL
MW11-012709	8270C	Pyridine	1.8	µg/L	R	LCS < LCL
MW11-042009	8270C-PAH	Fluoranthene	0.015	µg/L	B	MB
MW11-042009	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
MW11-042009	8270C-PAH	Phenanthrene	0.015	µg/L	B	MB
MW11-042009	8270C-PAH	Pyrene	0.012	µg/L	B	MB
MW11-072909	6010B	Arsenic	0.01	mg/L	B	MB
MW11-072909	8270C-PAH	Benzo(a)anthracene	0.015	µg/L	B	MB
MW11-072909	8270C-PAH	Benzo(g,h,i)perylene	0.0071	µg/L	UJ	LCS < LCL
MW11-072909	8270C-PAH	Dibenzo(a,h)anthracene	0.0051	µg/L	UJ	LCS < LCL
MW11-072909	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
MW12-111108	8260B	Chloromethane	0.31	µg/L	B	EB
MW12-111108	8260B	Methylene chloride	0.18	µg/L	R	MS < LCL, SD < LCL, MRL < LCL
MW12-111108	8270C	4-Nitroaniline	0.47	µg/L	UJ	MRL < LCL
MW12-111108	8270C	4-Nitrophenol	0.64	µg/L	UJ	MRL < LCL
MW12-111108	8270C	Di-n-octyl phthalate	0.16	µg/L	UJ	MRL < LCL
MW12-111108	8270C	Pyridine	1.8	µg/L	R	MRL < LCL, MS < LCL, SD < LCL, LCS < LCL (UJ)
MW12-111108	8270C-PAH	Naphthalene	0.021	µg/L	B	MB, EB
MW12-111108	6010B	Barium	0.071	mg/L	J	SerDIL
MW12-111108	6010B	Calcium	130	mg/L	J	SerDIL
MW12-111108	6010B	Magnesium	42	mg/L	J	SerDIL, MRL > UCL
MW12-111108	6010B	Copper	0.0012	mg/L	J	MRL < LCL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
MW12-111108	6010B	Nickel	0.001	mg/L	B	MB, MRL > UCL (J)
MW12-111108	6010B	Thallium	0.0013	mg/L	UJ	MRL < LCL
MW12-012809	6010B	Nickel	0.0011	mg/L	B	MB
MW12-012809	8260B	Chloromethane	0.67	µg/L	B	TB
MW12-012809	8260B	Methylene chloride	0.18	µg/L	UJ	CCV < LCL
MW12-012809	8270C	Pyridine	1.8	µg/L	R	LCS < LCL
MW12-042009	6010B	Aluminum	0.007	mg/L	UJ	MS < LCL
MW12-042009	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
MW12-042009	8270C-PAH	Phenanthrene	0.015	µg/L	B	MB
MW12-072909	6010B	Silver	0.0013	mg/L	J	ICV > UCL, CCV > UCL
MW12-072909	8270C-PAH	Benzo(a)anthracene	0.015	µg/L	B	MB
MW12-072909	8270C-PAH	Benzo(g,h,i)perylene	0.0071	µg/L	UJ	LCS < LCL
MW12-072909	8270C-PAH	Chrysene	0.012	µg/L	B	MB
MW12-072909	8270C-PAH	Dibenzo(a,h)anthracene	0.0051	µg/L	UJ	LCS < LCL
MW12-072909	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
MW12-072909	8270C-PAH	Pyrene	0.012	µg/L	B	MB
MW13-111108	8260B	Acetone	5.2	µg/L	B	EB, TB, MRL > UCL (J)
MW13-111108	8260B	Chloromethane	0.2	µg/L	B	EB
MW13-111108	8260B	Methylene chloride	0.18	µg/L	R	MRL < LCL
MW13-111108	8270C	4-Nitroaniline	0.47	µg/L	UJ	MRL < LCL
MW13-111108	8270C	4-Nitrophenol	0.63	µg/L	UJ	MRL < LCL
MW13-111108	8270C	Diethyl phthalate	1	µg/L	B	MB
MW13-111108	8270C	Di-n-butyl phthalate	2.6	µg/L	B	MB
MW13-111108	8270C	Di-n-octyl phthalate	0.16	µg/L	UJ	MRL < LCL
MW13-111108	8270C	Pyridine	1.8	µg/L	UJ	LCS < LCL, MRL < LCL
MW13-111108	8270C-PAH	Naphthalene	0.028	µg/L	B	MB, EB
MW13-111108	6010B	Copper	0.0012	mg/L	UJ	MRL < LCL
MW13-111108	6010B	Iron	0.069	mg/L	J	MRL > UCL
MW13-111108	6010B	Magnesium	23	mg/L	J	MRL > UCL
MW13-111108	6010B	Thallium	0.0013	mg/L	UJ	MRL < LCL
MW13-012709	6010B	Arsenic	0.0182	mg/L	J	MS > UCL
MW13-012709	6010B	Aluminum	0.323	mg/L	J	SerDIL
MW13-012709	6010B	Iron	0.709	mg/L	J	SerDIL
MW13-012709	6010B	Magnesium	18.5	mg/L	J	SerDIL
MW13-012709	6010B	Lead	0.0016	mg/L	J	MS > UCL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
MW13-012709	6010B	Zinc	0.0037	mg/L	J	MS > UCL
MW13-012709	8260B	Chloromethane	0.47	µg/L	B	TB
MW13-012709	8260B	Methylene chloride	0.18	µg/L	UJ	CCV < LCL
MW13-012709	8260B	Styrene	0.022	µg/L	UJ	MS < LCL, SD < LCL
MW13-012709	8270C	2,4,5-Trichlorophenol	0.81	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2,4,6-Trichlorophenol	0.88	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2,4-Dichlorophenol	0.62	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2,4-Dimethylphenol	1.2	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2,4-Dinitrophenol	1.6	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2-Chlorophenol	0.69	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2-Methyl-4,6-dinitrophenol	0.95	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2-Methylphenol	0.89	µg/L	UJ	Sur < LCL
MW13-012709	8270C	2-Nitrophenol	0.61	µg/L	UJ	Sur < LCL
MW13-012709	8270C	4-Chloro-3-methylphenol	1.1	µg/L	UJ	Sur < LCL
MW13-012709	8270C	4-Methylphenol	0.68	µg/L	UJ	Sur < LCL
MW13-012709	8270C	4-Nitrophenol	0.63	µg/L	UJ	Sur < LCL
MW13-012709	8270C	Aniline	0.33	µg/L	UJ	MS < LCL, SD < LCL
MW13-012709	8270C	Benzoic acid	12	µg/L	UJ	Sur < LCL
MW13-012709	8270C	Benzyl alcohol	0.32	µg/L	UJ	Sur < LCL
MW13-012709	8270C	Pentachlorophenol	0.91	µg/L	UJ	Sur < LCL
MW13-012709	8270C	Phenol	0.32	µg/L	UJ	Sur < LCL
MW13-012709	8270C	Pyridine	1.8	µg/L	R	LCS < LCL, MS < LCL SD < LCL
MW13-042109	8270C-PAH	Benzo(b)fluoranthene	0.021	µg/L	B	MB
MW13-042109	8270C-PAH	Fluoranthene	0.015	µg/L	B	MB
MW13-042109	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
MW13-042109	8270C-PAH	Phenanthrene	0.019	µg/L	B	MB
MW13-042109	8270C-PAH	Pyrene	0.012	µg/L	B	MB
MW13-072909	6010B	Arsenic	0.0139	mg/L	B	MB
MW13-072909	6010B-NaK	Sodium	64.3	mg/L	J	SerDIL
MW13-072909	8270C-PAH	Benzo(a)anthracene	0.015	µg/L	B	MB
MW13-072909	8270C-PAH	Benzo(g,h,i)perylene	0.0072	µg/L	UJ	LCS < LCL, MS < LCL, SD < LCL
MW13-072909	8270C-PAH	Chrysene	0.012	µg/L	B	MB
MW13-072909	8270C-PAH	Dibenzo(a,h)anthracene	0.0052	µg/L	UJ	LCS < LCL, MS < LCL, SD < LCL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
MW13-072909	8270C-PAH	Indeno(1,2,3-cd)pyrene	0.0062	µg/L	UJ	MS < LCL, SD < LCL
MW13-072909	8270C-PAH	Naphthalene	0.024	µg/L	B	MB
MW13-072909	8270C-PAH	Pyrene	0.012	µg/L	B	MB
QC03-111208-FD	6010B	Copper	0.0012	mg/L	UJ	MRL < LCL
QC03-111208-FD	6010B	Iron	0.011	mg/L	J	MRL > UCL
QC03-111208-FD	6010B	Magnesium	20	mg/L	J	MRL > UCL
QC03-111208-FD	6010B	Thallium	0.0013	mg/L	UJ	MRL < LCL
QC03-111208-FD	8260B	Acetone	5.2	µg/L	B	EB, TB, MRL > UCL (J)
QC03-111208-FD	8260B	Chloromethane	0.11	µg/L	B	EB
QC03-111208-FD	8260B	Methylene chloride	0.18	µg/L	R	MRL < LCL
QC03-111208-FD	8270C	2,4,5-Trichlorophenol	0.8	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2,4,6-Trichlorophenol	0.87	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2,4-Dichlorophenol	0.62	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2,4-Dimethylphenol	1.2	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2,4-Dinitrophenol	1.5	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2-Chlorophenol	0.69	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2-Methyl-4,6-dinitrophenol	0.94	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2-Methylphenol	0.88	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	2-Nitrophenol	0.61	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	4-Chloro-3-methylphenol	1.1	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	4-Methylphenol	0.68	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	4-Nitroaniline	0.46	µg/L	UJ	MRL < LCL
QC03-111208-FD	8270C	4-Nitrophenol	0.63	µg/L	UJ	Sur < LCL, MRL < LCL
QC03-111208-FD	8270C	Benzoic acid	12	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	Di-n-octyl phthalate	0.16	µg/L	UJ	MRL < LCL
QC03-111208-FD	8270C	Pentachlorophenol	0.9	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	Phenol	0.31	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C	Pyridine	1.8	µg/L	UJ	LCS < LCL, MRL < LCL
QC03-111208-FD	8270C-PAH	Acenaphthene	0.0052	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Acenaphthylene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Anthracene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Benzo(a)anthracene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Benzo(a)pyrene	0.0072	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Benzo(b)fluoranthene	0.0062	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Benzo(g,h,i)perylene	0.0072	µg/L	UJ	Sur < LCL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
QC03-111208-FD	8270C-PAH	Benzo(k)fluoranthene	0.0062	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Chrysene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Dibenzo(a,h)anthracene	0.0052	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Fluoranthene	0.0052	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Fluorene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Indeno(1,2,3-cd)pyrene	0.0062	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Naphthalene	0.042	µg/L	B	EB, Sur < LCL (UJ)
QC03-111208-FD	8270C-PAH	Phenanthrene	0.0041	µg/L	UJ	Sur < LCL
QC03-111208-FD	8270C-PAH	Pyrene	0.0041	µg/L	UJ	Sur < LCL
QC03-012709-FD	8260B	Chloromethane	1	µg/L	B	TB
QC03-012709-FD	8260B	Methylene chloride	0.18	µg/L	UJ	CCV < LCL
QC03-012709-FD	8270C	2,4,5-Trichlorophenol	0.83	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2,4,6-Trichlorophenol	0.91	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2,4-Dichlorophenol	0.64	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2,4-Dimethylphenol	1.3	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2,4-Dinitrophenol	1.6	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2-Chlorophenol	0.72	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2-Methyl-4,6-dinitrophenol	0.98	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2-Methylphenol	0.92	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	2-Nitrophenol	0.63	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	4-Chloro-3-methylphenol	1.2	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	4-Methylphenol	0.71	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	4-Nitrophenol	0.65	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	Benzoic acid	12	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	Benzyl alcohol	0.55	µg/L	J	Sur < LCL
QC03-012709-FD	8270C	Pentachlorophenol	0.94	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	Phenol	0.33	µg/L	UJ	Sur < LCL
QC03-012709-FD	8270C	Pyridine	1.9	µg/L	R	LCS < LCL
QC03-042009-FD	8270C-PAH	Naphthalene	0.021	µg/L	B	MB
QC03-042009-FD	8270C-PAH	Phenanthrene	0.015	µg/L	B	MB
QC03-042009-FD	8270C-PAH	Pyrene	0.012	µg/L	B	MB
QC03-042009-FD	6010B	Copper	0.0032	mg/L	U	CCB
QC03-072909-FD	6010B	Antimony	0.0056	mg/L	B	MB
QC03-072909-FD	6010B	Arsenic	0.01	mg/L	B	MB
QC03-072909-FD	6010B-NaK	Sodium	59.1	mg/L	J	SerDIL

TABLE 3
Data Qualifier Summary

Sample ID	Method	Analyte	Result	Units	Final Flag	Validation Reason
QC03-072909-FD	6010B	Silver	0.001	mg/L	J	ICV > UCL, CCV > UCL
QC03-072909-FD	8270C-PAH	Naphthalene	0.021	µg/L	B	MB

Validation Reasons:
CCB = Analyte detected in the continuing calibration blank less than the reporting limit
CCV < LCL = Continuing calibration verification recovery less than lower limit
CCV > UCL= Continuing calibration verification recovery greater than upper limit
EB = Analyte detected in the equipment blank less than reporting limit
ICV > UCL =Initial calibration verification recovery greater than upper limit
LCS < LCL = Laboratory control sample recovery less than lower limit
MB = Analyte detected in the method blank less than reporting limit
MRL < LCL = Method reporting limit standard recovery less than lower limit
MRL > UCL = Method reporting limit standard recovery greater than upper limit
MS < LCL = Matrix spike recovery less than lower limit
MS > UCL = Matrix spike recovery greater than upper limit
SD < LCL = Matrix spike duplicate recovery less than lower limit
SerDil = Serial dilution relative percent difference above criteria
Sur < LCL = Surrogate recovery less than lower limit
TB = Analyte detected in the trip blank less than reporting limit

Holding Times

All holding-time criteria were met.

Calibration

All initial and continuing calibration requirements were met with the following exceptions.

The percent difference (%D) for silver was greater than QAPP criteria in one initial calibration verification for method 6010B, indicating a possible high bias in the associated samples results. In addition, the %D for silver was greater than QAPP criteria in one continuing calibration verification. Detected results were qualified as estimated and flagged "J" in the associated samples. Nondetected results were not qualified.

The %D for methylene chloride was less than QAPP criteria in one VOC continuing calibration verification, indicating a possible low bias in the associated samples. The data were qualified as estimated nondetects and flagged "UJ" in the associated samples.

Copper was detected at a concentration less than the reporting limit (RL) in one continuing calibration blank associated with Method 6010B. The data were qualified as not detected at the concentration measured and flagged "U" when the sample concentration was less than five times the concentration detected in the blank.

Method Blanks

Method blanks were analyzed at the required frequency and were generally free of contamination. Detected results less than the RL were qualified as not detected, raised to the RL and flagged "B" in the associated samples. Detected results greater than the RL were

qualified as not detected at the concentration measured and flagged "B"in the associated samples.

Several analytes were detected at concentrations less than the RL in several method blanks associated with method 6010B. The data were qualified as not detected at the concentration measured and flagged "B" when the sample concentrations were less than five times the concentrations detected in the blanks.

Diethylphthalate, di-n-butylphthalate, or both were detected at concentrations less than the RL in several method blanks associated with the SVOC analysis. The data were qualified as not detected , raised to the RL, and flagged "B" when the associated sample concentrations were less than 10 times the concentrations detected in the blanks.

Several analytes were detected at concentrations less than the RL in multiple method blanks associated with the PAH analysis. The data were qualified as not detected, raised to the RL, and flagged "B" when the associated sample concentrations were less than five times the concentrations detected in the blanks.

Field Blanks

TBs and an EB were collected at the required frequency, analyzed and were generally free of contamination. Detected results less than the RL were qualified as not detected, raised to the RL and flagged "B" in the associated samples. Detected results greater than the RL were qualified as not detected at the concentration measured and flagged "B"in the associated samples.

Acetone, chloromethane and toluene were detected at concentrations less than the RL in one VOC EB. In addition, acetone, chloromethane, or both were detected at concentrations below the RL in several TBs. The data were qualified as not detected, raised to the RL, and flagged "B" when the associated sample concentrations were less than 5 times (10 times for acetone) the concentrations detected in the blanks.

Naphthalene was detected at a concentration less than the RL in one EB associated with the PAH analysis. The data were qualified as not detected, raised to the RL and flagged "B" when the associated sample concentrations were less than five times the concentrations detected in the blank.

Field Duplicates

Four FD sets were collected and analyzed during the investigation and all precision criteria were met. Table 4 lists the FDs and their associated parent samples.

TABLE 4
List of Field Duplicates

Field Duplicate Sample ID	Associated Parent Sample ID
QC03-111208-FD	MW11-111208
QC03-012709-FD	MW11-012709
QC03-042009-FD	MW11-042009
QC03-072909-FD	MW11-072909

Laboratory Duplicates

Laboratory duplicates were performed as required by the analytical methods. In some cases, other project samples were used to fulfill the laboratory's QC batch requirements. When samples from Shelby Horizons were selected as laboratory duplicates, the relative percent differences (RPD) were within laboratory established QC limits.

Surrogates

Surrogates were added to the methods that required their use and met all acceptance criteria with the following exceptions.

The recoveries of the surrogates associated with the acid fractions of the SVOC analysis were less than QAPP criteria in several samples, indicating the associated sample results may be biased low. The associated data were qualified as estimated detected and nondetected results and flagged "J" and "UJ," respectively, in the samples.

The recoveries of the surrogates were less than QAPP criteria in the PAH analysis of sample QC03-111208-FD, indicating the results may be biased low. The data were qualified as estimated detected and non-detected results and flagged "J" and "UJ," respectively, in the sample.

Laboratory Control Samples

LCSs were analyzed as required and met acceptance criteria with the following exceptions.

Pyridine was recovered less than QAPP limits in one SVOC LCS, indicating associated results may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the associated samples. In addition, there was one instance where pyridine was recovered less than 10 percent in the LCS. The data were rejected for project use and flagged "R" in the associated samples.

Benzo(g,h,i)perylene and dibenzo(a,h)anthracene were recovered less than QAPP limits in one PAH LCS, indicating associated results may be biased low. The data were qualified as estimated non-detected results and flagged "UJ" in the associated samples.

Matrix Spikes

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. In general, MS/MSD recoveries and the associated RPD met criteria with the following exceptions.

Aluminum was recovered less than the lower QAPP limits in the MS associated with the metal analysis for sample MW12-042009, indicating the parent sample result may be biased low. The result was qualified as an estimated non-detect and flagged "UJ" in the parent sample.

Several analytes were recovered greater than the upper QAPP limits in the MS associated with the metal analysis for sample MW13-012709, indicating the associated parent sample results may be biased high. Detected results were qualified as estimated and flagged "J" in the parent sample. Nondetected results were not qualified.

Styrene was recovered below the lower QAPP limits in the VOC MS/MSD for sample MW13-012709, indicating the parent sample result may be biased low. The result was qualified as an estimated nondetect and flagged "UJ" in the parent sample. In addition, several analytes were recovered greater than the upper QAPP limits in the MS/MSD. The data were not qualified because the parent sample did not contain reportable levels of the analytes.

Methylene chloride was recovered less than 10 percent in the VOC MS/MSD for sample MW12-111108, indicating the parent sample result may be significantly biased low. The result was rejected for project use and flagged "R" in the parent sample.

Pyridine was recovered less than 10 percent in the SVOC MS/MSD for sample MW12-111108, indicating the parent sample result may be significantly biased low. The result was rejected for project use and flagged "R" in the parent sample.

Aniline was recovered less than the lower QAPP limits in the SVOC MS/MSD for sample MW13-012709, indicating the parent sample result may be biased low. The result was qualified as an estimated nondetect and flagged "UJ" in the parent sample. In addition, pyridine was recovered less than 10 percent in the MS/MSD and was rejected for project use ("R" flagged).

Several analytes were recovered below QAPP limits in the PAH MS/MSD for sample MW13-072909, indicating the parent sample result may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the parent sample.

Table 5 lists the MS/MSD qualified data.

TABLE 5
Matrix Spike Summary

Sample Delivery Group	Sample ID	Analyte	MS/MSD Limits (%)	Recovery (%)
70211	MW12-111108	Methylene chloride	70-130	0/0
70211	MW12-111108	Pyridine	45-135	2/13
72585	MW12-042009	Aluminum	75-125	68
71268	MW13-012709	Arsenic	75-125	140
71268	MW13-012709	Lead	75-125	131
71268	MW13-012709	Zinc	75-125	127
71268	MW13-012709	Styrene	70-130	24/23
71268	MW13-012709	Aniline	45-135	16/20
71268	MW13-012709	Pyridine	45-135	0/0
74424	MW13-072909	Benzo(g,h,i)perylene	50-150	36/50
74424	MW13-072909	Dibenzo(a,h)anthracene	50-150	39/53
74424	MW13-072909	Indeno(1,2,3-cd)pyrene	50-150	38/53

Serial Dilutions

The RPDs of several analytes were above QAPP criteria in the serial dilution of sample MW12-111108 for method 6010B. The results were qualified as estimated detects and flagged "J" in the sample.

The RPDs of several analytes were above QAPP criteria in the serial dilution of sample MW13-012709 for method 6010B. The results were qualified as estimated detects and flagged "J" in the sample.

The RPD for sodium was above QAPP criteria in the serial dilution of sample MW13-072909. The analyte was qualified as an estimated detect and flagged "J" in the sample and its respective FD (QC03-072909-FD).

Post-digestion Spikes

All acceptance criteria were met.

Internal Standards

Internal standards were added to the samples requiring their use and all acceptance criteria were met.

Interference Check Standards

All acceptance criteria were met.

Method Reporting Limit Standards

The recoveries for copper and thallium were below QAPP criteria in several MRL standards for method 6010B, indicating the associated sample results may be biased low. The analytes were detected in the associated method detection limit (MDL) standards. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ," respectively, in the associated samples.

The recoveries for iron, magnesium, and nickel were greater than QAPP criteria in several MRL standards for method 6010B, indicating the associated sample results may be biased high. The analytes were detected in the associated MDL standards. Detected results were qualified as estimated and flagged "J" in the associated samples. Nondetected results were not qualified.

Methylene chloride was not recovered in several MRL standards, nor was it detected in the MDL standards for the VOC analysis, indicating the associated samples may contain a significant low bias. The data were rejected for project use and flagged "R" in the associated samples.

Acetone was recovered greater than QAPP criteria in several MRL standards for the VOC analysis, indicating the associated sample results may be biased high. Acetone was detected in the associated MDL standard. Detected results were qualified as estimated and flagged "J" in the associated samples. Nondetected results were not qualified.

The recoveries for several analytes were below QAPP criteria in several MRL standards for the SVOC analysis, indicating the associated sample results may be biased low. The analytes were detected in the associated MDL standards. The data were qualified as estimated nondetected results and flagged "UJ" in the associated samples.

Chain of Custody

Each sample was documented with a completed chain of custody and received at the laboratory in good condition.

Overall Assessment

The goal of the assessment was to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters were based on the Final

Quality Assurance Project Plan Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station, March 2007. The following summary highlights the findings for the above-defined events.

Precision of the data was verified through the review of the field and laboratory data quality indicators that include FD, MS/MSD, laboratory duplicate and serial dilution RPDs. Precision generally was acceptable, with a few compounds being qualified as estimated detected results because of serial dilution RPD issues. Data users should consider the impact to any result that is qualified as estimated as it may contain a bias which could affect the decision-making process.

Accuracy of the data was verified through the review of the calibration data, LCS, MS/MSD, internal standards, interference check standards, post digestion spikes, surrogate standards, MRL recoveries and the evaluation of method/field blank data. Accuracy was generally acceptable with a few compounds being qualified as estimated detected and nondetected results due to calibration, LCS, surrogate, MS/MSD, or MRL issues. In addition, there were several instances where analytes were rejected for project use because of LCS, MS/MSD, or MRL issues. Several compounds were qualified as not detected because of contamination in the method blank, EB, or TB for several samples.

Representativeness of the data was verified through the sample's collection, storage, and preservation procedures and the verification of holding-time compliance. The laboratory did not note any issues related to sample preservation or storage of the samples. All data were reported from analyses within the EPA recommended holding time.

Comparability of the data was verified through the use of standard EPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.

Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. Completeness is expressed as the percentage of valid or usable measurements compared to planned measurements. Valid data are those not rejected for project use. All data were considered valid with the exception of methylene chloride and pyridine which were rejected for project use in several samples associated with the VOC and SVOC analysis, respectively. The completeness goal was met for all compounds except methylene chloride (50 percent) and pyridine (38 percent).

Former Wilkins Air Force Station
Shelby Horizons Landfill Sediment/Soil Investigation, Data Quality Evaluation Report

Introduction

The object of the data quality evaluation (DQE) report was to assess the quality of analytical results for samples collected during the October sediment/soil investigation at the Former Wilkins Air Force Station Shelby Horizons Landfill in Shelby, Ohio. Samples were collected and analyzed in an effort to assess the presence of contaminants in sediments and soil at the former air force station and to determine if remedial action is required. Individual method requirements and guidelines from the *Final Quality Assurance Project Plan* (QAPP) *Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station* (March 2007) were used as the basis for this assessment.

This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers 8 sediment samples, 15 soil samples, 1 sediment field duplicate (FD), 2 soil FDs, 2 equipment blanks (EB), and 2 trip blanks (TB). Table 1 lists the samples and collection dates. Samples were collected October 29 and 30, 2008. The sample results were reported as one sample delivery group: 69995. CT Laboratories of Baraboo, Wisconsin, performed the analyses.

Six methods were used to analyze the environmental samples. Samples were collected and shipped by overnight carrier to the laboratory for analysis. Selected samples were analyzed for one or more of the analytes or methods listed in Table 2.

Data validation was patterned after the USEPA Contract Laboratory National Functional Guidelines for Inorganic Data Review (2004) and the USEPA Contract Laboratory National Functional Guidelines for Organic Data Review (1999), following the calibration and quality control requirements specified in the QAPP and the Louisville Army Corps Guidelines.

All data were validated per Level III data validation requirements, which include the following items:

- A review of the data set narrative to identify any issues that the lab reported in the data deliverable
- An evaluation of basic quality control (QC) measurements used to assess the accuracy, precision and representativeness of data including QC blanks, laboratory control samples (LCS), matrix spikes/matrix spike duplicates (MS/MSD), surrogate recovery when applicable, and field or laboratory duplicate results

TABLE 1
Samples Associated with DQE

SampleID	Sample Matrix	Sample Date and Time	Sample Type
SD01-102908	Soil	10/29/2008 10:15	N
SD02-102908	Soil	10/29/2008 10:50	N
SD03-102908	Soil	10/29/2008 11:30	N
SD04-102908	Soil	10/29/2008 12:05	N
SD05-102908	Soil	10/29/2008 12:30	N
SD06-102908	Soil	10/29/2008 13:00	N
SD07-102908	Soil	10/29/2008 14:00	N
SD08-102908	Soil	10/29/2008 14:30	N
SS01-103008	Soil	10/30/2008 15:05	N
SS02-103008	Soil	10/30/2008 16:00	N
SS03-103008	Soil	10/30/2008 14:10	N
SS04-103008	Soil	10/30/2008 14:20	N
SS05-103008	Soil	10/30/2008 13:50	N
SS06-103008	Soil	10/30/2008 13:55	N
SS07-103008	Soil	10/30/2008 13:15	N
SS08-103008	Soil	10/30/2008 12:15	N
SS09-103008	Soil	10/30/2008 11:30	N
SS10-103008	Soil	10/30/2008 16:45	N
SS11-103008	Soil	10/30/2008 15:45	N
SS12-103008	Soil	10/30/2008 17:15	N
SS13-103008	Soil	10/30/2008 16:20	N
SS14-103008	Soil	10/30/2008 17:45	N
SS15-103008	Soil	10/30/2008 16:50	N
QC08-103008-FD	Soil	10/30/2008 15:45	FD
QC09-103008-FD	Soil	10/30/2008 15:45	FD
QC14-102908-FD	Soil	10/29/2008 00:00	FD
QC10-103008-EB	Water	10/30/2008 18:00	EB
QC15-103008-EB	Water	10/30/2008 13:00	EB
QC16-102908-TB	Water	10/30/2008 00:00	TB
QC11-103008-TB	Water	10/29/2008 00:00	TB

TABLE 2
Analytical Parameters

Parameter	Prep/Analytical Method
Volatile organic compounds (VOC)	SW5035/8260B
Semivolatile organic compounds (SVOC)	SW3540C, 3541/8270C
Polynuclear aromatic hydrocarbons (PAH)	SW3540C, 3541/8270C-PAH
Mercury	SW3050B,3051/7471A
Metals	SW3050B, 3051/6010B/6010-NaK

- A check of sample integrity (sample collection, preservation, and holding times)
- A review of sample results, target compound lists, and detection limits to verify that project analytical requirements are met
- Initiation of corrective actions, as necessary, based on the data review findings
- Qualification of the data using appropriate qualifier flags, as necessary, to reflect data usability limitations
- Evaluation of calibration and quality control summary results against the project requirements
- Other method specific QC requirements

In addition, 10 percent of the data underwent further validation to verify identification of the analyte and to check initial calibrations and calculations.

Data flags were assigned as specified in the QAPP. The flags and the reasons for them were entered into the electronic database. Multiple flags were routinely applied to specific sample method/matrix/analyte combinations, but there is only one final flag. A final flag was applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts. The data flags are defined below:

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

R The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte could not be verified.

B The analyte was detected in the associated method or field blank as well as the samples.

U The analyte was analyzed for but was not detected above the reported sample quantitation limit.

UJ The analyte was not detected above the reported sample quantitation limit. The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Findings

The overall summaries of the data validation findings are contained in the following sections below and summarized in Table 4 (see p. 13).

Holding Times

All holding time criteria were met.

Calibration

All initial and continuing calibration requirements were met with the following exceptions:

The continuing calibration verification percent difference (%D) for calcium was greater than QAPP criteria for method 6010B, indicating a possible high bias in the associated samples results. Detected results were qualified as estimated and flagged "J" in the associated samples. Nondetected results were not qualified.

The initial calibration verification (ICV) percent difference (%D) for methylene chloride was greater than QAPP criteria for method 8260B, indicating a possible high bias in the associated samples results. Detected results were qualified as estimated and flagged "J" in the associated samples. Nondetected results were not qualified.

The %D for methylene chloride was less than QAPP criteria for method 8260B in several continuing calibration verifications, indicating a possible low bias in the associated samples. The %D for methylene chloride was also greater than QAPP criteria in several continuing calibration verifications, indicating a possible high bias. Detected results were qualified as estimated and flagged "J" in the associated samples.

Method Blanks

Method blanks were analyzed at the required frequency and were generally free of contamination. Detected results less than the RL were qualified as not detected, raised to the RL and flagged "B" in the associated samples. Detected results greater than the RL were qualified as not detected at the concentration measured and flagged "B"in the associated samples.

Di-n-butylphthalate was detected at a concentration less than the reporting limit (RL) in a method blank for method 8270C. The data were qualified as not detected and flagged "B" when the associated sample concentrations were less than 10 times the concentration detected in the blank.

Field Blanks

EBs and TBs were collected at the required frequency and analyzed, and were generally free of contamination. Detected results less than the RL were qualified as not detected, raised to the RL and flagged "B" in the associated samples. Detected results greater than the RL were qualified as not detected at the concentration measured and flagged "B"in the associated samples.

Acetone was detected at a concentration less than the RL in an EB associated with method 8260B. Methylene chloride was detected at a concentration greater than the RL in an EB and the TBs associated with method 8260B. Detected results were qualified as not detected and flagged "B" when the associated sample concentrations were less than 10 times the concentrations detected in the blanks.

Field Duplicates

Table 3 lists the three FD sets collected and analyzed with this event. The relative percent difference (RPD) criteria were met in all instances with the following exceptions.

TABLE 3
List of Field Duplicates

Field Duplicate Sample ID	Associated Parent Sample ID
QC08-103008-FD	SS07-103008
QC09-103008-FD	SS02-103008
QC14-103008-FD	SD06-102928

The RPDs were above QAPP criteria for beryllium and manganese in method 6010B and benzo(g,h,i)perylene and indeno(1,2,3-cd) pyrene in method 827C0-PAH for FD set SS07-103008/QC08-103008-FD. The data were qualified as estimated and flagged "J" in the FD pair.

The RPDs were above QAPP criteria for several analytes in methods 6010B and 8270C-PAH for FD set SS02-103008/QC09-103008-FD. The data were qualified as estimated and flagged "J" in the FD pair.

The RPDs were above QAPP criteria for di-n-butylphthalate in method 8270C and for multiple analytes in method 8270C-PAH for FD set SD06-102908/QC14-103008-FD. The data were qualified as estimated and flagged "J" in the FD pair.

Laboratory Duplicates

Laboratory duplicates were performed as required by the analytical methods. In some cases, other project samples were used to fulfill the laboratory's QC batch requirements. When samples from Shelby Horizons were selected as laboratory duplicates, the RPDs were generally within laboratory established QC limits.

The RPD between the parent sample and laboratory duplicate exceeded control limits for manganese in sample SS04-103008 for method 6010B. The result was qualified as estimated and flagged "J" in the parent sample.

Surrogates

Surrogates were added to the methods that required their use and met all acceptance criteria with the following exceptions.

A surrogate associated with method 8260B was recovered greater than QAPP criteria in sample SS01-103008, indicating the associated sample results may be biased high. Detected results were qualified as estimated and flagged "J" in the sample. Nondetected results were not qualified.

The recoveries of the surrogates associated with the acid and base fractions of method 8270C were less than QAPP criteria in several samples, indicating the associated sample results

may be biased low. The associated data were qualified as estimated detected and nondetected results and flagged "J" and "UJ," respectively, in the samples.

The recoveries of the surrogates for method 8270C-PAH were less than QAPP criteria in sample SD02-102908, indicating the associated sample results may be biased low. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ," respectively, in the associated samples.

Laboratory Control Samples

LCSs were analyzed as required and met acceptance criteria with the following exceptions.

Several analytes were recovered less than QAPP limits in one LCS associated with method 8260B, indicating associated results may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the associated samples.

Several analytes were recovered less than QAPP limits in a few LCSs associated with method 8270C, indicating associated results may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the associated samples. In addition, there were a few instances where pyridine recovered less than 10 percent in the LCSs. The data were rejected for project use and flagged "R" in the associated samples.

Matrix Spikes

The results of MS/MSD analyses provide information about the possible influence of the matrix on either accuracy or precision of the measurements. In general, MS/MSD recoveries and the associated RPD met criteria with the following exceptions:

Several analytes were recovered less than QAPP limits in the MSs for method 6010B, indicating the associated parent sample results may be biased low. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ", respectively, in the associated parent samples.

Several analytes were recovered less than QAPP limits in MSs or MSDs for method 8260B, indicating the associated parent sample results may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the associated parent samples.

Several analytes were recovered greater than QAPP limits in MSs or MSDs for method 8260B, indicating the associated parent sample results may be biased high. The data were not qualified because the parent samples did not contain reportable levels of these analytes.

Several analytes were recovered less than QAPP limits in MSs or MSDs for method 8270C, indicating the associated parent sample results may be biased low. The data were qualified as estimated nondetected results and flagged "UJ" in the associated parent samples. In addition, several analytes were not recovered in MSs or MSDs for samples SD04-102908 and SS11-103008. Detected results were qualified as estimated and flagged "J" in the associated parent samples. Nondetected data were rejected for project use and flagged "R" in the associated parent samples.

All the analytes were recovered less than QAPP limits in the 8270C-PAH MSD for sample SD04-102908, indicating the associated parent sample results may be biased low. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ,"

respectively, in the parent sample. Multiple analytes were not recovered in the MS/MSD for sample SS11-103008. The data were qualified as estimated detected results and flagged "J" in the parent sample.

Table 5 lists the MS/MSD qualified data.

TABLE 5
Matrix Spike Summary

Sample ID	Analyte[a]	MS/MSD Limits (%)	Recovery (%)
SD04-102908	Antimony	75-125	23
SD04-102908	Arsenic	75-125	73
SD04-102908	Barium	75-125	67
SD04-102908	Beryllium	75-125	73
SD04-102908	Cadmium	75-125	67
SD04-102908	Chromium	75-125	60
SD04-102908	Cobalt	75-125	57
SD04-102908	Copper	75-125	52
SD04-102908	Iron	75-125	33
SD04-102908	Magnesium	75-125	73
SD04-102908	Nickel	75-125	51
SD04-102908	Selenium	75-125	69
SD04-102908	Thallium	75-125	57
SD04-102908	Zinc	75-125	68
SD04-102908	1,2,3-Trichlorobenzene	70-130	23/20
SD04-102908	1,2,4-Trichlorobenzene	70-130	26/22
SD04-102908	*1,2-Dibromo-3-chloropropane*	70-130	*64*
SD04-102908	1,2-Dichlorobenzene	70-130	64/44
SD04-102908	1,3-Dichlorobenzene	70-130	63/42
SD04-102908	1,4-Dichlorobenzene	70-130	62/44
SD04-102908	*2-Hexanone*	70-130	*35*
SD04-102908	*Bromoform*	70-130	*64*
SD04-102908	*Bromomethane*	70-130	*61*
SD04-102908	*Chlorobenzene*	70-130	*61*
SD04-102908	cis-1,3-Dichloropropene	70-130	64/38
SD04-102908	*Ethylbenzene*	70-130	*66*
SD04-102908	*Isopropylbenzene*	70-130	*60*
SD04-102908	*m,p-Xylenes*	70-130	*62*
SD04-102908	*o-Xylene*	70-130	*55*

TABLE 5
Matrix Spike Summary

Sample ID	Analyte[a]	MS/MSD Limits (%)	Recovery (%)
SD04-102908	Styrene	70-130	61/39
SD04-102908	*Toluene*	70-130	*68*
SD04-102908	trans-1,3-Dichloropropene	70-130	65/43
SD04-102908	2,4,6-Trichlorophenol	45-135	44
SD04-102908	2,4-Dimethylphenol	45-135	34/0
SD04-102908	2,4-Dinitrophenol	45-135	23/26
SD04-102908	2-Chlorophenol	45-135	40
SD04-102908	2-Methyl-4,6-dinitrophenol	45-135	34
SD04-102908	2-Methylphenol	45-135	41
SD04-102908	3,3'-Dichlorobenzidine	45-135	15/35
SD04-102908	3-Nitroaniline	45-135	31
SD04-102908	4-Chloroaniline	45-135	16/32
SD04-102908	Aniline	45-135	9/20
SD04-102908	Benzoic acid	45-135	19/17
SD04-102908	Benzyl alcohol	45-135	2/16
SD04-102908	Bis(2-chloroethyl) ether	45-135	42
SD04-102908	Bis(2-chloroisopropyl) ether	45-135	44
SD04-102908	Hexachlorobutadiene	45-135	44
SD04-102908	Hexachlorocyclopentadiene	45-135	21/34
SD04-102908	Hexachloroethane	45-135	40
SD04-102908	Nitrobenzene	45-135	44
SD04-102908	N-Nitrosodimethylamine	45-135	40
SD04-102908	N-Nitrosodiphenylamine	45-135	42
SD04-102908	Pentachlorophenol	45-135	17/23
SD04-102908	Phenol	45-135	41
SD04-102908	*Pyridine*	45-135	*12*
SD04-102908	*Acenaphthene*	50-150	*14*
SD04-102908	*Acenaphthylene*	50-150	*15*
SD04-102908	*Anthracene*	50-150	*23*
SD04-102908	*Benzo(a)anthracene*	50-150	*17*
SD04-102908	*Benzo(a)pyrene*	50-150	*17*
SD04-102908	*Benzo(b)fluoranthene*	50-150	*14*
SD04-102908	*Benzo(g,h,i)perylene*	50-150	*19*

TABLE 5
Matrix Spike Summary

Sample ID	Analyte[a]	MS/MSD Limits (%)	Recovery (%)
SD04-102908	*Benzo(k)fluoranthene*	50-150	*20*
SD04-102908	*Chrysene*	50-150	*14*
SD04-102908	*Dibenzo(a,h)anthracene*	50-150	*24*
SD04-102908	*Fluoranthene*	50-150	*4*
SD04-102908	*Fluorene*	50-150	*18*
SD04-102908	*Indeno(1,2,3-cd)pyrene*	50-150	*21*
SD04-102908	*Naphthalene*	50-150	*5*
SD04-102908	*Phenanthrene*	50-150	*7*
SD04-102908	*Pyrene*	50-150	*7*
SS11-103008	Antimony	75-125	24
SS11-103008	Cadmium	75-125	65
SS11-103008	Chromium	75-125	65
SS11-103008	Cobalt	75-125	65
SS11-103008	Copper	75-125	64
SS11-103008	Iron	75-125	49
SS11-103008	Nickel	75-125	67
SS11-103008	Selenium	75-125	70
SS11-103008	Thallium	75-125	55
SS11-103008	Zinc	75-125	60
SS11-103008	1,2,3-Trichlorobenzene	70-130	22/20
SS11-103008	1,2,4-Trichlorobenzene	70-130	26/24
SS11-103008	1,2-Dibromo-3-chloropropane	70-130	55/53
SS11-103008	*1,2-Dibromoethane*	70-130	*68*
SS11-103008	1,2-Dichlorobenzene	70-130	64/63
SS11-103008	1,3-Dichlorobenzene	70-130	63/63
SS11-103008	1,4-Dichlorobenzene	70-130	69/68
SS11-103008	2-Butanone	70-130	43/33
SS11-103008	2-Hexanone	70-130	29/21
SS11-103008	4-Methyl-2-pentanone	70-130	60/45
SS11-103008	Acetone	70-130	60/54
SS11-103008	Bromoform	70-130	65/56
SS11-103008	Bromomethane	70-130	60/48
SS11-103008	cis-1,3-Dichloropropene	70-130	33/21

TABLE 5
Matrix Spike Summary

Sample ID	Analyte[a]	MS/MSD Limits (%)	Recovery (%)
SS11-103008	Dichlorodifluoromethane	70-130	135/140
SS11-103008	Isopropylbenzene	70-130	66/66
SS11-103008	Styrene	70-130	65/61
SS11-103008	trans-1,3-Dichloropropene	70-130	40/29
SS11-103008	2,4-Dinitrophenol	45-135	21/19
SS11-103008	2-Methyl-4,6-dinitrophenol	45-135	31/24
SS11-103008	3,3'-Dichlorobenzidine	45-135	9/9
SS11-103008	3-Nitroaniline	45-135	33/38
SS11-103008	4-Chloroaniline	45-135	19/22
SS11-103008	Aniline	45-135	13/15
SS11-103008	Benzoic acid	45-135	20/22
SS11-103008	Hexachlorocyclopentadiene	45-135	26/15
SS11-103008	N-Nitrosodimethylamine	45-135	37/39
SS11-103008	Pentachlorophenol	45-135	27/24
SS11-103008	*Pyridine*	45-135	*6*
SS11-103008	Acenaphthene	50-150	6/0
SS11-103008	Anthracene	50-150	0/0
SS11-103008	Benzo(a)anthracene	50-150	0/0
SS11-103008	Benzo(a)pyrene	50-150	0/0
SS11-103008	Benzo(b)fluoranthene	50-150	0/0
SS11-103008	Benzo(g,h,i)perylene	50-150	0/0
SS11-103008	Benzo(k)fluoranthene	50-150	0/0
SS11-103008	Chrysene	50-150	0/0
SS11-103008	Dibenzo(a,h)anthracene	50-150	38/29
SS11-103008	Fluorene	50-150	0/0
SS11-103008	Indeno(1,2,3-cd)pyrene	50-150	0/0

[a] Analytes which did meet acceptance criteria in the MSD are italicized.

Serial Dilutions

The RPDs of several analytes were above QAPP criteria in the serial dilution of sample SS11-103008 for methods 6010B and 7471A. The data were qualified as estimated detected and nondetected results and flagged “J” and “UJ”, respectively, in the sample.

The RPDs for potassium and sodium were above QAPP criteria in the serial dilution of sample SD04-102908. The data were qualified as estimated detected results and flagged "J" in the sample.

Post-digestion Spikes

The recovery for several analytes were greater than QAPP criteria in the post-digestion spikes (PDS) of samples SD04-102908 and SS11-103008 for method 6010B, indicating the associated parent sample result may be biased high. The associated detected results in the parent sample were qualified as estimated and flagged "J". Nondetected results were not qualified.

The recovery of aluminum and copper were less than QAPP criteria in the PDS of sample SD04-102908 and multiple analytes were recovered less than QAPP criteria in the PDS of sample SS11-103008, indicating the associated parent sample results may be biased low. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ", respectively, in the samples.

Internal Standards

All internal standard recovery criteria were met with the exception of several instances in method 8260B, where an internal standard was recovered less than control limits. The associated data were qualified as estimated and flagged "UJ" in the samples.

Interference Check Standards

All acceptance criteria were met.

Method Reporting Limit Standards

The recoveries for iron, magnesium and vanadium were below QAPP criteria in several MRL standards for method 6010B, indicating the associated sample results may be biased low. The analytes were detected in the associated method detection limit (MDL) standards. The data were qualified as estimated detected results and flagged "J" in the associated samples.

The recoveries for dichlorodifluoromethane and isopropylbenzene were below QAPP criteria in several MRL standards for method 8260B, indicating associated sample results may be biased low. The analytes were detected in the associated MDL standards. The data were qualified as estimated detected and nondetected results and flagged "J" and "UJ," respectively, in the associated samples.

Acetone and methylene chloride were not recovered in the MRL standards nor were they detected in the MDL standards for method 8260B, indicating the samples may contain a significant low bias. Detected results were qualified as estimated and flagged "J." Nondetected results were rejected for project use and flagged "R" in the associated samples.

The recovery of benzyl alcohol was below QAPP criteria in several MRL standards for method 8270C, indicating the associated sample results may be biased low. The analytes were detected in the associated MDL standards. The data were qualified as estimated nondetected results and flagged "UJ" in the associated samples.

Chain of Custody

Each sample was documented with a complete chain of custody and received at the laboratory in good condition.

Overall Assessment

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters were based on the Final Quality Assurance Project Plan Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station, March 2007. The following summary highlights the findings for the above-defined events.

Precision of the data was verified through the review of the field and laboratory data quality indicators that include FD, MS/MSD, laboratory duplicate, and serial dilution RPDs. Precision generally was acceptable, with a few compounds being qualified as estimated detected and nondetected results because of FD, serial dilution, or laboratory duplicate issues. Data users should consider the impact to any result that is qualified as estimated, as it may contain a bias that could affect the decision-making process.

Accuracy of the data was verified through the review of the calibration data, LCS, MS/MSD, internal standards, interference check standards, post-digestion spikes, surrogate standards, and MRL recoveries. Accuracy generally was acceptable with a few compounds being qualified as estimated detected and nondetected results because of calibration, LCS, internal standards, post-digestion spike, surrogate, MS/MSD, or MRL issues. There were several instances in which analytes were rejected for project use because of LCS, MS/MSD, or MRL issues in methods 8260B and 8270C.

Representativeness of the data was verified through the sample collection, storage, and preservation procedures, verification of holding-time compliance, and evaluation of method/field blank data. The laboratory did not note any issues related to sample preservation or storage of the samples. All data were reported from analyses within USEPA recommended holding time. Several analytes were detected in method or field blanks for methods 8260B and 8270C, resulting in data being qualified as nondetected results.

Comparability of the data was ensured through the use of standard EPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.

Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. Completeness is expressed as the percentage of valid or usable measurements compared to planned measurements. Valid data are defined as all data that are not rejected for project use. All data were considered valid except acetone and methylene chloride, which were rejected for project use in multiple samples associated with method 8260B, and a few analytes in several samples associated with method 8270C.

The completeness goal was met for all compounds except acetone (70 percent), methylene chloride (78 percent), and pyridine (0 percent).

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
6010B	QC08-103008-FD	Beryllium	0.81	mg/kg	J	FDRPD
6010B	QC08-103008-FD	Iron	25100	mg/kg	J	MRL
6010B	QC08-103008-FD	Magnesium	3580	mg/kg	J	MRL
6010B	QC08-103008-FD	Manganese	1310	mg/kg	J	FDRPD
8260B	QC08-103008-FD	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL
8260B	QC08-103008-FD	1,2,3-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	QC08-103008-FD	1,2,4-Trichlorobenzene	1.9	µg/kg	UJ	LCSL,ISL
8260B	QC08-103008-FD	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	ISL
8260B	QC08-103008-FD	1,2-Dichlorobenzene	1.1	µg/kg	UJ	ISL
8260B	QC08-103008-FD	1,3-Dichlorobenzene	1.4	µg/kg	UJ	LCSL,ISL
8260B	QC08-103008-FD	1,4-Dichlorobenzene	1.6	µg/kg	UJ	LCSL,ISL
8260B	QC08-103008-FD	Dichlorodifluoromethane	7.9	µg/kg	J	MRL
8260B	QC08-103008-FD	Isopropylbenzene	0.7	µg/kg	UJ	MRL
8260B	QC08-103008-FD	Tetrachloroethene	1.1	µg/kg	UJ	LCSL
8270C	QC08-103008-FD	4-Chloroaniline	78	µg/kg	UJ	LCSL
8270C	QC08-103008-FD	Aniline	73	µg/kg	UJ	LCSL
8270C	QC08-103008-FD	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	QC08-103008-FD	Di-n-butyl phthalate	170	µg/kg	B	LBL
8270C	QC08-103008-FD	N-Nitrosodimethylamine	170	µg/kg	UJ	LCSL
8270C	QC08-103008-FD	Pyridine	81	µg/kg	R	LCSL
8270C-PAH	QC08-103008-FD	Benzo(g,h,i)perylene	14	µg/kg	J	FDRPD
8270C-PAH	QC08-103008-FD	Indeno(1,2,3-cd)pyrene	11	µg/kg	J	FDRPD
6010B	QC09-103008-FD	Beryllium	0.26	mg/kg	J	FDRPD
6010B	QC09-103008-FD	Calcium	246000	mg/kg	J	FDRPD
6010B	QC09-103008-FD	Iron	10200	mg/kg	J	MRL, FDRPD
6010B	QC09-103008-FD	Magnesium	66100	mg/kg	J	MRL, FDRPD
6010B	QC09-103008-FD	Manganese	303	mg/kg	J	FDRPD
6010B	QC09-103008-FD	Vanadium	16.5	mg/kg	J	FDRPD
8260B	QC09-103008-FD	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL
8260B	QC09-103008-FD	1,2,3-Trichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	QC09-103008-FD	1,2,4-Trichlorobenzene	1.6	µg/kg	UJ	LCSL,ISL
8260B	QC09-103008-FD	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	QC09-103008-FD	1,2-Dichlorobenzene	0.89	µg/kg	UJ	ISL
8260B	QC09-103008-FD	1,3-Dichlorobenzene	1.2	µg/kg	UJ	LCSL,ISL
8260B	QC09-103008-FD	1,4-Dichlorobenzene	1.4	µg/kg	UJ	LCSL,ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	QC09-103008-FD	Dichlorodifluoromethane	12	µg/kg	J	MRL
8260B	QC09-103008-FD	Isopropylbenzene	0.59	µg/kg	UJ	MRL
8260B	QC09-103008-FD	Tetrachloroethene	0.89	µg/kg	UJ	LCSL
8270C	QC09-103008-FD	4-Chloroaniline	72	µg/kg	UJ	LCSL
8270C	QC09-103008-FD	Aniline	67	µg/kg	UJ	LCSL
8270C	QC09-103008-FD	Benzoic acid	320	µg/kg	UJ	LCSL
8270C	QC09-103008-FD	Di-n-butyl phthalate	150	µg/kg	B	LBL
8270C	QC09-103008-FD	N-Nitrosodimethylamine	150	µg/kg	UJ	LCSL
8270C	QC09-103008-FD	Pyridine	75	µg/kg	R	LCSL
8270C-PAH	QC09-103008-FD	Acenaphthene	12	µg/kg	J	FDRPD
8270C-PAH	QC09-103008-FD	Anthracene	23	µg/kg	J	FDRPD
8270C-PAH	QC09-103008-FD	Fluorene	11	µg/kg	J	FDRPD
8270C-PAH	QC09-103008-FD	Phenanthrene	160	µg/kg	J	FDRPD
6010B	QC14-102908-FD	Iron	20600	mg/kg	J	MRL
6010B	QC14-102908-FD	Vanadium	24.8	mg/kg	J	MRL
8260B	QC14-102908-FD	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,2-Dichlorobenzene	0.98	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,3-Dichlorobenzene	1.3	µg/kg	UJ	ISL
8260B	QC14-102908-FD	1,4-Dichlorobenzene	1.5	µg/kg	UJ	ISL
8260B	QC14-102908-FD	Acetone	6.5	µg/kg	R	MRL
8260B	QC14-102908-FD	Methylene chloride	2.1	µg/kg	R	MRL
8270C	QC14-102908-FD	Aniline	73	µg/kg	UJ	LCSL
8270C	QC14-102908-FD	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	QC14-102908-FD	Benzyl alcohol	93	µg/kg	UJ	MRL
8270C	QC14-102908-FD	Di-n-butyl phthalate	77	µg/kg	J	FDRPD
8270C	QC14-102908-FD	Pyridine	81	µg/kg	R	LCSL
8270C-PAH	QC14-102908-FD	Acenaphthene	14	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Anthracene	51	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Benzo(a)anthracene	91	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Benzo(a)pyrene	73	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Benzo(b)fluoranthene	94	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Benzo(g,h,i)perylene	31	µg/kg	J	FDRPD

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C-PAH	QC14-102908-FD	Benzo(k)fluoranthene	34	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Chrysene	76	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Dibenzo(a,h)anthracene	9.3	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Fluoranthene	210	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Fluorene	15	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Indeno(1,2,3-cd)pyrene	32	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Naphthalene	4.4	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Phenanthrene	150	µg/kg	J	FDRPD
8270C-PAH	QC14-102908-FD	Pyrene	160	µg/kg	J	FDRPD
6010B	SD01-102908	Iron	16000	mg/kg	J	MRL
6010B	SD01-102908	Vanadium	21.9	mg/kg	J	MRL
8260B	SD01-102908	Acetone	8.3	µg/kg	R	MRL
8260B	SD01-102908	Methylene chloride	2.6	µg/kg	R	MRL
8270C	SD01-102908	Aniline	70	µg/kg	UJ	LCSL
8270C	SD01-102908	Benzoic acid	330	µg/kg	UJ	LCSL
8270C	SD01-102908	Benzyl alcohol	89	µg/kg	UJ	MRL
8270C	SD01-102908	Pyridine	78	µg/kg	R	LCSL
6010B	SD02-102908	Iron	15500	mg/kg	J	MRL
6010B	SD02-102908	Vanadium	24.7	mg/kg	J	MRL
8260B	SD02-102908	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL
8260B	SD02-102908	1,2,3-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	SD02-102908	1,2,4-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	SD02-102908	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	ISL
8260B	SD02-102908	1,2-Dichlorobenzene	1.1	µg/kg	UJ	ISL
8260B	SD02-102908	1,3-Dichlorobenzene	1.4	µg/kg	UJ	ISL
8260B	SD02-102908	1,4-Dichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SD02-102908	Acetone	7.1	µg/kg	R	MRL
8260B	SD02-102908	Methylene chloride	10	µg/kg	B	EBH, TBH, ICVH (J), CCVL (J), MRL (J)
8270C	SD02-102908	Aniline	74	µg/kg	UJ	LCSL
8270C	SD02-102908	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	SD02-102908	Benzyl alcohol	95	µg/kg	UJ	MRL
8270C	SD02-102908	Pyridine	83	µg/kg	R	LCSL
8270C-PAH	SD02-102908	Acenaphthene	1.7	µg/kg	UJ	SSL
8270C-PAH	SD02-102908	Acenaphthylene	1.7	µg/kg	UJ	SSL
8270C-PAH	SD02-102908	Anthracene	1.9	µg/kg	J	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C-PAH	SD02-102908	Benzo(a)anthracene	13	µg/kg	J	SSL
8270C-PAH	SD02-102908	Benzo(a)pyrene	16	µg/kg	J	SSL
8270C-PAH	SD02-102908	Benzo(b)fluoranthene	29	µg/kg	J	SSL
8270C-PAH	SD02-102908	Benzo(g,h,i)perylene	14	µg/kg	J	SSL
8270C-PAH	SD02-102908	Benzo(k)fluoranthene	7.1	µg/kg	J	SSL
8270C-PAH	SD02-102908	Chrysene	19	µg/kg	J	SSL
8270C-PAH	SD02-102908	Dibenzo(a,h)anthracene	2.7	µg/kg	J	SSL
8270C-PAH	SD02-102908	Fluoranthene	25	µg/kg	J	SSL
8270C-PAH	SD02-102908	Fluorene	1.9	µg/kg	UJ	SSL
8270C-PAH	SD02-102908	Indeno(1,2,3-cd)pyrene	11	µg/kg	J	SSL
8270C-PAH	SD02-102908	Naphthalene	13	µg/kg	J	SSL
8270C-PAH	SD02-102908	Phenanthrene	19	µg/kg	J	SSL
8270C-PAH	SD02-102908	Pyrene	22	µg/kg	J	SSL
6010B	SD03-102908	Iron	17200	mg/kg	J	MRL
6010B	SD03-102908	Vanadium	24.6	mg/kg	J	MRL
8260B	SD03-102908	Acetone	10	µg/kg	B	EBL, MRL (J)
8260B	SD03-102908	Methylene chloride	20	µg/kg	B	EBH, ICVH (J), CCVL (J), MRL (J)
8270C	SD03-102908	Aniline	72	µg/kg	UJ	LCSL
8270C	SD03-102908	Benzoic acid	340	µg/kg	UJ	LCSL
8270C	SD03-102908	Benzyl alcohol	92	µg/kg	UJ	MRL
8270C	SD03-102908	Pyridine	80	µg/kg	R	LCSL
6010B	SD04-102908	Aluminum	10100	mg/kg	J	PSL
6010B	SD04-102908	Antimony	0.2	mg/kg	UJ	MSL
6010B	SD04-102908	Arsenic	9.8	mg/kg	J	MSL
6010B	SD04-102908	Barium	97.9	mg/kg	J	MSL,SDIL
6010B	SD04-102908	Beryllium	0.58	mg/kg	J	MSL,PSH
6010B	SD04-102908	Cadmium	0.46	mg/kg	J	MSL,SDIL
6010B	SD04-102908	Calcium	6340	mg/kg	J	PSH
6010B	SD04-102908	Chromium	13	mg/kg	J	MSL,SDIL
6010B	SD04-102908	Cobalt	8.6	mg/kg	J	MSL,SDIL
6010B	SD04-102908	Copper	22.5	mg/kg	J	MSL,PSL
6010B	SD04-102908	Iron	23000	mg/kg	J	MSL
6010B	SD04-102908	Lead	13.5	mg/kg	J	PSH
6010B	SD04-102908	Magnesium	3170	mg/kg	J	MSL
6010B	SD04-102908	Manganese	662	mg/kg	J	SDIL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
6010B	SD04-102908	Nickel	23	mg/kg	J	MSL
6010B	SD04-102908	Selenium	0.58	mg/kg	J	MSL,SDIL
6010B	SD04-102908	Thallium	0.58	mg/kg	UJ	MSL
6010B	SD04-102908	Vanadium	24.8	mg/kg	J	SDIL,MRL
6010B	SD04-102908	Zinc	49	mg/kg	J	MSL,SDIL
6010B-NaK	SD04-102908	Potassium	634	mg/kg	J	SDIL
6010B-NaK	SD04-102908	Sodium	40.3	mg/kg	J	SDIL
8260B	SD04-102908	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SD04-102908	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL,MSL,MSDL
8260B	SD04-102908	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	ISL,MSL,MSDL
8260B	SD04-102908	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL,MSDL
8260B	SD04-102908	1,2-Dichlorobenzene	0.95	µg/kg	UJ	ISL,MSL,MSDL
8260B	SD04-102908	1,3-Dichlorobenzene	1.3	µg/kg	UJ	ISL,MSL,MSDL
8260B	SD04-102908	1,4-Dichlorobenzene	1.5	µg/kg	UJ	ISL,MSL,MSDL
8260B	SD04-102908	2-Hexanone	5.3	µg/kg	UJ	MSDL
8260B	SD04-102908	Acetone	6.4	µg/kg	R	MRL
8260B	SD04-102908	Bromoform	0.74	µg/kg	UJ	MSDL
8260B	SD04-102908	Bromomethane	1.3	µg/kg	UJ	MSDL
8260B	SD04-102908	Chlorobenzene	0.85	µg/kg	UJ	MSDL
8260B	SD04-102908	cis-1,3-Dichloropropene	0.64	µg/kg	UJ	MSL,MSDL
8260B	SD04-102908	Ethylbenzene	0.74	µg/kg	UJ	MSDL
8260B	SD04-102908	Isopropylbenzene	0.64	µg/kg	UJ	MSL,MSDL
8260B	SD04-102908	m,p-Xylenes	1.8	µg/kg	UJ	MSDL
8260B	SD04-102908	Methylene chloride	2	µg/kg	R	MRL
8260B	SD04-102908	o-Xylene	1.1	µg/kg	UJ	MSDL
8260B	SD04-102908	Styrene	0.53	µg/kg	UJ	MSL,MSDL
8260B	SD04-102908	Toluene	0.64	µg/kg	UJ	MSDL
8260B	SD04-102908	trans-1,3-Dichloropropene	0.85	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	2,4,6-Trichlorophenol	88	µg/kg	UJ	MSL
8270C	SD04-102908	2,4-Dimethylphenol	89	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	2,4-Dinitrophenol	250	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	2-Chlorophenol	130	µg/kg	UJ	MSL
8270C	SD04-102908	2-Methyl-4,6-dinitrophenol	82	µg/kg	UJ	MSL
8270C	SD04-102908	2-Methylphenol	130	µg/kg	UJ	MSL
8270C	SD04-102908	3,3'-Dichlorobenzidine	320	µg/kg	UJ	MSL,MSDL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SD04-102908	3-Nitroaniline	37	µg/kg	UJ	MSL
8270C	SD04-102908	4-Chloroaniline	75	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	Aniline	70	µg/kg	R	MSL
8270C	SD04-102908	Benzoic acid	330	µg/kg	UJ	LCSL,MSL,MSDL
8270C	SD04-102908	Benzyl alcohol	90	µg/kg	R	MSL
8270C	SD04-102908	Bis(2-chloroethyl) ether	16	µg/kg	UJ	MSL
8270C	SD04-102908	Bis(2-chloroisopropyl) ether	13	µg/kg	UJ	MSL
8270C	SD04-102908	Hexachlorobutadiene	36	µg/kg	UJ	MSL
8270C	SD04-102908	Hexachlorocyclopentadiene	30	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	Hexachloroethane	20	µg/kg	UJ	MSL
8270C	SD04-102908	Nitrobenzene	46	µg/kg	UJ	MSL
8270C	SD04-102908	N-Nitrosodimethylamine	160	µg/kg	UJ	MSL
8270C	SD04-102908	N-Nitrosodiphenylamine	20	µg/kg	UJ	MSL
8270C	SD04-102908	Pentachlorophenol	81	µg/kg	UJ	MSL,MSDL
8270C	SD04-102908	Phenol	150	µg/kg	UJ	MSL
8270C	SD04-102908	Pyridine	78	µg/kg	R	LCSL,MSL
8270C-PAH	SD04-102908	Acenaphthene	2	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Acenaphthylene	1.6	µg/kg	UJ	MSDL
8270C-PAH	SD04-102908	Anthracene	3.5	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Benzo(a)anthracene	16	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Benzo(a)pyrene	14	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Benzo(b)fluoranthene	21	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Benzo(g,h,i)perylene	9.8	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Benzo(k)fluoranthene	7.7	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Chrysene	19	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Dibenzo(a,h)anthracene	2.4	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Fluoranthene	34	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Fluorene	2	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Indeno(1,2,3-cd)pyrene	7.8	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Naphthalene	13	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Phenanthrene	27	µg/kg	J	MSDL
8270C-PAH	SD04-102908	Pyrene	28	µg/kg	J	MSDL
6010B	SD05-102908	Iron	24300	mg/kg	J	MRL
6010B	SD05-102908	Vanadium	29.3	mg/kg	J	MRL
8260B	SD05-102908	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SD05-102908	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SD05-102908	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SD05-102908	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	ISL
8260B	SD05-102908	1,2-Dichlorobenzene	1	µg/kg	UJ	ISL
8260B	SD05-102908	1,3-Dichlorobenzene	1.4	µg/kg	UJ	ISL
8260B	SD05-102908	1,4-Dichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SD05-102908	Acetone	6.9	µg/kg	R	MRL
8260B	SD05-102908	Methylene chloride	10	µg/kg	B	EBH, TBH, ICVH (J), CCVL (J), MRL (J)
8270C	SD05-102908	Aniline	71	µg/kg	UJ	LCSL
8270C	SD05-102908	Benzoic acid	340	µg/kg	UJ	LCSL
8270C	SD05-102908	Benzyl alcohol	91	µg/kg	UJ	MRL
8270C	SD05-102908	Pyridine	80	µg/kg	R	LCSL
6010B	SD06-102908	Iron	20700	mg/kg	J	MRL
6010B	SD06-102908	Vanadium	25.4	mg/kg	J	MRL
8260B	SD06-102908	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL
8260B	SD06-102908	1,2,3-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	SD06-102908	1,2,4-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	SD06-102908	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	ISL
8260B	SD06-102908	1,2-Dichlorobenzene	1.1	µg/kg	UJ	ISL
8260B	SD06-102908	1,3-Dichlorobenzene	1.4	µg/kg	UJ	ISL
8260B	SD06-102908	1,4-Dichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	SD06-102908	Acetone	7.2	µg/kg	R	MRL
8260B	SD06-102908	Methylene chloride	2.3	µg/kg	R	MRL
8270C	SD06-102908	Aniline	73	µg/kg	UJ	LCSL
8270C	SD06-102908	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	SD06-102908	Benzyl alcohol	93	µg/kg	UJ	MRL
8270C	SD06-102908	Di-n-butyl phthalate	170	µg/kg	J	FDRPD
8270C	SD06-102908	Pyridine	81	µg/kg	R	LCSL
8270C-PAH	SD06-102908	Acenaphthene	1.7	µg/kg	UJ	FDRPD
8270C-PAH	SD06-102908	Anthracene	1.8	µg/kg	UJ	FDRPD
8270C-PAH	SD06-102908	Benzo(a)anthracene	3.6	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Benzo(a)pyrene	3.3	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Benzo(b)fluoranthene	5.6	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Benzo(g,h,i)perylene	2.6	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Benzo(k)fluoranthene	1.8	µg/kg	UJ	FDRPD

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C-PAH	SD06-102908	Chrysene	5.3	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Dibenzo(a,h)anthracene	1.7	µg/kg	UJ	FDRPD
8270C-PAH	SD06-102908	Fluoranthene	8.1	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Fluorene	1.9	µg/kg	UJ	FDRPD
8270C-PAH	SD06-102908	Indeno(1,2,3-cd)pyrene	1.9	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Naphthalene	3.1	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Phenanthrene	6.2	µg/kg	J	FDRPD
8270C-PAH	SD06-102908	Pyrene	6.8	µg/kg	J	FDRPD
6010B	SD07-102908	Iron	23200	mg/kg	J	MRL
6010B	SD07-102908	Vanadium	21.9	mg/kg	J	MRL
8260B	SD07-102908	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SD07-102908	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SD07-102908	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SD07-102908	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SD07-102908	1,2-Dibromoethane	0.34	µg/kg	UJ	ISL
8260B	SD07-102908	1,2-Dichlorobenzene	1	µg/kg	UJ	ISL
8260B	SD07-102908	1,3-Dichlorobenzene	1.3	µg/kg	UJ	ISL
8260B	SD07-102908	1,4-Dichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SD07-102908	2-Hexanone	5.6	µg/kg	UJ	ISL
8260B	SD07-102908	Acetone	6.7	µg/kg	R	MRL
8260B	SD07-102908	Bromodichloromethane	0.45	µg/kg	UJ	ISL
8260B	SD07-102908	Bromoform	0.78	µg/kg	UJ	ISL
8260B	SD07-102908	Chlorobenzene	0.9	µg/kg	UJ	ISL
8260B	SD07-102908	Ethylbenzene	0.78	µg/kg	UJ	ISL
8260B	SD07-102908	Isopropylbenzene	0.67	µg/kg	UJ	ISL
8260B	SD07-102908	m,p-Xylenes	1.9	µg/kg	UJ	ISL
8260B	SD07-102908	Methylene chloride	2.1	µg/kg	R	MRL
8260B	SD07-102908	o-Xylene	1.1	µg/kg	UJ	ISL
8260B	SD07-102908	Styrene	0.56	µg/kg	UJ	ISL
8270C	SD07-102908	Aniline	76	µg/kg	UJ	LCSL
8270C	SD07-102908	Benzoic acid	360	µg/kg	UJ	LCSL
8270C	SD07-102908	Benzyl alcohol	98	µg/kg	UJ	MRL
8270C	SD07-102908	Pyridine	85	µg/kg	R	LCSL
6010B	SD08-102908	Iron	23400	mg/kg	J	MRL
8260B	SD08-102908	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SD08-102908	1,2,3-Trichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SD08-102908	1,2,4-Trichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SD08-102908	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	SD08-102908	1,2-Dichlorobenzene	0.89	µg/kg	UJ	ISL
8260B	SD08-102908	1,3-Dichlorobenzene	1.2	µg/kg	UJ	ISL
8260B	SD08-102908	1,4-Dichlorobenzene	1.4	µg/kg	UJ	ISL
8260B	SD08-102908	Acetone	5.9	µg/kg	R	MRL
8260B	SD08-102908	Methylene chloride	1.9	µg/kg	R	MRL
8270C	SD08-102908	Aniline	74	µg/kg	UJ	LCSL
8270C	SD08-102908	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	SD08-102908	Benzyl alcohol	95	µg/kg	UJ	MRL
8270C	SD08-102908	Pyridine	83	µg/kg	R	LCSL
6010B	SS01-103008	Iron	14700	mg/kg	J	MRL
6010B	SS01-103008	Vanadium	13	mg/kg	J	MRL
8260B	SS01-103008	1,1,2,2-Tetrachloroethane	1	µg/kg	UJ	ISL
8260B	SS01-103008	1,2,3-Trichlorobenzene	1.5	µg/kg	UJ	ISL
8260B	SS01-103008	1,2,4-Trichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS01-103008	1,2-Dibromo-3-chloropropane	1	µg/kg	UJ	ISL
8260B	SS01-103008	1,2-Dibromoethane	0.27	µg/kg	UJ	ISL
8260B	SS01-103008	1,2-Dichlorobenzene	0.82	µg/kg	UJ	ISL
8260B	SS01-103008	1,3-Dichlorobenzene	1.1	µg/kg	UJ	LCSL,ISL
8260B	SS01-103008	1,4-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS01-103008	2-Hexanone	4.5	µg/kg	UJ	ISL
8260B	SS01-103008	Bromodichloromethane	0.36	µg/kg	UJ	ISL
8260B	SS01-103008	Bromoform	0.63	µg/kg	UJ	ISL
8260B	SS01-103008	Chlorobenzene	0.73	µg/kg	UJ	ISL
8260B	SS01-103008	Dichlorodifluoromethane	4.5	µg/kg	J	SSH
8260B	SS01-103008	Ethylbenzene	0.63	µg/kg	UJ	ISL
8260B	SS01-103008	Isopropylbenzene	0.54	µg/kg	UJ	MRL
8260B	SS01-103008	m,p-Xylenes	1.5	µg/kg	UJ	ISL
8260B	SS01-103008	o-Xylene	0.91	µg/kg	UJ	ISL
8260B	SS01-103008	Styrene	0.45	µg/kg	UJ	ISL
8260B	SS01-103008	Tetrachloroethene	0.82	µg/kg	UJ	LCSL
8260B	SS01-103008	Toluene	2.6	µg/kg	J	SSH
8270C	SS01-103008	4-Chloroaniline	73	µg/kg	UJ	LCSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS01-103008	Aniline	69	µg/kg	UJ	LCSL
8270C	SS01-103008	Benzoic acid	440	µg/kg	J	LCSL
8270C	SS01-103008	Di-n-butyl phthalate	160	µg/kg	B	LBL
8270C	SS01-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS01-103008	Pyridine	77	µg/kg	R	LCSL
n6010B	SS02-103008	Beryllium	0.03	mg/kg	J	FDRPD
6010B	SS02-103008	Calcium	141000	mg/kg	J	FDRPD
6010B	SS02-103008	Iron	4900	mg/kg	J	MRL, FDRPD
6010B	SS02-103008	Magnesium	29900	mg/kg	J	FDRPD
6010B	SS02-103008	Manganese	125	mg/kg	J	FDRPD
6010B	SS02-103008	Vanadium	8.7	mg/kg	J	MRL, FDRPD
8260B	SS02-103008	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL
8260B	SS02-103008	1,2,3-Trichlorobenzene	1.6	µg/kg	UJ	ISL
8260B	SS02-103008	1,2,4-Trichlorobenzene	1.6	µg/kg	UJ	LCSL,ISL
8260B	SS02-103008	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	SS02-103008	1,2-Dichlorobenzene	0.9	µg/kg	UJ	ISL
8260B	SS02-103008	1,3-Dichlorobenzene	1.2	µg/kg	UJ	LCSL,ISL
8260B	SS02-103008	1,4-Dichlorobenzene	1.4	µg/kg	UJ	LCSL,ISL
8260B	SS02-103008	Isopropylbenzene	0.6	µg/kg	UJ	MRL
8260B	SS02-103008	Tetrachloroethene	0.9	µg/kg	UJ	LCSL
8270C	SS02-103008	4-Chloroaniline	71	µg/kg	UJ	LCSL
8270C	SS02-103008	Aniline	66	µg/kg	UJ	LCSL
8270C	SS02-103008	Benzoic acid	320	µg/kg	UJ	LCSL
8270C	SS02-103008	Di-n-butyl phthalate	150	µg/kg	B	LBL
8270C	SS02-103008	N-Nitrosodimethylamine	150	µg/kg	UJ	LCSL
8270C	SS02-103008	Pyridine	74	µg/kg	R	LCSL
8270C-PAH	SS02-103008	Acenaphthene	23	µg/kg	J	FDRPD
8270C-PAH	SS02-103008	Anthracene	55	µg/kg	J	FDRPD
8270C-PAH	SS02-103008	Fluorene	23	µg/kg	J	FDRPD
8270C-PAH	SS02-103008	Phenanthrene	280	µg/kg	J	FDRPD
6010B	SS03-103008	Iron	17500	mg/kg	J	MRL
6010B	SS03-103008	Vanadium	18.4	mg/kg	J	MRL
8260B	SS03-103008	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL
8260B	SS03-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	SS03-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS03-103008	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	SS03-103008	1,2-Dibromoethane	0.31	µg/kg	UJ	ISL
8260B	SS03-103008	1,2-Dichlorobenzene	0.94	µg/kg	UJ	ISL
8260B	SS03-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	ISL
8260B	SS03-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS03-103008	2-Hexanone	5.2	µg/kg	UJ	ISL
8260B	SS03-103008	Bromodichloromethane	0.42	µg/kg	UJ	ISL
8260B	SS03-103008	Bromoform	0.73	µg/kg	UJ	ISL
8260B	SS03-103008	Chlorobenzene	0.83	µg/kg	UJ	ISL
8260B	SS03-103008	Ethylbenzene	0.73	µg/kg	UJ	ISL
8260B	SS03-103008	Isopropylbenzene	0.63	µg/kg	UJ	MRL
8260B	SS03-103008	m,p-Xylenes	1.8	µg/kg	UJ	ISL
8260B	SS03-103008	o-Xylene	1	µg/kg	UJ	ISL
8260B	SS03-103008	Styrene	0.52	µg/kg	UJ	ISL
8260B	SS03-103008	Tetrachloroethene	0.94	µg/kg	UJ	LCSL
8270C	SS03-103008	1,2,4-Trichlorobenzene	19	µg/kg	UJ	SSL
8270C	SS03-103008	1,2-Diphenylhydrazine	38	µg/kg	UJ	SSL
8270C	SS03-103008	2,4,5-Trichlorophenol	120	µg/kg	UJ	SSL
8270C	SS03-103008	2,4,6-Trichlorophenol	90	µg/kg	UJ	SSL
8270C	SS03-103008	2,4-Dichlorophenol	110	µg/kg	UJ	SSL
8270C	SS03-103008	2,4-Dimethylphenol	91	µg/kg	UJ	SSL
8270C	SS03-103008	2,4-Dinitrophenol	260	µg/kg	UJ	SSL
8270C	SS03-103008	2,4-Dinitrotoluene	27	µg/kg	UJ	SSL
8270C	SS03-103008	2,6-Dinitrotoluene	37	µg/kg	UJ	SSL
8270C	SS03-103008	2-Chloronaphthalene	15	µg/kg	UJ	SSL
8270C	SS03-103008	2-Chlorophenol	130	µg/kg	UJ	SSL
8270C	SS03-103008	2-Methyl-4,6-dinitrophenol	84	µg/kg	UJ	SSL
8270C	SS03-103008	2-Methylnaphthalene	65	µg/kg	J	SSL
8270C	SS03-103008	2-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS03-103008	2-Nitroaniline	31	µg/kg	UJ	SSL
8270C	SS03-103008	2-Nitrophenol	140	µg/kg	UJ	SSL
8270C	SS03-103008	3,3'-Dichlorobenzidine	330	µg/kg	UJ	SSL
8270C	SS03-103008	3-Nitroaniline	38	µg/kg	UJ	SSL
8270C	SS03-103008	4-Bromophenyl phenyl ether	12	µg/kg	UJ	SSL
8270C	SS03-103008	4-Chloro-3-methylphenol	110	µg/kg	UJ	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS03-103008	4-Chloroaniline	77	µg/kg	UJ	SSL,LCSL
8270C	SS03-103008	4-Chlorophenyl phenyl ether	37	µg/kg	UJ	SSL
8270C	SS03-103008	4-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS03-103008	4-Nitroaniline	37	µg/kg	UJ	SSL
8270C	SS03-103008	4-Nitrophenol	390	µg/kg	UJ	SSL
8270C	SS03-103008	Aniline	72	µg/kg	UJ	SSL,LCSL
8270C	SS03-103008	Benzoic acid	340	µg/kg	UJ	SSL,LCSL
8270C	SS03-103008	Benzyl alcohol	92	µg/kg	UJ	SSL
8270C	SS03-103008	Bis(2-chloroethoxy)methane	24	µg/kg	UJ	SSL
8270C	SS03-103008	Bis(2-chloroethyl) ether	17	µg/kg	UJ	SSL
8270C	SS03-103008	Bis(2-chloroisopropyl) ether	13	µg/kg	UJ	SSL
8270C	SS03-103008	Bis(2-ethylhexyl) phthalate	33	µg/kg	UJ	SSL
8270C	SS03-103008	Butylbenzyl phthalate	28	µg/kg	UJ	SSL
8270C	SS03-103008	Dibenzofuran	49	µg/kg	J	SSL
8270C	SS03-103008	Diethyl phthalate	45	µg/kg	UJ	SSL
8270C	SS03-103008	Dimethyl phthalate	31	µg/kg	UJ	SSL
8270C	SS03-103008	Di-n-butyl phthalate	170	µg/kg	B	LBL,SSL
8270C	SS03-103008	Di-n-octyl phthalate	46	µg/kg	UJ	SSL
8270C	SS03-103008	Hexachlorobenzene	18	µg/kg	UJ	SSL
8270C	SS03-103008	Hexachlorobutadiene	37	µg/kg	UJ	SSL
8270C	SS03-103008	Hexachlorocyclopentadiene	31	µg/kg	UJ	SSL
8270C	SS03-103008	Hexachloroethane	20	µg/kg	UJ	SSL
8270C	SS03-103008	Isophorone	32	µg/kg	UJ	SSL
8270C	SS03-103008	Nitrobenzene	47	µg/kg	UJ	SSL
8270C	SS03-103008	N-Nitrosodimethylamine	170	µg/kg	UJ	SSL,LCSL
8270C	SS03-103008	N-Nitroso-di-n-propylamine	36	µg/kg	UJ	SSL
8270C	SS03-103008	N-Nitrosodiphenylamine	20	µg/kg	UJ	SSL
8270C	SS03-103008	Pentachlorophenol	83	µg/kg	UJ	SSL
8270C	SS03-103008	Phenol	150	µg/kg	UJ	SSL
8270C	SS03-103008	Pyridine	81	µg/kg	R	LCSL
6010B	SS04-103008	Iron	3460	mg/kg	J	MRL
6010B	SS04-103008	Manganese	117	mg/kg	J	LabDupRPD
6010B	SS04-103008	Vanadium	6.9	mg/kg	J	MRL
8260B	SS04-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS04-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS04-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS04-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS04-103008	1,2-Dichlorobenzene	0.98	µg/kg	UJ	ISL
8260B	SS04-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS04-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS04-103008	Isopropylbenzene	0.66	µg/kg	UJ	MRL
8260B	SS04-103008	Tetrachloroethene	0.98	µg/kg	UJ	LCSL
8270C	SS04-103008	4-Chloroaniline	69	µg/kg	UJ	LCSL
8270C	SS04-103008	Aniline	65	µg/kg	UJ	LCSL
8270C	SS04-103008	Benzoic acid	310	µg/kg	UJ	LCSL
8270C	SS04-103008	Di-n-butyl phthalate	150	µg/kg	B	LBL
8270C	SS04-103008	N-Nitrosodimethylamine	150	µg/kg	UJ	LCSL
8270C	SS04-103008	Pyridine	72	µg/kg	R	LCSL
6010B	SS05-103008	Iron	23700	mg/kg	J	MRL
6010B	SS05-103008	Vanadium	14.1	mg/kg	J	MRL
8260B	SS05-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS05-103008	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SS05-103008	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	LCSL,ISL
8260B	SS05-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS05-103008	1,2-Dibromoethane	0.33	µg/kg	UJ	ISL
8260B	SS05-103008	1,2-Dichlorobenzene	0.99	µg/kg	UJ	ISL
8260B	SS05-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS05-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS05-103008	2-Hexanone	5.5	µg/kg	UJ	ISL
8260B	SS05-103008	Bromodichloromethane	0.44	µg/kg	UJ	ISL
8260B	SS05-103008	Bromoform	0.77	µg/kg	UJ	ISL
8260B	SS05-103008	Chlorobenzene	0.88	µg/kg	UJ	ISL
8260B	SS05-103008	Ethylbenzene	0.77	µg/kg	UJ	ISL
8260B	SS05-103008	Isopropylbenzene	0.66	µg/kg	UJ	MRL
8260B	SS05-103008	m,p-Xylenes	1.9	µg/kg	UJ	ISL
8260B	SS05-103008	o-Xylene	1.1	µg/kg	UJ	ISL
8260B	SS05-103008	Styrene	0.55	µg/kg	UJ	ISL
8260B	SS05-103008	Tetrachloroethene	0.99	µg/kg	UJ	LCSL
8270C	SS05-103008	4-Chloroaniline	73	µg/kg	UJ	LCSL
8270C	SS05-103008	Aniline	69	µg/kg	UJ	LCSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS05-103008	Benzoic acid	330	µg/kg	UJ	LCSL
8270C	SS05-103008	Di-n-butyl phthalate	160	µg/kg	B	LBL
8270C	SS05-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS05-103008	Pyridine	77	µg/kg	R	LCSL
6010B	SS06-103008	Iron	23200	mg/kg	J	MRL
6010B	SS06-103008	Vanadium	18.9	mg/kg	J	MRL
8260B	SS06-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS06-103008	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL
8260B	SS06-103008	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	LCSL,ISL
8260B	SS06-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS06-103008	1,2-Dibromoethane	0.33	µg/kg	UJ	ISL
8260B	SS06-103008	1,2-Dichlorobenzene	0.99	µg/kg	UJ	ISL
8260B	SS06-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS06-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS06-103008	2-Hexanone	5.5	µg/kg	UJ	ISL
8260B	SS06-103008	Bromodichloromethane	0.44	µg/kg	UJ	ISL
8260B	SS06-103008	Bromoform	0.77	µg/kg	UJ	ISL
8260B	SS06-103008	Chlorobenzene	0.88	µg/kg	UJ	ISL
8260B	SS06-103008	Ethylbenzene	0.77	µg/kg	UJ	ISL
8260B	SS06-103008	Isopropylbenzene	0.66	µg/kg	UJ	MRL
8260B	SS06-103008	m,p-Xylenes	1.9	µg/kg	UJ	ISL
8260B	SS06-103008	o-Xylene	1.1	µg/kg	UJ	ISL
8260B	SS06-103008	Styrene	0.55	µg/kg	UJ	ISL
8260B	SS06-103008	Tetrachloroethene	0.99	µg/kg	UJ	LCSL
8270C	SS06-103008	4-Chloroaniline	74	µg/kg	UJ	LCSL
8270C	SS06-103008	Aniline	70	µg/kg	UJ	LCSL
8270C	SS06-103008	Benzoic acid	330	µg/kg	UJ	LCSL
8270C	SS06-103008	Di-n-butyl phthalate	160	µg/kg	B	LBL
8270C	SS06-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS06-103008	Pyridine	78	µg/kg	R	LCSL
6010B	SS07-103008	Beryllium	0.47	mg/kg	J	FDRPD
6010B	SS07-103008	Iron	22500	mg/kg	J	MRL
6010B	SS07-103008	Manganese	712	mg/kg	J	FDRPD
8260B	SS07-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS07-103008	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS07-103008	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	LCSL,ISL
8260B	SS07-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS07-103008	1,2-Dibromoethane	0.34	µg/kg	UJ	ISL
8260B	SS07-103008	1,2-Dichlorobenzene	1	µg/kg	UJ	ISL
8260B	SS07-103008	1,3-Dichlorobenzene	1.4	µg/kg	UJ	LCSL,ISL
8260B	SS07-103008	1,4-Dichlorobenzene	1.6	µg/kg	UJ	LCSL,ISL
8260B	SS07-103008	2-Hexanone	5.6	µg/kg	UJ	ISL
8260B	SS07-103008	Bromodichloromethane	0.45	µg/kg	UJ	ISL
8260B	SS07-103008	Bromoform	0.79	µg/kg	UJ	ISL
8260B	SS07-103008	Chlorobenzene	0.9	µg/kg	UJ	ISL
8260B	SS07-103008	Ethylbenzene	0.79	µg/kg	UJ	ISL
8260B	SS07-103008	Isopropylbenzene	0.68	µg/kg	UJ	MRL
8260B	SS07-103008	m,p-Xylenes	1.9	µg/kg	UJ	ISL
8260B	SS07-103008	o-Xylene	1.1	µg/kg	UJ	ISL
8260B	SS07-103008	Styrene	0.56	µg/kg	UJ	ISL
8260B	SS07-103008	Tetrachloroethene	1	µg/kg	UJ	LCSL
8270C	SS07-103008	4-Chloroaniline	77	µg/kg	UJ	LCSL
8270C	SS07-103008	Aniline	72	µg/kg	UJ	LCSL
8270C	SS07-103008	Benzoic acid	340	µg/kg	UJ	LCSL
8270C	SS07-103008	Di-n-butyl phthalate	170	µg/kg	B	LBL
8270C	SS07-103008	N-Nitrosodimethylamine	170	µg/kg	UJ	LCSL
8270C	SS07-103008	Pyridine	81	µg/kg	R	LCSL
8270C-PAH	SS07-103008	Benzo(g,h,i)perylene	7.1	µg/kg	J	FDRPD
8270C-PAH	SS07-103008	Indeno(1,2,3-cd)pyrene	6.5	µg/kg	J	FDRPD
6010B	SS08-103008	Iron	18300	mg/kg	J	MRL
8260B	SS08-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS08-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	SS08-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS08-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS08-103008	1,2-Dibromoethane	0.32	µg/kg	UJ	ISL
8260B	SS08-103008	1,2-Dichlorobenzene	0.96	µg/kg	UJ	ISL
8260B	SS08-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS08-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS08-103008	2-Hexanone	5.3	µg/kg	UJ	ISL
8260B	SS08-103008	Bromodichloromethane	0.43	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS08-103008	Bromoform	0.74	µg/kg	UJ	ISL
8260B	SS08-103008	Chlorobenzene	0.85	µg/kg	UJ	ISL
8260B	SS08-103008	Ethylbenzene	0.74	µg/kg	UJ	ISL
8260B	SS08-103008	Isopropylbenzene	0.64	µg/kg	UJ	MRL
8260B	SS08-103008	m,p-Xylenes	1.8	µg/kg	UJ	ISL
8260B	SS08-103008	Methylene chloride	10	µg/kg	B	EBH, TBH, ICVH (J), CCVL (J), MRL (J)
8260B	SS08-103008	o-Xylene	1.1	µg/kg	UJ	ISL
8260B	SS08-103008	Styrene	0.53	µg/kg	UJ	ISL
8260B	SS08-103008	Tetrachloroethene	0.96	µg/kg	UJ	LCSL
8270C	SS08-103008	4-Chloroaniline	75	µg/kg	UJ	LCSL
8270C	SS08-103008	Aniline	70	µg/kg	UJ	LCSL
8270C	SS08-103008	Benzoic acid	330	µg/kg	UJ	LCSL
8270C	SS08-103008	Di-n-butyl phthalate	160	µg/kg	B	LBL
8270C	SS08-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS08-103008	Pyridine	78	µg/kg	R	LCSL
6010B	SS09-103008	Iron	18700	mg/kg	J	MRL
8260B	SS09-103008	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL
8260B	SS09-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	SS09-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS09-103008	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	SS09-103008	1,2-Dibromoethane	0.31	µg/kg	UJ	ISL
8260B	SS09-103008	1,2-Dichlorobenzene	0.94	µg/kg	UJ	ISL
8260B	SS09-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS09-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS09-103008	2-Hexanone	5.2	µg/kg	UJ	ISL
8260B	SS09-103008	Bromodichloromethane	0.42	µg/kg	UJ	ISL
8260B	SS09-103008	Bromoform	0.73	µg/kg	UJ	ISL
8260B	SS09-103008	Chlorobenzene	0.83	µg/kg	UJ	ISL
8260B	SS09-103008	Ethylbenzene	0.73	µg/kg	UJ	ISL
8260B	SS09-103008	Isopropylbenzene	0.63	µg/kg	UJ	MRL
8260B	SS09-103008	m,p-Xylenes	1.8	µg/kg	UJ	ISL
8260B	SS09-103008	o-Xylene	1	µg/kg	UJ	ISL
8260B	SS09-103008	Styrene	0.52	µg/kg	UJ	ISL
8260B	SS09-103008	Tetrachloroethene	0.94	µg/kg	UJ	LCSL
8270C	SS09-103008	1,2,4-Trichlorobenzene	18	µg/kg	UJ	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS09-103008	1,2-Diphenylhydrazine	37	µg/kg	UJ	SSL
8270C	SS09-103008	2,4,5-Trichlorophenol	120	µg/kg	UJ	SSL
8270C	SS09-103008	2,4,6-Trichlorophenol	87	µg/kg	UJ	SSL
8270C	SS09-103008	2,4-Dichlorophenol	110	µg/kg	UJ	SSL
8270C	SS09-103008	2,4-Dimethylphenol	89	µg/kg	UJ	SSL
8270C	SS09-103008	2,4-Dinitrophenol	250	µg/kg	UJ	SSL
8270C	SS09-103008	2,4-Dinitrotoluene	26	µg/kg	UJ	SSL
8270C	SS09-103008	2,6-Dinitrotoluene	36	µg/kg	UJ	SSL
8270C	SS09-103008	2-Chloronaphthalene	15	µg/kg	UJ	SSL
8270C	SS09-103008	2-Chlorophenol	130	µg/kg	UJ	SSL
8270C	SS09-103008	2-Methyl-4,6-dinitrophenol	82	µg/kg	UJ	SSL
8270C	SS09-103008	2-Methylnaphthalene	48	µg/kg	J	SSL
8270C	SS09-103008	2-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS09-103008	2-Nitroaniline	30	µg/kg	UJ	SSL
8270C	SS09-103008	2-Nitrophenol	140	µg/kg	UJ	SSL
8270C	SS09-103008	3,3'-Dichlorobenzidine	320	µg/kg	UJ	SSL
8270C	SS09-103008	3-Nitroaniline	37	µg/kg	UJ	SSL
8270C	SS09-103008	4-Bromophenyl phenyl ether	12	µg/kg	UJ	SSL
8270C	SS09-103008	4-Chloro-3-methylphenol	100	µg/kg	UJ	SSL
8270C	SS09-103008	4-Chloroaniline	75	µg/kg	UJ	SSL,LCSL
8270C	SS09-103008	4-Chlorophenyl phenyl ether	36	µg/kg	UJ	SSL
8270C	SS09-103008	4-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS09-103008	4-Nitroaniline	36	µg/kg	UJ	SSL
8270C	SS09-103008	4-Nitrophenol	380	µg/kg	UJ	SSL
8270C	SS09-103008	Aniline	70	µg/kg	UJ	SSL,LCSL
8270C	SS09-103008	Benzoic acid	330	µg/kg	UJ	SSL,LCSL
8270C	SS09-103008	Benzyl alcohol	90	µg/kg	UJ	SSL
8270C	SS09-103008	Bis(2-chloroethoxy)methane	23	µg/kg	UJ	SSL
8270C	SS09-103008	Bis(2-chloroethyl) ether	16	µg/kg	UJ	SSL
8270C	SS09-103008	Bis(2-chloroisopropyl) ether	13	µg/kg	UJ	SSL
8270C	SS09-103008	Bis(2-ethylhexyl) phthalate	32	µg/kg	UJ	SSL
8270C	SS09-103008	Butylbenzyl phthalate	28	µg/kg	UJ	SSL
8270C	SS09-103008	Dibenzofuran	43	µg/kg	UJ	SSL
8270C	SS09-103008	Diethyl phthalate	44	µg/kg	UJ	SSL
8270C	SS09-103008	Dimethyl phthalate	30	µg/kg	UJ	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS09-103008	Di-n-butyl phthalate	170	µg/kg	B	LBL,SSL
8270C	SS09-103008	Di-n-octyl phthalate	45	µg/kg	UJ	SSL
8270C	SS09-103008	Hexachlorobenzene	17	µg/kg	UJ	SSL
8270C	SS09-103008	Hexachlorobutadiene	36	µg/kg	UJ	SSL
8270C	SS09-103008	Hexachlorocyclopentadiene	30	µg/kg	UJ	SSL
8270C	SS09-103008	Hexachloroethane	20	µg/kg	UJ	SSL
8270C	SS09-103008	Isophorone	31	µg/kg	UJ	SSL
8270C	SS09-103008	Nitrobenzene	46	µg/kg	UJ	SSL
8270C	SS09-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	SSL,LCSL
8270C	SS09-103008	N-Nitroso-di-n-propylamine	35	µg/kg	UJ	SSL
8270C	SS09-103008	N-Nitrosodiphenylamine	20	µg/kg	UJ	SSL
8270C	SS09-103008	Pentachlorophenol	81	µg/kg	UJ	SSL
8270C	SS09-103008	Phenol	150	µg/kg	UJ	SSL
8270C	SS09-103008	Pyridine	78	µg/kg	R	LCSL
6010B	SS10-103008	Iron	2570	mg/kg	J	MRL
8260B	SS10-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS10-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL
8260B	SS10-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS10-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS10-103008	1,2-Dichlorobenzene	0.95	µg/kg	UJ	ISL
8260B	SS10-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS10-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS10-103008	Dichlorodifluoromethane	1.7	µg/kg	J	MRL
8260B	SS10-103008	Isopropylbenzene	0.64	µg/kg	UJ	LCSL
8260B	SS10-103008	Methylene chloride	10	µg/kg	B	TBH, ICVH (J), CCVH (J), MRL (J)
8260B	SS10-103008	Tetrachloroethene	0.95	µg/kg	UJ	LCSL
8270C	SS10-103008	1,2,4-Trichlorobenzene	16	µg/kg	UJ	SSL
8270C	SS10-103008	1,2-Diphenylhydrazine	33	µg/kg	UJ	SSL
8270C	SS10-103008	2,4,5-Trichlorophenol	110	µg/kg	UJ	SSL
8270C	SS10-103008	2,4,6-Trichlorophenol	78	µg/kg	UJ	SSL
8270C	SS10-103008	2,4-Dichlorophenol	96	µg/kg	UJ	SSL
8270C	SS10-103008	2,4-Dimethylphenol	79	µg/kg	UJ	SSL
8270C	SS10-103008	2,4-Dinitrophenol	230	µg/kg	UJ	SSL
8270C	SS10-103008	2,4-Dinitrotoluene	24	µg/kg	UJ	SSL
8270C	SS10-103008	2,6-Dinitrotoluene	32	µg/kg	UJ	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS10-103008	2-Chloronaphthalene	13	µg/kg	UJ	SSL
8270C	SS10-103008	2-Chlorophenol	110	µg/kg	UJ	SSL
8270C	SS10-103008	2-Methyl-4,6-dinitrophenol	73	µg/kg	UJ	SSL
8270C	SS10-103008	2-Methylnaphthalene	20	µg/kg	UJ	SSL
8270C	SS10-103008	2-Methylphenol	110	µg/kg	UJ	SSL
8270C	SS10-103008	2-Nitroaniline	27	µg/kg	UJ	SSL
8270C	SS10-103008	2-Nitrophenol	120	µg/kg	UJ	SSL
8270C	SS10-103008	3,3'-Dichlorobenzidine	290	µg/kg	UJ	SSL
8270C	SS10-103008	3-Nitroaniline	33	µg/kg	UJ	SSL
8270C	SS10-103008	4-Bromophenyl phenyl ether	10	µg/kg	UJ	SSL
8270C	SS10-103008	4-Chloro-3-methylphenol	94	µg/kg	UJ	SSL
8270C	SS10-103008	4-Chloroaniline	67	µg/kg	UJ	SSL,LCSL
8270C	SS10-103008	4-Chlorophenyl phenyl ether	32	µg/kg	UJ	SSL
8270C	SS10-103008	4-Methylphenol	110	µg/kg	UJ	SSL
8270C	SS10-103008	4-Nitroaniline	32	µg/kg	UJ	SSL
8270C	SS10-103008	4-Nitrophenol	340	µg/kg	UJ	SSL
8270C	SS10-103008	Aniline	63	µg/kg	UJ	SSL,LCSL
8270C	SS10-103008	Benzoic acid	300	µg/kg	UJ	SSL,LCSL
8270C	SS10-103008	Benzyl alcohol	80	µg/kg	UJ	SSL
8270C	SS10-103008	Bis(2-chloroethoxy)methane	21	µg/kg	UJ	SSL
8270C	SS10-103008	Bis(2-chloroethyl) ether	14	µg/kg	UJ	SSL
8270C	SS10-103008	Bis(2-chloroisopropyl) ether	11	µg/kg	UJ	SSL
8270C	SS10-103008	Bis(2-ethylhexyl) phthalate	29	µg/kg	UJ	SSL
8270C	SS10-103008	Butylbenzyl phthalate	25	µg/kg	UJ	SSL
8270C	SS10-103008	Dibenzofuran	38	µg/kg	UJ	SSL
8270C	SS10-103008	Diethyl phthalate	39	µg/kg	UJ	SSL
8270C	SS10-103008	Dimethyl phthalate	27	µg/kg	UJ	SSL
8270C	SS10-103008	Di-n-butyl phthalate	140	µg/kg	B	LBL,SSL
8270C	SS10-103008	Di-n-octyl phthalate	40	µg/kg	UJ	SSL
8270C	SS10-103008	Hexachlorobenzene	15	µg/kg	UJ	SSL
8270C	SS10-103008	Hexachlorobutadiene	32	µg/kg	UJ	SSL
8270C	SS10-103008	Hexachlorocyclopentadiene	27	µg/kg	UJ	SSL
8270C	SS10-103008	Hexachloroethane	17	µg/kg	UJ	SSL
8270C	SS10-103008	Isophorone	28	µg/kg	UJ	SSL
8270C	SS10-103008	Nitrobenzene	41	µg/kg	UJ	SSL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8270C	SS10-103008	N-Nitrosodimethylamine	140	µg/kg	UJ	SSL,LCSL
8270C	SS10-103008	N-Nitroso-di-n-propylamine	31	µg/kg	UJ	SSL
8270C	SS10-103008	N-Nitrosodiphenylamine	17	µg/kg	UJ	SSL
8270C	SS10-103008	Pentachlorophenol	72	µg/kg	UJ	SSL
8270C	SS10-103008	Phenol	130	µg/kg	UJ	SSL
8270C	SS10-103008	Pyridine	70	µg/kg	R	LCSL
6010B	SS11-103008	Aluminum	7860	mg/kg	J	SDIL
6010B	SS11-103008	Antimony	0.18	mg/kg	UJ	MSL,PSL,SDIL
6010B	SS11-103008	Arsenic	6.8	mg/kg	J	PSL,SDIL
6010B	SS11-103008	Barium	54.2	mg/kg	J	SDIL
6010B	SS11-103008	Beryllium	0.41	mg/kg	J	SDIL
6010B	SS11-103008	Cadmium	0.25	mg/kg	J	MSL,PSH,SDIL
6010B	SS11-103008	Calcium	33900	mg/kg	J	SDIL
6010B	SS11-103008	Chromium	9.5	mg/kg	J	MSL,PSL,SDIL
6010B	SS11-103008	Cobalt	4.3	mg/kg	J	MSL,SDIL
6010B	SS11-103008	Copper	10	mg/kg	J	MSL,PSL
6010B	SS11-103008	Iron	16100	mg/kg	J	MSL,SDIL,MRL
6010B	SS11-103008	Lead	16.9	mg/kg	J	PSL,SDIL
6010B	SS11-103008	Magnesium	5690	mg/kg	J	SDIL
6010B	SS11-103008	Manganese	190	mg/kg	J	SDIL
6010B	SS11-103008	Nickel	9.8	mg/kg	J	MSL,PSL
6010B	SS11-103008	Selenium	0.43	mg/kg	UJ	MSL,PSL,SDIL
6010B	SS11-103008	Thallium	0.54	mg/kg	UJ	MSL,PSL,SDIL
6010B	SS11-103008	Vanadium	20.3	mg/kg	J	SDIL
6010B	SS11-103008	Zinc	35.2	mg/kg	J	MSL,PSL,SDIL
7471A	SS11-103008	Mercury	0.17	mg/kg	J	SDIL
8260B	SS11-103008	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL
8260B	SS11-103008	1,2,3-Trichlorobenzene	1.9	µg/kg	UJ	MSL,MSDL,ISL
8260B	SS11-103008	1,2,4-Trichlorobenzene	1.9	µg/kg	UJ	LCSL,MSL,MSDL,ISL
8260B	SS11-103008	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	MSL,MSDL,ISL
8260B	SS11-103008	1,2-Dibromoethane	0.36	µg/kg	UJ	MSL, MSDL
8260B	SS11-103008	1,2-Dichlorobenzene	1.1	µg/kg	UJ	MSL,MSDL,ISL
8260B	SS11-103008	1,3-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,MSL,MSDL,ISL
8260B	SS11-103008	1,4-Dichlorobenzene	1.7	µg/kg	UJ	LCSL,MSL,MSDL,ISL
8260B	SS11-103008	2-Butanone	7.3	µg/kg	UJ	MSL,MSDL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS11-103008	2-Hexanone	6.1	µg/kg	UJ	MSL,MSDL
8260B	SS11-103008	4-Methyl-2-pentanone	3.5	µg/kg	UJ	MSDL
8260B	SS11-103008	Acetone	7.3	µg/kg	UJ	MSL, MSDL
8260B	SS11-103008	Bromoform	0.85	µg/kg	UJ	MSDL
8260B	SS11-103008	Bromomethane	1.5	µg/kg	UJ	MSDL
8260B	SS11-103008	cis-1,3-Dichloropropene	0.73	µg/kg	UJ	MSL,MSDL
8260B	SS11-103008	Dichlorodifluoromethane	1.9	µg/kg	J	MSDH
8260B	SS11-103008	Isopropylbenzene	0.73	µg/kg	UJ	LCSL,MSL,MSDL
8260B	SS11-103008	Styrene	0.61	µg/kg	UJ	MSL,MSDL
8260B	SS11-103008	Tetrachloroethene	1.1	µg/kg	UJ	LCSL
8260B	SS11-103008	trans-1,3-Dichloropropene	0.97	µg/kg	UJ	MSL,MSDL
8270C	SS11-103008	2,4-Dinitrophenol	240	µg/kg	UJ	MSL,MSDL
8270C	SS11-103008	2-Methyl-4,6-dinitrophenol	77	µg/kg	UJ	MSL
8270C	SS11-103008	3,3'-Dichlorobenzidine	300	µg/kg	R	MSL,MSDL
8270C	SS11-103008	3-Nitroaniline	35	µg/kg	UJ	MSL,MSDL
8270C	SS11-103008	4-Chloroaniline	70	µg/kg	UJ	LCSL,MSL,MSDL
8270C	SS11-103008	Aniline	66	µg/kg	UJ	LCSL,MSL,MSDL
8270C	SS11-103008	Benzoic acid	310	µg/kg	UJ	LCSL,MSL,MSDL
8270C	SS11-103008	Di-n-butyl phthalate	150	µg/kg	B	LBL
8270C	SS11-103008	Hexachlorocyclopentadiene	28	µg/kg	UJ	MSL,MSDL
8270C	SS11-103008	N-Nitrosodimethylamine	150	µg/kg	UJ	LCSL,MSL,MSDL
8270C	SS11-103008	Pentachlorophenol	76	µg/kg	UJ	MSL,MSDL
8270C	SS11-103008	Pyridine	74	µg/kg	R	LCSL,MSL,MSDL
8270C-PAH	SS11-103008	Acenaphthene	73	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Anthracene	120	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Benzo(a)anthracene	300	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Benzo(a)pyrene	250	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Benzo(b)fluoranthene	360	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Benzo(g,h,i)perylene	99	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Benzo(k)fluoranthene	140	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Chrysene	270	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Dibenzo(a,h)anthracene	34	µg/kg	J	MSDL
8270C-PAH	SS11-103008	Fluorene	86	µg/kg	J	MSL,MSDL
8270C-PAH	SS11-103008	Indeno(1,2,3-cd)pyrene	120	µg/kg	J	MSL,MSDL
6010B	SS12-103008	Iron	14300	mg/kg	J	MRL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS12-103008	1,1,2,2-Tetrachloroethane	1.3	µg/kg	UJ	ISL
8260B	SS12-103008	1,2,3-Trichlorobenzene	1.9	µg/kg	UJ	ISL
8260B	SS12-103008	1,2,4-Trichlorobenzene	1.9	µg/kg	UJ	LCSL,ISL
8260B	SS12-103008	1,2-Dibromo-3-chloropropane	1.3	µg/kg	UJ	ISL
8260B	SS12-103008	1,2-Dichlorobenzene	1.1	µg/kg	UJ	ISL
8260B	SS12-103008	1,3-Dichlorobenzene	1.4	µg/kg	UJ	LCSL,ISL
8260B	SS12-103008	1,4-Dichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS12-103008	Dichlorodifluoromethane	7.6	µg/kg	J	MRL
8260B	SS12-103008	Isopropylbenzene	0.72	µg/kg	UJ	LCSL
8260B	SS12-103008	Tetrachloroethene	1.1	µg/kg	UJ	LCSL
8270C	SS12-103008	2,4,5-Trichlorophenol	120	µg/kg	UJ	SSL
8270C	SS12-103008	2,4,6-Trichlorophenol	88	µg/kg	UJ	SSL
8270C	SS12-103008	2,4-Dichlorophenol	110	µg/kg	UJ	SSL
8270C	SS12-103008	2,4-Dimethylphenol	90	µg/kg	UJ	SSL
8270C	SS12-103008	2,4-Dinitrophenol	260	µg/kg	UJ	SSL
8270C	SS12-103008	2-Chlorophenol	130	µg/kg	UJ	SSL
8270C	SS12-103008	2-Methyl-4,6-dinitrophenol	83	µg/kg	UJ	SSL
8270C	SS12-103008	2-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS12-103008	2-Nitrophenol	140	µg/kg	UJ	SSL
8270C	SS12-103008	4-Chloro-3-methylphenol	110	µg/kg	UJ	SSL
8270C	SS12-103008	4-Chloroaniline	76	µg/kg	UJ	LCSL
8270C	SS12-103008	4-Methylphenol	130	µg/kg	UJ	SSL
8270C	SS12-103008	4-Nitrophenol	380	µg/kg	UJ	SSL
8270C	SS12-103008	Aniline	71	µg/kg	UJ	LCSL
8270C	SS12-103008	Benzoic acid	340	µg/kg	UJ	LCSL
8270C	SS12-103008	Di-n-butyl phthalate	170	µg/kg	B	LBL
8270C	SS12-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS12-103008	Pentachlorophenol	81	µg/kg	UJ	SSL
8270C	SS12-103008	Phenol	150	µg/kg	UJ	SSL
8270C	SS12-103008	Pyridine	79	µg/kg	R	LCSL
6010B	SS13-103008	Calcium	236000	mg/kg	J	CCVH
6010B	SS13-103008	Iron	4270	mg/kg	J	MRL
6010B	SS13-103008	Magnesium	44100	mg/kg	J	MRL
8260B	SS13-103008	1,1,2,2-Tetrachloroethane	1.1	µg/kg	UJ	ISL
8260B	SS13-103008	1,2,3-Trichlorobenzene	1.7	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS13-103008	1,2,4-Trichlorobenzene	1.7	µg/kg	UJ	LCSL,ISL
8260B	SS13-103008	1,2-Dibromo-3-chloropropane	1.1	µg/kg	UJ	ISL
8260B	SS13-103008	1,2-Dichlorobenzene	0.94	µg/kg	UJ	ISL
8260B	SS13-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS13-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS13-103008	Acetone	30	µg/kg	J	MRL
8260B	SS13-103008	Dichlorodifluoromethane	7.3	µg/kg	J	MRL
8260B	SS13-103008	Isopropylbenzene	0.63	µg/kg	UJ	LCSL
8260B	SS13-103008	Tetrachloroethene	0.94	µg/kg	UJ	LCSL
8270C	SS13-103008	4-Chloroaniline	72	µg/kg	UJ	LCSL
8270C	SS13-103008	Aniline	67	µg/kg	UJ	LCSL
8270C	SS13-103008	Benzoic acid	320	µg/kg	UJ	LCSL
8270C	SS13-103008	Di-n-butyl phthalate	150	µg/kg	B	LBL
8270C	SS13-103008	N-Nitrosodimethylamine	150	µg/kg	UJ	LCSL
8270C	SS13-103008	Pyridine	75	µg/kg	R	LCSL
6010B	SS14-103008	Iron	15100	mg/kg	J	MRL
8260B	SS14-103008	1,1,2,2-Tetrachloroethane	1.5	µg/kg	UJ	ISL
8260B	SS14-103008	1,2,3-Trichlorobenzene	2.1	µg/kg	UJ	ISL
8260B	SS14-103008	1,2,4-Trichlorobenzene	2.1	µg/kg	UJ	LCSL,ISL
8260B	SS14-103008	1,2-Dibromo-3-chloropropane	1.5	µg/kg	UJ	ISL
8260B	SS14-103008	1,2-Dichlorobenzene	1.2	µg/kg	UJ	ISL
8260B	SS14-103008	1,3-Dichlorobenzene	1.6	µg/kg	UJ	LCSL,ISL
8260B	SS14-103008	1,4-Dichlorobenzene	1.9	µg/kg	UJ	LCSL,ISL
8260B	SS14-103008	Dichlorodifluoromethane	9.5	µg/kg	J	MRL
8260B	SS14-103008	Isopropylbenzene	0.8	µg/kg	UJ	MRL
8260B	SS14-103008	Tetrachloroethene	1.2	µg/kg	UJ	LCSL
8270C	SS14-103008	4-Chloroaniline	74	µg/kg	UJ	LCSL
8270C	SS14-103008	Aniline	70	µg/kg	UJ	LCSL
8270C	SS14-103008	Benzoic acid	330	µg/kg	UJ	LCSL
8270C	SS14-103008	Di-n-butyl phthalate	160	µg/kg	B	LBL
8270C	SS14-103008	N-Nitrosodimethylamine	160	µg/kg	UJ	LCSL
8270C	SS14-103008	Pyridine	78	µg/kg	R	LCSL
6010B	SS15-103008	Iron	17600	mg/kg	J	MRL
8260B	SS15-103008	1,1,2,2-Tetrachloroethane	1.2	µg/kg	UJ	ISL
8260B	SS15-103008	1,2,3-Trichlorobenzene	1.8	µg/kg	UJ	ISL

TABLE 4
Data Qualifier Summary

Method	Sample ID	Analyte	Result	Units	Final Flag	Validation Reason
8260B	SS15-103008	1,2,4-Trichlorobenzene	1.8	µg/kg	UJ	LCSL,ISL
8260B	SS15-103008	1,2-Dibromo-3-chloropropane	1.2	µg/kg	UJ	ISL
8260B	SS15-103008	1,2-Dichlorobenzene	0.99	µg/kg	UJ	ISL
8260B	SS15-103008	1,3-Dichlorobenzene	1.3	µg/kg	UJ	LCSL,ISL
8260B	SS15-103008	1,4-Dichlorobenzene	1.5	µg/kg	UJ	LCSL,ISL
8260B	SS15-103008	Dichlorodifluoromethane	1.7	µg/kg	J	MRL
8260B	SS15-103008	Isopropylbenzene	0.66	µg/kg	UJ	MRL
8260B	SS15-103008	Methylene chloride	11	µg/kg	B	EBH,TBH, ICVH (J), CCVH (J), MRL (J)
8260B	SS15-103008	Tetrachloroethene	0.99	µg/kg	UJ	LCSL
8270C	SS15-103008	4-Chloroaniline	78	µg/kg	UJ	LCSL
8270C	SS15-103008	Aniline	73	µg/kg	UJ	LCSL
8270C	SS15-103008	Benzoic acid	350	µg/kg	UJ	LCSL
8270C	SS15-103008	Di-n-butyl phthalate	170	µg/kg	B	LBL
8270C	SS15-103008	N-Nitrosodimethylamine	170	µg/kg	UJ	LCSL
8270C	SS15-103008	Pyridine	81	µg/kg	R	LCSL

CCVL = Continuing calibration verification recovery less than lower limit
CCVH= Continuing calibration verification recovery greater than upper limit
FDRPD = FD RPD criteria exceeded
EBL = Equipment blank contamination less than reporting limit
EBH = Equipment blank contamination greater than reporting limit
ICVH =Initial calibration verification recovery greater than upper limit
ISL = Internal standard recovery less than lower limit
LBL = Laboratory blank contamination less than reporting limit
LCSL = Laboratory control sample recovery less than lower limit
LabDupRPD= Lab replicate RPD criteria exceeded
MRL = Method reporting limit standard recovery less than lower limit
MSL = Matrix spike recovery less than lower limit
MSDL = Matrix spike duplicate recovery less than lower limit
MSDH = Matrix spike duplicate recovery greater than upper limit
PSH = Post-digestion spike greater than upper limit
PSL = Post-digestion spike less than lower limit
SDil = Serial dilution relative percent difference above criteria
SSL = Surrogate recovery less than lower limit
SSH = Surrogate recovery greater than upper limit

Lab Change for Former Wilkins Air Station Projects

PREPARED FOR: Nat Peters/USACE Project Manager

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Shane Lowe/CH2M HILL

DATE: October 24, 2008

Purpose

The purpose of this technical memorandum is to inform the USACE Louisville District of a required change in the project laboratory for work to be performed on the Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station.

Findings

During preparation for the field events scheduled to take place the former Wilkins Air Force Station in October 2008 it was revealed to CH2M HILL that the initial lab chosen to perform the analytical for the project was unable to comply with the QAPP (*Quality Assurance Project Plan, Pioneer/Shelby Horizons Landfill Areas at Former Wilkins Air Force Station, CH2M HILL)*. Upon receiving this information, CH2M HILL contacted the USACE and then began the process of selecting a new laboratory. The other qualified labs that had previously bid were contacted and those that could comply with the QAPP responded. CH2M HILL identified a lab that could meet the QAPP and had all appropriate certifications.

Recommendations

It is CH2M HILL's recommendation that the laboratory moving forward be:

CT Laboratories
1230 Lange Court
Baraboo, WI 53913
Contact Personnel: Eric Korthals (608) 356-2760

They are a NELAP certified lab and can comply with the project QAPP with few exceptions, and are currently performing work on other USACE Louisville District projects in Ohio. Please see the attached table for their exceptions to the project QAPP. Please note that some reporting limits (RLs) and all method detection limits (MDLs) will change from what is presented in the QAPP.

Table 4

Groundwater Reporting Limit Objectives for Metals by SW6010/SW7000 Series
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limits (Tap Water) (µg/L)	Reporting Limits (Method Detection Limit)[c] (µg/L)	CT RLs	CT MDLs
Aluminum	**50-200**	36,000	200	16	5
Antimony	6	--	6	**8.8**	2.6
Arsenic	10	--	3	7.4	2.2
Barium	2,000	--	10	1	0.3
Beryllium	4	--	5 (0.097)	0.59	0.18
Cadmium	5	--	5 (0.19)	1.1	0.3
Calcium	--	--	100	55	16
Chromium	100	--	10	13	4
Cobalt	--	730	10	2.8	0.8
Copper	1,300[b]	--	10	4	1.2
Iron	**300**	11,000	100	27	8
Lead	15[b]	--	5	4.6	1.4
Magnesium	--	--	100	17	5
Manganese	**50**	880	15	14	4
Mercury	2	--	0.2	**0.15**	0.05
Nickel	--	730	20	3.5	1
Potassium	--	--	500	540	160
Selenium	50	--	2	14	4
Silver	**100**	180	10	11	3
Sodium	--	--	1000	560	170
Thallium	2	--	3 (1.9)	**4.3**	1.3
Vanadium	--	36	20	4.9	1.5
Zinc	**5,000**	11,000	20	6.3	1.9

Notes:
[a] SMCL = Secondary Contaminant Level (bolded)
[b] USEPA Action Level
[c] Laboratory Method Dection Limit (MDL) are in parentheses
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
Highlighted RLs = CT RLs greater than QAPP RLs
Bold RLs= CT RL greater than screening criteria
Bold/Italicized Analytes = CT RL/MDL greater than screening criteria

Table 5

Soil Reporting Limit Objectives for Metals by SW6010/SW7000 series
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG (Residential Soil) (mg/kg)	Region V ESL Limits (mg/kg)	Reporting Limits (Method Detection Limits)[a] (mg/kg)	CT RLs	CT MDLs
Aluminum	76,000	--	8	0.47	0.15
Antimony	31	0.142	*2.4 (0.192)*	***0.55***	0.17
Arsenic	0.39	5.7	1.6	1.6	0.5
Barium	5,400	1.04	0.4	0.048	0.015
Beryllium	150	--	0.2	0.014	0.004
Cadmium	37	0.002	0.2 *(0.013)*	0.048	0.014
Calcium	--		4	1	0.3
Chromium	--	0.4	0.4 (0.049)	0.36	0.11
Cobalt	900	0.14	0.4 (0.022)	0.094	0.028
Copper	3100	5.4	0.4	0.11	0.03
Iron	23,000	--	4	0.63	0.19
Lead	--	0.054	*0.6 (0.097)*	***0.37***	0.11
Magnesium	--	--	4	3.8	1.1
Manganese	1,800	--	0.6	0.092	0.028
Mercury	23	0.1	0.01	0.007	0.0021
Nickel	1,600	1360	1.6	0.069	0.021
Potassium	--	--	8	60	18
Selenium	390	0.028	*0.12 (0.056)*	***1.3***	0.4
Silver	390	4.04	0.4	0.11	0.03
Sodium	--	--	40	32	10
Thallium	5.2	0.057	*0.18 (0.068)*	***1.6***	0.5
Vanadium	78	1.59	0.8	0.27	0.08
Zinc	23,000	6.62	0.8	0.74	0.22

Notes:
[a] Laboratory Method Dection Limit (MDL) are in parentheses
Highlighted RLs = CT RLs greater than QAPP RLs
Bold RLs= CT RL greater than screening criteria
Bold/Italicized Analytes = CT RL/MDL greater than screening criteria
mg/kg = milligram per kilogram

Table 6

Groundwater Reporting Limit Objectives for Volatile Organic Compounds by SW8260B
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limits (Tap Water) (µg/L)	Reporting Limits (Method Detection Limits)[b] (µg/L)	CT RLs	CT MDLs
1,1,1-Trichloroethane	200	--	1	0.2	0.05
1,1,2,2-Tetrachloroethane	--	0.055	1	0.2	0.019
1,1,2-Trichloroethane	5	--	1	0.2	0.06
1,1,2-Trichlorotrifluoroethane	--	--	1	0.4	0.027
1,1-Dichloroethane	--	810	1	0.2	0.06
1,1-Dichloroethene	7	--	1	0.2	0.05
1,2,3-Trichlorobenzene	--	--	5	0.22	0.07
1,2,4-Trichlorobenzene	70	--	1	0.2	0.06
1,2-Dibromo-3-chloropropane	0.2	--	1 (0.107)	0.2	0.05
1,2-Dibromoethane	0.05	--	1 (0.017)	**0.2**	0.05
1,2-Dichlorobenzene	600	--	1	0.2	0.05
1,2-Dichloroethane	5	--	1	0.2	0.03
1,2-Dichloropropane	5	--	1	0.2	0.05
1,3-Dichlorobenzene	--	--	1	0.2	0.027
1,4-Dichlorobenzene	75	--	1	0.2	0.04
2-Butanone	--	7,000	5	2	0.6
2-Hexanone	--	--	1	5.2	1.6
4-Methyl-2-Pentanone	--	2,000	1	2.8	0.8
Acetone	--	5,500	5	5.2	1.5
Benzene	5	--	1	0.2	0.05
Bromochloromethane	--	--	1	0.2	0.028
Bromodichloromethane	--	0.18	1 (0.022)	**0.2**	0.03
Bromoform	--	8.5	1	0.2	0.04
Bromomethane	--	8.7	1	0.25	0.07
Carbon Disulfide	--	1000	1	0.4	0.09
Carbon Tetrachloride	5	--	1	0.2	0.022
Chlorobenzene	100	--	1	0.2	0.04
Chlorodibromomethane	--	0.13	1 (0.015)	**0.2**	0.026
Chloroethane	--	4.6	1	0.23	0.07
Chloroform	--	0.17	1	**0.2**	0.022
Chloromethane	--	160	1	0.2	0.05
Cis-1,2-Dichloroethene	70	--	1	0.2	0.05
Cis-1,3-Dichloropropene	--	--	1	0.2	0.017
Dichlorodifluoromethane	--	390	1	0.2	0.03
Ethylbenzene	700	--	1	0.2	0.024
Isopropylbenzene	--	660	1	0.2	0.04
Methyl tert-Butyl Ether	**20-40**	11	1	0.26	0.08

Table 6 cont

Groundwater Reporting Limit Objectives for Volatile Organic Compounds by SW8260B
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limits (Tap Water) (µg/L)	Reporting Limits (Method Detection Limits)[b] (µg/L)	CT RLs	CT MDLs
Methylene Chloride	5	--	2	0.59	0.18
Styrene	100	--	1	0.2	0.022
Tetrachloroethene	5	--	1	0.2	0.05
Toluene	1,000	--	1	0.2	0.06
Trans-1,2-Dichloroethene	100	--	1	0.21	0.06
Trans-1,3-Dichloropropene	--	--	1	0.2	0.017
Trichloroethene	5	--	1	0.2	0.05
Trichlorofluoromethane	--	1,300	1	0.2	0.06
Vinyl Chloride	2	--	1	0.2	0.013
Total Xylenes	10,000	--	2	0.4	0.08

Notes:
[a] SMCL = Secondary Contaminant Level (bolded)
[b] Laboratory Method Dection Limit (MDL) are in parentheses
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
Highlighted RLs = CT RLs greater than QAPP RLs
Bold RLs= CT RL greater than screening criteria
Bold/Italicized Analytes = CT RL/MDL greater than screening criteria

Table 7

Soil Reporting Limit Objectives for Volatile Organic Compounds by SW8260B
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG Limits (Residential Soil) (µg/kg)	Region V ESL Limits (µg/kg)	Reporting Limits (Method Detection Limits)[a] (µg/kg)	CT RLS
1,1,1-Trichloroethane	1,200,000	29,800	5	5
1,1,2,2-Tetrachloroethane	410	127	5	5
1,1,2-Trichloroethane	730	28,600	5	5
1,1,2-Trichlorotrifluoroethane (Freon 113)	560,000	--	5	5
1,1-Dichloroethane	510,000	20,100	5	5
1,1-Dichloroethene	120,000	8280	5	5
1,2,3-Trichlorobenzene	--	--	5	5
1,2,4-Trichlorobenzene	62,000	--	5	5
1,2-Dibromo-3-chloropropane	460	35.2	5	5
1,2-Dibromoethane	32	1230	5	5
1,2-Dichlorobenzene	600,000	2960	5	5
1,2-Dichloroethane	280	21,200	5	5
1,2-Dichloropropane	340	32,700	5	5
1,3-Dichlorobenzene	530,000	37,700	5	5
1,4-Dichlorobenzene	3,400	546	5	5
2-Butanone	22,000,000	89,600	5	20
2-Hexanone	--	12,600	5	20
4-Methyl-2-Pentanone	5,300,000	--	5	20
Acetone	--	2,500	25	20
Benzene	640	255	5	5
Bromochloromethane	--	--	5	5
Bromodichloromethane	820	540	5	5
Bromoform	62,000	15,600	5	5
Bromomethane	3,900	--	5	5
Carbon Disulfide	360,000	94.1	5	5
Carbon Tetrachloride	250	2980	5	5
Chlorobenzene	150,000	13,100	5	5
Chlorodibromomethane	1100	2050	5	5
Chloroethane	3,000	--	5	10
Chloroform	220	1,190	5	5
Chloromethane	470,000	--	5	5
Cis-1,2-Dichloroethene	430,000	--	5	5
Cis-1,3-Dichloropropene	--	398	5	5
Dichlorodifluoromethane	940,000	39,500	5	10
Ethylbenzene	400,000	5,160	5	5
Isopropylbenzene	570,000	--	5	5
Methyl tert-Butyl Ether	32,000	--	5	5

Table 7 cont

Soil Reporting Limit Objectives for Volatile Organic Compounds by SW8260B
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG Limits (Residential Soil) (µg/kg)	Region V ESL Limits (µg/kg)	Reporting Limits (Method Detection Limits)[a] (µg/kg)	CT RLS
Methylene Chloride	9,100	4,050	10	10
Styrene	1,700,000	4,696	5	5
Tetrachloroethene	480	9,920	5	5
Toluene	520,000	5,450	5	5
Trans-1,2-Dichloroethene	69,000	784	5	5
Trans-1,3-Dichloropropene	--	398	5	5
Trichloroethene	53	12,400	5	5
Trichlorofluoromethane	390,000	16,400	5	5
Vinyl Chloride	79	646	5	5
Xylenes (Total)	270,000	10,000	10	10

Notes:
[a] Laboratory Method Dection Limit (MDL) are in parentheses
Highlighted RLs = CT RLs greater than QAPP RLs
Bold RLs= CT RL greater than screening criteria
Bold/Italicized Analytes = CT RL/MDL greater than screening criteria
µg/kg = microgram per kilogram

Table 8

Groundwater Reporting Limit Objectives for Semi-Volatile Organic Compounds by SW8270C

Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limits (Tap Water) (µg/L)	Reporting Limits (Method Detection Limits)[b] (µg/L)	CT RLs	CT MDLs
1,2,4-Trichlorobenzene	70	--	10	1	0.07
1,2-Diphenylhydrazine	--	0.084	*10 (0.204)*	***2***	0.18
2,4-Dinitrotoluene	--	73	10	1	0.19
2,6-Dinitrotoluene	--	36	10	1	0.12
2,4,5-Trichlorophenol	--	3600	10	2.65	0.79
2,4,6-Trichlorophenol	--	3.6	10 (0.419)	2.86	0.86
2,4-Dichlorophenol	--	110	10	2.03	0.61
2,4-Dimethylphenol	--	730	10	3.96	1.19
2,4-Dinitrophenol	--	73	50	5.08	1.52
2-Chloronaphthalene	--	490	10	1	0.1
2-Chlorophenol	--	30	10	2.27	0.68
4,6-Dinitro-2methylphenol	--	---	50	5	0.93
2-Methylphenol	--	1800	10	2.88	0.87
2-Nitrophenol	--	--	10	2.01	0.6
2-Nitroaniline	--	110	50	1	0.11
3-Nitroaniline	--	3.2	50	1	0.21
3,3'-Dichlorobenzidine	--	0.15	*20 (2.08)*	**9.86**	*2.96*
4-Bromophenyl Phenyl Ether	--	--	10	1	0.15
4-Chloro-3-methylphenol	--	--	10	3.71	1.11
4-Chloroaniline	--	150	10	1	0.17
4-chlorophenyl phenyl ether	--	--	10	1	0.08
3 & 4-Methylphenol	--	180	10	2.23	0.67
4-Nitrophenol	--	--	50	5	0.62
4-Nitroaniline	--	--	50	1.53	0.46
Bis (2-chloroethoxy) methane	--	--	10	1	0.09
Bis (2-chloroethyl) ether	--	0.01	*10 (0.47)*	***1***	0.2
Bis (2-chloroisopropyl) ether	--	0.27	*10 (0.528)*	1	0.09
Bis (2-ethylhexyl) phthalate	--	4.8	10 (1.91)	2.03	0.61
Butyl benzyl phthalate	--	7,300	10	1	0.11
Dibenzofuran	--	12	10	1	0.08
Diethyl phthalate	--	29,000	10	1	0.17
Dimethyl phthalate	--	360,000	10	1	0.09
Di-n-butyl phthalate	--	--	10	2.51	0.75
Di-n-octyl phthalate	--	1,500	10	1	0.16
Hexachlorobenzene	1	--	10 (0.257)	1	0.22
Hexachlorobutadiene	--	0.86	10	**1**	0.3

Table 8 cont

Groundwater Reporting Limit Objectives for Semi-Volatile Organic Compounds by SW8270C

Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limits (Tap Water) (µg/L)	Reporting Limits (Method Detection Limits)[b] (µg/L)	CT RLs	CT MDLs
Hexachlorocylopentadiene	50	--	10	1	0.12
Hexachloroethane	--	4.8	10 (0.842)	**38.21**	0.07
Isophorone	--	71	10	1	0.11
Nitrobenzene	--	3.4	10 (0.362)	1	0.15
n-Nitrosodimethylamine	--	0.0013	*10 (1.01)*	***2.32***	0.7
n-Nitroso-di-n-propylamine	--	0.0096	*10 (0.510)*	***1***	0.18
n-Nitrosodiphenylamine	--	14	10	2	0.19
Pentachlorophenol	--	0.56	*50 (1.06)*	***5***	0.89
Phenol	--	11,000	10	1.02	0.31
Aniline	--	12	10	1.08	0.32
Benzoic Acid	--	150,000	50	38.21	11.46
Benzyl Alcohol	--	11,000	10	1.03	0.31
Pyridine	--	36	10	5.87	1.76
2-methylnaphthalene	--	--	10	1	0.12

Notes:

[a] SMCL = Secondary Contaminant Level (bolded)

[b] Laboratory Method Dection Limit (MDL) are in parentheses

MCL = Maximum Contaminant Level

µg/L = micrograms per liter

Highlighted RLs = CT RLs greater than QAPP RLs

Bold RLs= CT RL greater than screening criteria

Bold/Italicized Analytes = CT RL/MDL greater than screening criteria

Table 9

Soil Reporting Limit Objectives for Semi-Volatile Organic Compounds by SW8270C

Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG Limits (Residential Soils) (µg/kg)	Region V ESL Limits (µg/kg)	Reporting Limits (Method Detection Limits)[a] ((µg/kg)	CT RLS	CT MDLs
1,2,4-Trichlorobenzene	62,000	11,100	330	100	16
1,2-Diphenylhydrazine	610	--	330	100	32
2,4-Dinitrotoluene	120,000	1280	330	100	23
2,6-Dinitrotoluene	61,000	32.8	330 (5.7)	**110**	31
2,4,5-Trichlorophenol	6,100,000	14,100	330	350	105
2,4,6-Trichlorophenol	6,100	9940	330	260	76
2,4-Dichlorophenol	180,000	87,500	330	320	93
2,4-Dimethylphenol	1,200,000	10	*330 (54.4)*	***260***	*77*
2,4-Dinitrophenol	120,000	60.9	1670 (19)	***710***	220
2-Chloronaphthalene	4,900,000	12.2	*330 (24.2)*	***100***	*13*
2-Chlorophenol	63,000	243	330 (24.8)	**350**	110
4,6-Dinitro-2methylphenol	--	144	1670 (12.5)	**500**	71
2-Methylphenol	3,100,000	40,400	330	340	110
2-Nitrophenol	--	1,600	330	400	120
2-Nitroaniline	180,000	74,100	1670 (7.55)	100	26
3-Nitroaniline	18,000	3,160	1670	110	32
3,3'-Dichlorobenzidine	1,100	646	660 (56)	**930**	280
4-Bromophenyl Phenyl Ether	--	--	330	100	10
4-Chloro-3-methylphenol	--	7,950	330	310	91
4-Chloroaniline	240,000	1,100	330	220	65
4-chlorophenyl phenyl ether	--	--	330	110	31
3 & 4-Methylphenol[b]	310,000	3,490	330	350	110
4-Nitrophenol	--	5,120	1670	1100	330
4-Nitroaniline	23,000	21,900	1670	110	31
Bis (2-chloroethoxy) methane	--	--	330	100	20
Bis (2-chloroethyl) ether	220	23,700	330 (35.9)	100	14
Bis (2-chloroisopropyl) ether	2,900	--	330	100	11
Bis (2-ethylhexyl) phthalate	35,000	925	330	100	28
Butyl benzyl phthalate	12,000,000	239	330 (7.6)	100	24
Dibenzofuran	150,000	--	330	130	37
Diethyl phthalate	49,000,000	--	330	130	38
Dimethyl phthalate	100,000,000	734,000	330	100	26
Di-n-butyl phthalate	--	150	330 (6.64)	140	40
Di-n-octyl phthalate	2,400,000	709,000	330	130	39
Hexachlorobenzene	,300	199	330 (9.61)	100	15
Hexachlorobutadiene	6,200	39.8	330 (32.2)	110	31

Table 9 cont

Soil Reporting Limit Objectives for Semi-Volatile Organic Compounds by SW8270C
Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG Limits (Residential Soils) (µg/kg)	Region V ESL Limits (µg/kg)	Reporting Limits (Method Detection Limits)[a] ((µg/kg)	CT RLS	CT MDLs
Hexachlorocylopentadiene	370,000	755	330	100	26
Hexachloroethane	35,000	596	330	100	17
Isophorone	510,000	139,000	330	100	27
Nitrobenzene	20,000	1,310	330	140	40
n-Nitrosodimethylamine	9.5	0.0321	*330 (39.7)*	***460***	*140*
n-Nitroso-di-n-propylamine	69	544	330 (7.48)	110	30
n-Nitrosodiphenylamine	99,000	545	330	200	17
Pentachlorophenol	3,000	119	1670 (29.3)	500	70
Phenol	18,000,000	120,000	330	410	130
Aniline	85,000	56.8	330 (42.7)	***210***	61
Benzoic Acid	100,000,000	--	1670	980	290
Benzyl Alcohol	18,000,000	65,800	330	270	78
Pyridine	61,000	1,030	330	230	68
2-methylnaphthalene	--	3,240	330	100	19

Notes:
[a] Laboratory Method Dection Limit (MDL) are in parentheses
Highlighted RLs = CT RLs greater than QAPP RLs
Bold RLs= CT RL greater than screening criteria
Bold/Italicized Analytes = CT RL/MDL greater than screening criteria
µg/kg = microgram per kilogram

Table 10

Groundwater Reporting Limit Objectives for PAHs by SW8270C SIM

Former Wilkins Air Force Station, Shelby, Ohio

Analyte	USEPA MCL/SMCL[a] (µg/L)	Region IX PRG Limit (µg/L)	Reporting Limits (Method Detection Limits)[b] Water (µg/L)	CT RLs	CT MDLs
Acenaphthene	--	370	0.1	0.016	0.005
Acenaphthylene	--	--	0.1	0.014	0.004
Anthracene	--	1800	0.2	0.015	0.004
Benzo (a) anthracene	--	0.092	0.1 (0.013)	0.015	0.004
Benzo (a) pyrene	0.2	0.092	0.1	0.022	0.007
Benzo(b)fluoranthene	--	0.092	0.1 (0.02)	0.021	0.006
Benzo (g,h,i) perylene	--	--	0.1 (0.017)	0.022	0.007
Benzo(k)fluoranthene	--	0.92	0.1	0.02	0.006
Chrysene	--	9.2	0.1	0.012	0.004
Dibenz(a,h)anthracene	--	0.0092	*0.1 (0.02)*	***0.018***	0.005
Fluoranthene	---	1500	0.1	0.015	0.005
Fluorene	--	240	0.1	0.014	0.004
Indeno(1,2,3-c,d)pyrene	--	0.092	0.1 (0.014)	0.021	0.006
Naphthalene	--	6.2	0.2	0.021	0.006
Phenanthrene	--	--	0.2	0.015	0.004
Pyrene	--	180	0.1	0.012	0.004

Notes:

[a] SMCL = Secondary Contaminant Level (bolded)

[b] Laboratory Method Dection Limit (MDL) are in parentheses

MCL = Maximum Contaminant Level

µg/L = micrograms per liter

Highlighted RLs = CT RLs greater than QAPP RLs

Bold RLs= CT RL greater than screening criteria

Bold/Italicized Analytes = CT RL/MDL greater than screening criteria

Table 11

Soil Reporting Limit Objectives for PAHs by SW8270C SIM

Former Wilkins Air Force Station, Shelby, Ohio

Analyte	Region IX PRG Limits (µg/kg)	Region V ESL Limits (µg/kg)	Reporting Limits (Method Detection Limits)[a] Soil (µg/kg)	CT RLs	CT MDLs
Acenaphthene	3,700,000	682,000	15	4.72	1.42
Acenaphthylene	--	682,000	30	4.64	1.39
Anthracene	22,000,000	1,480,000	3	4.98	1.5
Benzo (a) anthracene	620	5,210	3	4.81	1.44
Benzo (a) pyrene	62	1,520	3	4.57	1.37
Benzo(b)fluoranthene	620	59,800	3	4.78	1.43
Benzo (g,h,i) perylene	--	119,000	3	4.75	1.43
Benzo(k)fluoranthene	6200	148,000	3	4.95	1.48
Chrysene	62000	4,730	3	5.11	1.53
Dibenz(a,h)anthracene	620,000	184,000	3	4.87	1.46
Fluoranthene	2,300,000	122,000	3	5.21	1.56
Fluorene	2,700,000	122,000	15	5.2	1.56
Indeno(1,2,3-c,d)pyrene	620	109,000	3	4.61	1.38
Naphthalene	56,000	99.4	7.5	4.34	1.33
Phenanthrene	--	45,700	3	5.25	1.58
Pyrene	2,300,000	78,500	3	4.93	1.48

Notes:

[a] Laboratory Method Dection Limit (MDL) are in parentheses

Highlighted RLs = CT RLs greater than QAPP RLs

Bold RLs= CT RL greater than screening criteria

Bold/Italicized Analytes = CT RL/MDL greater than screening criteria

µg/kg = microgram per kilogram

Please note that laboratory data package 69995 contains groundwater analytical data from the Pioneer AOC Remedial Investigation (RI) supplemental sampling, which was conducted concurrently with the Shelby Horizons AOC RI soil sampling.

The Pioneer AOC RI supplemental investigation data was presented and evaluated in the Pioneer AOC Remedial Investigation Addendum: Former Wilkins Air Force Station, Shelby Ohio report submitted to Ohio EPA July 2010 (CH2M HILL 2010).