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April 10, 2013

U.S. Army Engineer District, Nashville
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Subject: ***Submittal of the Final Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment for Waste Water Treatment Plant No. 3 Former Plum Brook Ordnance Works, Sandusky, Ohio Contract No. W912QR-08-D-0013: Shaw Project Number 132457***

Dear Ms. Coleman:

In accordance with the requirements of Delivery Order No. DX02 of Contract No. W912QR-08-D-0013 to Shaw Environmental & Infrastructure, Inc., a CB&I company, we are pleased to submit the Final Baseline Human Health Risk Assessment and the Final Screening Level Ecological Risk Assessment for Waste Water Treatment Plant No. 3 at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. Responses to comments received on the draft risk assessment reports have been incorporated into the final reports and are attached to these documents.

Enclosed for your records are four copies of this report. Copies have also been sent to those on the distribution list as indicated.

Should you have any questions of require additional information regarding this submittal, please do not hesitate to contact me at (865) 694-7496.

Sincerely,

Steven. T. Downey, PE, PMP
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Client Name: U.S. Army Engineer District, Nashville; CELRN-EC-E

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Former Plum Brook Ordnance Works, Sandusky, Ohio

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Final
Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3

Plum Brook Ordnance Works
Sandusky, Ohio

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List of Acronyms

ARP	assessment receptor profile
BAF	bioaccumulation factor
BCF	bioconcentration factor
bgs	below ground surface
BSC	background screening concentration
COPEC	chemical of potential ecological concern
CT	central tendency
D&M	Dames and Moore, Inc.
DERP-FUDS	Defense Environmental Restoration Program-Formerly Used Defense Sites
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESBSNP	Erie Sand Barrens State Nature Preserve
ESCM	ecological site conceptual model
ESV	ecological screening value
HQ	hazard quotient
IAEA	International Atomic Energy Agency
IT	IT Corporation
K_{ow}	octanol-water partition coefficient
LANL	Los Alamos National Laboratory
LOAEL	lowest-observed-adverse-effect level
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
NASA	National Aeronautics and Space Administration
NOAEL	no-observed-adverse-effect level
NWI	National Wetlands Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl

List of Acronyms *(Continued)*

RME	reasonable maximum exposure
Shaw	Shaw Environmental, Inc.
SLERA	screening-level ecological risk assessment
SVOC	semivolatile organic compound
TNT	trinitrotoluene
TNTA	TNT Area A
TNTB	TNT Area B
TNTC	TNT Area C
TRV	toxicity reference value
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
WRS	Wilcoxon Rank Sum
WWTP1	Waste Water Treatment Plant No. 1
WWTP2	Waste Water Treatment Plant No. 2
WWTP3	Waste Water Treatment Plant No. 3

Executive Summary

A screening-level ecological risk assessment (SLERA) was performed to provide an estimate of current and future ecological hazard associated with potential hazardous substance releases within the Waste Water Treatment Plant No. 3 site at Plum Brook Ordnance Works in Sandusky, Ohio. Although the term “ecological risk assessment” is commonly used in guidance documents and available technical literature, it should be noted that ecological “risk” is not calculated in the SLERA, as no statistical probabilities of toxicological effects are generated in the SLERA. The results of the screening-level ecological risk assessment contribute to the overall characterization of the site and serve as part of the baseline used to develop, evaluate, and select appropriate remedial alternatives, if necessary. The objective of the screening-level ecological risk assessment is to present information for risk managers regarding the potential for adverse impacts to occur to ecological receptors as a result of site-related releases. The assessment addresses the potential for adverse effects to the vegetation, wildlife, aquatic life, and endangered and threatened species.

Vegetative communities at the site were classified during two site reconnaissance trips. The site consists of a mixture of mowed fields, upland old fields, and shrub thicket. A north-south-trending drainage ditch is present in the western portion of the site. This drainage ditch contains water only intermittently but drains to the north into a larger drainage ditch that is more regularly inundated with water. No wetlands were formally identified at the site. Vegetative stress attributable to chemicals was not observed at the site. No threatened or endangered species were documented at the site. Based on the site reconnaissance information, there was no indication that ecological threats exist at the site, as there was no definitive absence of biota or animal life in areas expected to support these ecological components.

The maximum detected concentrations of chemicals in sampled media were compared with risk-based screening ecotoxicity values during an initial screening step. Chemicals that exceeded the screening values or for which no screening values were available and that did not meet additional screening criteria (e.g., comparison with background data, nutrient status, frequency of detection, etc.) were retained as chemicals of potential ecological concern (COPEC) and assessed further. It is noted that the background screening protocol used in this assessment, which is based on Plum Brook Ordnance Works Project Delivery Team agreement, differs somewhat from the current Ohio Environmental Protection Agency guidance. Twenty-one COPECs were selected for soil, seven were selected for surface water, and one was selected for sediment. Ninety-five percent

upper confidence limits were calculated for these chemicals and used as their exposure point concentrations during the subsequent stages of the risk assessment, as appropriate.

Eight representative receptor species that are expected to be present at the site were selected as indicator species for the potential effects of the COPECs. The eight species selected included six terrestrial birds and mammals (the deer mouse, short-tailed shrew, Eastern cottontail rabbit, marsh wren, white-tailed deer, and red-tailed hawk), one semiaquatic mammal (raccoon), and one aquatic mammal (muskrat). Although the drainage ditch does not represent a viable aquatic system, the semiaquatic and aquatic receptors are conservatively included to address potential impacts to the larger drainage ditch to the north of the site, where the presence of such receptors is more plausible. It should be noted that although these eight receptors were selected for evaluation, most if not all of the selected ecological receptors are not spatially relevant to the site.

The assessment endpoints for the site were the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, omnivorous aquatic mammals, and omnivorous aquatic birds. Measurement assessment endpoints, or measurable responses to stressors, included lowest-observed-adverse-effect levels and no-observed-adverse-effect levels, collectively termed “toxicity endpoint values.”

Measurable responses to stressors, collectively termed toxicity reference values (TRV), were selected as measurement endpoints. The most appropriate measurement endpoints were chosen based on exposure pathways as well as ecotoxicity of the contaminant. An exposure analysis combining the spatial and temporal distribution of the assessment receptors and the COPECs was performed to evaluate potential exposure. The focus of the analysis was dependent on the assessment receptors evaluated and the assessment and measurement endpoints.

The intake estimates were combined with the TRVs to derive estimates of potential adverse ecological effects. The uncertainties associated with the estimation of potential adverse ecological effects were identified, with the degree of uncertainty estimated qualitatively or quantitatively, and the impact of the uncertainty estimated qualitatively (overestimate or underestimate, as appropriate).

Risk characterization integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. The result is an estimate of the severity, and characteristics of adverse effects to ecological receptors resulting from exposure to

environmental stressors present at the site. Qualitative and semiquantitative approaches were taken to provide an estimate of the potential for adverse effects occurring as a result of exposure of the selected site receptors to chemicals.

For the semiquantitative predictive assessment, TRVs and exposure rates were calculated and were used to generate hazard quotients (HQ) by dividing the receptor exposure rate for each chemical by the calculated reference toxicity values. HQs are a means of estimating the potential for adverse effects to organisms at a contaminated site and assessing the potential for toxicological effects to occur.

For soil, terrestrial invertebrates and plants may have slightly elevated HQs based upon the exceedance of ecological benchmarks. However, detected concentrations in soil were not highly elevated. It should also be noted that flora and fauna communities, including avifauna that rely on both plant (berries) and animal (invertebrates) food sources, appeared to be vigorous, with the expected diversity and abundance given the habitat present at the site. Because of the conservative nature of benchmark values, it is unlikely that these communities are adversely impacted at the site.

Benthic invertebrates and plants may have slightly elevated hazard based upon the exceedance of ecological benchmarks. However, due to the limited aquatic habitat present near the site and the limited number of exceedances, it is unlikely that these communities are significantly impacted.

Ecological hazard from soil, surface water, and sediment was primarily evaluated using food chain models for the selected assessment receptors (i.e., deer mouse, short-tailed shrew, Eastern cottontail rabbit, marsh wren, white-tailed deer, raccoon, red-tailed hawk, and muskrat). Lead, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons (PAH), and carbazole (a PAH heterocycle) in soil and selenium in sediment had HQs greater than 1 based on the food chain model. However, detected concentrations and frequency of occurrence of samples exceeding screening criteria were generally low, and the HQs were not significantly elevated; with the exception of one chemical (carbazole), all HQs were below 20 using the most conservative assumptions, and only one chemical marginally exceeded an HQ of 1 when more realistic assumptions were applied. Carbazole in soil had elevated HQs for several receptors, due to the extremely conservative TRV used in the food chain models. Carbazole is chemically related to PAHs and was detected at low concentrations that were consistent with PAHs at the site. However, the TRV for carbazole used in the food chain model was five orders of magnitude lower than PAHs, which resulted in a correspondingly higher HQ. No corroborating toxicity information for mammals was identified, but soil toxicity studies indicate that carbazole and

PAHs are similarly toxic. Therefore, the validity of the TRV for carbazole is considered questionable, and ecological impacts associated with exposure to carbazole are assumed to be negligible.

Based on the findings of the screening-level ecological risk assessment, the potential for adverse effects to populations of ecological receptors exposed to chemicals in soil, surface water, and sediment is expected to be very low.

1.0 Introduction

This screening-level ecological risk assessment (SLERA) evaluates the potential for adverse effects posed to ecological receptors from potential releases at Waste Water Treatment Plant No. 3 (WWTP3) at the former Plum Brook Ordnance Works (PBOW). The approaches used to evaluate the potential for ecological risk are described in the WWTP3 SLERA work plan (Shaw Environmental, Inc. [Shaw], 2009). This SLERA is consistent with the ecological risk assessment process described in U.S. Environmental Protection Agency (EPA) guidance (e.g., EPA [1997]), with Ohio Environmental Protection Agency (OEPA) Division of Emergency and Remedial Response guidance (OEPA, 2008), and with the procedures established in previous ecological risk assessments performed at PBOW (e.g., IT Corporation [IT], 2001a; Shaw, 2010a), with some adjustments to accommodate current practices in the field of ecological risk assessment.

This work is being conducted by Shaw for the U.S. Army Corps of Engineers (USACE) under the Defense Environmental Restoration Program-Formerly Used Defense Sites (DERP-FUDS) and managed by the USACE Huntington District, with technical oversight provided by the USACE Nashville District.

1.1 Facility Description and Location

PBOW is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland (Figure 1-1). Although located primarily in Perkins and Oxford Townships, the eastern edge of the facility extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S. Highway 250. The areas surrounding PBOW are mostly agricultural and residential. The facility is currently surrounded by a chain-link fence, and the perimeter is regularly patrolled. Access by authorized personnel is limited to established checkpoints. Public access is restricted. Hunting is allowed by permit on portions of PBOW during the annual deer hunting season.

1.2 Facility History and Background

The PBOW facility was constructed on property comprising 9,009 acres in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene, and pentolite (USACE, 1995). Production of explosives at PBOW began in December 1941 and continued until 1945. It is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured during the 4-year operating period. The three explosive manufacturing areas were designated

TNT Area A (TNTA), TNT Area B (TNTB), and TNT Area C (TNTC). Twelve process lines were used in the manufacture of TNT, including four lines at TNTA, three lines at TNTB, and five lines at TNTC.

After plant operations ceased, the manufacturing process lines were decontaminated by the War Department in late 1945. During decontamination, all structures, equipment, and manufacturing debris were either removed and salvaged or removed and burned. After decontamination, 3,230 acres of the property was initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified by the U.S. Army to be decontaminated. In 1949, PBOW was transferred to the General Services Administration. This transfer did not include the Plum Brook depot areas, which consist of approximately 2,800 acres. The Department of the Army reacquired the 3,230 acres in 1954 and performed remedial efforts from the mid-1950s until 1963. In 1955, the Army completed further decontamination of manufacturing process lines. This effort included removal of contaminated surface and subsurface soil around the building and wooden and ceramic waste disposal lines containing TNT. Thousands of pounds of TNT were discovered in catch basins; this TNT was removed and burned at the burning grounds.

Two property use agreements were entered into by the Army and the National Advisory Committee of Aeronautics, the predecessor of the National Aeronautics and Space Administration (NASA), in 1956 and 1958, respectively. Accountability and custody for the entire portion of the former PBOW property (6,030 acres) that had been under the accountability and custody of the Department of the Army were transferred to NASA on March 15, 1963. NASA performed further decontamination efforts during 1964. The NASA decontamination process included removing contaminated surface soil above the drain tiles, flumes, etc.; destruction of all buildings by fire; and removal of all soil, debris, sumps, and above-grade portions of concrete foundations. Portions of the concrete foundations located below grade were left buried, and some that had been previously slightly above grade were likewise buried. All materials, including the soil in those areas, were flashed. The area was then rough-graded. The decontamination process was also to have included the burning of nitroaromatic-filled flumes that were excavated (Dames and Moore, Inc. [D&M], 1997).

NASA has operated and maintained the former PBOW property since 1963, and the facility is currently the NASA Glenn Research Center, Plum Brook Station. NASA operates the property as a space research facility in support of their John Glenn Research Center at Lewis Field, Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the facility are currently on standby or inactive status. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. The Perkins Township Board of Education acquired 46 acres of the

excess acreage and uses this area as a bus transportation area. The General Services Administration retains ownership of the remaining excess acreage and currently has a use agreement with the Ohio National Guard for 604 acres of this land. The details of land transactions are listed in the site management plan (USACE, 1995).

1.3 Waste Water Treatment Plant No. 3 Description and History

The former WWTP3 is located in the western midsection of PBOW, approximately 650 feet southwest of the intersection of Maintenance Road and Ransom Road and 450 feet southeast of the patrol road. The area represented by the WWTP3 environmental samples occupies approximately 3 acres of land (Figure 1-2). During PBOW manufacturing operations from 1941 to 1944, WWTP3 acted as an overflow treatment plant for Waste Water Treatment Plant No. 1 (WWTP1) and Waste Water Treatment Plant No. 2 (WWTP2) and was connected to those facilities by a 6-inch steel sewer line (USACE, 1995). WWTP1 received wastes from TNTA and TNTB, while WWTP2 received waste from TNTC. The purpose of the treatment plants was to reduce the volume of waste water discharged from each of the manufacturing areas to the waste water ponds. The waste water that was transferred and received from the TNT manufacturing areas consisted of spent sulfuring acid and nitric acids and red water from the TNT purification process. Chemicals in the waste streams included sodium salts of sulfite, sulfate, nitrite, nitrate, sulfonates of unwanted TNT isomers, trinitrobenzoic acid, trinitrobenzaldehyde, trinitrobenzyl alcohol, nitrotoluenes, and dinitrotoluenes (D&M, 1996).

WWTP3 consisted of a neutral storage tank, an equalization tank, a condensate storage tank, an evaporator building, an incinerator, and a thick liquid storage tank. The waste water treatment plants received waste water from the TNT manufacturing settling basins and neutralized the slurry through a chemical depuration process. The liquid was discharged to open ditches or ponds surrounding the facilities or thickened by evaporation. The thickened liquid was then incinerated. The incinerators were located to the north of the storage tanks at WWTP3. Ash from the incinerator was disposed of in nearby ash pits associated with the waste water treatment plants.

The neutral storage tank of WWTP3 was converted by NASA into the K-Site control building. The K-Site itself was operated in the former Power House 3 Building (USACE, 2000), which is approximately 300 feet to the southeast of WWTP3. Operations at the K-Site Test Facility officially ceased in 2007. D&M (1995) conducted a review of records and found that a bermed, square depression north of WWTP3 and south of Maintenance Road may have been used as an ash settling basin.

1.4 Scope and Objectives

The objective of this SLERA is to provide an estimate of the potential for adverse ecological effects associated with contamination resulting from former PBOW activities at WWTP3. The results of the SLERA will contribute to the overall characterization of the site and may be used to determine the need for additional investigations or to develop, evaluate, and select appropriate remedial alternatives. Guidance documents used to perform the SLERA include the general guidelines of the *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel, et al., 1996), as well as the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1997), *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Guidance Bulletin No. 1* (EPA, 1996), and *Guidance for Conducting Ecological Risk Assessments* (OEPA, 2008). The SLERA fits into Steps 1 and 2 of the ecological risk assessment guidance for Superfund process (EPA, 1997), and Level I through a maximum of Level III evaluation using the OEPA (2008) process.

The goal of the SLERA is to evaluate the potential for adverse ecological effects to ecological receptors from site-related contaminants at the WWTP3. This objective is met by characterizing the ecological communities in the vicinity of the site, determining the particular contaminants present, identifying pathways for receptor exposure, and estimating the potential for adverse effects to identified receptors. The SLERA addresses the potential for adverse effects to the vegetation, wildlife, aquatic life (e.g., sediment-dwelling organisms), threatened and endangered species, and wetlands or other sensitive habitats associated with the site.

Concentrations of chemicals measured in relevant environmental media were used to perform a SLERA, which includes a problem formulation (Chapter 2.0), exposure characterization (Chapter 3.0), ecological effects characterization (Chapter 4.0), risk characterization (Chapter 5.0), and summary and conclusions (Chapter 6.0). These subtasks are described in greater detail in the following sections.

The SLERA evaluates the chemicals of potential ecological concern (COPEC), the ecosystems and receptors at risk, the ecotoxicity of the contaminants known or suspected to be present, and observed or anticipated ecological effects. This evaluation is conducted in two steps: (1) a screening assessment step and (2) a predictive assessment step. Ecological endpoints to be addressed in both steps are identified. The results and conclusions of the screening assessment determine whether a predictive assessment is needed. The criteria by which the need for a predictive assessment is measured are formalized as null hypotheses to be accepted (in which case a predictive assessment is not needed) or rejected (in which case a predictive assessment is needed).

2.0 Problem Formulation

The screening assessment null hypotheses are stated as follows:

- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of viable habitat for potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential exposure pathways.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential chemical stressors.

If one or more of these null hypotheses are accepted, a predictive assessment is not triggered. All four null hypotheses must be rejected for a predictive assessment to be triggered. The first three null hypotheses are tested with the results of the ecological site description, the pre-assessment reconnaissance, the documentation of potential receptors of special concern and critical habitats, and the determination of significant ecological threats (Section 2.1). The fourth null hypothesis is tested with the results of COPEC selection (Section 2.2).

If a predictive assessment is triggered, terrestrial and aquatic ecological conceptual site models are developed, as appropriate, and additional problem formulation tasks are performed as described in Sections 2.3 through 2.5.

2.1 Ecological Site Description

This ecological site description includes a general discussion of site background and the area of concern, surface water resources, wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities. A photographic record was made during the site reconnaissance (Figure 2-1). Information was obtained on the presence of state- and federally listed, threatened, and endangered species; species of special concern; and wildlife and fisheries resources. A botanist searched for threatened and endangered plant species during the reconnaissance visits. A checklist of biological species present at the site was developed using existing site investigation reports, environmental data sources mentioned previously, and information gathered during the site

reconnaissance. Information on unique and special-concern habitats, preserves, wildlife refuge parks, and natural areas within the general vicinity was also obtained.

2.1.1 General Site Background

PBOW, approximately 6,400 acres in size, is located within the Eastern Lake Plains physiographic region of the Eastern Huron/Erie Lake Plain Ecoregion (Lafferty, 1979; Omernik, 1986). This region is generally characterized as containing flat plains as the predominant land surface form and as having a dominant natural vegetation of elm and ash in undisturbed areas. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs. Much of the region is poorly drained due to the flat topography and low stream gradients. Many of the wetlands adjacent to Lake Erie in this region have been preserved by various federal, state, and private organizations (Peterjohn and Rice, 1991), thereby providing important wetland habitat for wildlife.

Across PBOW, the land slopes gently to the north-northeast towards Lake Erie. Elevations range from 675 feet above mean sea level at the southwest edge of the site to 625 feet above mean sea level in the northern portion of the property at Bogart Road, resulting in an average slope of approximately 0.3 percent. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (Ohio Department of Natural Resources [ODNR], 1985). However, since the U.S. Army acquired the site in 1941 and removed the land from agricultural production, undeveloped portions of the former PBOW have become second-generation forest and open fields. This has resulted in PBOW becoming an island of forest and open fields within a sea of agricultural land in north-central Ohio.

WWTP3 is approximately 3 acres in size, with minimal topography. WWTP3 surface water drains toward a small ditch or creek located in the northwest portion of the site that eventually drains into Pipe Creek.

Multiple site reconnaissance visits were performed by Shaw ecologists in the early fall of 2008 and the spring and early fall of 2009. A photographic record of the site was prepared and is presented on Figure 2-1. Prior to arrival at the site, Shaw personnel obtained relevant information on the site, including topographic, township, county, or other appropriate maps, and determined the location of potential ecological units such as streams, creeks, ponds, grasslands, forest, and wetlands on or near the site. Biological inventories performed in 1994 and 2001 at PBOW (ODNR, 1995; NASA, 2002) that identify and indicate the locations of threatened and endangered species at the installation were also reviewed. Shaw personnel completed a checklist similar to EPA’s checklist for ecological assessment/sampling (EPA, 1997); also, information

from this checklist was used to complete Chapter 2.0. The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Shaw personnel also used the reconnaissance to search for any indication of potential effects from contaminant release.

2.1.2 Surface Water

Due to the minimal topography at this site, surface water tends to pool in localized shallow depressions. The area as a whole drains to a north-south-trending ditch, which in turn drains to a small creek in the northwest portion of the site (Photos 6, 7, and 8 on Figure 2-1). This ditch is approximately 8 feet wide at the top, narrowing slightly towards the bottom of the ditch. Water was present in this ditch during the spring ecological site reconnaissance visit. The larger east-west-trending ditch to the northwest of WWTP3 also contained approximately 1 foot of water. No flow was observed in either ditch.

2.1.3 Wetlands

According to the National Wetland Inventory (NWI) maps for the area (U.S. Fish and Wildlife Services, 2011), there are no designated wetlands at the WWTP3 site. However, the NWI maps identify Ash Pit 3, which is a DERP-FUDS site approximately 400 feet to the south of WWTP3, as a freshwater pond wetland (wetland classification code PUBG, i.e., a palustrine system with an unconsolidated bottom, intermittently exposed). It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes such as PBOW, because minor depressions often contain isolated wetlands not easily identified through aerial photograph interpretation (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps). NASA is currently performing a wetland delineation study at PBOW. This delineation effort was not complete at the time of this SLERA's submittal. The delineation effort will better identify locations and extent of sensitive wetland habitat throughout the installation.

2.1.4 Vegetative Communities

Vegetative communities at the site were classified during the site reconnaissance trips and are documented in the photographic log (Figure 2-1) and vegetation community diagram (Figure 2-2). A list of the plant species identified at the site is presented in Table 2-1. WWTP3 consists mostly of an upland old field containing grasses and herbs (Photos 2 and 3 on Figure 2-1). This area appears to be periodically mowed and has a low diversity of grasses and herbs. A small area of successional woods is found along the banks of the drainage ditch (background of Photo 5, and Photo 6 on Figure 2-1). The drainage ditch contains some emergent wetland vegetation such as *Carex* spp. (sedges).

During the site reconnaissance, the study area was examined for vegetative stress, which included looking for plants displaying stunted growth, poor foliage growth, tissue discoloration, and a loss of leaf coverage. Vegetative stress attributable to chemical contamination was not observed at WWTP3. Based on site reconnaissance information, WWTP3 is a partially managed area characterized by disturbed and successional vegetation in the areas that are not regularly mowed. The shrub thicket areas adjacent to the ditch represent the areas of densest (and least disturbed) vegetation cover.

2.1.5 Species Inventory

Based on information from ODNR (1995) and collected during the site reconnaissance, species lists were prepared for plants, mammals, birds, reptiles, amphibians, and fish (Tables 2-1 through 2-6). Unless noted on the tables, the species listed in Tables 2-1 through 2-6 apply to the former PBOW as a whole and are not necessarily specific to WWTP3.

A total of 87 plant species were documented at WWTP3 during the spring and fall vegetation survey (Table 2-1). This comprises approximately 20 percent of the total number of species documented at PBOW either during the 1994 biological inventory (ODNR, 1995) or during vegetation surveys at other sites at the former PBOW (Appendix A).

Signs of 4 of the 43 species of mammals that may be found in the region based on species range maps were observed at the WWTP3 during site visits (Table 2-2), including opossum, cottontail rabbit, raccoon, and white-tailed deer. It is likely that other species are present but were not observed due to the short duration of the field visits.

A total of 130 species of birds are likely to be found in the region based on species range maps and field observations, and 105 species have been recorded at the former PBOW by ODNR during their multiyear studies (Table 2-3). PBOW lies within a major migratory corridor that is used by birds travelling between their southern wintering grounds and their breeding grounds in Canada. Of the species recorded by ODNR, 49 are neotropical migrants and would not be expected to nest at the former PBOW. Of the 20 bird species documented at the WWTP3 during the site visits performed by Shaw, 10 were identified as being present during the breeding season (Table 2-3).

Of the 14 species of reptiles that may be found in the region based on species range maps, 10 (71 percent) have been observed at the former PBOW, including turtles and snakes (ODNR, 1995; Table 2-4). No reptiles were observed during the WWTP3 site reconnaissance.

Of the 10 species of amphibians likely to be found in the region based on species range maps, 9 (90 percent) have been observed at the former PBOW (ODNR, 1995; Table 2-5), including salamanders, toads, and frogs. No amphibians were observed during the WWTP3 site reconnaissance.

According to ODNR (1995), a combination of electroshocking and seining conducted during the field investigation identified 14 species of fish at PBOW. Species observed included suckers, sunfish, minnows, sticklebacks, and bullheads (Table 2-6). Due to the intermittent nature of this ditch, fish are unlikely to be present. The larger ditch to the northwest of the site is likely to support some of the smaller fish species, however.

2.1.6 Threatened and Endangered Species Information

According to an Ohio Division of Natural Areas and Preserves review of their natural heritage maps and files (ODNR, 2010), there are records of State of Ohio threatened or endangered species within a 2-mile radius of the site. No federally listed species were identified. The state-listed species include the following:

- Bushy aster (*Symphyotrichum dumosum*) – endangered
- Canada St. John's wort (*Hypericum canadense*) – endangered
- Flat-leaved rush (*Juncus platyphyllus*) – endangered
- Rough rattlesnake-root (*Prenanthes aspera*) – endangered
- Ashy sunflower (*Helianthus mollis*) – threatened
- Dwarf bulrush (*Lipocarpha micrantha*) – threatened
- Field sedge (*Carex conoidea*) – threatened
- Greene's rush (*Juncus greenei*) – threatened
- Slender spike-rush (*Eleocharis tenuis*) – threatened
- Southern hairy panic grass (*Panicum meridionale*) – threatened
- Thin-leaved sedge (*Carex cephaloidea*) – threatened
- Tufted fescue sedge (*Carex brevior*) – threatened
- Twisted yellow-eye-grass (*Xyris torta*) – threatened
- Upland sandpiper (*Bartramia longicauda*) – threatened.

In addition, based on information contained in ODNR (1995) and NASA (2002), several species of threatened or endangered plants, potentially threatened plants, and threatened or endangered birds have been recorded at PBOW, as follows (current status as of September 2011, if different, is listed in parentheses):

- Grove sandwort (*Arenaria lateriflora*) – threatened (**not listed**)
- Purple triple-awned grass (*Aristida purpurenscens*) – potentially threatened
- Prairie false indigo (*Baptisia lactea*) – potentially threatened
- Broad-winged sedge (*C. alata*) – potentially threatened

- Round-fruited hedge-hyssop (*Gratiola virginiana*) – potentially threatened
- Tall St. John's wort (*H. majus*) – potentially threatened (**not listed**)
- Least St. John's Wort (*H. gymnanthum*) – endangered
- Rough pennyroyal (*Hedeoma hispidum*) – threatened (**potentially threatened**)
- Butternut (*Juglans cinerea*) – potentially threatened (**not listed**)
- Northern panic-grass (*Panicum boreale*) – threatened (**potentially threatened**)
- Virginia meadow beauty (*Rhexia virginica*) – potentially threatened
- Deer's tongue arrowhead (*Sagittaria rigida*) – threatened (**potentially threatened**)
- Tall nut rush (*Scleria triglomerata*) – potentially threatened
- Pale carrion flower (*Smilax herbacea*) – threatened (**not listed**)
- Lance-leaved violet (*Viola lanceolata*) – potentially threatened
- Cattle egret (*Bublucus ibis*) – endangered
- Bald eagle (*Haliaeatus leucocephalis*) – federally threatened (**state-threatened**)
- Black-crowned night heron (*Nycticorax nycticorax*) – threatened
- Trumpeter swan (*Cygnus buccinator*) – endangered
- Indiana bat (*Mytolis sodalis*) – endangered.

The site reconnaissance included detailed searches performed by a qualified botanist subcontractor during the October 2008 and June 2009 site visits. Based on the results of the site reconnaissance, no threatened or endangered plant species were found at WWTP3.

None of the threatened or endangered bird species are expected to be at the site. The cattle egret, trumpeter swan, and upland sandpiper are all considered rare visitors or migrants at the former PBOW (ODNR, 1995) and have not been documented nesting in the vicinity of the site. Upland sandpipers have been documented approximately 4,500 feet to the southeast of the WWTP3 (ODNR, 2010); however, breeding populations of this species are no longer present in this area (PBOW, 2010; NASA, 2002). The black-crowned night heron, an Ohio threatened species, is a regular visitor at ponds, streams, and ditches within the former PBOW, but it does not nest at the former PBOW (ODNR, 1995, 2010; NASA, 2002). The species is typically found near water and wetlands. Since the early 1980s, there has been a nesting colony of approximately 100 pairs located on an island in Sandusky Bay, approximately 10 miles north northwest of the study area (Peterjohn and Rice, 1991). As discussed in the SLERA for Ash Pit 3 (Shaw, 2010b), an active bald eagle nest was present at Ash Pit 3, which is located approximately 400 feet south of WWTP3. A sign near the southern boundary of WWTP3 states that trespassing is prohibited due to the presence of an endangered species. The bald eagle is an Ohio threatened species, having been delisted from the federal list of endangered species in 2007. The nest has been used by a pair of eagles for several years, during which time the pair has successfully hatched and fledged a number of young. However, a strong storm knocked down the nest in May, 2009. Two eaglets were recovered from the damaged nest and taken to a raptor rehabilitation facility. It is unknown if the nest has been rebuilt or if the adults have relocated their nesting site elsewhere in the area.

The Indiana bat, the only mammal in the above list, has widespread records from throughout Ohio, but is more concentrated in the southwestern portion of the state (NASA, 2002). This species has not been documented at the site and is generally not expected at PBOW because its preferred habitat (e.g., caves along streams or trees with exfoliated bark) is absent at the installation and is not present at the WWTP3. Trees with exfoliated bark, such as shagbark or shellbark hickory, are rare or not present at the site, respectively, thereby providing little bat roosting habitat (Appendix A). No Indiana bats were detected at the installation during the 2001 bat survey at PBOW (NASA, 2002).

With the exception of the Erie Sand Barrens State Nature Preserve (ESBSNP), there are no existing or proposed state nature preserves or scenic rivers near the site. ODNR is unaware of any unique ecological sites, geological features, breeding or nonbreeding animal concentrations, champion trees, state parks, forests, or wildlife areas within a 2-mile radius of the site (ODNR, 2010). The ESBSNP is located to the west-southwest of PBOW, approximately 0.5 mile from Patrol Road. The 32-acre preserve is a remnant sand beach of Lake Warren, the fifth ancestral Lake Erie, that supports many threatened and endangered plant species such as field sedge, Least St. John's wort, dwarf bullrush, twisted yellow-eyed-grass, flat-leaved rush, bushy aster, and Virginia meadow beauty. Many of the preserve's rare plant species thrive in open windswept conditions such as those found on the sand barrens. The Ohio Division of Natural Areas and Preserves actively manages the preserve to ensure that the wind-swept areas remain open and do not become overgrown with woody vegetation.

2.1.7 Pre-Assessment Reconnaissance

Shaw ecological scientists performed site visits to WWTP3 on October 16, 2008, and April 27 and June 2, 2009. The primary purpose of the April trip was to perform a habitat assessment and fauna inventory at the site, and it was intentionally performed during the period when birds are migrating north to their breeding grounds to ensure that transient species utilizing the site were identified. The primary purposes of the June and October site visits were to perform a summer and early fall walkover to identify plant species (including threatened and endangered species). The June visit was also used as a follow-up to the April fauna visit; during early June, breeding birds are vocalizing as they establish and defend territories, while nonbreeding birds have continued their migration to their breeding grounds further north and moved out of the area. Therefore, bird species identified during the June site visit were assumed be using the site for breeding. The list of plant species observed during the two site walks is presented in Table 2-1. The mammal and bird species observed at the WWTP3 are indicated in Tables 2-2 and 2-3, respectively.

Information obtained during the reconnaissance trips was used to select representative receptors, refine exposure scenarios for the risk assessment, and identify protected species or habitats of special concern in the study area. Reconnaissance personnel completed a checklist similar to that on EPA's checklist for ecological assessment/sampling (EPA, 1997) and OEPA's ecological risk assessment guidance (OEPA, 2008). The locations of known or potential contaminant sources affecting the site and the probable gradient of the pathway by which contaminants may be released from the site to the surrounding environment were identified. Reconnaissance personnel used the site visit to evaluate the site for more subtle clues of potential effects from contaminant release.

The methods used to characterize natural resources focused on aquatic and terrestrial resources at the site and within the immediate vicinity. General habitat maps showing the types and extent of vegetation communities present within the immediate vicinity of the site were prepared based on information collected during the site reconnaissance.

2.2 Selection of Chemicals of Potential Ecological Concern

A list of the WWTP3 media samples used for the SLERA is presented in Table 2-7. Sample locations are presented on Figure 2-3. From the chemical results of samples on this list, a COPEC selection process was performed to develop a subset of chemicals detected at the site that are not naturally occurring or are associated with non-site-related sources. These chemicals are also present at sufficient frequencies, concentrations, and spatial areas to pose a potential risk to ecological receptors. Examples of screening criteria that were used include the following: analytical detection limit, frequency of detection less than 5 percent, comparability with background, status as a nutrient, and comparison with risk-based screening ecotoxicity values. This selection process is described in more detail in Section 2.2.3.

2.2.1 Data Organization

Chemical analytical data, as well as all previous and ongoing investigations, were reviewed and evaluated for quality, usefulness, and uncertainty. Data identified as being of acceptable quality for use in the SLERA were summarized in a manner that presents the pertinent information to be applied in the SLERA. Any data rejected during the data evaluation as a result of the data evaluation ("R"-qualified data) were identified along with the rejection rationale. All data used in the SLERA were validated.

The data for each chemical were sorted by medium. For ecological impacts, soil from 0 to 6 feet below ground surface (bgs) was considered. The 0 to 6 feet depth interval was selected for three

primary reasons: (1) to maintain consistency with other PBOW ecological risk assessments (e.g., IT [2001a]), (2) to include potential exposure to ecological receptors that may be exposed to deeper soil, and (3) to increase the size of the total soil database by including samples collected from up to 6 feet bgs. Therefore, soil COPEC selection was performed for the 0 to 6 feet interval. At WWTP3, as at many sites at PBOW, following closure and removal of the manufacturing structures, tanks, and equipment, a local fill sand was brought to the areas to cover the remaining building foundations and demolition and to provide a natural landscape appearance. For this investigation, soil samples were collected from the original land surface (i.e., the soil below any encountered fill material) (Shaw, 2008). Therefore, the intended soil sampling depth intervals of 0 to 1, 3 to 5, and 8 to 10 feet bgs were adjusted downward based on the presence and depth of any fill material. For example, for sample WW0034, the intended sampling depth of 0 to 1 foot bgs was adjusted to 0.7 to 1.7 feet bgs due to the presence of 0.7 foot of fill material.

Chemicals not detected at least once in a medium were not included in the risk assessment. Available background data were determined for each medium. Potential sources of background information include data from previous and current investigations as well as monitoring wells in areas unaffected by site activities.

The analytical data included qualifiers from the analytical laboratory quality control or from the data validation process that reflect the level of confidence in the data. Some of the data qualifiers reported in the data evaluated for this SLERA and their meanings are as follows (EPA, 1989):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit.
- J - Value is estimated, concentration reported above the method detection limit and below the contract-required quantitation limit.
- R - Quality control indicates that the data are unusable (chemical may or may not be present).
- B - Concentration of chemical in the sample is not sufficiently higher than concentration in the blank. If the concentration in the sample is less than 5 times the blank concentration or less than 10 times the concentration of a common laboratory contaminant, the result is given a B-qualifier and is not used in the risk assessment. Common laboratory contaminants include acetone, 2-butanone, methylene chloride, toluene, and phthalate esters (EPA, 1989).

"J"-qualified data are used in the risk assessment; "R"- and "B"-qualified data are not. The handling of "U"-qualified data (nondetects) is described in the following sections.

2.2.2 Descriptive Statistical Calculations

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the 95 percent upper confidence limit (UCL) of the mean are usually estimated for chemicals of interest. The EPA ProUCL software (Version 4.00.05 [EPA, 2010]) was used to estimate UCLs for the data sets of all environmental media represented by at least five samples. If the data set consisted of fewer than five data points, the maximum detected concentration (MDC) was selected as the exposure point concentration (EPC). One-half the reporting limit was used as the ProUCL input concentration for nondetects.

ProUCL generates a variety of UCL estimates for each data set. Generally, the results of one or two (sometimes more) of the UCL estimates are recommended. This recommendation is based on a variety of factors, including the distribution (i.e., normal, lognormal, gamma, or not discernible) that provides the best fit, number of nondetects, size of the data set, and skewness. Occasionally, ProUCL will recommend the 97.5 or 99 percent UCL on the arithmetic mean estimated by the Chebyshev method. In these cases, the 95 percent UCL estimated by the Chebyshev method was selected as the EPC because this is more consistent with the intent of the reasonable maximum exposure (RME) paradigm as defined by EPA (1989; 2002).

Analytical data from field duplicates were joined with parent sample results to yield one result for use in the generation of mean and UCL concentrations, as follows:

- The average of field duplicate and parent sample was used if both were positive detections or if both were nondetects.
- The detected value was used if one sample was a positive detection and the other was a nondetect.

The UCL generated by the ProUCL protocol described in the preceding paragraphs or the MDC, whichever is lower, is selected as the EPC and is understood to represent a conservative estimate of average for use in the risk assessment. Unusually high detected values were retained in the calculation of the UCL concentration. Inclusion of these high values increases the statistical variability and the overall conservativeness of the hazard estimate.

2.2.3 COPEC Selection Criteria

The criteria used to identify COPECs in the SLERA are described in the following sections.

2.2.3.1 Comparison to Ecological Screening Values

MDCs of chemicals detected in various media were compared with ecological screening values (ESV) for ecological endpoints following recommendations received from OEPA and as discussed in EPA *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Bulletin No. 1* (EPA, 1996). Chemicals that exceed the ESVs, or for which no ESVs are available, were retained as COPECs if other COPEC selection criteria were also met. The following ESVs, or ESV hierarchy (as noted), were used for the ecological evaluation:

- ***Soil.*** Soil screening values were selected using the following hierarchy: (1) EPA ecological soil screening levels (EPA, 2008), (2) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), (3) EPA Region 5 ecological screening levels (EPA, 2003), (4) *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process* (Efroymson, et al., 1997b), and (5) *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants* (Efroymson, et al., 1997c). It should be noted that effects on heterotrophic processes may not be relevant to ecological receptors of concern at the site.

- ***Surface Water.*** The lowest surface water screening value was selected from the following three sources: (1) OEPA Water Quality Criteria (OAC Chapter 3745-1) for the protection of aquatic life, (2) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), and (3) EPA Region 5 ecological screening levels (EPA, 2003). Because OEPA water quality criteria do not consider food-chain effects, a hierarchy could potentially eliminate important surface water COPECs.

- ***Sediment.*** Sediment screening values were selected using the following hierarchy: (1) Consensus-based threshold effect concentration values (MacDonald, et al., 2000), (2) EPA Region 5 ecological screening levels (EPA, 2003), (4) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), and (5) *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* (Ontario Ministry of the Environment and Energy, 1993).

The development of the ESVs used for the former PBOW SLERAs is presented in Appendix B.

2.2.3.2 Frequency of Detection

Chemicals that are detected infrequently may be artifacts in the data that may not reflect site-related activity or disposal practices. These chemicals are not evaluated further in the risk assessment. Generally, chemicals that are detected only at low concentrations in 5 percent or less of the samples from a given medium (if at least 20 samples are analyzed) are dropped from further consideration, unless their presence is expected based on historical information about the site. Chemicals detected infrequently at elevated concentrations as compared with applicable

risk-based thresholds may identify the existence of “hot spots” and have been retained in the evaluation, unless other information exists to suggest that their presence is unlikely to be related to site activities.

2.2.3.3 Background Evaluation

Chemical concentrations were compared to site-specific background concentrations (see next paragraph for details) as an indication of whether a chemical is present from site-related activity or as natural background. This comparison is generally valid for inorganic chemicals but not for organic chemicals, because inorganic chemicals are naturally occurring and most organic chemicals related to waste water treatment are not. Statistical techniques are used as tools to aid the exercise of professional judgment in resolving site-related issues for metals, because metals are naturally present in most environmental media. The statistical techniques generally involve comparing the site data with background data. Background data are only available for soil at PBOW. Background soil values were also used to compare to concentrations in sediment from samples collected from the drainage ditch, as the bottom of the ditch is most likely composed of native soil, and accumulates sediment as a result of overland runoff from adjacent soils. Background data do not exist for surface water; therefore, a statistical background evaluation for this medium cannot be performed.

The first statistical technique used for the background screen is the comparison of the MDC of the site data set to the PBOW background screening concentration (BSC). It is noted that the method agreed upon for the development of BSCs, as recorded in the May 10, 2000 PBOW team meeting minutes, differs from that shown in current OEPA (2009) guidance. This PBOW team agreement, which has been used for all PBOW risk assessments to date, takes precedence over OEPA (2009) guidance. The background data set and derivation of soil BSCs for all PBOW soil investigations are described in IT (1998). The background soil samples were collected from near the property boundary, away from any potential source areas. BSCs were calculated for use at PBOW based on concentrations found in these background soil samples. Each BSC is either the MDC of the concentrations found in these background soil samples or the calculated 95th percent upper tolerance limit of the background data set, whichever value is lower (Shaw, 2005). The upper tolerance limit is the concentration, with a probability of 0.95 (or a confidence of 95 percent), that would cover 95 percent of background population if a larger number of samples were collected. Chemicals with MDCs less than their respective BSCs are consistent with background concentrations and are eliminated from further consideration. Use of this method for the development of BSCs and as part of the COPEC screening process ensures consistency among all of the PBOW FUDS project sites.

If the MDC of a chemical exceeds the BSC, the chemical is retained as a COPEC, or a more detailed statistical analysis may be performed to determine if the background data and the site data are drawn from the same population. The Wilcoxon Rank Sum (WRS) test is used for this purpose. The WRS test (also known as the Mann-Whitney U test) is described in Appendix M of Shaw (2005). WRS testing is performed for inorganic chemicals in soil whose MDCs exceed their respective BSCs and when the site and background data sets each contain less than 50 percent nondetects. The WRS test is not performed on data sets containing 50 percent or more nondetects because the medians of such data sets are unknown and the test lacks sufficient power to yield reliable results. Likewise, the WRS test is not performed on data sets of size $n < 5$; in such cases, the test lacks sufficient power to identify differences between the two samples. Site data sets are interpreted as being significantly different from PBOW background if the associated p-level is less than 0.05. WRS statistical output and box-and-whisker plots of the various inorganic COPEC data sets are appended to the SLERA for each inorganic data set evaluated against the site background data set. Analytes shown by the WRS results to exceed background (or for which the WRS testing was not run) are assumed to be site related and retained as COPECs. Analytes shown by the WRS results to be drawn from the same population as the background samples are assumed to be naturally occurring and are not retained as COPECs. Lead and nickel in soil met the criteria for performing the WRS test. Concentrations of nickel in soil were not statistically different from background concentrations; therefore, this metal is considered to be naturally occurring. Concentrations of lead in soil were determined to be significantly greater than background soil concentrations, and this metal was retained as a COPEC for further evaluation. Supporting information for the WRS tests, including box-and-whisker plots, are presented in Appendix C.

Chemicals that fail the background evaluation are assumed to be site related, and are not eliminated at this point of the screening process.

2.2.3.4 Essential Nutrients

Evaluating essential nutrients is a special form of risk-based screening applied to certain ubiquitous elements that are generally considered to be required nutrients. Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPECs because they are generally considered to be innocuous in environmental media. Other essential nutrients, including chloride, iodine, and phosphorus, may be eliminated as COPECs, provided that their presence in a particular medium is shown to be unlikely to cause adverse effects to biological health.

2.2.4 Summary of COPEC Selection

The results of the COPEC screening are presented in Tables 2-8 through 2-10 for soil, surface water, and sediment, respectively. The tables present the following information for each medium:

- Chemical name
- Frequency of detection
- Range of detected concentrations
- Range of detection limits
- Arithmetic mean (average) of site concentrations
- Distribution type
- UCL of the mean of the concentration (only for chemicals selected as COPECs)
- Appropriate ESV
- BSC
- COPEC selection conclusion: NO (with rationale for exclusion) or YES (selected).

The selected EPC is also presented for each chemical identified as a COPEC. For soil, two EPC results are presented, a total soil EPC for concentrations in the 0 to 6 feet bgs depth range and a surface soil EPC for concentrations in the 0 to 1 foot bgs depth range (with the depth ranges adjusted, as necessary, to account for the presence of sand fill material, as described in Section 2.2.1). These two sets of EPCs are used to evaluate various ecological receptors that may be exposed to different soil depths associated with their various life history characteristics (Section 3.1).

Footnotes in the tables provide the rationale for selecting or rejecting a chemical as a COPEC. In some situations, it is appropriate to reinstate as COPECs chemicals that have been eliminated using one or more of the screening criteria. Examples of these exceptions include potential breakdown products, chemicals known to have been used on site historically, chemicals with detection limits greater than the ESVs, and chemicals with high bioconcentration and/or bioaccumulation factors. A qualitative evaluation of the COPEC tables for soil, surface water, and sediment was performed to determine whether any rejected chemicals should be reinstated as COPECs. Three explosives compounds in soil (4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and 2,4,6-TNT) were selected as COPECs by the ESV comparison but were detected in less than 5 percent of soil samples (Table 2-8) and initially eliminated as COPECs. Due to the historical function of PBOW as a munitions manufacturing and storage plant, all three of these explosives compounds are likely site related. Therefore, these three chemicals were reinstated as COPECs due to their potential nature as site-related contaminants. The practice of reinstating infrequently detected chemicals that are known or strongly suspected of being site related,

as recommended by EPA (2001) guidance, does not follow the USACE's standard practice for performing SLERAs at Army sites.

Twenty-one COPECs were selected for total soil (Table 2-8), seven were selected for surface water (Table 2-9), and one was selected for sediment (Table 2-10). As discussed in Section 2.0, the SLERA null hypotheses state that potential for adverse ecological effects is minimal or nonexistent due to the lack of viable habitat, potential ecological receptors, potential exposure pathways, and/or potential chemical stressors. Given the selection of COPECs in multiple media and the finding that viable habitat, potential receptors, and potential exposure pathways exist at the site, none of the null hypotheses are accepted, and a predictive assessment is triggered. Chemicals not eliminated using the screening procedures previously presented are considered COPECs and are quantitatively evaluated in the predictive SLERA.

2.3 Ecological Endpoint (Assessment and Measurement) Identification

The first step in the predictive SLERA is the identification of assessment and measurement endpoints. The protection of ecological resources, such as habitats and species of plants and animals, is a principal motivation for conducting the SLERA. Key aspects of ecological protection are presented as policy goals. These are general goals established by legislation or regulatory agency policy that are based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (e.g., the Comprehensive Environmental Response, Compensation, and Liability Act and the National Environmental Policy Act). Other legislation includes the Endangered Species Act, 16 U.S. Code 1531-1544 (1993, as amended), and the Migratory Bird Treaty Act, 16 U.S. Code 703-711 (1993, as amended). To determine whether these protection goals are met at the site, assessment and measurement endpoints have been formulated to define the specific ecological values to be protected and to define the degree to which each may be protected.

Unlike the human health risk assessment process, which focuses on individual receptors, the SLERA focuses on populations or groups of interbreeding nonhuman, nondomesticated receptors. This is accomplished by selecting measurement endpoints (discussed below) that are related to parameters most likely to result in population-level effects (e.g., survival, growth, or reproduction) and consideration of lowest-observed-adverse-effect levels (LOAEL) in addition to no-observed-adverse-effect level (NOAEL) endpoints (Chapter 4.0). In the SLERA process, risks to individual receptors are assessed only if they are protected under the Endangered Species Act, are species that are candidates for protection, or are species of special concern.

Given the diversity of the biological world and the multiple values placed on it by society, there is no universally applicable list of assessment endpoints. Suggested criteria that may be considered in selecting assessment endpoints suitable for a specific ecological risk assessment are (1) ecological relevance, (2) susceptibility to the contaminant(s), (3) accessibility to prediction and/or measurement, and (4) definability in clear, operational terms (Suter, 1993). Selected assessment endpoints reflect environmental values that are protected by law, are critical resources, or have relevance to ecological functions that may be impaired. Both the entity and attribute are identified for each assessment endpoint.

Assessment endpoints are inferred from effects to one or more measurement endpoints. The measurement endpoint is a measurable response to a stressor that is related to the valued attribute of the chosen assessment endpoint. It serves as a surrogate attribute of the ecological entity of interest (or of a closely related ecological entity) that can be used to draw a predictive conclusion about the potential for effects to the assessment endpoint.

Measurement endpoints for this SLERA are based on toxicity values from the available literature and not statistical or arithmetic summaries of actual field or laboratory observations or measurements. When possible, receptors and endpoints have been concurrently selected by identifying those that are known to be adversely affected by chemicals at the site based on published literature. COPECs for those receptors and endpoints have been identified by drawing on the scientific literature to obtain information regarding potential toxic effects of site chemicals to site species. This process ensures that a conservative approach is taken in selecting endpoints and evaluating receptors that are likely to be adversely affected by the potentially most toxic chemicals at the site.

2.3.1 Assessment Endpoints

The assessment endpoints for WWTP3 are stated as “the protection of long-term survival and reproductive capabilities for terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, omnivorous aquatic mammals, and omnivorous aquatic birds.” The corresponding null hypothesis for each of the assessment endpoints is stated as “the presence of site contaminants within soil, surface water, sediment, vegetation, and prey will have no effect on the survival or reproductive capabilities of terrestrial invertebrates, herbivorous mammals, omnivorous mammals, insectivorous mammals and birds, carnivorous birds, benthic invertebrates, omnivorous aquatic mammals, and omnivorous aquatic birds.”

The list of assessment receptor species selected for the site is intended to provide a comprehensive representation of the foraging guilds that could be exposed to the site media on a regular, semi-regular, or highly infrequent basis. Historical information, the site reconnaissance (performed October 16, 2008, and April 27 and June 2, 2009), and the availability of toxicological data were used to select terrestrial and aquatic assessment receptor species. These receptors species are depicted in food web models (Figures 2-4 and 2-5). Food web models are simplified versions of the possible movement of contaminants through the food chain present or potentially present at the site. Due to lack of data for all possible species, key species have been selected to represent broad classes of organisms, or guilds.

The food web conceptual site models were developed to illustrate how the selected terrestrial and aquatic species are ecologically linked within food webs. One species was used to represent each of the major trophic levels and habitats at the site. The decision was made not to complicate the food web models with species names for organisms at the base of the food web (e.g., species names of terrestrial invertebrates). Thus, generic terrestrial invertebrates, benthic invertebrates, and aquatic invertebrates were used to represent the bottom of the food chain. For terrestrial invertebrates and plants, partitioning coefficients and simple empirical uptake models were employed to estimate COPEC concentrations within tissues (Chapter 3.0). Brief life history descriptions for the selected receptor species are provided in Appendix D.

All trophic levels may be exposed to COPECs, either by direct exposure to contaminated abiotic media or through ingestion of lower trophic level food items. Primary producers (plants) absorb COPECs (as well as nutrients) from soil and/or water. COPECs can adsorb to the sediment and detritus particles through abiotic processes. When these particles settle and become part of the benthic substrate, they may also become a source of COPECs to benthic communities. Various species of aquatic biota fulfill the role of aquatic herbivores (feeding on aquatic plants and suspended detritus) and predatory invertebrates (feeding on benthic invertebrate species). The combination of COPEC bioconcentration from water, ingestion of contaminated prey, and restricted ranges for aquatic organisms provides good conditions for significant bioaccumulation of COPECs. In terrestrial species, bioconcentration occurs in plants and invertebrates, and higher food chain receptors bioaccumulate COPECs through the ingestion of food items.

2.3.2 Measurement Endpoints

Measurement endpoints are frequently numerical expressions of observations (e.g., toxicity test results or community diversity indices) that can be compared statistically to detect adverse responses to a site contaminant. Examples of typical measurement endpoints include mortality,

growth, or reproduction parameters in toxicity tests; individual abundance; and species diversity (EPA, 1997).

For assessments, measurable responses to stressors may include LOAELs, NOAELs, lethal concentration to 50 percent of the test population, lethal dose to 50 percent of the test population, or effective concentration for 20 percent of the test population, collectively termed toxicity reference values (TRV) (see Chapter 4.0 for further explanation).

2.4 Selection of Assessment Receptors

In order to focus the exposure characterization portion of the SLERA on species or components that are the most likely to be affected and on those that, if affected, are most likely to result in significant impacts to the on-site ecosystem, the selection of assessment receptors focuses on species, groups of species, or functional groups that are directly related to the previously identified assessment endpoints (Section 2.3.1).

Site biota were organized into major functional groups. For terrestrial communities, the major groups are plants and wildlife, including terrestrial invertebrates, mammals, and birds. For aquatic and/or wetland communities, the major groups are flora and fauna, including vertebrates (water fowl and fish), aquatic invertebrates, and wetland/terrestrial mammals. Species presence and relative abundance were partly determined during the site reconnaissance.

Primary criteria for selecting appropriate assessment receptors include, but are not limited to, the following:

- The assessment receptor has a relatively high likelihood of contacting chemicals via direct or indirect exposure.
- The assessment receptor exhibits marked sensitivity to chemicals.
- The assessment receptor is a key component of ecosystem structure or function (e.g., importance in the food web, ecological relevance).
- The assessment receptor may be listed as rare, threatened, or endangered by a governmental organization, or the receptor consists of critical habitat for rare, threatened, or endangered species.

Additional criteria for selection of assessment receptors were used to identify species that offer the most favorable combination of characteristics for determining the implications of on-site contaminants. These criteria included (1) limited home range, (2) role in local nonhuman food

chains, (3) potential high abundance and wide distribution at the site, (4) sufficient toxicological information available in the literature for comparative and interpretive purposes, (5) sensitivity to COPECs, (6) relatively high likelihood of occurrence on site following remediation (if required), (7) suitability for long-term monitoring, (8) importance to the stability of the ecological food chain or biotic community of concern, and (9) relatively high likelihood that they will be present at the site or that habitats present at the site could support the species. Assessment receptors are representative species that are modeled for exposure to contaminants via multiple exposure routes. Organisms at the base of the food chain (i.e., plants, invertebrates, etc.) are not evaluated for food chain effects because direct exposure is the primary exposure route of concern for these organisms, and direct exposure effects are evaluated by the ecological benchmark comparison during the initial COPEC screening process. Therefore, these types of organisms are not selected as assessment receptors.

2.4.1 Terrestrial Receptors

Seven representative terrestrial receptor species that are expected or possible in the area of the WWTP3 (based on the ecological description of the site presented in Section 2.1) were selected as indicator species for the potential effects of COPECs. These indicator species represent two classes of vertebrate wildlife (mammals and birds) and a range of both body size and food habits and include herbivores, omnivores, and carnivores. The seven species selected include the deer mouse (*Peromyscus maniculatus*) (small omnivorous mammal), short-tailed shrew (*Blarina brevicauda*) (small insectivorous mammal), Eastern cottontail rabbit (*Sylvilagus floridanus*) (medium-sized terrestrial herbivorous mammal), marsh wren (*Cistothorus palustris*) (small insectivorous bird), white-tailed deer (*Odocoileus virginianus*) (large herbivorous mammal), raccoon (*Procyon lotor*) (medium-sized omnivorous mammal), and red-tailed hawk (*Buteo jamaicensis*) (large carnivorous bird).

A terrestrial food web is presented on Figure 2-4. Many of the species evaluated, particularly the deer mouse, cottontail rabbit, short-tailed shrew, marsh wren, and muskrat, have limited home ranges which make them particularly vulnerable to exposure from site contaminants. All of the selected terrestrial receptor species have a potential high abundance and wide distribution at the site; also, sufficient toxicological information (with the exception of some bird species) is available in the literature for comparative and interpretive purposes. All species are considered important to the stability of the local ecological food chain and biotic community. Finally, all the selected species have readily available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993).

Larger mammal species were generally not selected as sensitive receptors due to their large home ranges; however, the red-tailed hawk was retained due to its unique role as a top predator in the food chain and the white-tailed deer was retained due to its high abundance at the site. Small sites such as WWTP3 are unlikely to be spatially relevant for large ranging receptors such as deer, with home ranges of hundreds or even thousands of acres. However, such receptors are included for evaluation in the SLERA to meet administrative requirements. Smaller birds were generally not included because most are migratory. Estimated hazards to the selected terrestrial indicator receptors are considered protective of organisms with larger home ranges and/or migratory organisms. Area use factors were set to 100 percent for the mouse, shrew, rabbit, wren, and muskrat due to their relatively small home ranges (Section 3.1). However, for the deer, hawk, and raccoon, the area use factor was set at 0.002, 0.001, and 0.008 (or 0.2, 0.1, and 0.8 percent), respectively, based on these species' relatively large home ranges (518, 842, and 156 hectares, or 1,280, 2,081, and 385 acres, respectively), compared with the size of the site (approximately 3 acres).

Results of the assessment receptor selection process are presented in detailed biological and ecological descriptions called assessment receptor profiles (ARP). The biologically relevant criteria used to select the seven terrestrial assessment receptors are also discussed and summarized in the ARPs (Appendix D).

2.4.2 Aquatic Receptors

The only aquatic habitat at the site is the drainage ditch that runs through the western portion of the site. This ditch is only sporadically filled with water. Surface water samples were not collected during the 1999 site investigation because water was not present (Shaw, 2008). During the current environmental investigation, two of the three surface water samples collected in this ditch were modified slightly to account for dry conditions (one sample was moved approximately 20 feet north of the original location, and a sump was dug to collect enough water at a second location) (Shaw, 2008). However, this ditch flows into another ditch located parallel to Maintenance Road that has a more permanent supply of water (see Photos 7 and 8 on Figure 2-1), and it is assumed that the concentrations in WWTP3 ditch surface water and sediment could easily flow or drain into this more robust aquatic system.

Exposure to aquatic organisms within the ditch is assumed to occur via direct exposure to contaminants in the water column and via ingestion of benthic invertebrates as well as prey exposed to contaminants in surface water and sediment. Potential uptake through the aquatic food chain is evaluated for the raccoon (also considered as a terrestrial receptor) and muskrat (*Ondatra zibethicus*) (medium-sized aquatic herbivorous mammal). U.S. Public Health

Command, which provides review and counsel on ecological risk assessments for the Army, does not agree to the inclusion of the muskrat in the assessment. An avian aquatic omnivore such as the mallard (*Anas platyrhynchos*) is not evaluated because open water that can be used by mallards and other "dabblers" to forage for vegetation and other food sources is not present at the site.

Aquatic organisms represent some of the prey base for aquatic receptors (represented by the raccoon and muskrat). An aquatic food web is presented on Figure 2-5. The raccoon has been documented at the installation (Section 2.1) and has a potential high abundance and wide distribution at the site, and sufficient toxicological information is available in the literature for comparative and interpretive purposes. The muskrat is also likely to be found at PBOW (Table 2-2). Although the ditches adjacent to WWTP3 may be too small to support muskrat populations, this receptor is conservatively included to represent mammalian aquatic herbivores. Both the raccoon and muskrat have readily available exposure data, as summarized in the *Wildlife Exposure Factors Handbook* (EPA, 1993).

Results of the assessment receptor selection process, including a summary of the relevant biological criteria used to select the aquatic assessment receptors, are presented in the ARPs (Appendix D).

2.5 Ecological Site Conceptual Model

Pictorial representations of the evaluated food webs are presented on Figures 2-4 and 2-5. The accompanying text presented in Section 3.1 is intended to clarify the ecological site conceptual models (ESCM). The ESCMs trace the contaminant pathways through both abiotic components and biotic food web components of the environment. The ESCMs present all potentially complete exposure pathways. The ESCMs have been used as a tool for judging the appropriateness and usefulness of the selected measurement endpoints in evaluating the assessment endpoints and for identifying sources of uncertainty in the exposure characterization. Because of the small size of the site, the site is not spatially relevant to any significant degree for many of the depicted receptors. However, it is important to note that the site-specific SLERA was performed to satisfy administrative requirements.

3.0 Exposure Characterization

An estimate of the nature, extent, and magnitude of potential exposure of assessment receptors to COPECs that are present at or migrating from the site is presented in this section, considering both current and reasonably plausible future use of the site. Exposure characterization is critical in further evaluating the potential hazard associated with chemicals identified as COPECs during the screening process (Section 2.2). The exposure assessment has been conducted by linking the magnitude (concentration) and distribution (locations) of the contaminants detected in the media sampled during the investigation, evaluating pathways by which chemicals may be transported through the environment, and determining the points at which organisms found in the study area may contact contaminants.

3.1 Exposure Analysis

An exposure analysis was performed that combines the spatial and temporal distribution of the ecological receptors with those of the COPECs to evaluate exposure. The exposure analysis focuses on the bioavailable chemicals and the means by which the ecological receptors are exposed (e.g., exposure pathways). The focus of the analysis is dependent on the assessment receptors being evaluated as well as the assessment and measurement endpoints.

Exposure pathways consist of four primary components: source and mechanism of contaminant release, transport medium, potential receptors, and exposure route. A chemical may also be transferred between several intermediate media before reaching the potential receptor. All of these components have been addressed within this SLERA. If any of these components is not complete, then contaminants in the affected media do not constitute an environmental risk at the site. The major fate and transport properties associated with typical site contaminants are described in subsequent sections. These properties directly affect a contaminant's behavior in each of the exposure pathway components.

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil or sediment (e.g., during burrowing or dust-bathing activities), animals ingesting surface water, plants absorbing contaminants by uptake from contaminated sediment or soil, and dermal contact of aquatic organisms with contaminated surface water or sediment. Given the scarcity of available data for wildlife dermal and inhalation exposure pathways, potential hazard from these pathways is not estimated in this

SLERA. In addition, these pathways are generally considered to be incidental for most species, with the possible exceptions of burrowing animals and dust-bathing birds.

Food web exposure can occur when terrestrial or aquatic fauna consume contaminated biota. Examples of food web exposure include animals at higher trophic levels consuming plants or animals that bioaccumulate contaminants.

Bioavailability is an important contaminant characteristic that influences the degree of chemical-receptor interaction. The bioavailability of a chemical refers to the degree to which a receptor is able to absorb a chemical from the environmental medium. A chemical's bioavailability is a function of several physical and chemical factors such as grain size, organic carbon content, water hardness, and pH. Unless site-specific data are available, bioavailability is conservatively assumed to be 100 percent.

Daily doses of COPECs for vertebrate receptors were calculated using standard exposure algorithms. These algorithms incorporate species-specific natural history parameters (i.e., feeding rates, water ingestion rates, dietary composition, etc.) and also use site-specific area use factors, as follows:

$$Total\ Daily\ Dose = \left(\frac{\left(\left[Soil_j * IR_{soil} \right] + \left[Water_j * IR_{water} \right] + \left[\sum_{i=1}^{N} B_{ji} * P_i * IR_{food} \right] \right)}{Body\ Weight} \right) * AUF \qquad \text{Eq. 3.1}$$

where:

$Soil_j$	=	Concentration of COPEC "j" in soil
$Water_j$	=	Concentration of COPEC "j" in surface water
B_{ji}	=	Concentration of COPEC "j" in food type "i"
IR_{soil}	=	Soil ingestion rate
IR_{water}	=	Surface water ingestion rate
IR_{food}	=	Food ingestion rate
P_i	=	Proportion of food $type_i$ in receptor diet
AUF	=	Area use factor (equal to area of exposure unit/home range of receptor
Body Weight	=	Body weight of receptor.

Sediment may replace soil in Equation 3.1 for aquatic or semiaquatic receptors.

The first step in estimating exposure rates for terrestrial wildlife involves the calculation of feeding and drinking rates for site receptors. EPA (1993) includes a variety of exposure

information for a number of avian, herptile, and mammalian species. Information regarding feeding and drinking rates and dietary composition are available for many species or may be estimated using allometric equations (Nagy, 1987). Data on incidental ingestion of soil have also been gathered and are incorporated for the receptor species. Literature values for animal-specific sediment ingestion are used if available. However, such values generally are not available in the literature. Where sediment ingestion rates could not be found, the animal-specific incidental soil ingestion rate is used for sediment ingestion as well, if the receptor's life history profile suggests a significant aquatic component (e.g., raccoons' use of surface water in foraging activities). This information is summarized in Table 3-1.

To estimate dose associated with ingested food items, concentrations of COPECs in the vegetation or prey in the species' diet is estimated using bioaccumulation factors (BAF) (sometimes referred to as bioconcentration factors [BCF]). BAFs are based on regression models or scalar variables that reflect the potential for the COPECs to be present in food items at concentrations different from (usually greater than) the ambient environment. Differences in concentration are due to chemical-specific properties of the COPEC that affect its tendency to bioaccumulate in tissue, balanced by the innate ability of the species to regulate body burden levels of the chemical via metabolic and excretory processes.

Selection of appropriate BAFs is a critical component of food chain modeling. General approaches for BAF selection have been discussed in Sample and Suter (1994), EPA (1999a), U.S. Army Environmental Center (2005), and EPA (2008). An approach that is consistent with these sources was followed in the selection of BAFs for PBOW. The general hierarchy for selection of BAFs based on types of sources is as follows:

1. Use of regression equations derived from paired field- or laboratory-based measurements

2. Ratio-derived BAFs developed based on paired data of tissue concentrations compared to media concentrations where the BAF is equal to the tissue concentration divided by the concentration in the abiotic medium

3. Modeled equilibrium partitioning-derived BAFs based on physical or chemical characteristics

4. Assumptions based on values common to chemical class.

Both U.S. Army Environmental Center (2005) and EPA (1999a) support the use of ratio BAFs in preference to equilibrium partitioning-based BAFs, which are typically calculated based on

factors such as log octanol-water partition coefficient (K_{ow}) values, fraction of organic carbon in soil, or percent of lipids in invertebrates.

Other general recommendations provided in EPA (2008) were also followed, including the following:

- For selection of ratio-based BAFs, median values are selected over maximum or other high-end BAFs.
- BAFs for polycyclic aromatic hydrocarbon (PAH) accumulation into mammalian prey are assumed to equal zero due to the high metabolic breakdown of PAHs in mammals.

Regression equations used to calculate prey tissue concentrations of a specific chemical typically take the following general equation form:

$$\text{Ln}\ (C_{food}) = \text{slope value x ln}\ (C_{abiotic_media}) + \text{intercept value} \qquad \text{Eq. 3.2}$$

where:

C_{food}	=	Concentration of chemical in food type
$C_{abiotic_media}$	=	Concentration of chemical in abiotic media.

Ratio BAFs can be generally presented as follows:

$$C_{food} = \text{BAF x}\ (C_{abiotic_media}) \qquad \text{Eq. 3.3}$$

where:

C_{food}	=	Concentration of chemical in food type
$C_{abiotic_media}$	=	Concentration of chemical in abiotic media
BAF	=	Bioaccumulation factor.

BAFs calculated based on equilibrium partitioning typically use a physical constant of a chemical to generate a BAF. A generalized form for this calculation would be as follows:

$$\text{Log (BAF)} = \text{slope value x Log}\ (K_{ow}) + \text{intercept value} \qquad \text{Eq. 3.4}$$

where:

Log (BAF)	=	Log of the BAF for chemical in food type
K_{ow}	=	Octanol-water partition coefficient.

BAFs calculated based on equilibrium partitioning are applied in the same fashion as ratio-based BAFs to generate a tissue concentration value. Any K_{ow} values needed for BAFs based on equilibrium partitioning are obtained using the K_{ow} WIN application in EPA's EPI Suite software (http://www.epa.gov/oppt/exposure/pubs/episuite.htm).

Finally, where ratio-based BAFs are missing and where no equilibrium partitioning method has been developed for calculating BAFs, other methods, such as using BAFs for chemicals in the same class as surrogates, may be presented for establishing ratio-based BAFs.

Site-specific soil-to-earthworm and sediment-to-benthic invertebrate BAFs were developed for the Red Water Ponds site at PBOW. These BAFs were developed as part of a Phase II baseline ecological risk assessment (IT, 2001b) based on 28-day bioaccumulation studies performed using the earthworm species *Eisenia foetida* and the invertebrate species *Lumbriculus variegates.* BAFs were calculated after comparing tissue concentrations with concentrations detected in soil or sediment samples collected from the PBOW Red Water Pond areas. For the current SLERA, these PBOW-specific BAFs were used for the WWTP3 food chain models as well, when available. Both RME and central tendency (CT) BAFs were estimated in the Red Water Ponds risk assessment. The RME BAFs were based on all tissue concentration results, even if blank related, and the CT BAFs were based on blank-corrected tissue results. Although EPA recommends that median values are selected over maximum or other high-end BAFs, the RME sediment-to-aquatic invertebrate and soil-to-worm BAFs were conservatively selected over the CT BAFs as the selected BAFs for the WWTP3 SLERA, when available. The Red Water Ponds baseline ecological risk assessment also developed CT and RME BAFs for surface water to fish for two different PBOW sites, the West Area Red Water Ponds and Pentolite Road (IT, 2001b). These values were also adopted for use in the WWTP3 SLERA. When two surface water-to-fish values were available for a given chemical from the two areas, the average of the RME values was used as the BAF for the WWTP3 SLERA.

The hierarchies used to select BAFs specific to the various types of biota are presented below. Chemical-specific BAFs (or the regression equation used to calculate COPEC concentrations) for COPECs selected using the respective hierarchies are presented in Tables 3-2 through 3-6.

Table 3-2 presents the soil-to-plants BAFs for COPECs at the WWTP3. Soil-to-plants BAFs are also used to evaluate sediment-to-plant uptake at PBOW. Soil-to-plants BAFs are selected using the following specific hierarchy of sources:

1. EPA (2008) selected regressions
2. Efroymson, et al. (2001) regressions
3. EPA (2008) recommended non-regression BAFs
4. International Atomic Energy Agency (IAEA) (1994) BAFs
5. Baes, et al. (1984) BAFs (these values were often updated in the more recent IAEA [1994] publication).

Table 3-3 presents the soil-to-invertebrates (earthworms) BAFs for COPECs at WWTP3. Soil-to-invertebrates BAFs are selected using the following hierarchy of sources:

1. PBOW site-specific BAFs (IT, 2001b)
2. EPA (2008) selected regressions
3. Sample, et al. (1998a) regressions
4. Sample, et al. (1998a) median BAFs
5. Equilibrium BAF calculation method in EPA (2008) based on Jager (1998).

Table 3-4 presents the soil-to-mammals BAFs for COPECs at WWTP3. Soil-to-mammals BAFs are selected using the following hierarchy or sources:

1. EPA (2008) or Sample, et al. (1998b) selected regressions
2. EPA (2008) referenced BAFs (Note: per EPA [2008], a BAF of zero is used for all PAHs, TNT, and cyclotrimethylenetrinitramine.)
3. Sample, et al. (1998b) median BAFs
4. IAEA (1994) BAFs
5. Baes, et al. (1984) BAFs (These values were often updated in the newer IAEA [1994] publication.)
6. EPA (1999b) maximum calculated BAFs/BCFs for feeding guilds.

Table 3-5 presents the sediment-to-aquatic invertebrates BAFs for COPECs at WWTP3.

Sediment-to-aquatic invertebrates BAFs are selected using the following hierarchy of sources:

1. PBOW site-specific BAFs (IT, 2001b)
2. Ratio BAFs from Bechtel Jacobs Company, LLC (1998)
3. Ratio BAFs from EPA (1999b)
4. Ratio BAFs from other literature sources
5. Conservative default based on median BAF for polychlorinated biphenyls (PCB) from Bechtel-Jacobs Corporation, LLC (1998).

Table 3-6 presents the surface water-to-fish BAFs for COPECs at WWTP3. Surface water-to-fish BAFs are selected using the following hierarchy:

1. PBOW site-specific BAFs (IT, 2001b)
2. EPA (1999b) ratio BAFs

3. EPA (1989) ratio BAFs
4. Risk Assessment Information System database (Oak Ridge National Laboratory, 2008)
5. Equilibrium partitioning equation (Bintein and Devillers, 1993).

It should be noted that the BAFs presented in EPA (1989; 1999b) are given in units of milligrams per kilogram (mg/kg) (wet) per milligrams per liter (mg/L). These BAFs were adjusted to BAFs with dry weight units of mg/kg (dry) per mg/L by dividing by the proportion of solids of a fish (20 percent, as detailed in Table C-5 in EPA [2000]).

Ingestion rates for receptor species are typically developed as a quantity of wet weight material ingested. Soil analytical data results are typically reported on a dry weight basis. Literature-derived BAFs are often a mixture of dry weight to wet weight and dry weight to dry weight values. To avoid underestimating or overestimating food concentrations based on confusion over dry weight versus wet weight, final food concentrations are adjusted in the SLERA to report concentrations on a dry weight basis. Although it was not necessary to convert food intake rates from wet weight to dry weight in this SLERA, the moisture contents of the invertebrate and vegetative material in the receptor species' diets from the EPA's *Wildlife Exposure Factors Handbook* (EPA, 1993) can be used for this conversion, as follows:

- Earthworms - 84 percent
- Fruit - 77 percent
- Roots/young grass - 82 percent
- Seeds - 9.3 percent
- Fruit/young grass - 78 percent.

Exposure to four categories of environmental media are addressed in the SLERA, as discussed in the following subsections.

Soil Exposure Pathway. Soil exposure pathways are potentially important for terrestrial plants and animals at the site. For nonburrowing animals, exposure to soil from a depth of 0 to 1 foot bgs (extended to 0 to 1.7 feet bgs for this SLERA, due to the presence of fill material [Section 2.2.1]) was considered, as this soil depth would represent the depth of regular exposure. For burrowing animals such as the shrew, exposure to soil from a depth of 0 to 6 feet bgs was considered. It is noted that although the shrew itself may not actually burrow to a depth of 6 feet, there may be other burrowing mammals that do burrow this deep. For plants and herbivores that feed on deep-rooted plants (e.g., the white-tailed deer, which is assumed to ingest leaves of trees translocating COPECs from subsoils), exposure to soil from a depth of 0 to 6 feet bgs (or the water table surface) was also evaluated because most feeder roots are located within this depth.

Thus, the shrew and the white-tailed deer (Figure 2-4) were evaluated for exposure to deeper (0 to 6 feet bgs) soil. All other receptors exposed to soil were evaluated for exposure to concentrations in surface (0 to 1 foot bgs) soil.

Environmental conditions such as soil moisture, soil pH, and cation exchange capacities significantly influence whether potential soil contaminants remain chemically bound in the soil matrix or can be chemically mobilized (in a bioavailable form) and released for plant absorption. Generally, neutral to alkaline soils (soil pH of 6.5 or greater) restrict the absorption of toxic metals, making pathway completion to plants difficult.

Sediment Exposure Pathway. Sediment consists of materials precipitated or settled out of suspension in surface water, or native soils underlying flowing or standing surface water bodies. Potential contaminant sources for sediment include overground transport from the WWTP3 area and contaminated surface water, groundwater, and soil. The release mechanisms include surface water runoff, groundwater discharge, and airborne deposition. Potential receptors of chemicals in contaminated sediment include aquatic flora and fauna. Direct exposure routes for contaminated sediment include contact by benthic-dwelling organisms such as amphipod invertebrates, uptake by aquatic flora, and ingestion by aquatic fauna. Indirect exposure pathways from sediment include consumption of bioaccumulated contaminants by consumers in the food chain. Chemical bioavailability of many nonpolar organic compounds (e.g., PCBs and pesticides) decreases with increasing concentrations of total organic carbon in the sediment; however, these compounds can still bioaccumulate up the food chain (Landrum and Robbins, 1990).

Surface Water Exposure Pathway. Surface water represents a potential transport medium for COPECs. Potential sources for contaminated surface water include overground transport from the WWTP3 area, contaminated soil/sediment and groundwater, and deposition of airborne contaminants. The release mechanisms include surface runoff, leaching, and groundwater seepage. Potential receptors of contaminated surface water include terrestrial and aquatic fauna and aquatic flora. Exposure routes for contaminated surface water include ingestion by terrestrial fauna and uptake and absorption by aquatic flora and fauna. Consumption of bioaccumulated contaminants constitutes a potential indirect exposure pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness, pH, and total suspended solids.

Groundwater Exposure Pathway. Groundwater represents a potential transport medium for COPECs. Potential contaminant sources for groundwater include leaching of contaminants in soil.

Groundwater itself is not an exposure point in ecological risk assessments, although contaminant transport along the shallow groundwater pathway may be considered an exposure route to wildlife where the groundwater discharges to surface water. This pathway is of importance to aquatic receptors if groundwater is found to be discharging to surface water. Because this scenario is unlikely at WWTP3, groundwater was not directly evaluated in this SLERA. However, surface water samples were collected from the drainage ditch in May 2009 during the wet season, the season when groundwater discharge to the ditch is most likely. Thus, the surface water evaluation considers potential impact from contaminants that may be present in groundwater under exposure conditions in an aquatic habitat.

3.2 Exposure Characterization Summary

The estimated chemical intakes for each exposed receptor group under each exposure pathway and scenario are presented in the risk characterization spreadsheets in Appendix E. These intake estimates are combined with the COPEC toxicity values, discussed in the following chapter, to derive estimates and characterize potential ecological hazard. The chemical data used in the SLERA are presented in Appendix F. The uncertainties associated with the estimation of chemical intake are discussed in Section 5.2.

4.0 Ecological Effects Characterization

The ecological effects characterization primarily describes the development of TRVs, which provide a reference point for the comparison of toxicological effects upon exposure to a contaminant and are compared against calculated receptor doses. For the assessment receptors described in Section 2.4, TRVs are compared to the daily dose of a COPEC the receptor incurs from all relevant exposure pathways to calculate an HQ for that chemical. TRVs are not used for evaluating plants or invertebrates, which are evaluated in terms of potential hazards at a community scale rather than a species scale. For these types of receptors, potential hazard associated with direct contact with the medium of concern is evaluated using the original comparison of the COPEC's concentration to ESVs (Section 2.2.3.1), which are generic benchmarks protective of the survival of aquatic and terrestrial organisms..

Development of Toxicity Reference Values. TRVs focusing on the growth, survival, and reproduction of species and/or populations have been developed for the WWTP3 SLERA. TRVs used in PBOW SLERAs were obtained from EPA guidance documents and the open literature, as available, including the following sources:

- *Toxicological Benchmarks for Wildlife* (Sample, et al., 1996)
- *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA, 1999b)
- Los Alamos National Laboratory (LANL) ECORISK Database (LANL, 2010)
- U.S. Army Center for Health Promotion and Preventive Medicine Wildlife Toxicity Assessments
- Technical papers published in peer-reviewed journals (e.g., Rigdon and Neal [1963]).

Empirical data are available for the specific receptor-endpoint combinations in some instances. Data on surrogate species and/or on endpoints other than the NOAEL and LOAEL were considered as necessary. The NOAEL is a dose of each COPEC that produced no known adverse effects in the test species. The NOAEL was judged to be an appropriate toxicological endpoint because it would provide the greatest degree of protection to the receptor species. In addition, the LOAEL was used as a point of comparison for risk management decisions. In instances where data are unavailable for a site-associated COPEC, toxicological information for surrogate chemicals or groups of chemical was used. Safety factors were used to adjust for these

differences and extrapolate risks to the site's receptors at the NOAEL and/or LOAEL endpoint. This process is described in the following paragraphs.

Toxicity information pertinent to identified receptors has been gathered for those analytes identified as COPECs. Because the measurement endpoint ranges from the NOAEL to the LOAEL, preference has been given to chronic studies noting concentrations at which no adverse effects were observed and those for which the lowest concentrations associated with adverse effects were observed. Where data are unavailable for the exposure of a receptor to a COPEC, data for a surrogate chemical or group of chemicals were considered for use in the SLERA.

Whenever possible, studies that use the site-specific target wildlife receptors were utilized. When studies for these species were not available, alternative species studies were used. TRVs are not applied across classes under any circumstances (e.g., a TRV for a bird species may not be used to estimate hazard for a mammal species). In instances where TRVs for multiple avian or mammalian species are supported, the TRV for the most similar species to the assessment receptor based on feeding strategy and physiological attributes were used in the SLERA. For example, avian TRVs based on both quail and kestrel test species data are available for lead, which was identified as a COPEC in soil and surface water. The quail TRV was used in the food chain model to evaluate the marsh wren measurement receptor because both the quail and the wren have an insectivorous component to their diet, whereas the kestrel TRV was used for the red-tailed hawk due to closer taxonomic similarity and foraging patterns (i.e., carnivorous). The following TRVs had values for multiple test species available, which were applied to the various assessment receptors according to the table below:

COPEC	TRV Test Species	Assessment Receptor
Lead	quail	Marsh Wren
	kestrel	Red-Tailed Hawk
Mercury	mink	Raccoon, Muskrat
	mouse	Deer Mouse, Short-Tailed Shrew, Cottontail Rabbit, White-Tailed Deer
Selenium	duck	Marsh Wren
	owl	Red-Tailed Hawk
Aroclor 1254	mink	Raccoon, Muskrat
	mouse	Deer Mouse, Short-Tailed Shrew, Cottontail Rabbit, White-Tailed Deer

Using the relevant toxicity information, TRVs were calculated for each of the COPECs. TRVs represent NOAELs and LOAELs with the safety factors presented in Wentsel, et al. (1996),

applied to toxicity information that was derived from studies other than no-effects or lowest-effects studies (Figure 4-1).

Because NOAELs and LOAELs for the selected wildlife receptor species are based on data from test species that are usually different from the species of concern, previous ecological risk assessment often applied a mathematical adjustment to the TRVs using a power function of the ratio of species body weights (e.g., Sample, et al. [1996]). This practice is often referred to as allometric scaling. Alternately, uncertainty factors have also been used to adjust the TRVs when the toxicity values were based on a different species from the evaluated receptor to account for the potential differences in species' chemical sensitivities. However, in recent years, these practices have been discouraged by most scientific and regulatory groups. Recent reviews of these practices (EPA, 2008; Allard, et al., 2009) have concluded that the use of allometric scaling of TRVs does not reflect a sound application of toxicological or ecological risk practices because supporting data for this practice are limited, and the ratio relationships used for the mathematical conversions were developed based on acute (rather than chronic) toxicity data. Allard, et al. (2009), also concluded that uncertainty factors based on an arbitrary multiplier should not be used without a scientific basis for their application. Therefore, the use of toxicity data without adjustments as reported in the literature is regarded as the most technically sound approach and is adopted for this SLERA. The TRVs used for this SLERA are summarized in Tables 4-1 and 4-2 for mammals and birds, respectively.

5.0 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. The result is a determination of the potential, severity, and characteristics of adverse ecological effects to environmental stressors present at a site. Qualitative and semiquantitative approaches were used to estimate the potential for adverse ecological effects occurring as a result of exposure of the selected site receptors to COPECs. Because potential adverse effects to terrestrial and aquatic plants and invertebrates have been qualitatively assessed during the initial COPEC screening step, the risk characterization focuses on potential impacts to assessment receptors (Section 2.3).

For the semiquantitative predictive assessment, TRVs and exposure rates were calculated and used to generate hazard quotients (HQ) (Wentsel, et al., 1996). HQs are calculated by summing intake doses across all exposure pathways for each chemical for a given receptor and dividing by the TRV. HQs for those chemicals that have a similar mode of toxicological action are typically summed to account for cumulative effects. In this SLERA, the two PCBs and the four dinitrotoluenes were identified as potentially having similar mechanisms of toxicity, and their HQs were summed. HQs are a means of estimating the potential for adverse effects to organisms at a contaminated site and for assessing the potential that toxicological effects will occur among site receptors.

5.1 Hazard Estimation for Terrestrial and Aquatic Wildlife

The hazard estimation was performed through a series of quantitative HQ calculations that compare receptor-specific exposure doses with TRVs. The HQs are compared to HQ guidelines for assessing the hazard posed from contaminants. HQs less than or equal to 1 represent no probable risk. Uncertainties associated with HQs are discussed in Section 5.2.

Table 5-1 summarizes the NOAEL and LOAEL-based HQs for the eight evaluated assessment receptors. Two metals (lead and selenium), two PCBs (Aroclor 1016 and Aroclor 1254), and four semivolatile organic compounds (SVOC) (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and carbazole) had HQs greater than 1 when rounded to one significant figure. These chemicals are discussed in greater detail in the following paragraphs.

Lead exceeded an HQ of 1 only for the marsh wren (Table 5-1). Lead is a COPEC in both soil (Table 2-8) and surface water (Table 2-9), although soil exposure pathways accounted for nearly the entire hazard (earthworm ingestion accounted for approximately 95 percent of the exposure

dose [Table E-4 in Appendix E]). Lead was detected in 4 out of 23 samples at concentrations exceeding both its ESV and BSC (range: 60.1 to 134 mg/kg). The HQ for the wren was not elevated (i.e., greater than 10) and the LOAEL-based HQ did not exceed 1, which suggests that there is low concern for ecological toxicity associated with exposure to lead.

Selenium exceeded an HQ of 1 only for the muskrat (Table 5-1). Selenium is a COPEC in both surface water (Table 2-9) and sediment (Table 2-10), although sediment exposure pathways accounted for nearly the entire hazard (aquatic plant ingestion accounted for approximately 99.9 percent of the exposure dose [Table E-8 in Appendix E]). Selenium was detected in one out of three sediment samples at a concentration that marginally exceeded its BSC (2.8 mg/kg compared with a BSC of 2 mg/kg). No ESV was available for selenium; therefore, it was conservatively retained as a COPEC. The NOAEL-based HQ for the muskrat was not elevated (i.e., greater than 10) and the LOAEL-based HQ did not exceed 1, which suggests that there is low concern for ecological toxicity associated with exposure to selenium.

Two PCBs, Aroclor 1016 and Aroclor 1254, were identified as COPECs in soil (Table 2-8) and had HQs greater than 1 for the marsh wren. Aroclor 1254 also had HQs greater than 1 for the deer mouse and short-tailed shrew. Total PCBs exhibited a similar pattern of HQ exceedances. Of these exceedances, only the marsh wren exposed to Aroclor 1016 had both NOAEL- and LOAEL-based HQs greater than 1 when rounded; however, the LOAEL-based HQ only marginally exceeded 1 (HQ = 1.9 [Table 5-1]). Aroclor 1016 and Aroclor 1254 were detected in 3 and 2 out of 16 soil samples, respectively. For both PCBs, only one sample had a concentration that exceeded the ESV of 0.371 mg/kg; WWTP3-SB02 had a concentration of 1.22 mg/kg for Aroclor 1016 and PBOW99-SSW302 had a concentration of 1 mg/kg for Aroclor 1254. Due to the infrequent detection frequency, the relatively low HQ values, and the fact that only 1 out of 16 samples exceeded the ESV for each chemical, Aroclor 1016 and 1254 are considered to be of relatively low concern for ecological exposure.

Three PAH COPECs in soil had HQs greater than 1 when rounded to one significant figure. Benzo(a)anthracene had an HQ greater than 1 for the deer mouse (HQ = 2.4), short-tailed shrew (HQ = 1.67), and marsh wren (HQ = 2.04). Benzo(b)fluoranthene had an HQ greater than 1 only for the marsh wren (HQ = 4.46), and chrysene had an HQ greater than 1 only for the deer mouse (HQ = 2.01). All exceedances were based on NOAELs; all LOAEL-based HQs for these three PAHs did not exceed 1 when rounded. PAHs are anthropogenic compounds that are commonly found in the environment due to their widespread generation from the incomplete combustion of fossil fuels. For all three PAHs, the same four samples exceeded the ESV of 1.1 mg/kg: WWTP3-SB02, PBOW99-SSW303, WWTP3-SB01, and PBOW99-SSW302. The MDCs for all

PAHs were detected at sample location WWTP3-SB02, which is just to the southwest of the former neutralization tank.

Possible non-U.S. Department of Defense-related sources exist for the surface soil samples with elevated PAHs. WWTP3-SB02 and WWTP3-SB01 were collected immediately to the southwest and northwest, respectively, of the former neutralization tank, which has been used by NASA as the K-Site control building and associated patio. During the May 2011 ecological reconnaissance visit, a gas grill was located on the small patio outside the building, within approximately 20 feet of boring SB-02. This grill was also observed during a 2009 reconnaissance. It is possible that the grill may be a source of PAHs at the SB-01 and SB-02 locations, although no evidence was observed that the grill was cleaned immediately near either of these sampling locations. Another possible source for the PAHs at SB-01 is a utility pole immediately adjacent to this sampling location; PAHs associated with the preservative treatment used on the pole may over time have made their way to the soil. NASA received funding to demolish this building and has agreed to take responsibility for addressing elevated PAH concentrations in the immediate vicinity of the former K-Site building and patio during demolition. NASA razed the building in October 2012, and the associated soil was appropriately disposed of. This area of NASA responsibility, depicted on Figure 3-2, has been excluded from the DERP-FUDS program and is thus no longer part of DERP-FUDS Project G05OH001817. Samples PBOW99-SSW302 and PBOW99-SSW303 are outside of the area of NASA responsibility. PBOW99-SSW303 is immediately east of an access road, and PBOW99-SSW302 is in a parking area less than 50 feet from the access road and adjacent to a utility pole. It is likely that asphalt, preservative treatment from the utility pole, and possibly vehicle traffic represent sources of PAHs at these two sample location. Because the three PAHs with elevated HQs are common anthropogenic compounds that are likely not site related, and because the NOAEL-based HQs were not elevated (i.e., were not greater than 10) and the LOAEL-based HQs did not exceed 1 when rounded, benzo(a)anthracene, benzo(b)fluoranthene, and chrysene are considered to be of relatively low concern for ecological exposure.

One chemical, carbazole, had very high HQs, ranging from 7.64 for the raccoon to over 5,000 for the deer mouse (Table 5-1). Carbazole is a heterocycle, which is a PAH in which one of the carbons within the aromatic structure is substituted by a nitrogen atom. Carbazole occurs as a natural constituent of creosote and coal tar (Agency for Toxic Substances and Disease Registry, 2002). This chemical was a COPEC in soil and was detected in 3 out of 16 samples at concentrations ranging from 0.0443 to 1.12 mg/kg (Table 2-8), which are consistent with detected concentrations of other PAHs. Also, the MDC was detected at the same sample location (WWTP3-SB02) as the MDC for the PAHs and was an estimated (i.e., “J”-qualified)

concentration below the detection limit. It is noted that this sample location is within the area of NASA responsibility and is no longer within the DERP-FUDS program. No ESV was available for this chemical. The elevated food chain model HQs for carbazole are the result of the use of a mammalian NOAEL and LOAEL TRV of 2.3E-05 and 2.3E-04 milligrams per kilogram per day (mg/kg-day), respectively (Table 4-1). Avian TRVs were not identified for this chemical. These mammalian TRVs are approximately three orders of magnitude lower than the next-lowest TRV used in this SLERA, which is the Aroclor 1254 TRV of 0.068 mg/kg-day, and are approximately five orders of magnitude lower than other PAHs (benzo[a]pyrene TRV = 0.17 mg/kg-day). The carbazole TRV was adopted from the LANL EcoRisk database (LANL, 2010) and was derived from a chronic study in which female mice were exposed orally to carbazole mixed in feed at 0.6, 0.3, or 0.15 percent carbazole in their diet for 96 weeks. Survival rates of the test organisms were reduced in relation to control groups due to intraperitoneal hemorrhaging associated with rupture of liver tumors (LANL, 2010). No alternate mammalian TRVs for carbazole were identified in the literature, but several soil toxicity studies have shown that heterocycles, including carbazole, do not exhibit significantly different toxicity to soil invertebrates compared with their unsubstituted hydrocarbon counterparts (i.e., PAHs) (Wassenberg, et al., 2005; Sverdrup, et al., 2001, 2002a,b). Therefore, these studies do not corroborate or support the use of a TRV for carbazole that is five orders of magnitude lower than TRVs for PAHs.

TRVs were not identified for dibenzofuran (both mammals and birds) or carbazole (birds only). Both chemicals were selected as COPECs in soil because they lacked screening values (Table 2-8). Dibenzofuran was detected in 3 out of 16 samples at estimated ("J"-qualified) concentrations of 0.078 to 1.35 mg/kg. Carbazole detection patterns were discussed in the previous paragraph. Although the lack of toxicity data represents an uncertainty in the SLERA, the presence of low-level concentrations of these two chemicals in fewer than 20 percent of the samples is unlikely to impact ecological receptors at the site.

5.2 Uncertainty Analysis

A number of factors contribute to the overall variability and uncertainty inherent in ecological risk assessments. Variability is due primarily to measurement error and natural variability of chemical concentrations in environmental media. Laboratory media analyses, sampling design/methods, and receptor study design are the major sources of this kind of error. Uncertainty, on the other hand, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable; therefore, all toxicity information derived from toxicity testing, field studies, or observation have uncertainties associated with them. Laboratory studies conducted to obtain site-specific, measured information often suffer from

poor relevance to the actual exposure and uptake conditions on site (i.e., bioavailability, exposure, assimilation, etc., are generally greater under laboratory conditions than under field conditions). Calculating an estimated value based on a large number of assumptions is often the only alternative to the accurate, albeit costly, methods of direct field or laboratory observation, measurement, and/or testing. Finally, habitat- or site-specific species may be misidentified if, for example, the observational assessment results are based on only one or even two brief site reconnaissance surveys.

The uncertainty analysis describes many of the major assumptions made for the SLERA. When discernible, the direction of bias caused by each assumption (i.e., whether the uncertainty results in an overestimate or underestimate of risk) is provided as well. Where possible, a description of recommendations for minimizing the identified uncertainties if the SLERA progresses to higher-level assessment phases is also presented.

The most important uncertainties associated with this SLERA are discussed in the following paragraphs.

Assumptions of Bioavailability. The assumption that COPECs are 100 percent bioavailable likely overestimates the potential for adverse effects. The time that has lapsed since the contaminant release affects bioavailability as the contaminant becomes sequestered or transformed within the environmental media. Sequestration, transformation, and bioavailability are influenced by medium characteristics including pH, temperature, and organic carbon content. Factor interactions and nonlinear relationships among these characteristics increase the complexity in predicting bioavailability at a given site. Further, these characteristics have not been extensively measured at WWTP3. Therefore, the magnitude of the overestimation of the potential for adverse effects resulting from the assumption that COPECs are 100 percent bioavailable is unknown at this site.

Use of Laboratory-Derived or Empirically Estimated Partitioning and Transfer Factors. The use of laboratory-derived or empirically estimated partitioning and transfer factors to predict COPEC concentrations in plants, invertebrates, prey species, and sediment likely overestimates potential hazards. As discussed previously, the incorporation of COPECs into the food chain is influenced by the characteristics of the exposure medium, which likely differs from that used in the laboratory to derive partitioning and transfer factors.

Use of Laboratory-Derived Toxicity Reference Values. The use of laboratory-derived TRVs may overestimate or underestimate the potential for adverse effects. The method of

administration of the contaminant in the laboratory is typically different than that experienced in the wild by the receptors. Also, laboratories typically use "naïve" organisms in their toxicity testing, which are likely to be much more sensitive to toxicants than organisms living in the wild or at the site, which have likely developed resistances or have otherwise adapted to ambient concentrations of chemicals in their environment.

Use of the HQ Method to Estimate Risks to Populations or Communities. The calculation of HQs also introduces uncertainty. The following limitations associated with HQs (Tannenbaum, et al., 2003) are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (e.g., estimated HQs greater than 1,000, such as those calculated for carbazole [Table 5-1]).
- Trace soil concentrations of inorganic chemicals (including concentrations well below background levels) can lead to HQ threshold exceedances.
- HQs are not linked to a temporal scheme (e.g., any particular HQ value holds the same interpretation for a site of any age).

Therefore, it should be understood that HQs greater than 1 do not mean that adverse ecological effects are occurring or may occur in the future. Although OEPA considers HQs greater than 1 to be potentially significant, the following interpretation of HQ ranges from Wentsel, et al. (1996) takes into consideration the uncertainties inherent in HQs and provides a basis for possible recommendations:

- HQs from 1 to less than 10 represent a low potential for environmental effects.
- HQs from 10 to less than 100 represent a significant potential that effects could result from greater exposure.
- HQs greater than 100 represent the highest potential for expected effects.

Although HQs are effective as screening tools in eliminating chemicals from further consideration, the presence of many innocuous chemicals (including chemicals that are naturally occurring) also often have HQs that exceed 1. When interpreting HQs, it can be stated that when

HQs are below 1, toxicological effects are unlikely to occur, and the potential for adverse ecological effects minimal. HQs that exceed 1 only indicate that there is the potential for unacceptable risk (Tannenbaum et al., 2003). Therefore, an HQ above 1, even exceedingly so, does not definitively indicate that there is even one individual expressing the toxicological effect(s) associated with a given chemical to which it was exposed (Tannenbaum, 2005; Bartell, 1996).

Sampling and Analytical Limitations. It is not possible to completely characterize the nature and extent of contamination on any site. Uncertainties arise from limits on the number of locations that can be sampled. The sampling protocol used at WWTP3, however, was designed to optimize efficiency of the sampling effort and reduce uncertainty by providing coverage of the affected area using historical data and site process knowledge to focus on the most likely contaminated areas. This approach will bias potential soil contaminant concentrations higher than that for the entire region to provide a more conservative estimate of potential risk. The sampling and analytical data are considered sufficient to conclude that the potential for adverse impacts associated with chemicals present at the site is very low.

Selection and Quantification of Chemicals of Potential Ecological Concern. Uncertainty associated with the processes used to identify COPECs and estimate EPCs arises from the following:

- ***Identifying Background Chemicals.*** Metals are judged to be present at concentrations comparable to background if the MDC does not exceed the BSC or if statistical testing demonstrates that the site data and background data are drawn from the same population. Statistical testing of site data versus background data was performed for this SLERA. Some organic chemicals, such as PAHs, may be considered to be anthropogenic background. The inclusion of ambient anthropogenic compounds in the SLERA may impart a conservative bias to the risk assessment. Soil background values were compared with concentrations of metals detected in WWTP3 sediment in this SLERA. The use of soil background values for comparison to concentrations detected in sediment results in some added uncertainty to the SLERA. Naturally occurring levels of metals can differ in soil and sediment because the presence of metals in the sediment matrix can be affected by factors such as pH of the sediment and overlying water, oxidation-reduction conditions, sediment texture, presence/absence of organic matter, dissolved oxygen levels, etc. Although the concentrations of naturally occurring metals in soil and sediment may differ somewhat, soil background values can provide a reasonable point of reference for determining concentrations in sediment that may be associated with contamination and that warrant further consideration. Because concentrations in “true” background sediment may be higher or lower than their equivalent BSCs in soil, the direction of bias is unknown. However, the impact of the bias is considered to be negligible even

if the direction of the bias is unknown. Therefore, this uncertainty did not affect the overall conclusions of the assessment provided in Section 5.1.

- ***Estimated EPCs are Uncertain.*** For statistical purposes, if a constituent is positively identified at a site and has at least a single detection, all the samples with nondetects are assumed to have a value equal to half the reporting limit and are included in the data set, although identified for the ProUCL software (EPA, 2010) as nondetects. However, typical laboratory methods are able to detect concentrations of a chemical well below the reporting limit or even half the reporting limit. Therefore, although the exact concentration of a nondetect chemical is unknown, the use of half the reporting limit as a surrogate concentration likely overestimates the actual concentration and introduces a conservative bias into the risk assessment. Computed 95 percent UCL values are only estimates of the actual UCLs associated with each data set. Examples of factors affecting the uncertainty of these UCL estimates include the number of samples, proportion of nondetects, conformance with an assumed mathematical distribution, imprecision of laboratory data, elevated reporting limits (from dilutions, matrix interference, etc.), and statistical methodology. For some data sets, the MDC was used for the UCL. The following uncertainties are associated with the statistical determination of EPCs for the COCs in each medium:

  – A limited number of samples may not completely characterize the site because they provide less information about the population from which they are drawn than do larger sample sets. Accordingly, small data sets tend to have a greater variability, which results in the calculation of wider confidence intervals on the mean concentration and higher EPCs. The MDC was used as the EPC for surface water at WWTP3 because only three samples are available. The use of the MDC likely overestimated the true average concentration in surface water, as there is only a 1 out of 8 (12.5 percent) chance of three randomly selected samples from a given population being greater than the population mean.

  – Biased soil sampling is a common practice at contaminated sites to identify nature and extent of contamination and to reduce the potential for Type I errors when performing environmental investigations (i.e., concluding that a site is clean when it really is not). The biased sampling approach likely overestimates average chemical concentrations, resulting in greater chemical concentrations and predicted hazard. The WWTP3 sampling strategy was not strongly biased, however, and this uncertainty is considered minor for this particular SLERA.

  – The selected SW-846 laboratory analytical methods have a degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the degree of certainty of measurement. For example, some data were estimated (e.g., J-qualified). The direction of bias is unclear.

In summary, the use of the 95 percent UCL as the EPC is likely to impart an overall conservative bias to the risk assessment. Biased soil sampling may further add to the conservativeness of the EPC.

6.0 Risk Summary and Conclusions

Chemicals detected in soil, surface water, and sediment were screened against conservative benchmark values and other criteria to identify COPECs in media present at the WWTP3. Because of its small size, the site is not spatially relevant to any significant degree for many of the evaluated receptors. However, it is important to note that the site-specific SLERA was performed to satisfy administrative requirements.

Twenty-one chemicals in soil, 7 chemicals in surface water, and 1 chemical in sediment were identified as COPECs for further evaluation. A food chain model was used to evaluate the potential hazard associated with exposure to these chemicals by representative measurement receptors. Two metals (lead and selenium), two PCBs (Aroclor 1016 and Aroclor 1254), and four SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and carbazole) had HQs greater than 1 when rounded. Although some of these chemicals were COPECs in more than one medium, nearly all of the hazard was associated with soil exposure routes with the exception of selenium, which was associated with sediment exposure.

Lead and selenium had HQs below 10 for a single receptor (marsh wren and muskrat, respectively). The HQ exceedances for both metals were based only on the NOAEL TRVs; the LOAEL-based HQs were less than 1. Concern for adverse ecological impacts associated with exposure to lead and selenium is low because HQ values using conservative input values did not exceed 10 when rounded. Further, only 4 out of 23 samples for lead in soil and 1 out of 3 samples for selenium in sediment exceeded both background and toxicity-based screening values; therefore, from a spatial perspective, it is highly improbable that populations of receptors of concern would regularly be exposed to these elevated concentrations. Given the relatively small percentage of samples with elevated concentrations and the fact that HQs calculated using conservative assumptions did not exceed 10, the potential for adverse impacts to populations of organisms associated with exposure to lead in soil and selenium in sediment is considered to be very low.

Aroclor 1016 and Aroclor 1254, which were COPECs in soil, both had HQs greater than 1 for the marsh wren, while Aroclor 1254 had HQs greater than 1 for the deer mouse and short-tailed shrew as well. Of these exceedances, only the marsh wren exposed to Aroclor 1016 had both a NOAEL- and LOAEL-based HQ greater than 1 when rounded; however, the LOAEL-based HQ only marginally exceeded 1 (HQ = 1.9). Aroclor 1016 and Aroclor 1254 were detected in 3 and 2 out of 16 soil samples, respectively, and only one sample for each chemical had a concentration

that exceeded the ESV of 0.371 mg/kg (WWTP3-SB02 had a concentration of 1.22 mg/kg of Aroclor 1016, and PBOW99-SSW302 had a concentration of 1 mg/kg of Aroclor 1254). Therefore, from a spatial perspective, it is highly improbable that populations of receptors of concern would regularly be exposed to these elevated concentrations. Given the small percentage of samples with elevated concentrations and the fact that HQs calculated using more realistic (yet still conservative) assumptions only marginally exceeded 1 for Aroclor 1016, the potential for adverse impacts to populations of organisms associated with exposure to Aroclor 1016 and Aroclor 1254 in soil is considered to be very low.

Three PAH COPECs in soil (benzo[a]anthracene, benzo[b]fluoranthene, and chrysene) had HQs greater than 1 when rounded for the deer mouse (benzo[a]anthracene and chrysene), short-tailed shrew (benzo[a]anthracene), and marsh wren (benzo[a]anthracene and benzo[b]fluoranthene). No HQ was greater than 5, and all exceedances were based only on NOAELs; no LOAEL-based HQs for these three PAHs exceeded 1 when rounded. Samples WWTP3-SB02, PBOW99-SSW303, WWTP3-SB01, and PBOW99-SSW302 were identified as having elevated concentrations of all three PAHs. PAHs are common anthropogenic contaminants, and their presence at an industrial/military facility is expected, but they are unlikely related to specific historical processes performed at WWTP3. Samples WWTP3-SB01 and WWTP3-SB02 are located immediately adjacent to the NASA K-Site control building and associated patio, and may be present as a result of NASA operations. NASA has agreed to take responsibility for this area, and the area where these samples is located are no longer within the DERP-FUNDS program (Figure 2-3). Because these three PAHs are common anthropogenic compounds that are likely not site-related, the NOAEL-based HQs were not elevated (i.e., were not greater than 10), and the LOAEL-based HQs did not exceed 1, these three PAHs are considered to be of relatively low concern for ecological exposure.

One SVOC, carbazole, had very high HQs, ranging from 7.64 for the raccoon to over 5,000 for the deer mouse (Table 5-1). Carbazole is chemically similar to PAHs, and occurs as a natural constituent of creosote and coal tar (Agency for Toxic Substances and Disease Registry, 2002). This chemical was a COPEC in soil and was detected in 3 out of 16 samples at concentrations ranging from 0.0443 to 1.12 mg/kg, which are consistent with detected concentrations of other PAHs. Also, the MDC was detected at the same sample location (WWTP3-SB02) as the MDC for the PAHs and was an estimated (i.e., “J”-qualified) concentration below the detection limit. Sample location SB02 is within the area recently designated as being the responsibility of NASA and is no longer part of the DERP-FUDS program. The elevated food chain model HQs for carbazole are the result of the use of TRVs that are approximately three orders of magnitude lower (i.e., more conservative) than the next-lowest TRV used in this SLERA and approximately

five orders of magnitude lower than PAHs. Given the structural similarity to PAHs, the appropriateness of using such a conservative TRV is highly questionable, particularly in light of the fact that soil toxicity studies have shown carbazole exhibits similar toxic responses as PAHs in soil invertebrates. Because of the low detection frequency, the low concentrations observed, and the similarities of carbazole to other PAHs that are present as a result of ubiquitous anthropogenic sources, further investigation of this chemical in soil for ecological purposes alone is not recommended, regardless of the elevated HQs observed in the food chain model.

In general, concern regarding exposure to chemicals at WWTP3 is unwarranted for most species because considerations such as the home range size and density characteristics of various ecological species of concern make it unlikely that multiple individuals of a given species (i.e., local populations) would be exposed to media at the 3-acre WWTP3 site on a regular basis. It is important to note that the ecological HQs were computed to satisfy administrative requirements. Even without performing an investigation, the conclusion could be reached that the site is safe for ecological receptors because of spatial considerations alone (e.g., number of animals present, time spent contacting the site).The results of this exercise revealed that the potential for adverse ecological impacts is considered to be minimal at his site for the following reasons:

- For all chemicals except carbazole, HQ exceedances using the most conservative assumptions were relatively low and only exceeded 10 for PCBs; however, PCB HQs based on more realistic assumptions only marginally exceeded 1.
- The number of samples detected at elevated concentrations represents a very small portion of a 3-acre site. Therefore, exposure frequency of receptors of concern to these areas is expected to be highly limited such that adverse effects to populations are considered unlikely.
- The only COPEC with elevated HQs, carbazole, had a TRV that was improbably low (conservative). Because of its chemical similarity to PAHs, its low range of detected concentrations, and its ubiquitousness in the environment as a creosote compound, it is likely that the toxicity for this chemical is overestimated and its presence is non-site related.
- The area where the highest PAHs (including carbazole) were detected is within an area near the K-site building that is now the responsibility of NASA, and is no longer within the FUDS-DERP program.

Therefore, for these reasons, the potential for adverse ecological impacts is considered to be very low at WWTP3.

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TABLES

Table 2-1

Plant Species Observed at Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Vegetation observed during the October 16,2008 site walk	
Acer rubrum	Red maple
Achillea millefolium	Yarrow
Acorus calamus	Sweet flag
Agrostis alba	Redtop
Apocynum cannabinum	Dogbane
Asclepias syriaca	Common milkweed
Aster lateriflorus	Calico aster
Aster novae-angliae	New England aster
Carex frankii	Frank's sedge
Carex granularis	sedge
Cichorium intybus	Chicory
Cirsium arvense	Creeping thistle
Cirsium vulgare	Bull thistle
Cornus racemosa	Gray dogwood
Dactylis glomerata	Orchard grass
Daucus carota	Queen Anne's lace
Dichanthelium clandestinum	Deer tongue grass
Dipsacus sylvestris	Teasel
Echinochloa muricata	Barnyard grass
Eleagnus umbellata	Autumn olive
Eleocharis obtusa	Blunt spikerush
Elymus sp.	Wild rye
Equisetum arvense	Field horsetail
Eupatorium perfoliatum	Boneset
Eupatorium rugosum	White snakeroot
Euthamia graminifolia	Fragrant flat-topped goldenrod
Festuca sp.	Fescue
Fragaria virginiana	Strawberry
Fraxinus pennsylvanica	Green ash
Galium aparine	Cleavers
Geum laciniatum	Rough avens
Glecoma hederacea	Ground ivy
Glyceria striata	Fowl manna grass
Hypericum perforatum	St. John's wort
Juncus effusus	Soft rush
Juncus torreyi	Torrey's rush
Leersia oryzoides	Rice cutgrass
Lonicera tatarica	Tartarian honeysuckle
Ludwigia palustris	Marsh seedbox
Lycopus americanus	American bugleweed
Lycopus virginicus	Virginia bugleweed
Melilotus officinalis	Yellow sweet clover
Mimulus ringens	Monkeyflower
Morus alba	Mulberry

Table 2-1

Plant Species Observed at Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Oxalis stricta	Sorrel
Panicum virgatum	Switch grass
Parthenocissus quinquefolia	Virginia creeper
Penstemon digitalis	beardtongue
Phalaris arundinacea	Reed canary grass
Phleum pratense	Timothy
Plantago lanceolata	English plantain
Poa pratensis	Kentucky bluegrass
Populus deltoides	Cottonwood
Potentilla simplex	Old field cinquefoil
Ranunculus abortivus	Kidney-leaf buttercup
Ranunculus sceleratus	Cursed crowfoot
Rosa multiflora	Multiflora rose
Rubus flagellaris	Dewberry
Rubus occidentalis	Black raspberry
Rumex crispus	Curly dock
Salix amygdaloides	Peachleaf willow
Salix sp.	willow
Scirpus atrovirens	Green bulrush
Setaria glauca	Bristle grass
Solanum carolinense	Horse nettle
Solidago canadensis	Canada goldenrod
Teucrium canadense	Germander
Toxicodendron radicans	Poison ivy
Trifolium repens	White clover
Typha latifolia	Broad-leaf cattail
Verbena hastata	Blue vervain
Verbesina alternifolia	Wingstem
Vitis aestivalis	Summer grape
Vitis riparia	Riverbank grape
Vegetation observed during the June 2, 2009 site walk	
Acer rubrum	Red maple
Achillea millefolium	Yarrow
Acorus calamus	Sweet flag
Agrostis alba	Redtop
Alisma plantago-aquatica	Water plantain
Apocynum cannabinum	Dogbane
Asclepias syriaca	Common milkweed
Boehmeria cylindrica	Small-spike false nettle
Brassica nigra	Yellow rocket
Bromus inermis	Smooth brome
Carex amphibola var. turgida	Eastern narrowleaf sedge
Carex blanda	Eastern woodland sedge
Carex frankii	Frank's sedge
Carex granularis	sedge

Table 2-1

Plant Species Observed at Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Carex vulpinoidea	Fox sedge
Cichorium intybus	Chicory
Cirsium arvense	Creeping thistle
Cirsium vulgare	Bull thistle
Cornus racemosa	Gray dogwood
Cryptotaenia canadensis	Honewort
Dactylis glomerata	Orchard grass
Daucus carota	Queen Anne's lace
Dichanthelium clandestinum	Deer tongue grass
Dipsacus sylvestris	Teasel
Eleagnus umbellata	Autumn olive
Eleocharis obtusa	Blunt spikerush
Elymus sp.	Wild rye
Equisetum arvense	Field horsetail
Eupatorium perfoliatum	Boneset
Eupatorium rugosum	White snakeroot
Euthamia graminifolia	Fragrant flat-topped goldenrod
Festuca sp.	Fescue
Fragaria virginiana	Strawberry
Fraxinus pennsylvanica	Green ash
Galium aparine	Cleavers
Galium asprellum	Rough bedstraw
Geum laciniatum	Rough avens
Glecoma hederacea	Ground ivy
Glyceria striata	Fowl manna grass
Hypericum perforatum	St. John's wort
Juncus effusus	Soft rush
Juncus torreyi	Torrey's rush
Leersia oryzoides	Rice cutgrass
Lonicera tatarica	Tartarian honeysuckle
Ludwigia palustris	Marsh seedbox
Lycopus americanus	American bugleweed
Lycopus virginicus	Virginia bugleweed
Lysimachia ciliata	Fringed loosestrife
Medicago lupulina	Black medick
Melilotus officinalis	Yellow sweet clover
Mentha piperita	Peppermint
Mimulus ringens	Monkeyflower
Morus alba	Mulberry
Oxalis stricta	Sorrel
Panicum virgatum	Switch grass
Parthenocissus quinquefolia	Virginia creeper
Penstemon digitalis	beardtongue
Phalaris arundinacea	Reed canary grass
Phleum pratense	Timothy

Table 2-1

Plant Species Observed at Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Scientific Name	Common Name
Plantago lanceolata	English plantain
Poa pratensis	Kentucky bluegrass
Populus deltoides	Cottonwood
Potentilla simplex	Old field cinquefoil
Ranunculus abortivus	Kidney-leaf buttercup
Ranunculus sceleratus	Cursed crowfoot
Rosa multiflora	Multiflora rose
Rubus flagellaris	Dewberry
Rubus occidentalis	Black raspberry
Rumex crispus	Curly dock
Salix amygdaloides	Peachleaf willow
Salix sp.	willow
Scirpus atrovirens	Green bulrush
Solidago canadensis	Canada goldenrod
Teucrium canadense	Germander
Toxicodendron radicans	Poison ivy
Trifolium repens	White clover
Typha latifolia	Broad-leaf cattail
Verbena hastata	Blue vervain
Verbesina alternifolia	Wingstem
Viola sp.	violet
Vitis aestivalis	Summer grape
Vitis riparia	Riverbank grape

Table 2-2

Mammals Observed On Site and Likely to be Found in Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site [a]
Didelphidae	*Didelphis virginiana*	Virginia opossum	X
Talpidae	*Condylura cristata*	star-nosed mole (**T**)	
	Parascalops breweri	hairy-tailed mole	
	Scalopus aquaticus	Eastern mole	
Verspertilionidae	*Myotis keenii*	Keen's bat	
	M. lucifugus	little brown bat	
	M. sodalis	Indiana bat **(E*)**	
	Eptesicus fuscus	big brown bat	
	Lasionycteris noctivagans	silver-haired bat	
	Lasiurus borealis	red bat	
	L. cinereus	hoary bat	
	Nycticeius humeralis	evening bat	
	Pipistrellus subflavus	Eastern pipistrelle	
Leporidae	*Sylvilagus floridanus*	cottontail rabbit	X
Sciuridae	*Glaucomys volans*	Southern flying squirrel	
	Marmota monax	woodchuck	
	Sciurus carolinensis	gray squirrel	
	S. niger	fox squirrel	
	Spermophilus tridecemlineatus	thirteen-lined ground squirrel	
	Tamias striatus	Eastern chipmunk	

Table 2-2

Mammals Observed On Site and Likely to be Found in Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site [a]
	Tamiasciurus hudsonicus	red squirrel	
	Blarina brevicauda	short-tailed shrew	
	Cryptotis parva	least shrew	
	Sorex cinereus	masked shrew	
Castoridae	*Castor canadensis*	beaver	
Cricetidae	*Microtus pennsylvanicus*	meadow vole	
	Mus musculus	house mouse	
	Ondatra zibethicus	muskrat	
	Peromyscus leucopus	white-footed mouse	
	P. maniculatus	deer mouse	
	Rattus norvegicus	Norway rat	
	Synaptomys cooperi	Southern bog lemming	
	Zapus hudsonius	meadow jumping mouse	
Procyonidae	*Procyon lotor*	raccoon	X
Mustelidae	*Mephitis mephitis*	striped skunk	
	Mustela frenata	long-tailed weasel	
	M. nivalis	least weasel	
	M. vison	mink	
	Taxidea taxus	Badger (**T**)	

Table 2-2

Mammals Observed On Site and Likely to be Found in Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site [a]
Canidae	*Canis latrans*	coyote	
	Urocyon cinereoargenteus	gray fox	
	Vulpes vulpes	red fox	
Cervidae	*Odocoileus virginianus*	white-tailed deer	X

Mammals likely to be found in Erie County based on information presented in
Gottschang, J. L., 1981, *A Guide to the Mammals of Ohio* , Ohio State University Press, 176 pages.
T - Ohio threatened species.
E* - Federally endangered species.

[a] Shaw Site Reconnaissance, April 27, June 2, and September 9, 2009.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Ardeidae	*Ardea herodias*	great blue heron	(1) (2) Regular visitor at ponds, streams, and ditches.
	Bublucus ibis	cattle egret (**E**)	(1) Rare visitor in short grass areas
	Butorides striatus	green heron	(1) Confirmed breeder, rare at ponds, streams.
	Casmerodius albus	great egret	(1) Regular visitor at ponds, streams, and ditches.
	Nycticorax nycticorax	black-crowned night heron (**T**)	(1) Regular visitor at ponds, streams, and ditches.
Anserinae	*Branta canadensis*	Canada goose	(1) Confirmed breeder; uncommon around ponds.
Anatinae	*Aix sponsa*	Wood duck	(1) Confirmed breeder, uncommon around ponds.
	Anas discors	blue-winged teal	Confirmed and/or probable breeder in county.
	A. platyrhynchos	mallard	(1) Confirmed breeder, uncommon at ponds, streams.
	A. rubripes	American black duck	(1) Possible breeder, rare at ponds, streams, ditches.
Merginae	*Lophodytes cucullatus*	hooded merganser	Confirmed and/or probable breeder in county.
Accipitrinae	*Accipiter striatus*	sharp-shinned hawk	Confirmed and/or probable breeder in county.
Buteoninae	*Buteo jamaicensis*	red-tailed hawk	Confirmed and/or probable breeder in county.
	B. lineatus	red-shouldered hawk	Confirmed and/or probable breeder in county.
	B. platypterus	broad-winged hawk	Confirmed and/or probable breeder in county.
	Haliaeetus leucocephalus	bald eagle (**T**)	(2) Confirmed and/or probable breeder in county.
Anatidae	*Cygnus buccinator*	Trumpeter swan (**E**)	(1) Rare migrant seen flying toward lake.
Falconinae	*Falco sparverius*	American kestrel	(2) Confirmed and/or probable breeder in county.
Phasianidae	*Colinus virginianus*	Northern bobwhite quail	Confirmed and/or probable breeder in county.
	Phasianus colchicus	ring-necked pheasant	Confirmed and/or probable breeder in county.
Rallidae	*Gallinula chloropus*	common moorhen	Confirmed and/or probable breeder in county.
	Porzana carolina	Sora	Confirmed and/or probable breeder in county.
Cathartidae	*Cathartes aura*	turkey vulture	Possible breeder in county.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Charadriidae	*Charadrius vociferus*	killdeer	Confirmed and/or probable breeder in county.
Scolopacidae	*Actitis macularia*	spotted sandpiper	Confirmed and/or probable breeder in county.
	Bartramia longicauda	upland sandpiper (**T**)	(1) Confirmed breeder, rare in grassy areas.
	Gallinago gallinago	common snipe	Confirmed and/or probable breeder in county.
	Scolopax minor	American woodcock	(1) Confirmed breeder, uncommon in moist woodlots.
Larinae	*Larus argentatus*	herring gull	(1) Regular visitor.
	L. delawarensis	ring-billed gull	(1) Regular visitor.
Columbidae	*Columba livia*	rock dove	(1) Confirmed breeder, very common.
	Zenaida macroura	mourning dove	(1)Confirmed breeder, very common.
Cuculidae	*Coccyzus americanus*	yellow-billed cuckoo	(1) Confirmed breeder, uncommon in woodlots, shrubs.
	C. erythropthalmus	black-billed cuckoo	(1) Probable breeder, rare in woodlots & shruby areas.
Tytonidae	*Bubo virginianus*	great horned owl	(1) Confirmed breeder, uncommon in woodlots.
	Otus asio	Eastern screech-owl	(1) Confirmed breeder, common in woodlots, shrubs.
	Strix varia	barred owl	Confirmed and/or probable breeder in county.
Caprimulgidae	*Chordeiles minor*	common nighthawk	(1) Possible breeder, rare.
Apodidae	*Chaetura pelagica*	chimney swift	(1) Confirmed breeder, uncommon.
Trochilidae	*Archilochus colubris*	ruby-throated hummingbird	(1) Confirmed breeder, uncommon in woodlots, shrubs.
Alcedinidae	*Ceryle alcyon*	belted kingfisher	(1) Confirmed breeder, rare around ponds, streams.
Picidae	*Colaptes auratus*	Northern flicker	(1) Confirmed breeder, common in woodlots.
	Dryocopus pileatus	pileated woodpecker	Confirmed and/or probable breeder in county.
	Melanerpes carolinus	red-bellied woodpecker	(1) Confirmed breeder, common in mature woods.
	M. erythrocephalus	red-headed woodpecker	(1) Confirmed breeder, uncommon in mature woods.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
	Picoides pubescens	downy woodpecker	(1) Confirmed breeder, common in woodlots.
	P. villosus	*hairy woodpecker*	(1) Confirmed breeder, uncommon in large woodlots.
Tyrannidae	*Contopus virens*	Eastern wood-pewee	(1) Confirmed breeder, very common in large woodlots.
	Empidonax alnorum	alder flycatcher	(1) Possible breeder, rare in shrubby wet areas.
	E. minimus	least flycatcher (**T**)	(1) Probable breeder, rare in shrubby areas.
	E. traillii	willow flycatcher	(1) Confirmed breeder, very common in shrubby areas.
	E. virescens	Acadian flycatcher	(1) Confirmed breeder, uncommon in mature woodlots.
	Myiarchus crinitus	great crested flycatcher	(1) Confirmed breeder, common in large woodlots.
	Sayornis phoebe	Eastern phoebe	(1) Confirmed breeder, common near stream bridges.
	Tyrannus tyrannus	Eastern kingbird	(1) Confirmed breeder, very common - open shrub area.
Alaudidae	*Eremophila alpestris*	horned lark	(1) Probable breeder, rare in grassland, cultiv. fields.
Hirundinidae	*Hirundo pyrrhonota*	cliff swallow	Confirmed and/or probable breeder in county.
	H. rustica	barn swallow	(1) Confirmed breeder, very common near vacant bldgs.
	Progne subis	purple martin	(1) Probable breeder, rare.
	Riparia riparia	bank swallow	(1) Rare migrant or visitor.
	Stelgidopteryx seripennis	Northern rough-winged swallow	(1) Confirmed breeder, rare along streams, ditches.
	Tachycineta bicolor	tree swallow	(1) Confirmed breeder, rare around ponds.
Corvidae	*Corvus brachyrhynchos*	American crow	(1) Confirmed breeder, very common in woodlots.
	Cyanocitta cristata	blue jay	(1) (2*) Confirmed breeder, abundant in woods.
Paridae	*Parus atricapillus*	black-capped chickadee	(1) Confirmed breeder, common in woodlots.
	P. bicolor	tufted titmouse	(1) Confirmed breeder, common in woodlots.
Sittidae	*Sitta carolinensis*	white-breasted nuthatch	(1) Confirmed breeder, uncommon in woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Troglodytidae	*Cistothorus palustris*	marsh wren	(1) Possible breeder, rare in wetlands with cattails.
	C. platensis	sedge wren	(1) Confirmed breeder, common in old grassy fields.
	Thryothorus ludovicianus	Carolina wren	(1) Probable breeder, rare in shrubby areas & woodlots.
	Troglodytes aedon	house wren	(1) (2*) Confirmed breeder, abundant in shrubby areas.
	T. troglodytes	winter wren	(1) Rare migrant.
Mimidae	*Dumetella carolinensis*	gray catbird	(1) Confirmed breeder, abundant in shrubby areas.
	Mimus polyglottos	Northern mockingbird	(1) Confirmed breeder, rare in shrubby areas.
	Toxostoma rufum	brown thrasher	(1) (2*) Confirmed breeder, common in shrubby areas.
Turdidae	*Catharus fuscescens*	veery	(1) Confirmed breeder, uncommon in large woodlots.
	Hylocichla mustelina	wood thrush	(1) (2) Confirmed breeder, very common in large woodlots.
	Sialia sialis	Eastern bluebird	(1) Confirmed breeder, common in openfields & edges.
	Turdus migratorius	American robin	(1) Confirmed breeder, abundant everywhere.
Sylviidae	*Polioptila caerulea*	blue-gray gnatcatcher	(1) Confirmed breeder, uncommon in woodlots.
	Regulus calendula	ruby-crowned kinglet	(1) (2) Rare migrant.
Bombycillidae	*Bombycilla cedrorum*	cedar waxwing	(1) Confirmed breeder, very common everywhere.
Sturnidae	*Sturnus vulgaris*	European starling	(1) Confirmed breeder, abundant everywhere.
Vireonidae	*Vireo bellii*	Bell's vireo	Confirmed and/or probable breeder in county.
	V. flavifrons	yellow-throated vireo	(1) Confirmed breeder, uncommon in mature woodlots.
	V. gilvus	warbling vireo	(1) Confirmed breeder, common in large woodlots.
	V. griseus	white-eyed vireo	(1) (2) Confirmed breeder, uncommon in shrubby areas.
	V. olivaceus	red-eyed vireo	(1) Confirmed breeder, very common in woodlots.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
Parulidae	*Dendroica cerulea*	cerulean warbler	(1) Possible breeder, rare in mature woodlots.
	D. coronata	yellow-rumped warbler	(2) Probable breeder, uncommon in shrubby areas.
	D. dominica	yellow-throated warbler	(1) Confirmed and/or probable breeder in county.
	D. pensylvanica	chestnut-sided warbler	(1) Probable breeder, uncommon in shrubby areas.
	D. petechia	yellow warbler	(1) (2*) Confirmed breeder, abundant in shrubby areas.
	D. virens	black-throated green warbler	(1) Possible breeder, rare in mature woodlots.
	Geothylpis trichas	common yellowthroat	(1) (2*) Confirmed breeder, abundant in shrub areas, fields.
	Icteria virens	yellow-breasted chat	(1) Confirmed breeder, uncommon in shrubby areas.
	Mniotilta varia	black and white warbler	(1) Possible breeder, rare in mature woodlots.
	Oporornis formosus	Kentucky warbler	(1) Possible breeder, rare in mature woodlots.
	Protonotaria citrea	prothonotary warbler	Confirmed and/or probable breeder in county.
	Seiurus aurocapillus	overbird	(1) Probable breeder, rare in mature woodlots.
	S. motacilla	Louisiana waterthrush	Confirmed and/or probable breeder in county.
	Setophaga ruticilla	American redstart	(1) Probable breeder, rare in shrubby areas & woodlots.
	Vermivora leucobronchialis	Brewster's warbler	(1) Possible breeder, rare in shrubby areas and edges.
	V. pinus	blue-winged warbler	(1) Confirmed breeder, common in shrubby areas.
	Vermivora ruficapilla	Nashville warbler	(2) Possible breeder, rare in mature woodlots.
	Wilsonia citrina	hooded warbler	Confirmed and/or probable breeder in county.
Icteridae	*Agelaius phoeniceus*	red-winged blackbird	(1) (2*) Confirmed breeder, abund. in grasslands, streams.
	Dolichonyx oryzivorus	bobolink	(1) Confirmed breeder, uncommon in grasslands.
	Icterus galbula	Northern oriole	(1) Confirmed breeder, uncommon in open woods.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
	I. spurius	orchard oriole	(1) Confirmed breeder, common in open woods & edges.
	Molothrus ater	brown-headed cowbird	(1) Confirmed breeder, abundant everywhere.
	Quiscalus quiscula	common grackle	(1) Confirmed breeder, abundant everywhere.
	Sturnella magna	Eastern meadowlark	(1) (2*) Confirmed breeder, common in grasslands.
Ploceidae	*Passer domesticus*	house sparrow	(1) Confirmed breeder, uncommon near buildings.
Thraupidae	*Piranga olivacea*	scarlet tanager	(1) (2*) Possible breeder, rare on open woods.
	P. ruba ruba	summer tanager	(1) Confirmed breeder, common in mature woodlots.
Fringillidae	*Ammodramus henslowii*	Henslow's sparrow	(1) Probable breeder, rare in old fields.
	A. savannarum	grasshopper sparrow	(1) Confirmed breeder, common in grasslands.
	Cardinalis cardinalis	Northern cardinal	(1)(2) Confirmed breeder, abundant everywhere.
	Carduelis tristis	American goldfinch	(1) Confirmed breeder, abundant in shrubby areas.
	Carpodacus mexicanus	house finch	(1) Confirmed breeder, uncommon around buildings.
	Melospiza georgiana	swamp sparrow	(1) Confirmed breeder, rare in wet fields and ditches.
	M. melodia	song sparrow	(1) (2*) Confirmed breeder, abundant everywhere.
	Passerculus sandwichensis	Savannah sparrow	(1) Confirmed breeder, common in grasslands.
	Passerina cyanea	indigo bunting	(1) Confirmed breeder, abundant everywhere.
	Pheucticus ludovicianus	rose-breasted grosbeak	(1) Confirmed breeder, common in woodlots & edges.
	Pipilo erythrophthalmus	Eastern towhee	(1) (2) Confirmed breeder, very common in woodlots, edges.
	Pooecetes gramineus	vesper sparrow	(1) Confirmed breeder, uncommon in grassland & fields.
	Spiza amercana	dickcissel	Confirmed and/or probable breeder in county.
	Spizella passerina	chipping sparrow	(1) Confirmed breeder, common in open woods & lawns.

Table 2-3

Birds Observed On Site and/or Likely to be Breeding
In Erie County, Ohio
Plum Brook Ordnance Works, Sandusky, Ohio

Family Name[a]	Scientific Name[b]	Common Name[c]	Status and Frequency
	S. pusilla	field sparrow	(1) (2*) Confirmed breeder, abundant in grasslands, shrubs.
	Zonotrichia albicollis	white-throated sparrow	(1) (2) Late migrant, rare.

[a] Family names from Peterson, R. T., 1947, *A Field Guide to the Birds*, Sponsored by the National Audubon Society, Houghton Mifflin Company, Boston, Massachusetts.
[b] Peterjohn, B. G. and D. L. Rice, 1991, *Ohio Breeding Bird Atlas*, The Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio, 416 pages.
[c] E - Ohio Endangered species; T - Ohio Threatened species.

Observation References:

(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1994).

(2) Observed during Shaw Site Reconnaissance on April 27 or June 2, 2009. An asterisk (*) indicates the species was detected during the June site visit, and is likely using the site for breeding.

Table 2-4

Reptiles Observed On Site and Likely to be Found at Plum Brook Ordnance Works Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site
Chelydridae	*Chelydra serpentina*	snapping turtle	(1)
Kinosternidae	*Sternotherus odoratus*	musk turtle	
Emydidae	*Chrysemys picta*	painted turtle	(1)
	Emys blandingii	Blanding's turtle	(1)
	Terrapene carolina	box turtle	(1)
Colubridae	*Elaphe vulpina*	fox snake	(1)
	Heterodon platyrhinos	hog-nosed snake	
	Nerodia septemvittata	queen snake	
	N. sipedon sipedon	water snake	(1)
	Opheodrys vernalis	green snake	(1)
	Storeria dekayi	Dekay's brown snake	(1)
	Thamnophis butleri	Butler's garter snake	(1)
	T. sauritus	ribbon snake	
	T. sirtalis	common garter snake	(1)

References:

Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America* , Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.

Pfingsten, R. A. and F. L. Downs (eds.), 1989, *Salamanders of Ohio* , Ohio Biological Survey Bulletin, New Series, Vol. 7, No. 2, 315 pages, 29 pls.

Wright, A. H. and A. A. Wright, 1957, *Handbook of Snakes of the United States and Canada* , Volumes I and II, Comstock Publishing Associates, Ithaca and London, 1105 pages.

Reference for on-site observation:

(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).

Table 2-5

Amphibians Observed On Site and Likely to be Found at Plum Brook Ordnance Works Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site
Ambystomatidae	*Ambystoma texanum*	smallmouth salamander	(1)
	Plethodon cinereus	redback salamander	(1)
Bufonidae	*Bufo americanus*	American toad	(1)
Hylidae	*Acris gryllus*	cricket frog	(1)
	Hyla versicolor	gray treefrog	(1)
	Pseudacris crucifer	spring peeper	(1)
	P. triseriata	chorus frog	(1)
Ranidae	*Rana catesbeiana*	bullfrog	(1)
	R. clamitans	green frog	(1)
	R. pipiens	Northern leopard frog	(1)

References:

Conant, R. and J. T. Collins, 1991, *Reptiles and Amphibians, Eastern/Central North America* , Peterson Field Guide, Third Edition, Houghton Mifflin Company, Boston.

Pfingsten, R. A. and F. L. Downs (eds.), 1989, *Salamanders of Ohio* , Ohio Biological Survey Bulletin, New Series, Vol. 7, No. 2, 315 pages, 29 pls.

Reference for on-site observation:

(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1995).

Table 2-6

Fish Species Observed at
Plum Brook Ordnance Works
Sandusky, Ohio

Family Name	Scientific Name	Common Name	Observed On Site	Habitat[a]
Catostomidae	*Catostomus commersoni*	white sucker	(1)	lotic
Centrarchidae	*Lepomis cyanellus*	green sunfish	(1)	lentic, lotic
	Lepomis species	green sunfish hybrid	(1)	lentic
	L. gibbosus	pumpkinseed sunfish	(1)	lentic
	L. macrochirus	bluegill	(1)	lentic
	Micropterus salmoides	largemouth bass	(1)	lentic
Cyprinidae	*Campostoma anomalum*	central stoneroller	(1)	lotic
	Carassius auratus	goldfish	(1)	lentic
	Luxilus chrysocephalus	striped shiner	(1)	lotic
	Pimephales notatus	bluntnose minnow	(1)	lotic
	P. promelas	fathead minnow	(1)	lotic
	Semotilus atromaculatus	creek chub	(1)	lotic
Gasterosteidae	*Culaea inconstans*	brook stickleback	(1)	lotic
Ichtaluridae	*Ameiurus melas*	black bullhead	(1)	lentic

[a] lotic - Flowing water such as brooks, ditches, and creeks.
lentic - Still waters such as ponds and lakes.

Reference for on-site observation:
(1) *Biological Inventory of Plum Brook Station* (Ohio Department of Natural Resources, 1994).

Table 2-7

Summary of Samples Evaluated in the Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Location	Sample Number	Sample Purpose	Sample Date	Depth (feet)	Analyses
Soil Samples					
PBOW99-SSW301	PBOW99SSW301	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW302	PBOW99SSW302	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals, PCB, SVOC, VOC
PBOW99-SSW303	PBOW99SSW303	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals, PCB, SVOC, VOC
PBOW99-SSW304	PBOW99SSW304	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW305	PBOW99SSW305	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW306	PBOW99SSW306	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW307	PBOW99SSW307	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW307	PBOW99SSW308	FD	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW309	PBOW99SSW309	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
PBOW99-SSW310	PBOW99SSW310	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals
WWTP3-SB01	WW0034	REG	10-Dec-08	0.7 - 1.7	Explosives, Gen Chem, Metals, PCB, SVOC
WWTP3-SB01	WW0035	REG	10-Dec-08	5 - 5.7	Explosives, Metals, PCB, SVOC
WWTP3-SB02	WW0038	REG	10-Dec-08	0.5 - 1.5	Explosives, Metals, PCB, SVOC
WWTP3-SB02	WW0039	REG	10-Dec-08	5 - 5.5	Explosives, Metals, PCB, SVOC
WWTP3-SB03	WW0041	REG	10-Dec-08	0 - 1	Explosives, Metals, PCB, SVOC
WWTP3-SB03	WW0042	REG	10-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
WWTP3-SB03	WW0043	FD	10-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
WWTP3-SB05	WW0048	REG	11-Dec-08	0 - 1	Explosives, Metals, PCB, SVOC
WWTP3-SB05	WW0049	REG	11-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
WWTP3-SB06	WW0051	REG	11-Dec-08	0 - 1	Explosives, Metals, PCB, SVOC
WWTP3-SB06	WW0052	REG	11-Dec-08	3 - 3.7	Explosives, Metals, PCB, SVOC
WWTP3-SB07	WW0054	REG	11-Dec-08	0 - 1	Explosives, Metals, PCB, SVOC
WWTP3-SB07	WW0055	REG	11-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
WWTP3-SB09	WW0060	REG	11-Dec-08	0.2 - 1.6	Explosives, Metals, PCB, SVOC
WWTP3-SB09	WW0061	REG	11-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
WWTP3-SB09	WW0063	FD	11-Dec-08	3 - 5	Explosives, Metals, PCB, SVOC
Sediment Samples					
PBOW99-SDW301	PBOW99SDW301	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals, SVOC
PBOW99-SDW302	PBOW99SDW302	REG	2-Sep-99	0 - 0	Explosives, Gen Chem, Metals, SVOC
WWTP3-SD01	WW1004	REG	23-May-09	0 - 0.5	Gen Chem, PCB
WWTP3-SD01	WW1005	FD	23-May-09	0 - 0.5	Gen Chem, PCB
WWTP3-SD02	WW1007	REG	23-May-09	0 - 0.5	Gen Chem, PCB
WWTP3-SD03	WW1008	REG	23-May-09	0 - 0.5	Explosives, Gen Chem, Metals, PCB, SVOC
Surface Water Samples					
WWTP3-SW01	WW2004	REG	23-May-09	NA	Explosives, Metals, SVOC
WWTP3-SW02	WW2005	REG	23-May-09	NA	Explosives, Metals, SVOC
WWTP3-SW03	WW2006	REG	23-May-09	NA	Explosives, Metals, SVOC
WWTP3-SW03	WW2007	FD	23-May-09	NA	Explosives, Metals, SVOC

FD - Field duplicate; averaged with the regular sample at the same location to create one result.
Gen Chem - General chemistry.
NA - Not applicable.
PCB - Polychlorinated biphenyls.
Pest - Organochlorine pesticides.
REG - Regular sample.
SVOC - Semivolatile organic compounds.
VOC - Volatile organic compounds.

Table 2-8

Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Soil (0-6 Feet)
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean (mg/kg)	BSC [a] (mg/kg)	ESV [b] (mg/kg)	COPEC? [c,d]	Distribution [e]	95% UCL [e] (mg/kg)	EPC [f] (mg/kg)	UCL 0-1' soil depth [g] (mg/kg)	MDC 0-1' soil depth [g] (mg/kg)	EPC 0-1' soil depth [g] (mg/kg)
Inorganics																		
Aluminum	23 / 23	100	3.11E+03		1.05E+04		1.70E+00	2.40E+01	7.41E+03	1.55E+04	pH Dependent	N (b)			---			---
Antimony	13 / 23	57	2.61E-01	J	4.14E-01	J/J	4.24E-01	7.20E+00	1.52E+00	9.30E+00	0.27	N (b)			---			---
Arsenic	23 / 23	100	3.90E+00		2.08E+01		8.49E-01	1.20E+00	7.44E+00	3.65E+01	18	N (b)			---			---
Barium	23 / 23	100	2.97E+01		1.97E+02		1.74E-01	2.40E+01	5.85E+01	8.26E+02	330	N (a)			---			---
Beryllium	16 / 23	70	5.90E-01		8.44E+00		1.70E-01	6.00E-01	3.73E+00	1.00E+00	21	N (a)			---			---
Cadmium	9 / 23	39	2.24E-01	J	1.01E+00		4.24E-01	6.00E-01	2.99E-01	NA	0.36	Y	Nonparametric	3.64E-01	3.64E-01	3.10E-01	3.64E-01	3.10E-01
Calcium	23 / 23	100	3.29E+03		6.07E+04		4.24E+00	6.00E+02	1.90E+04	5.23E+04	Nutrient	N (c)			---			---
Chromium	23 / 23	100	6.90E+00		1.78E+01		4.24E-01	1.20E+00	1.19E+01	2.90E+01	26	N (a)			---			---
Cobalt	21 / 23	91	3.97E+00	J	2.21E+01		1.70E-01	6.00E+00	7.12E+00	1.16E+02	13	N (b)			---			---
Copper	23 / 23	100	7.10E+00		2.84E+01		4.24E-01	3.00E+00	1.68E+01	5.62E+01	28	N (b)			---			---
Iron	23 / 23	100	1.02E+04	J	2.90E+04		1.70E+00	1.20E+01	1.69E+04	2.34E+05	pH Dependent	N (b)			---			---
Lead	23 / 23	100	9.60E+00		1.34E+02	J	3.10E-01	5.00E-01	2.96E+01	4.86E+01	11	Y	Nonparametric	5.75E+01	5.75E+01	6.70E+01	1.34E+02	6.70E+01
Magnesium	23 / 23	100	2.01E+03		1.18E+04	J	1.74E+00	6.00E+02	5.60E+03	1.04E+04	Nutrient	N (c)			---			---
Manganese	23 / 23	100	1.70E+02		2.52E+03		1.74E-01	1.80E+00	4.29E+02	3.51E+03	220	N (b)			---			---
Mercury	21 / 23	91	1.63E-02	J	5.97E-01		2.06E-02	4.00E-02	8.03E-02	8.50E-02	0.00051	Y	Lognormal	1.91E-01	1.91E-01	2.48E-01	5.97E-01	2.48E-01
Nickel	23 / 23	100	8.40E+00		5.71E+01		2.55E-01	4.80E+00	1.84E+01	5.51E+01	38	N (d)			---			---
Potassium	22 / 23	96	3.21E+02		9.36E+02		2.12E+01	6.00E+02	5.71E+02	3.39E+03	Nutrient	N (c)			---			---
Selenium	13 / 23	57	4.83E-01	J	1.10E+00		5.20E-01	1.00E+00	6.03E-01	2.00E+00	0.52	N (b)			---			---
Sodium	14 / 23	61	2.50E+01		1.62E+02		8.49E+00	6.00E+02	1.49E+02	NA	Nutrient	N (c)			---			---
Thallium	9 / 23	39	2.21E-01	J	1.10E+00		4.24E-01	1.20E+00	4.62E-01	1.30E+00	1	N (b)			---			---
Vanadium	23 / 23	100	1.38E+01		2.85E+01		1.70E-01	6.00E+00	1.99E+01	4.09E+01	7.8	N (b)			---			---
Zinc	23 / 23	100	3.38E+01		1.05E+02		2.10E+00	2.50E+00	5.73E+01	3.22E+02	46	N (b)			---			---
Polychlorinated biphenyls (PCB)																		
Aroclor 1016	3 / 16	19	1.00E-01	J	1.22E+00	J	3.99E-02	2.05E-01	1.53E-01		0.371	Y	Normal	3.21E-01	3.21E-01	7.64E-01	1.22E+00	7.64E-01
Aroclor 1254	2 / 16	13	2.50E-01		1.00E+00	J	3.99E-02	2.05E-01	1.36E-01		0.371	Y	Nonparametric	4.09E-01	4.09E-01	5.40E-01	1.00E+00	5.40E-01
Aroclor 1260	3 / 16	19	6.67E-02	J	2.29E-01		3.99E-02	4.60E-01	9.52E-02		0.371	N (a)			---			---
Explosives																		
2,4,6-Trinitrotoluene	1 / 23	4	8.80E-01		8.80E-01		2.50E-01	3.14E-01	1.70E-01		NSV	Y [h]	Nonparametric	2.31E-01	2.31E-01	2.70E-01	8.80E-01	2.70E-01
2-Amino-4,6-dinitrotoluene	1 / 23	4	2.28E-01	/U	2.28E-01	/U	2.50E-01	3.14E-01	1.42E-01		0.0328	Y [h]	Nonparametric	1.50E-01	1.50E-01	1.52E-01	2.28E-01	1.52E-01
4-Amino-2,6-dinitrotoluene	1 / 23	4	2.60E-01		2.60E-01		2.50E-01	3.14E-01	1.43E-01		0.0328	Y [h]	Nonparametric	1.54E-01	1.54E-01	1.58E-01	2.60E-01	1.58E-01
Semivolatile Organic Compounds																		
Acenaphthene	3 / 16	19	5.92E-02	J	6.43E-01	J	3.60E-01	2.00E+00	2.87E-01		29	N (a)			---			---
Acenaphthylene	7 / 16	44	5.41E-02	J	3.23E+00		3.60E-01	2.00E+00	4.64E-01		29	N (a)			---			---
Anthracene	8 / 16	50	5.04E-02	J	4.53E+00		3.60E-01	2.00E+00	6.77E-01		29	N (a)			---			---
Benzo(a)anthracene	11 / 16	69	3.98E-02	J	1.19E+01		3.60E-01	2.00E+00	1.53E+00		1.1	Y	Gamma	2.82E+00	2.82E+00	8.20E+00	1.19E+01	8.20E+00
Benzo(a)pyrene	10 / 16	63	9.09E-02	J	1.00E+01		3.60E-01	2.00E+00	1.35E+00		1.1	Y	Gamma	2.67E+00	2.67E+00	6.96E+00	1.00E+01	6.96E+00
Benzo(b)fluoranthene	10 / 16	63	1.40E-01	J	1.39E+01		3.60E-01	2.00E+00	1.71E+00		1.1	Y	Gamma	3.29E+00	3.29E+00	9.35E+00	1.39E+01	9.35E+00
Benzo(ghi)perylene	9 / 16	56	1.20E-01	J	5.57E+00		3.60E-01	2.00E+00	8.36E-01		1.1	Y	Gamma	1.46E+00	1.46E+00	2.45E+00	5.57E+00	2.45E+00
Benzo(k)fluoranthene	7 / 16	44	1.27E-01	J	4.49E+00		3.60E-01	2.00E+00	8.03E-01		1.1	Y	Normal	1.42E+00	1.42E+00	2.21E+00	4.49E+00	2.21E+00
Bis(2-ethylhexyl)phthalate	1 / 16	6	1.21E-01	U/J	1.21E-01	U/J	3.60E-01	2.00E+00	2.95E-01		0.925	N (a)			---			---
Carbazole	3 / 14	21	4.43E-02	J	1.12E+00	J	3.92E-01	2.00E+00	3.30E-01		NSV	Y	Normal	3.35E-01	3.35E-01	8.34E-01	1.12E+00	8.34E-01
Chrysene	10 / 16	63	9.25E-02	J	1.03E+01		3.60E-01	2.00E+00	1.38E+00		1.1	Y	Gamma	2.58E+00	2.58E+00	7.16E+00	1.03E+01	7.16E+00
Dibenz(a,h)anthracene	3 / 16	19	3.97E-01	J	1.46E+00	J	3.60E-01	2.00E+00	3.74E-01		1.1	Y	Normal	6.40E-01	6.40E-01	8.54E-01	1.46E+00	8.54E-01
Dibenzofuran	3 / 16	19	7.80E-02	J	1.35E+00	J	3.60E-01	2.00E+00	3.29E-01		NSV	Y	Normal	3.66E-01	3.66E-01	8.31E-01	1.35E+00	8.31E-01
Fluoranthene	11 / 16	69	5.05E-02	J	2.48E+01		3.60E-01	2.00E+00	2.99E+00		1.1	Y	Gamma	5.76E+00	5.76E+00	1.70E+01	2.48E+01	1.70E+01
Fluorene	4 / 16	25	1.14E-01	J	1.78E+00	J	3.60E-01	2.00E+00	3.93E-01		1.1	Y	Normal	8.08E-01	8.08E-01	1.05E+00	1.78E+00	1.05E+00
Indeno(1,2,3-cd)pyrene	10 / 16	63	2.84E-01	J/U	8.10E+00		3.60E-01	2.00E+00	1.16E+00		1.1	Y	Appr. Gamma	2.10E+00	2.10E+00	5.55E+00	8.10E+00	5.55E+00
Methylnaphthalene, 2-	2 / 16	13	7.21E-01		1.57E+00	J	3.60E-01	2.00E+00	3.68E-01		3.24	N (a)			---			---
Naphthalene	2 / 16	13	6.77E-01		1.38E+00	J	3.60E-01	2.00E+00	3.54E-01		29	N (a)			---			---
Phenanthrene	10 / 16	63	6.77E-02	J	1.39E+01		3.60E-01	2.00E+00	1.71E+00		29	N (a)			---			---
Pyrene	11 / 16	69	4.06E-02	J	1.81E+01		3.60E-01	2.00E+00	2.33E+00		1.1	Y	Gamma	4.42E+00	4.42E+00	1.27E+01	1.81E+01	1.27E+01
Volatile Organic Compounds																		
Methylene chloride	2 / 2	100	1.20E-02		1.30E-02		5.50E-03	6.00E-03	1.25E-02		4.05	N (a)			---			---

Table 2-8

Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Soil (0-6 Feet)
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

BSC - Background screening concentration.
COPEC - Chemical of potential ecological concern
EPC - Exposure point concentration.
ESV - Ecological screening value
mg/kg - Milligrams per kilogram.
NA - Not available.
NSV - No screening value.
UCL - Upper confidence limit.
VQ - Validation qualifier (a "/" indicates combined VQs for a regular and field duplicate sample pair):
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed
U - Not detected.

[a] IT Corporation (IT), 1998, ***Site Investigation of Acid Areas*** , Plum Brook Ordnance Works, Sandusky, Ohio, August.
[b] ESVs and their sources are in Appendix B.
[c] N = Chemical is not chosen as a COPEC:
(a) = maximum detected concentration is less than the ESV.
(b) = maximum detected concentration is less than the BSC.
(c) = essential nutrient.
(d) = statistical test shows background and site data to be the same; see Appendix C.
(e) = infrequently detected (fewer than 5 percent of all samples)
[d] Y = Chemical is chosen as COPEC.
[e] 95% UCL (Upper confidence limit) determined using ProUCL Version 4.00.05 (U.S. Environmental Protection Agency (EPA), 2010, ProUCL Version 4.00.05, Office of Research and Development, Las Vegas, Nevada, and Technology Support Center, Atlanta, GA, May, on line at http://www.epa.gov/esd/tsc/TSC_form.htm.
[f] Concentration used in risk assessment equal to 95% UCL or maximum detected concentration, whichever is lower.
[g] The EPC for the COPEC at the surface soil depth range is used as the exposure concentration for some ecological receptors. Note that the end depth of the surface soil data set is extended beyond 1 foot due to the presence of fill material (see text for details).
[h] The chemical may be a site-related contaminant, and was included as a COPEC even though it was infrequently detected.

Table 2-9

Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Surface Water
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of values, µg/L: Detected Conc Minimum	VQ	Detected Conc Maximum	VQ	Reporting Limits Minimum	Reporting Limits Maximum	Arithmetic Mean µg/L	ESV [a] µg/L	COPEC? [b,c]	EPC [d] µg/L
Metals												
Aluminum	3 / 3	100	1420		3590	JJ	200	200	2.22E+03	8.70E+01	Y	3.59E+03
Arsenic	2 / 3	67	6.1	J	7.2	JU	10	10	6.10E+00	3.10E+00	Y	7.20E+00
Barium	3 / 3	100	47	J	105	JJ	200	200	7.25E+01	4.00E+00	Y	1.05E+02
Calcium	3 / 3	100	91200		119500		1000	1000	1.07E+05	Nutrient	N (b)	---
Chromium	3 / 3	100	2.1	J	5.65	JJ	10	10	3.42E+00	4.20E+01	N (a)	---
Cobalt	3 / 3	100	1.6	J	5.95	JJ	50	50	3.22E+00	2.30E+01	N (a)	---
Copper	2 / 3	67	6.9	J	8.4	JJ	25	25	9.27E+00	1.58E+00	Y	8.40E+00
Iron	3 / 3	100	2440		11300		300	300	5.98E+03	Nutrient	N (b)	---
Lead	3 / 3	100	2.2	J	7.2		5	5	4.63E+00	1.17E+00	Y	7.20E+00
Magnesium	3 / 3	100	23600		29300		5000	5000	2.57E+04	Nutrient	N (b)	---
Manganese	3 / 3	100	134		1980		15	15	9.67E+02	1.20E+02	Y	1.98E+03
Nickel	1 / 3	33	4.1	JJ	4.1	JJ	40	40	1.47E+01	2.89E+01	N (a)	---
Potassium	3 / 3	100	703	J	1465	JJ	20000	20000	9.81E+02	Nutrient	N (b)	---
Selenium	1 / 3	33	4.6	JJ	4.6	JJ	10	10	4.87E+00	3.90E-01	Y	4.60E+00
Sodium	3 / 3	100	3850	J	4955	JJ	20000	20000	4.43E+03	Nutrient	N (b)	---
Vanadium	3 / 3	100	4.7	J	9.65	JJ	50	50	6.45E+00	1.20E+01	N (a)	---

ESV - Ecological screening value.
EPC - Exposure point concentration.
COPEC - Chemical of Potential Ecological Concern.
µg/L - Micrograms per liter.
VQ - Validation qualifier.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.

[a] ESVs and their sources are in Appendix B.
[b] N = Chemical is not chosen as a COPEC:
(a) - Maximum detected concentration is less than the ESV.
(b) - Essential nutrient.
[c] Y = Chemical is chosen as COPEC.
[d] Concentration used in risk assessment equal to maximum detected concentration.

Table 2-10

Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Sediment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg: Detected Concentrations Minimum	VQ	Maximum	VQ	Reporting Limits Minimum	Maximum	Mean mg/kg	BSC [a] mg/kg	ESV [b] mg/kg	COPC? [c,d]
Inorganics												
Aluminum	3 / 3	100	8.41E+03		9.58E+03		2.10E+01	2.54E+01	9.00E+03	1.55E+04	NSV	N (b)
Arsenic	3 / 3	100	6.40E+00		7.20E+00		8.50E-01	1.30E+00	6.80E+00	3.65E+01	9.79E+00	N (a)
Barium	3 / 3	100	5.86E+01		8.25E+01		2.10E+01	2.54E+01	6.91E+01	8.26E+02	NSV	N (b)
Beryllium	1 / 3	33	6.40E-01		6.40E-01		5.30E-01	6.30E-01	4.20E-01	1.00E+00	NSV	N (b)
Cadmium	1 / 3	33	8.60E-01		8.60E-01		4.20E-01	6.30E-01	4.93E-01	NA	9.90E-01	N (a)
Calcium	3 / 3	100	7.24E+03		3.30E+04		5.30E+02	6.35E+02	2.38E+04	5.23E+04	Nutrient	N (c)
Chromium	3 / 3	100	1.41E+01		1.51E+01		1.10E+00	1.30E+00	1.45E+01	2.90E+01	4.34E+01	N (a)
Cobalt	3 / 3	100	7.10E+00		1.14E+01		5.30E+00	6.30E+00	8.90E+00	1.16E+02	5.00E+01	N (a)
Copper	3 / 3	100	1.79E+01		2.64E+01		2.60E+00	3.20E+00	2.11E+01	5.62E+01	3.16E+01	N (a)
Iron	3 / 3	100	1.83E+04		1.93E+04		1.10E+01	1.27E+01	1.87E+04	2.34E+05	Nutrient	N (c)
Lead	3 / 3	100	9.40E+00		1.86E+01		3.60E-01	1.10E+01	1.47E+01	4.86E+01	3.58E+01	N (a)
Magnesium	3 / 3	100	3.78E+03		1.10E+04		5.30E+02	6.35E+02	8.39E+03	1.04E+04	Nutrient	N (c)
Manganese	3 / 3	100	1.42E+02		1.87E+03		1.80E+00	1.60E+01	8.01E+02	3.51E+03	4.60E+02	N (b)
Mercury	2 / 3	67	4.70E-02		5.80E-02	J	4.00E-02	1.80E-01	4.17E-02	8.50E-02	1.80E-01	N (a)
Nickel	3 / 3	100	1.91E+01		2.37E+01		4.20E+00	5.10E+00	2.11E+01	5.51E+01	2.27E+01	N (b)
Potassium	2 / 2	100	8.77E+02		9.98E+02		6.05E+02	6.35E+02	9.38E+02	3.39E+03	Nutrient	N (c)
Selenium	3 / 3	100	7.10E-01		2.80E+00	J	6.10E-01	1.10E+01	1.50E+00	2.00E+00	NSV	Y
Sodium	1 / 3	33	1.72E+02	J	1.72E+02	J	6.05E+02	2.20E+03	2.64E+02	NA	Nutrient	N (c)
Thallium	1 / 3	33	1.20E+00		1.20E+00		1.20E+00	4.40E+00	1.35E+00	1.30E+00	NSV	N (b)
Vanadium	3 / 3	100	2.20E+01		2.45E+01		5.30E+00	6.30E+00	2.36E+01	4.09E+01	NSV	N (b)
Zinc	3 / 3	100	5.26E+01		7.19E+01		2.10E+00	2.50E+00	6.32E+01	3.22E+02	1.21E+02	N (a)
Semivolatiles Organic Compounds												
Benzo(a)pyrene	1 / 3	33	1.20E-01	J	1.20E-01	J	3.50E-01	4.20E-01	1.77E-01		1.50E-01	N (a)
Benzo(b)fluoranthene	1 / 3	33	1.91E-01	J	1.91E-01	J	3.50E-01	4.20E-01	2.00E-01		1.04E+01	N (a)
Benzo(ghi)perylene	1 / 3	33	1.05E-01	J	1.05E-01	J	3.50E-01	4.20E-01	1.72E-01		1.70E-01	N (a)
Chrysene	1 / 3	33	1.03E-01	J	1.03E-01	J	3.50E-01	4.20E-01	1.71E-01		1.66E-01	N (a)
Fluoranthene	1 / 3	33	1.56E-01	J	1.56E-01	J	3.50E-01	4.20E-01	1.89E-01		4.23E-01	N (a)
Indeno(1,2,3-cd)pyrene	1 / 3	33	1.10E-01	J	1.10E-01	J	3.50E-01	4.20E-01	1.73E-01		2.00E-01	N (a)
Pyrene	1 / 3	33	1.38E-01	J	1.38E-01	J	3.50E-01	4.20E-01	1.83E-01		1.95E-01	N (a)

BSC - Background screening concentration. The soil BSC is used for sediment in this evaluation. See text for details.
COPEC - Chemical of potential ecological concern.
EPC - Exposure point concentration
ESV - Ecological screening value.
J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.

Table 2-10

Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Sediment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

mg/kg - Milligrams per kilogram.
NA - Not available.
NSV - No screening value available.
VQ - Validation qualifier.

[a] Soil background screening concentrations are used for sediment. See text for details.
[b] ESVs and their sources are in Appendix B.
[c] N = Chemical is not chosen as a COPEC:
(a) - Maximum detected concentration is less than the ESV.
(b) - Maximum detected concentration is less than the BSC.
(c) - Essential nutrient.
[d] Y = Chemical is chosen as COPEC.
[e] Due to the low sample size (< 5), the maximum detected concentration is selected as the EPC.

Table 3-1

Data Used to Model Exposure in the Indicator Wildlife Species
Waste Water Treatment Plant No. 3, Plum Brook Ordnance Works
Sandusky, Ohio

Indicator Species	Class/ Order	Average Body Weight[a] (kg)	Average Home Range[a] (ha)	Dietary Intake[a] (kg[dw]/day)	Soil/Sed. Intake (kg[dw]/day)	Water Intake (L/day)[b]	Trophic Level	Dietary Composition[a] (percent)
Deer mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	0.0148	0.062	0.0028[d]	0.000056 (2%)	0.0022	Omnivore	Terr. Inverts. : 39 Plants: 61
Eastern cottontail (*Sylvilagus floridanus*)	Mammalia/ Lagomorpha	1.132	3.1	0.096[d]	0.006 (6.3%)	0.11	Herbivore	Plants: 100
Short-tailed shrew (*Blarina brevicauda*)	Mammalia/ Insectivora	0.015	0.39	0.0022[d]	0.00023 (10.4%)	0.0023	Insectivore	Terr. Inverts.: 100
White-tailed deer (*Odocoileus virginianus*)	Mammalia/ Artiodactyla	61[c]	518[c]	2.0[d]	0.04 (2%)	4	Herbivore	Plants: 100
Marsh wren (*Cistothorus palustris*)	Aves/ Passeriformes	0.01	0.054	0.0029[d]	0.000058 (2%)	0.0027	Insectivore	Terr. Inverts.: 100
Red-tailed hawk (*Buteo jamaicensis*)	Aves/ Falconiformes	0.957	842	0.057[d]	0.00114 (2%)	0.057	Carnivore	Rabbits: 25.3 Shrews: 25.3 Mice: 25.3 Birds: 24
Muskrat[e] (*Ondata zibethicus*)	Mammalia/ Rodentia	1.174	0.13	0.352	negligible	0.11	Herbivore	Aquatic plants: 100
Raccoon (*Procyon lotor*)	Mammalia/ Carnivora	5.1	156	0.26[d]	0.024 (9.4%) (assumed 50% soil and 50% sediment)	0.43	Omnivore	Aq. Inverts.: 21 Terr. Inverts.: 30 Mice: 5 Plants: 42 (50% terrestrial, 50% aquatic) Fish: 2

[a] From EPA (1993), except as noted.
[b] Allometric equations for mammals and birds from EPA (1993), as follows:
Mammals: WI (water ingestion; L/day) = 0.099 Wt $^{0.90}$ (kg), where Wt = body weight.
Birds: WI (L/day) = 0.059 Wt $^{0.67}$ (kg).
[c] Information is from *A Guide to the Mammals of Ohio* (Gottschang, 1981).
[d] Allometric equation for mammals: FI (kg/day) = 0.0687 Wt $^{0.822}$ for shrew, deer, and raccoon; FI (g/day) = 0.621 Wt $^{0.564}$ for rodents (deer mouse); and FI (g/day) = 0.577 Wt $^{0.727}$ for small herbivores (cottontail).
Allometric equation for birds: FI (kg/day) = 0.0582 Wt0.651 (EPA, 1993), where FI = food ingestion (dry weight) and Wt = body weight. Allometric equations from EPA (1993).
[e] Exposure parameters obtained from OEPA-DERR (2008) Ecological Risk Assessment Guidance Document, Revised April 2008, On line: http://www.epa.ohio.gov/portals/30/rules/RR-031.pdf.

References

U.S. Environmental Protection Agency (EPA), 1993, *Wildlife Exposure Factors Handbook*, Vols. I and II, Office of Research and Development, Washington, D.C., EPA/600/R-93/187a.

Table 3-2

Bioaccumulation Factors or Regression
Equations Utilized for the Soil-to-Plant and Sediment-to-Aquatic Plant Pathways
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

COPEC in Soil or Sediment	EPA, 2008	Efroymson et al., 2001 Minimum BAF/BCF	Median BAF/BCF	90th Percentile BAF/BCF[b]	Maximum BAF/BCF	Other BAF/BCF (1)		Regression Equation (2)	Recommended BAF/BCF (3)	Source
Inorganics										
Cadmium	ln (AGP)=0.546(ln[soil])-0.475	0.0087	0.59	3.3	23	0.35	a	ln (AGP)=0.55(ln[soil])-0.48	Eco-SSL Regression	EPA (2008), Table 4a
Lead	ln (AGP)=0.561(ln[soil])-1.328	0.00011	0.039	0.47	11	0.0011	c	--	Eco-SSL Regression	EPA (2008), Table 4a
Mercury	--	0.0015	0.65	5	12	0.55	a	ln (AGP)=0.54(ln[soil])-1.00	Regression Equation	Efroymson et al. (2001)
Selenium	ln (AGP)=1.104(ln[soil])-0.677	0.02	0.67	3	77	0.025	a	ln (AGP)=0.56(ln[soil])+1.58	Eco-SSL Regression	EPA (2008), Table 4a
PCBs										
Aroclor 1016	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.020	Travis & Arms Kow Regression Eq.
Aroclor 1254	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.004	Travis & Arms Kow Regression Eq.
Nitroaromatics										
2,4,6-Trinitrotoluene	4.23	--	--	--	--	--		--	4.230	EPA (2008), Table 4b
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	3.346	Travis & Arms Kow Regression Eq.
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	3.346	Travis & Arms Kow Regression Eq.
Semivolatile Organics										
Benzo(a)anthracene	ln (AGP)=0.5944(ln[soil])-2.7078	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Benzo(a)pyrene	ln(AGP) = 0.975(ln[soil])-2.0615	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Benzo(b)fluoranthene	0.31	--	--	--	--	0.31	b	--	0.310	EPA (2008), Table 4b
Benzo(ghi)perylene	ln(AGP) = 1.1829(ln[soil])-0.9313	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Benzo(k)fluoranthene	ln(AGP) = 0.8595(ln[soil])-2.1579	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Carbazole	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.530	Travis & Arms Kow Regression Eq.
Chrysene	ln (AGP)=0.5944(ln[soil])-2.7078	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Dibenz(a,h)anthracene	0.13	--	--	--	--	0.13	b	--	0.130	EPA (2008), Table 4b
Dibenzofuran	--	--	--	--	--	--		Log (BCF)=-0.578(Log[Kow])+1.588	0.084	Travis & Arms Kow Regression Eq.
Fluoranthene	0.5	--	--	--	--	0.5	b	--	0.5	EPA (2008), Table 4b
Fluorene	ln(AGP) = -0.8556(ln[soil])-5.562	--	--	--	--	--		--	Eco-SSL Regression	EPA (2008), Table 4b
Indeno(1,2,3-cd)pyrene	0.11	--	--	--	--	0.11	b	--	0.110	EPA (2008), Table 4b
Pyrene	0.72	--	--	--	--	0.72	b	--	0.72	EPA (2008), Table 4b

Notes:

1. For inorganic chemicals without BAF/BCF data, BAF/BCFs were derived from the Baes et al. (1984) and IAEA (1994) data.
2. Efroymson, R.A., et. al., 2001, *Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data*, Environ. Tox. Chem., 20:2561-2571 for AGP (above ground plant tissue concentration) and Travis and Arms (1988) for BCF.
3. For the values estimated using Travis and Arms (1988) Kow regression equation, Kow values were obtained using the Kow WIN application in EPA's EPI Suite software (http://www.epa.gov/oppt/exposure/pubs/episuite.htm).

[a] Average of the vegetative and reproductive transfer factors presented in Baes et al. (1984); note: value from this reference used if no appropriate value available from IAEA (1994).

[b] From EPA (2008).

[c] IAEA (1994); note: value from this reference used, compared with Baes et al. (1984), as IAEA (1994) is more current.
International Atomic Energy Agency (IAEA), 1994, Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments, Technical Report Series No. 364, Vienna.

References:

Baes, C. F., R.D. Sharp, A.L. Sjoreen and R. W. Shor, 1984, *A review and analysis of parameters for assessing transport of environmentally released radionuclides through agriculture,* ORNL-5786, September.
Efroymson, R.A., et. al., 2001, *Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data*, Environ. Tox. Chem., 20:2561-2571
EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, OSWER 9285.7-55, November.
Travis, C.C., and A.D. Arms, 1988, *Bioconcentration of Organics in Beef, Milk, and Vegetation*, Enironmental Science and Technology 22(3): 271-274.

Table 3-3

Bioaccumulation Factors or Regression Equations
Utilized for the Soil-to-Earthworm Pathway
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Constituent	PBOW Site-Specific BCF [a]	Sample, et al. 1998			Beyer, 1990 BAF/BCF	Regression Equation	Recommended BAF/BCF	Source of BAF/BCF	Rationale for BAF/BCF
		Median BAF/BCF	90th Percentile BAF/BCF	Maximum BAF/BCF					
Inorganics									
Cadmium	--	7.708	40.69	190	--	ln (EW)=0.795(ln[soil])+2.114	Regression Equation	EPA 2008, Table 4a	Chemical-specific regression equation
Lead	--	0.266	1.522	228.261	--	ln (EW)=0.807(ln[soil])-0.218	Regression Equation	EPA 2008, Table 4a	Chemical-specific regression equation
Mercury	--	1.693	20.625	33	--	ln (EW)=0.33(ln[soil])+0.078	Regression Equation	Sample et al. 1998	Chemical-specific regression equation
PCBs									
Aroclor 1016	--	--	--	--	--	Calculated; see footnote c	15.6	See footnote c	
Aroclor 1254	--	--	--	--	--	Calculated; see footnote c	16.01	See footnote c	
Nitroaromatics									
2,4,6-Trinitrotoluene	--	--	--	--	--	Calculated; see footnote c	12.2	See footnote c	
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--	0.1	Site field study	Use 2,4-Dinitrotoluene as surrogate
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--	0.1	Site field study	Use 2,4-Dinitrotoluene as surrogate
Semivolatile Organics									
Benzo(a)anthracene	0.58	--	--	--	0.13	--	0.58	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(a)pyrene	0.46	--	--	--	0.3421	--	0.46	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(b)fluoranthene	0.21	--	--	--	0.319	--	0.21	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(ghi)perylene	0.5	--	--	--	0.244	--	0.5	Site field study	Plum Brook site-specific BAF (IT, 2001)
Benzo(k)fluoranthene	0.47	--	--	--	0.253	--	0.47	Site field study	Plum Brook site-specific BAF (IT, 2001)
Carbazole	--	--	--	--	--	Calculated; see footnote c	1.24	See footnote c	
Chrysene	0.55	--	--	--	0.18	--	0.55	Site field study	Plum Brook site-specific BAF (IT, 2001)
Dibenz(a,h)anthracene	1.42	--	--	--	--	--	1.42	Site field study	Plum Brook site-specific BAF (IT, 2001)
Dibenzofuran	--	--	--	--	--	Calculated; see footnote b	14.4	See footnote b	
Fluoranthene	0.21	--	--	--	0.079	--	0.21	Site field study	Plum Brook site-specific BAF (IT, 2001)
Fluorene	2.5	--	--	--	--	--	2.5	Site field study	Plum Brook site-specific BAF (IT, 2001)
Indeno(1,2,3-cd)pyrene	0.51	--	--	--	0.419	--	0.51	Site field study	Plum Brook site-specific BAF (IT, 2001)
Pyrene	0.45	--	--	--	0.092	--	0.45	Site field study	Plum Brook site-specific BAF (IT, 2001)

-- indicates that a BAF/BCF or regression equation is not available.
BAF - Bioaccumulation factor.
BCF - Bioconcentration factor.
PAH - Polynuclear aromatic hydrocarbon

[a] IT Corporation (IT), 2001, *Redwater Pond Areas Baseline Ecological Risk Assessment, Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for U.S. Army Corps of Engineers, Nashville District, April.

[b] For Organics: Ecological Soil Screening Level (SSL) Guidance, EPA, 2008 (Section 3.2.2 in Appendix 4-1, given site-specific soil total organic carbon [TOC]).
The biota/soil water partitioning coefficient of $10^{(logKow-0.6)}$ was replaced with Equation 3 from Jager (1998) of F_{lipid} x Kow. The F_{water} variable of Equation 3 was not included, since it only improves the model fit for extremely hydrophilic compounds (i.e. chemicals with log Kow < 2, approximately).

$$BAF - \frac{Flipid * Kow}{FOC * 10^{(0.983 * logKow + 0.00028)}}$$

Flipid = 0.079 The lipid content in insects was estimated at 3.1 percent fresh weight (Taylor, 1975), which is 7.9 percent of dry weight, using a value of 61 percent water content in beetles (EPA, 1993), calculated as follows: 0.031/(1-0.61) = 0.079, or 7.9 percent.

Kow values obtained from EPA EPI Suite Version 4.0, http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm

Table 3-3

Bioaccumulation Factors or Regression Equations
Utilized for the Soil-to-Earthworm Pathway
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

References:

Beyer, W. N., 1990, *Evaluating Soil Contamination, Biological Report 90(2)*, U.S. Department of the Interior, U.S. Fish and Wildlife Service.
EPA, 1993, *Wildlife Exposure Factors Handbook, Volume I of II*, EPA 600/R-93/187a.
EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)*, Office of Solid Waste and Emergency Response, Directive 92857.7-55, Washington, D.C.
IT Corporation (IT), 2001, *Redwater Pond Areas Baseline Ecological Risk Assessment, Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for U.S. Army Corps of Engineers, Nashville District, April.
Jager, T., 1998, *Mechanistic Approach for Estimating Bioconcentration of Organic Chemicals in Earthworms (Oligochaeta)*, Environmental Toxicology and Chemistry 17: 2080-2090.
Sample, B. E, et. al., 1998, *Development and Validation of Bioaccumulation Models for Earthworms*, ES/ER/TM-220.
Taylor, R. L., 1975, Butterflies in My Stomach, Woodbridge Press Publishing Company, Santa Barbara, California.

Table 3-4

Bioaccumulation Factors or Regression Equations Utilized for the Soil-to-Mammal/Bird[a] Pathway
Waste Water Treatment Plant No. 3
Locomotive Building Area, Plum Brook Ordnance Works
Sandusky, Ohio

Constituent	Sample et al., (1998)						EPA (1999)	Other BAF		Regression Equation	Recommended BAF	Rationale for Recommended BAF
	Insectivore Median BAF	Herbivore Median BAF	Omnivore Median BAF	General[b] Median BAF	General[b] Maximum BAF	General[b] 90th percentile BAF	Maximum BAF Avian or Mammal					
Inorganics												
Cadmium	2.105	0.1258	0.1217	0.3333	69.561	3.9905	0.0044	--	--	ln (M)=0.4723(ln[soil]) -1.2571	Regression	EPA (2008)-Attach 4-1, Table 4a
Lead	0.1601	0.0522	0.0659	0.1054	2.659	0.2864	--	--	--	ln (M)=0.4422(ln[soil]) +0.0761	Regression	EPA (2008)-Attach 4-1, Table 4a
Mercury	1.046	0.0239 d	0.0543	0.0543	1.046	0.192	--	--	--	--	0.192	"General: 90th Percentile" used because of uncertainties regarding the type of mammalian prey items.
PCBs												
Aroclor 1016	--	--	--	--	--	--	1.32E-03	--	--	--	0.00132	EPA (1999), max for any taxa in Table D-3
Aroclor 1254	--	--	--	--	--	--	1.32E-03	--	--	--	0.00132	EPA (1999), max for any taxa in Table D-3
Nitroaromatics												
2,4,6-Trinitrotoluene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for TNT
2-Amino-4,6-dinitrotoluene	--	--	--	--	--	--	7.24E-08	--	--	--	7.24E-08	Average of 2,4- and 2,-6 dinitrotoluene
4-Amino-2,6-dinitrotoluene	--	--	--	--	--	--	7.24E-08	--	--	--	7.24E-08	Average of 2,4- and 2,-6 dinitrotoluene
Semivolatile Organics												
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(ghi)perylene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Carbazole	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Chrysene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Dibenzofuran	--	--	--	--	--	--	--	--	--	--	1.1	See Footnote c
Fluoranthene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Fluorene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs
Pyrene	--	--	--	--	--	--	--	--	--	--	0	EPA (2008) recommendation for PAHs

-- indicates that a BAF is not available.
BAF - Bioaccumulation factor.
[a] Bird BAF values were based on the recommended small mammal BAF values, as bird uptake values are not readily available.
[b] "General" indicates that the combination dataset used for insectivore, herbivore, and omnivore receptors was used to estimate a "general" receptor BAF value.
[c] The median BAF of 1.1 for dioxin (TCDD) from Sample et al. (1998) is used as a conservative surrogate for organic chemicals.

References:

EPA, 2008, *Guidance for Developing Ecological Soil Screening Levels (Eco-SSL)* , Office of Solid Waste and Emergency Response, Directive 92857.7-55, Washington, D.C.
EPA, 1999, *Screening level ecological risk assessment protocol for hazardous waste combustion facilities* , August, EPA530-D-99-001A.
Sample et al., 1998, *Development and Validation of Bioaccumulation Models for Small Mammals,* ES/ER/TM-219.

Table 3-5

Bioaccumulation Factors Utilized
for the Sediment-to-Benthic Invertebrate Pathway
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Constituent	PBOW Site-Specific BCFs [a]	Bechtel Jacobs (1998)			EPA (1999) BAF/BCF (dry weight)	Other BAF/BCF (dry weight)	Recommended BAF/BCF (dry weight)	Rationale for Recommended BAF/BCF
		Median BAF/BCF (dry weight)	90th Percentile BAF/BCF (dry weight)	Maximum BAF/BCF (dry weight)				
Inorganics								
Selenium	--	--	--	--	5.39 [a]	--	5.39	EPA, 1999

-- indicates that a BAF/BCF or regression equation is not available.
BAF - Bioaccumulation factor.
BCF - Bioconcentration factor.

[a] Empirical data not available in EPA, 1999. Value presented is based on the mean of 6 recommended values for metals with empirical data as presented in Table C-6 (EPA, 1999).

References:

Bechtel Jacobs Company LLC, 1998, *Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation* , BJC/OR-112. (Depurated and nondepurated results used).

EPA, 1999, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* , EPA530-D-99-001A (Peer Review Draft). **Note:** Only values based on empirical studies were used. Values were reported on a wet weight basis. Values were multiplied by 5.99 to convert to a dry-weight basis (see EPA, 1999).

Table 3-6

Bioaccumulation Factors and Regression Equations Utilized for the Surface Water-to-Fish Pathway Waste Water Treatment Plant No. 3 Plum Brook Ordnance Works, Sandusky, Ohio

Constituent	PBOW Site-Specific BCFs [a]	EPA (1999) BAF/BCF [b] (dry weight)	EPA (1989) BAF/BCF [c] (dry weight)	RAIS Database [d] (dry weight)	Regression Equation	Recommended BCF	Rationale for Recommended BAF/BCF
Inorganic Chemicals							
Aluminum	780	13.5	--	2,500	--	780	Site specific BCF used (IT, 2001)
Arsenic	174	570	1,750	1,500	--	174	Site specific BCF used (IT, 2001)
Barium	146	3165	--	20	--	146	Site specific BCF used (IT, 2001)
Copper	1211.5	3,550	5,915	1,000	--	1211.5	Site specific BCF used (IT, 2001)
Lead	63.8	0.45	895	1,500	--	63.8	Site specific BCF used (IT, 2001)
Manganese	247	--	--	2,000		247	Site specific BCF used (IT, 2001)
Selenium	--	645	--	1,000	--	645	EPA (1999)

-- indicates that a BAF/BCF or regression equation is not available.
BAF - Bioaccumulation factor.
BCF - Bioconcentration factor.

[a] Values are from IT, 2001. The listed BCF is the average of the West Area Red Water Pond reasonable maximum exposure value, and the average of the BCFs for the three aquatic organisms evaluated for the Pentolite Road area.
[b] Values are from EPA, 1999, adjusted to dry weight by multiplying by a factor of 5.
[c] Values are from EPA, 1989, and assumed to be in wet weight; adjusted to dry weight by multiplying by a factor of 5.
[d] Values are from Risk Assessment Information System (RAIS), current as of June 2010. Values were assumed to be in wet weight and were adjusted to dry weight by multiplying by a factor of 5.

References:

EPA, 1999, *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-D-99-001A (Peer Review Draft).

EPA, 1989, *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish*, EPA503-8-89-002.

IT Corporation (IT), 2001, *Redwater Pond Areas Baseline Ecological Risk Assessment, Plum Brook Ordnance Works, Sandusky, Ohio*, prepared for U.S. Army Corps of Engineers, Nashville District, April.

Risk Assessment Information System (RAIS), on-line database, current as of June 2007, http://rais.ornl.gov

Table 4-1

Toxicity Reference Values for Mammals
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference
Inorganics								
Aluminum	--	1.93	mouse	Sample, et al. (1996)	--	19.30	mouse	Sample, et al. (1996)
Arsenic	--	0.126	mouse	Sample, et al. (1996)	--	1.26	mouse	Sample, et al. (1996)
Barium	--	5.1	rat	Sample, et al. (1996)	--	19.8	rat	Sample, et al. (1996)
Cadmium	--	1	rat	Sample, et al. (1996)	--	10	rat	Sample, et al. (1996)
Copper	--	11.7	mink	Sample, et al. (1996)	--	15.14	mink	Sample, et al. (1996)
Lead	--	8	rat	Sample, et al. (1996)	--	80	rat	Sample, et al. (1996)
Manganese	--	88	rat	Sample, et al. (1996)	--	284	rat	Sample, et al. (1996)
Mercury (mink)	--	1	mink	Sample, et al. (1996)	1.0 (NOAEL)	5	mink	Sample, et al. (1996)
Mercury (mouse)	--	13.2	mouse	Sample, et al. (1996)	--	132	mouse	Sample, et al. (1996)
Selenium	--	0.2	rat	Sample, et al. (1996)	--	0.33	rat	Sample, et al. (1996)
PCBs								
Aroclor-1016	--	1.37	mink	Sample, et al. (1996)	--	3.43	mink	Sample, et al. (1996)
Aroclor-1254 (mink)	--	0.140	mink	Sample, et al. (1996)	--	0.69	mink	Sample, et al. (1996)
Aroclor-1254 (mouse)	--	0.068	mouse	Sample, et al. (1996)	--	0.68	mouse	Sample, et al. (1996)
Nitroaromatics								
2,4,6-Trinitrotoluene	--	35	rat	LANL (2010)	--	173.5	rat	LANL (2010)
2-Amino-4,6-dinitrotoluene	--	9	mouse/rat	USACHPPM (2005)	--	48	mouse/rat	USACHPPM (2005)
4-Amino-2,6-dinitrotoluene	--	9	mouse/rat	USACHPPM (2005)	--	48	mouse/rat	USACHPPM (2005)
Semivolatile Organics								
Benzo(a)anthracene	--	0.17	mouse	LANL (2010)	--	0.85	mouse	LANL (2010)
Benzo(a)pyrene	--	1	mouse	Sample, et al. (1996)	--	10	mouse	Sample, et al. (1996)
Benzo(b)fluoranthene	40 (Chronic LOAEL)	4	rodent	LANL (2010)	--	20	rodent	LANL (2010)
Benzo(ghi)perylene	72 (Chronic LOAEL)	7.2	rodent	LANL (2010)	--	72	rodent	LANL (2010)
Benzo(k)fluoranthene	72 (Chronic LOAEL)	7.2	rodent	LANL (2010)	--	72	rodent	LANL (2010)
Carbazole	0.00023 (Chronic LOAEL)	2.3E-05	mouse	LANL (2010)	--	2.3E-04	mouse	LANL (2010)
Chrysene	--	0.17	mouse	LANL (2010)	--	0.85	mouse	LANL (2010)
Dibenz(a,h)anthracene	13.3 (Chronic LOAEL)	1.33	mouse	LANL (2010)	--	13.3	mouse	LANL (2010)
Dibenzofuran	NA							
Fluoranthene	125 (subchronic NOAEL)	12.5	mouse	LANL (2010)	--	62.5	mouse	LANL (2010)
Fluorene		125	mouse	LANL (2010)	--	625	mouse	LANL (2010)
Indeno(1,2,3-cd)pyrene	72 (chronic LOAEL)	7.2	rodent	LANL (2010)	--	36	rodent	LANL (2010)
Pyrene	75 (subchronic NOAEL)	7.5	mouse	LANL (2010)	--	37.5	mouse	LANL (2010)

NA - No toxicity data available

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Table 4-2

Toxicity Reference Values for Birds
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

COPEC	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Reference	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Reference
Inorganics								
Aluminum	--	110	ringed dove	Sample, et al. (1996)	--	1100	ringed dove	Sample, et al. (1996)
Arsenic	--	5.14	mallard duck	Sample, et al. (1996)	--	12.84	mallard duck	Sample, et al. (1996)
Barium	--	20.8	chicks	Sample, et al. (1996)	--	41.7	chicks	Sample, et al. (1996)
Cadmium	--	1.45	mallard duck	Sample, et al. (1996)	--	20	mallard duck	Sample, et al. (1996)
Copper	--	47	chicks	Sample, et al. (1996)	--	61.7	chicks	Sample, et al. (1996)
Lead (quail)	--	1.13	Japanese quail	Sample, et al. (1996)	--	11.3	Japanese quail	Sample, et al. (1996)
Lead (kestrel)	--	3.85	Am. Kestrel	Sample, et al. (1996)	--	38.50	Am. Kestrel	Sample, et al. (1996)
Manganese	--	977	Japanese quail	Sample, et al. (1996)	--	9770	Japanese quail	Sample, et al. (1996)
Mercury	--	0.45	Japanese quail	Sample, et al. (1996)	--	0.90	Japanese quail	Sample, et al. (1996)
Selenium (duck)	--	0.5	mallard duck	Sample, et al. (1996)	--	1	mallard duck	Sample, et al. (1996)
Selenium (owl)	--	0.44	screech owl	Sample, et al. (1996)	--	1.5	screech owl	Sample, et al. (1996)
PCBs								
Aroclor-1016	--	0.18	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)	--	1.80	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)
Aroclor-1254	--	0.18	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)	--	1.80	ring neck pheasant	Aroclor-1254 as surrogate; Sample, et al. (1996)
Nitroaromatics								
2,4,6-Trinitrotoluene	--	9.75	Bobwhite quail	LANL (2010)	--	48.75	Bobwhite quail	LANL (2010)
2-Amino-4,6-dinitrotoluene	7	9.75	Bobwhite quail	2,4,6-TNT as surrogate; LANL (2010)	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate; LANL (2010)
4-Amino-2,6-dinitrotoluene	7	9.75	Bobwhite quail	2,4,6-TNT as surrogate; LANL (2010)	--	48.75	Bobwhite quail	2,4,6-TNT as surrogate; LANL (2010)
Semivolatile Organics								
Benzo(a)anthracene	7 (subchronic NOAEL)	0.7	Bobwhite quail	LANL (2010)	--	3.5	Bobwhite quail	LANL (2010)
Benzo(a)pyrene	--	1	chicken	EPA (1999)	--	5	chicken	EPA (1999)
Benzo(b)fluoranthene	--	0.14	chicken	EPA (1999)	--	0.7	chicken	EPA (1999)
Benzo(ghi)perylene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Benzo(k)fluoranthene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Carbazole	NA							
Chrysene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Dibenz(a,h)anthracene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Dibenzofuran	NA							
Fluoranthene	--	39.5	chicken	Rigdon and Neal, 1963	--	395	chicken	Rigdon and Neal, 1963
Fluorene	--	1	chicken	BaP as surrogate; EPA (1999)	--	5	chicken	BaP as surrogate; EPA (1999)
Indeno(1,2,3-cd)pyrene	--	1	chicken	EPA (1999)	--	5	chicken	EPA (1999)
Pyrene	--	39.5	chicken	Rigdon and Neal (1963)	--	395	chicken	Rigdon and Neal (1963)

NA - No toxicity value available

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Table 5-1

Wildlife Hazard Quotients for All Assessment Receptors
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

COPEC	Deer Mouse		Short-tailed Shrew		Cottontail Rabbit		Marsh Wren		White-tailed Deer		Raccoon		Red-Tailed Hawk		Muskrat	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals																
Aluminum	2.77E-01	2.77E-02	2.85E-01	2.85E-02	7.08E-02	7.08E-03	8.81E-03	8.81E-04	2.86E-04	2.86E-05	1.27E-02	1.27E-03	2.80E-06	2.80E-07	1.74E-01	1.74E-02
Arsenic	8.49E-03	8.49E-04	8.76E-03	8.76E-04	2.17E-03	2.17E-04	3.78E-04	1.51E-04	8.78E-06	8.78E-07	1.17E-04	1.17E-05	1.20E-07	4.82E-08	5.35E-03	5.35E-04
Barium	3.06E-03	7.88E-04	3.16E-03	8.13E-04	7.84E-04	2.02E-04	1.36E-03	6.80E-04	3.16E-06	8.15E-07	3.74E-05	9.64E-06	4.34E-07	2.16E-07	1.93E-03	4.97E-04
Cadmium	2.80E-01	2.80E-02	5.49E-01	5.49E-02	1.15E-02	1.15E-03	6.54E-01	4.74E-02	2.81E-05	2.81E-06	4.25E-04	4.25E-05	1.01E-05	7.29E-07	0.00E+00	0.00E+00
Copper	1.07E-04	8.25E-05	1.10E-04	8.51E-05	2.73E-05	2.11E-05	4.83E-05	3.68E-05	1.10E-07	8.53E-08	7.38E-06	5.70E-06	1.54E-08	1.17E-08	6.73E-05	5.20E-05
Lead	2.93E-01	2.93E-02	4.98E-01	4.98E-02	2.92E-02	2.92E-03	**6.49E+00**	6.49E-01	3.59E-05	3.59E-06	5.60E-04	5.60E-05	1.85E-04	1.85E-05	8.43E-05	8.43E-06
Manganese	3.34E-03	1.04E-03	3.45E-03	1.07E-03	8.56E-04	2.65E-04	5.47E-04	5.47E-05	3.46E-06	1.07E-06	5.89E-05	1.83E-05	1.74E-07	1.74E-08	2.11E-03	6.53E-04
Mercury	5.40E-03	5.40E-04	7.18E-03	7.18E-04	4.75E-04	4.75E-05	4.43E-01	2.21E-01	8.98E-07	8.98E-08	1.01E-04	2.03E-05	1.00E-05	5.02E-06	0.00E+00	0.00E+00
Selenium	3.42E-03	2.07E-03	3.53E-03	2.14E-03	8.75E-04	5.30E-04	2.48E-03	1.24E-03	3.53E-06	2.14E-06	7.35E-03	4.45E-03	8.98E-07	2.63E-07	**2.38E+00**	1.44E+00
PCBs																
Aroclor 1016	6.45E-01	2.58E-01	5.40E-01	2.16E-01	1.54E-03	6.14E-04	**1.92E+01**	**1.92E+00**	7.20E-07	2.88E-07	1.05E-03	4.19E-04	7.77E-06	7.77E-07	0.00E+00	0.00E+00
Aroclor 1254	**9.41E+00**	9.41E-01	**1.42E+01**	1.42E+00	1.77E-02	1.77E-03	**1.39E+01**	1.39E+00	1.11E-05	1.11E-06	7.43E-03	1.51E-03	5.49E-06	5.49E-07	0.00E+00	0.00E+00
All PCBs (summed)	**1.01E+01**	***1.20E+00***	**1.48E+01**	**1.64E+00**	***1.92E-02***	***2.38E-03***	**3.32E+01**	**3.32E+00**	***1.18E-05***	***1.40E-06***	***8.48E-03***	***1.93E-03***	***1.33E-05***	***1.33E-06***	***0.00E+00***	***0.00E+00***
Nitroaromatics																
2,4,6-Trinitrotoluene	1.07E-02	2.17E-03	1.19E-02	2.40E-03	1.10E-03	2.22E-04	9.81E-02	1.96E-02	2.16E-06	4.35E-07	1.41E-05	2.84E-06	4.76E-08	9.52E-09	0.00E+00	0.00E+00
2-Amino-4,6-dinitrotoluene	6.71E-03	1.26E-03	4.99E-04	9.35E-05	1.91E-03	3.59E-04	5.43E-04	1.09E-04	4.31E-06	8.08E-07	5.23E-06	9.81E-07	2.68E-08	5.36E-09	0.00E+00	0.00E+00
4-Amino-2,6-dinitrotoluene	6.97E-03	1.31E-03	5.12E-04	9.60E-05	1.99E-03	3.73E-04	5.64E-04	1.13E-04	4.43E-06	8.30E-07	5.44E-06	1.02E-06	2.78E-08	5.57E-09	0.00E+00	0.00E+00
All Nitrotoluenes (summed)	***2.44E-02***	***4.73E-03***	***1.29E-02***	***2.59E-03***	***5.00E-03***	***9.53E-04***	***9.92E-02***	***1.98E-02***	***1.09E-05***	***2.07E-06***	***2.48E-05***	***4.84E-06***	***1.02E-07***	***2.04E-08***	***0.00E+00***	***0.00E+00***
Semivolatile Organics																
Benzo(a)anthracene	**2.40E+00**	4.81E-01	**1.67E+00**	3.33E-01	1.46E-01	2.93E-02	**2.04E+00**	4.08E-01	8.14E-05	1.63E-05	4.35E-03	8.70E-04	2.01E-05	4.03E-06	0.00E+00	0.00E+00
Benzo(a)pyrene	3.60E-01	3.60E-02	2.21E-01	2.21E-02	4.26E-02	4.26E-03	9.69E-01	1.94E-01	2.96E-05	2.96E-06	5.82E-04	5.82E-05	1.20E-05	2.39E-06	0.00E+00	0.00E+00
Benzo(b)fluoranthene	1.29E-01	2.57E-02	3.78E-02	7.57E-03	2.90E-02	5.79E-03	**4.46E+00**	8.91E-01	2.08E-05	4.17E-06	1.63E-04	3.25E-05	1.15E-04	2.30E-05	0.00E+00	0.00E+00
Benzo(ghi)perylene	3.20E-02	3.20E-03	1.80E-02	1.80E-03	5.94E-03	5.94E-04	3.69E-01	7.37E-02	6.89E-06	6.89E-07	3.97E-05	3.97E-06	4.20E-06	8.40E-07	0.00E+00	0.00E+00
Benzo(k)fluoranthene	1.55E-02	1.55E-03	1.66E-02	1.66E-03	1.69E-03	1.69E-04	3.14E-01	6.28E-02	1.97E-06	1.97E-07	2.55E-05	2.55E-06	3.79E-06	7.59E-07	0.00E+00	0.00E+00
Carbazole	**5.67E+03**	**5.67E+02**	**2.87E+03**	**2.87E+02**	**7.14E+02**	**7.14E+01**	NA	NA	6.16E-01	6.16E-02	**7.64E+00**	7.64E-01	NA	NA	0.00E+00	0.00E+00
Chrysene	**2.01E+00**	4.03E-01	1.45E+00	2.91E-01	1.30E-01	2.60E-02	1.18E+00	2.37E-01	7.62E-05	1.52E-05	3.65E-03	7.30E-04	1.23E-05	2.46E-06	0.00E+00	0.00E+00
Dibenz(a,h)anthracene	7.93E-02	7.93E-03	1.08E-01	1.08E-02	4.12E-03	4.12E-04	3.57E-01	7.13E-02	5.55E-06	5.55E-07	1.28E-04	1.28E-05	1.47E-06	2.93E-07	0.00E+00	0.00E+00
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	1.04E-01	2.09E-02	2.12E-02	4.25E-03	2.54E-02	5.07E-03	2.86E-02	2.86E-03	1.84E-05	3.68E-06	1.16E-04	2.32E-05	7.38E-07	7.38E-08	0.00E+00	0.00E+00
Fluorene	1.59E-03	3.18E-04	2.47E-03	4.94E-04	1.86E-05	3.72E-06	7.70E-01	1.54E-01	1.28E-08	2.55E-09	2.67E-06	5.34E-07	1.81E-06	3.62E-07	0.00E+00	0.00E+00
Indeno(1,2,3-cd)pyrene	4.17E-02	8.34E-03	2.62E-02	5.24E-03	4.43E-03	8.86E-04	8.53E-01	1.71E-01	2.91E-06	5.81E-07	6.83E-05	1.37E-05	9.53E-06	1.91E-06	0.00E+00	0.00E+00
Pyrene	2.04E-01	4.08E-02	4.78E-02	9.57E-03	4.41E-02	8.83E-03	4.39E-02	4.39E-03	3.35E-05	6.69E-06	2.25E-04	4.49E-05	5.54E-07	5.54E-08	0.00E+00	0.00E+00

COPEC - Chemical of potential ecological concern.
LOAEL - Lowest observed adverse effect level.
NA - No toxicity data available; hazard quotients not calculated.
NOAEL - No observed adverse effect level.

Shaded cells indicate a hazard quotient greater than 1, when rounded.

FIGURES

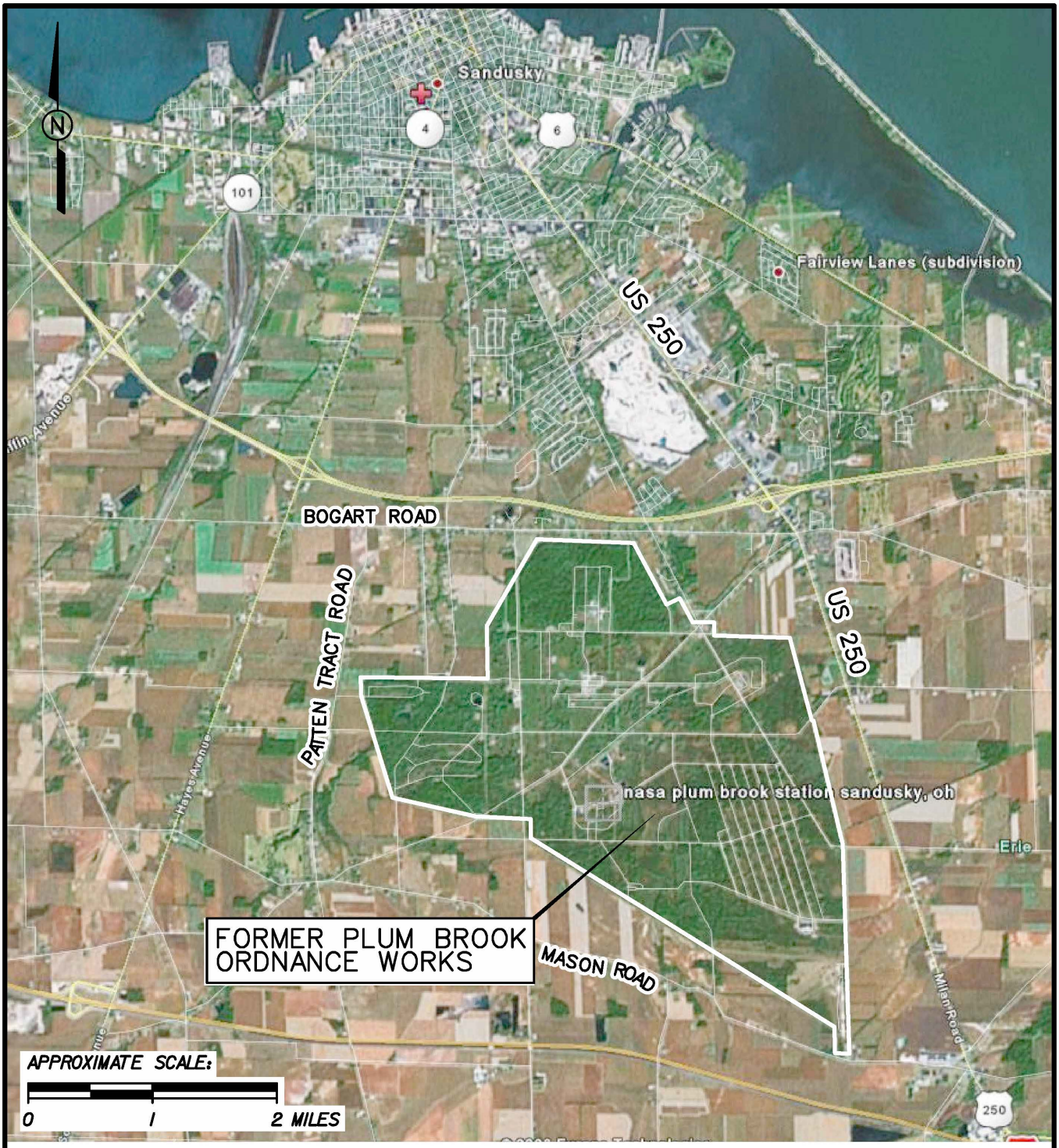

FIGURE 1-1
PBOW VICINITY MAP

WWTP3 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

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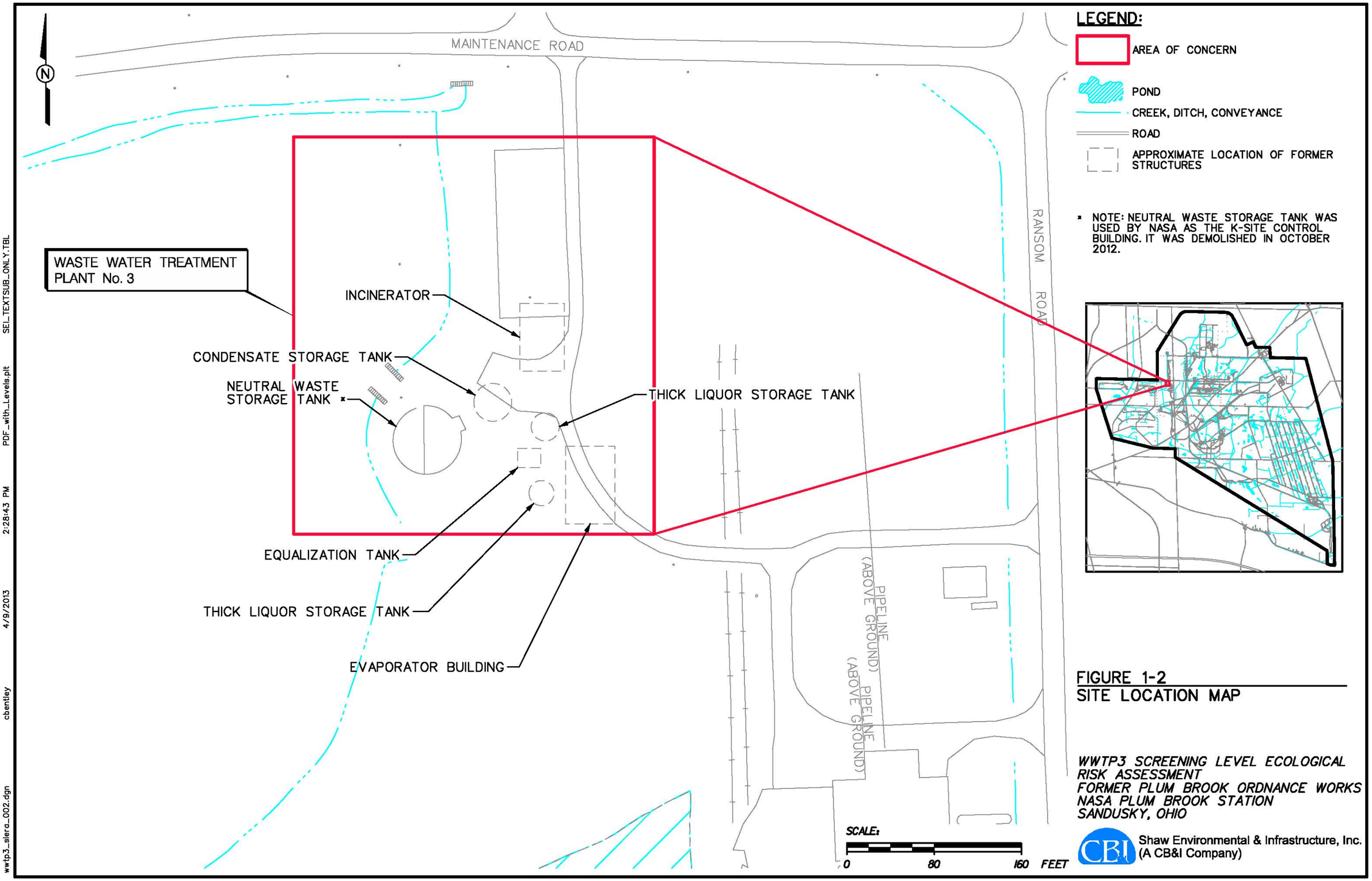

FIGURE 1-2
SITE LOCATION MAP

WWTP3 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw Environmental & Infrastructure, Inc.
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Figure 2-1

Photo Log of Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 1. Grassy area and shallow depression on east side of WWTP3, looking north.

Photo 2. Upland old field habitat at WWTP3.

Figure 2-1

Photo Log of Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 3. Overgrown grassy area at WWTP3.

Photo 4. Former power plant building, and K-Site location (off-site of WWTP3).

Figure 2-1

Photo Log of Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 5. View of the former neutralization tank, with access road in the foreground.

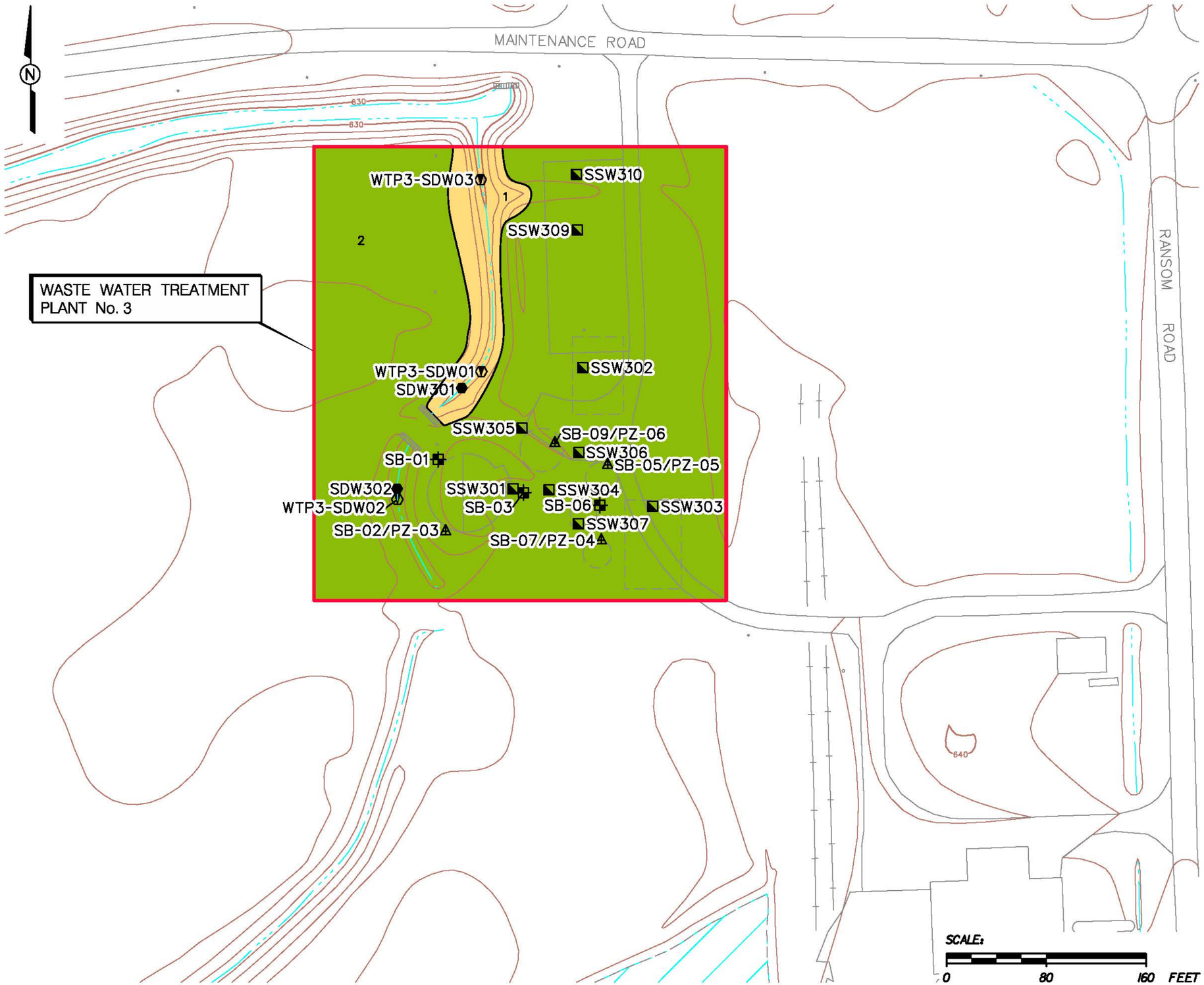
Photo 6. Overgrown grassy area and shrubby vegetation bordering drainage ditch on the west side of WWTP3, north of the former neutralization tank.

Figure 2-1

Photo Log of Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Photo 7. View of the small creek/ditch parallel to Maintenance Road in the northwest corner of the site.

Photo 8. View of the small creek/ditch in the northwest corner of the site, looking west, adjacent to Maintenance Road.



LEGEND:

- AREA OF CONCERN
- POND
- CREEK, DITCH, CONVEYANCE
- ROAD
- 640 TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)
- APPROXIMATE LOCATION OF FORMER STRUCTURES
- 1999 SURFACE SOIL SAMPLE (USACE, 2000)
- 1999 SEDIMENT SAMPLE (USACE, 2000)
- SOIL BORING
- SOIL BORING/PIEZOMETER
- SURFACE WATER / SEDIMENT SAMPLE
- 1 SUCCESSIONAL WOODS
- 2 UPLAND OLD FIELD

FIGURE 2-2
VEGETATION COMMUNITIES AT WASTE WATER TREATMENT PLANT No. 3

WWTP3 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw Environmental & Infrastructure, Inc.
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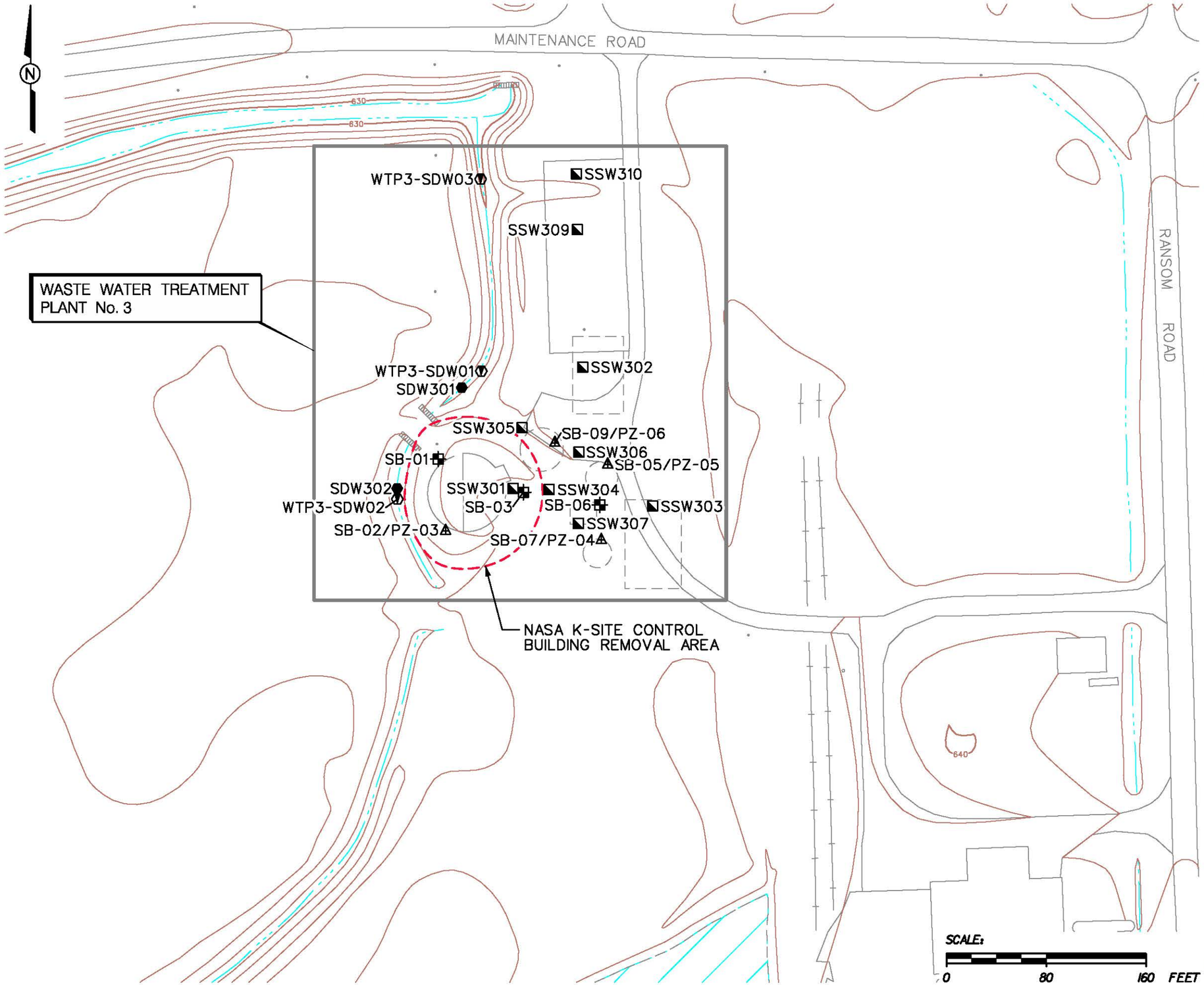

LEGEND:

- AREA OF CONCERN
- POND
- CREEK, DITCH, CONVEYANCE
- ROAD
- 640 TOPOGRAPHIC CONTOUR (2 FT. INTERVAL)
- APPROXIMATE LOCATION OF FORMER STRUCTURES
- 1999 SURFACE SOIL SAMPLE (USACE, 2000)
- 1999 SEDIMENT SAMPLE (USACE, 2000)
- SURFACE WATER/SEDIMENT SAMPLE
- SOIL BORING
- SOIL BORING/PIEZOMETER
- BOUNDARY OF BUILDING REMOVAL AREA

NOTE:

NASA ACCEPTED RESPONSIBILITY FOR THE REMOVAL OF THE K-SITE CONTROL BUILDING AND THE CONTAMINATED SOIL IN THE ASSOCIATED AREA. THIS AREA EXTENDED TO THE CREST OF A BERM WHICH PARTIALLY SURROUNDED THE BUILDING. THE BUILDING AND CONTAMINATED SOIL WERE REMOVED IN OCTOBER 2012.

FIGURE 2-3
SAMPLE LOCATIONS AT WASTE WATER TREATMENT PLANT No. 3

WWTP3 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

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Figure 2-4

Simplified Terrestrial Food Web Conceptual Site Model
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

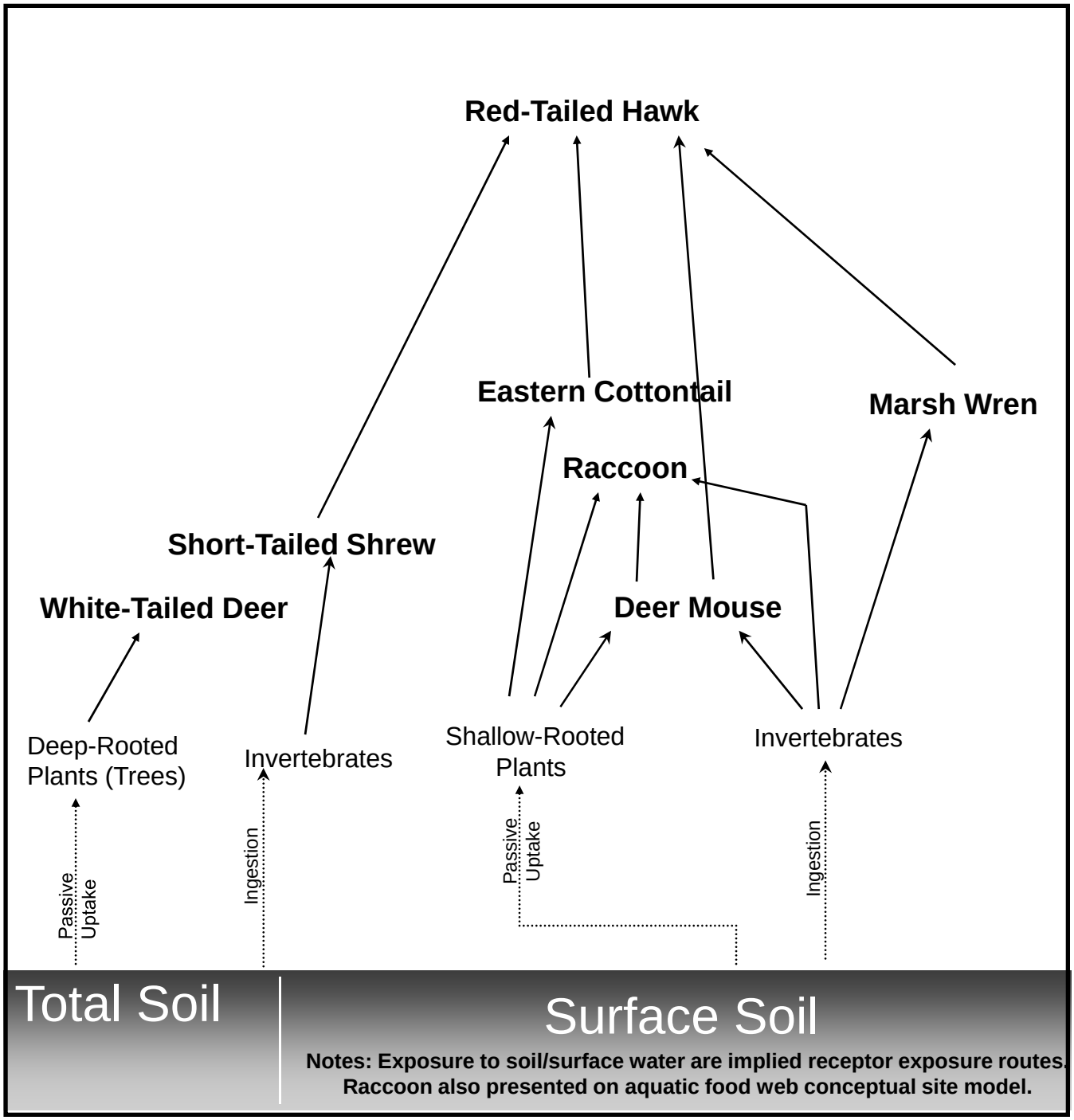
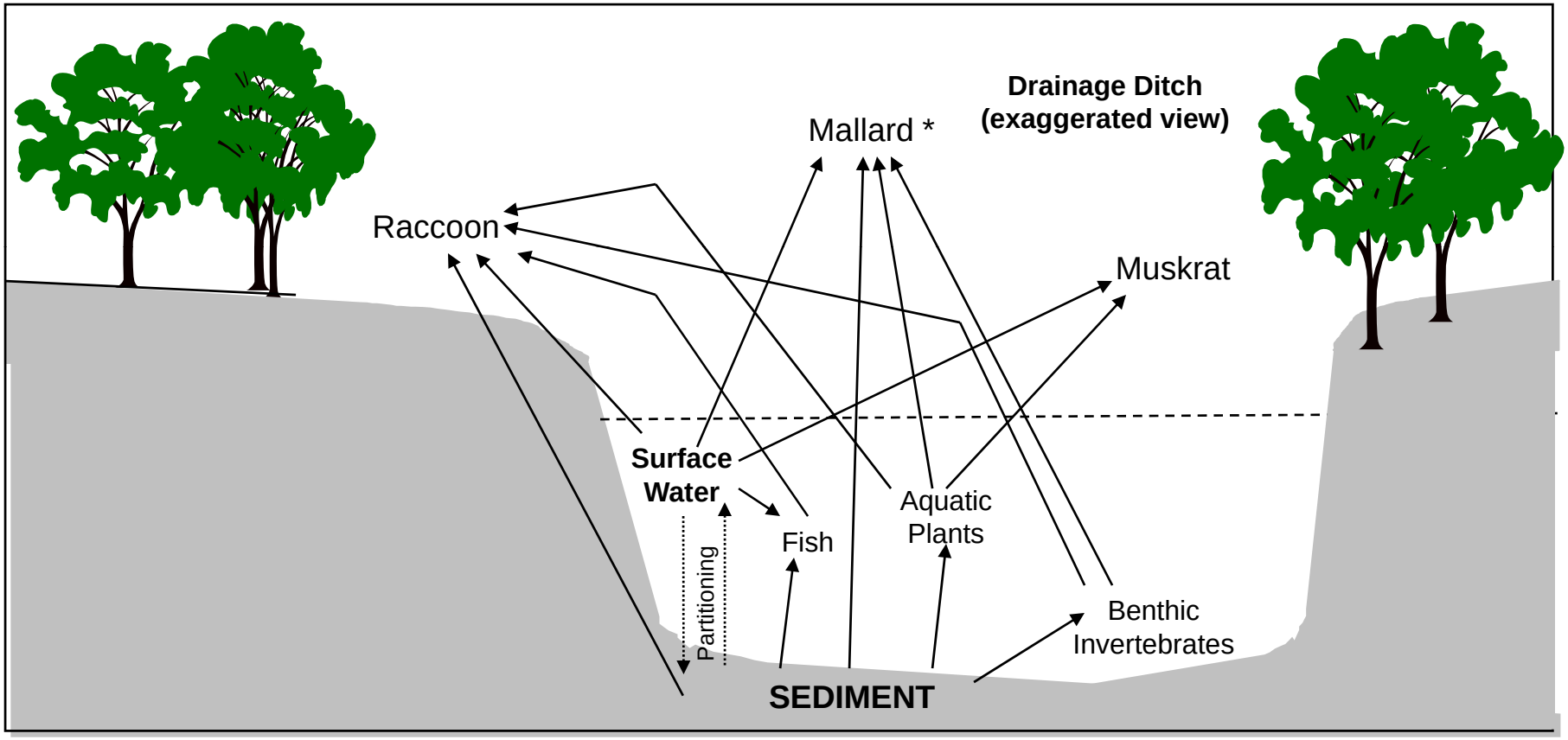


Figure 2-5

Simplified Aquatic Food Web Conceptual Site Model
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

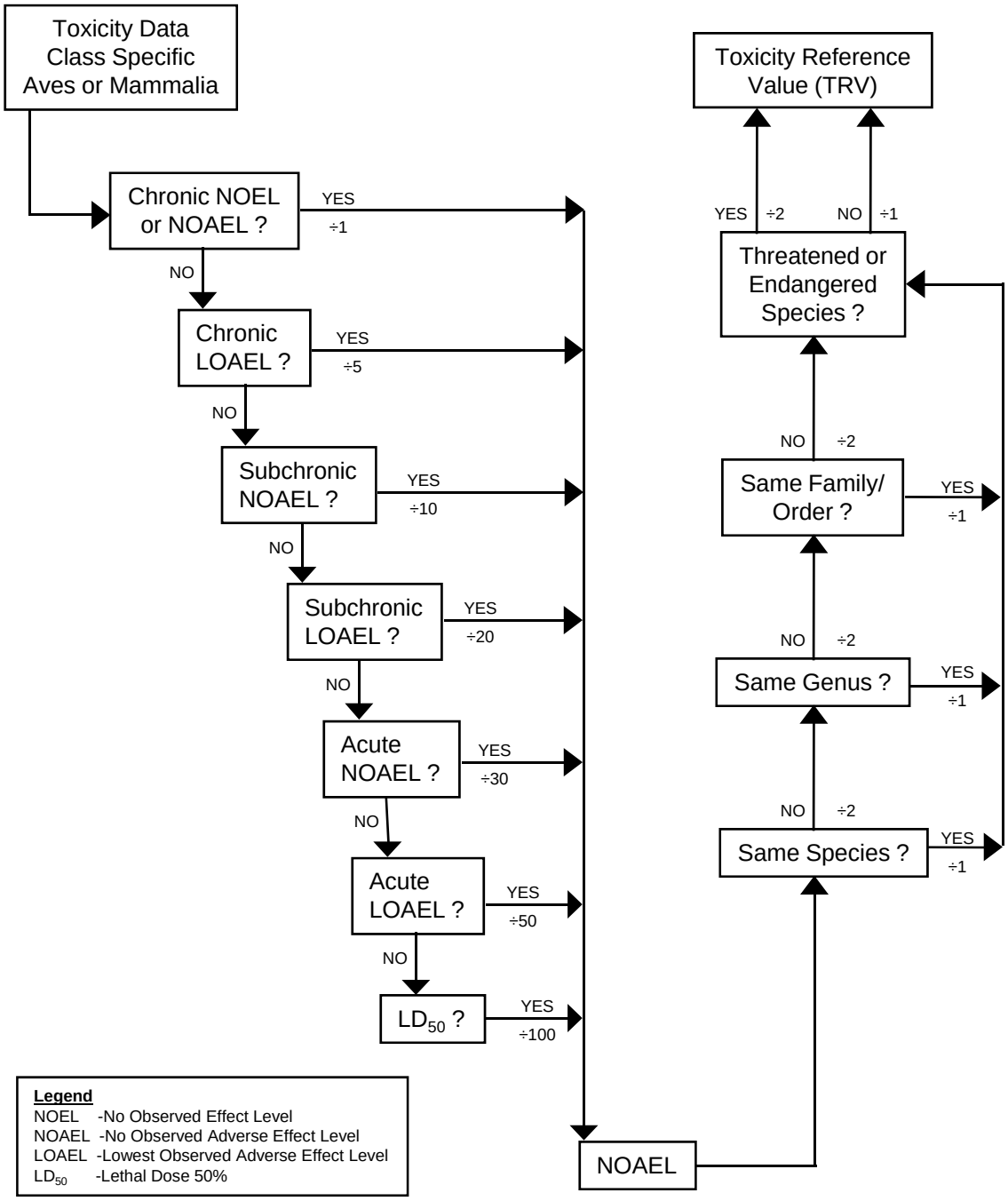


Note: The raccoon is also presented on terrestrial food web conceptual site model.

*** = The mallard is not evaluated in the risk assessment.**

Figure 4-1

Procedural Flow Chart for Deriving Toxicity Reference Values from Class-Specific Toxicity Data Plum Brook Ordnance Works, Sandusky, Ohio



Credit: Adapted from Ford et al. (1992) in *Tri-Service Procedural Guidelines for Ecological Risk Assessments*, 1996

APPENDIX A

VASCULAR PLANT SPECIES DOCUMENTED ON SITE

Appendix A

Vascular Plant Species Documented On Site
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works
Sandusky, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
**Acer platanoides*	Norway maple	Occasional		Disturbed woods	1
**Achillea millefolium*	Yarrow	Frequent		Dry fields, roadsides, and about buildings	1,2
**Agropyron repens*	Quack grass	Frequent		Old fields and roadsides	3
**Agrostis gigantea*	Redtop	Common		Moist fields, ditches, and roadsides	1,2
**Alliaria petiolata*	garlic mustard	Frequent		Dry to moist wood lots	1,3
**Andropogon virginicus*	broom-sedge	Occasional, frequent		Dry fields and roadsides	1,3
**Anthoxanthum odoratum*	vernal-grass	Occasional		Dry fields and openings, especially on shale	1
**Arabidopsis thaliana*	mouse-ear cress	Occasional		Road berms and about buildings	1
**Arctium minus*	Burdock	Occasional		Disturbed fields and about buildings	1
**Artemisia ludoviciana var. gnaphaloides*	white sage	Occasional		Grassy roadsides	1
**Berberis thunbergii*	Japanese barberry	Occasional, rare		Woodland borders	1
**Brassica nigra*	black mustard	Occasional		Roadsides	1
**Bromus inermis*	smooth brome	Frequent		Dry to moist fields and roadsides	1,2
**Bromus tectorum*	downy chess	Occasional		Dry openings and roadsides on shale	1
**Campsis radicans*	trumpet-vine	Occasional		Disturbed openings and roadsides	1
**Capsella bursa-pastoris*	shepherd's-purse	Occasional		Roadsides and about buildings	1,3
**Cardamine hirsuta*	bitter-cress	Occasional		Roadsides and about buildings	1
**Carduus nutans*	musk-thistle	Occasional, frequent		Dry fields and roadsides	1
**Cerastium fontanum*	mouse-ear chickweed	Frequent		Road berms and about buildings	1
**Cerastium semidecandrum*	NA	Occasional		Road berms and about buildings	1
**Chaenorrhinum minus*	dwarf snapdragon	Occasional		Road berms and about buildings	1
**Chrysanthemum leucanthemum*	ox-eye daisy	Frequent		Dry to moist fields and roadsides	1
**Cichorium intybus*	Chicory	Occasional		Roadsides	1,2
**Cirsium arvense*	Canada thistle	Common		Disturbed fields and roadsides	1,3
**Cirsium vulgare*	bull thistle	Frequent		Disturbed fields and roadsides	1,2
**Confolvulus arvensis*	field bindweed	Occasional		Disturbed fields and roadsides	1,3
**Convallaria majalis*	lilly-of-the-valley	Rare		Grassy field along Columbus Avenue	1
**Coronilla varia*	crown-vetch	Occasional, common		Grassy fields and roadsides	1,3
**Cyperus esculentus*	yellow nutgrass	Occasional, frequent		Moist, disturbed openings	1
**Dactylis glomerata*	orchard-grass	Occasional		Dry to moist fields and roadsides	1,2
**Daucus carota*	wild carrot	Frequent		Dry fields and roadsides	1
**Dianthus armeria*	Deptford pink	Occasional, rare		Dry openings and roadsides on shale	1
**Dipsacus fullonum*	common teasel	Frequent		Dry, disturbed openings and roadsides	1
**Draba verna*	early whitlow-wort	Occasional		Dry roadsides and about buildings	1
**Eleagnus umbellata*	autumn-olive	Occasional		Roadsides and woodland borders	1,2
**Elytrigia repens*	quack-grass	Frequent		Dry fields and roadsides	1
**Festuca elatior*	tall fescue	Occasional		Roadsides and grassy fields	1
**Festuca obtusa*	Fescue	Common		Old fields	2
**Glecoma hederacea*	ground-ivy	Frequent		Moist openings, roadsides, and about buildings	1,2
**Hieracium piloselloides*	king-devil	Frequent		Dry openings on shale, fields	1
**Hypericum perforatum*	dotted St. John's-wort	Frequent		Disturbed fields and roadsides	1
**Inula helenium*	Elecampane	Rare		Moist roadside along Taft Road	1
**Lamium purpureum*	dead-nettle	Frequent		Disturbed fields, roadsides, and about buildings	1
**Lepidium campestre*	field-cress	Occasional		Roadsides and about buildings	1
**Linaria vulgaris*	butter-and-eggs	Occasional		Roadsides and about buildings	1
**Lonicera maackii*	Amur honeysuckle	Rare		Roadsides and thickets along Columbus Avenue near Scheid Ditch	1
**Lonicera morrowii*	Asiatic honeysuckle	Frequent		Thickets, borders, and roadsides	1
**Lonicera tatarica*	Tatarian honeysuckle	Frequent, common		Thickets, borders, and roadsides	1,2
**Lotus corniculatus*	bird's-foot trefoil	Occasional		Grassy fields and road berms	1
**Matricaria matricarioides*	pineapple-weed	Occasional		Roadsides and about buildings	1
**Medicago lupulina*	Black medic	Occasional		Old fields and disturbed areas	3
**Melilotus alba*	white sweet-clover	Occasional, frequent		Disturbed fields and roadsides	1,3
**Melilotus officinalis*	yellow sweet-clover	Occasional		Disturbed fields and roadsides	1,2
**Najas minor*	Eurasian naiad	Frequent		Artificial ponds	1
**Nepeta cataria*	catnip	Occasional, frequent		Roadsides and weedy openings	1,3
**Oxalis europea*	Sorrel	Common		Old fields and disturbed areas	3
**Pastinaca sativa*	wild parsnip	Occasional		Roadsides	1
**Phleum pratense*	timothy	Frequent		Disturbed fields and roadsides	1,2
**Plantago lanceolata*	English plantain	Frequent		Disturbed openings and about buildings	1,2
**Plantago major*	broad-leaved plantain	Frequent		Road berms and about buildings (1) disturbed areas and old fields (2a)	1
**Poa annua*	early bluegrass	Common		Road berms and about buildings	1
**Poa compressa*	Canada bluegrass	Frequent		Dry openings, especially on shale, and roadsides	1,3
**Polygonum caespitosum*	NA	Rare		Moist, shaded ground in bunker area	1
**Polygonum hydropiper*	water-pepper	Occasional		Margins of ponds	1,3
**Rosa multiflora*	multiflora rose	Occasional		Disturbed openings, borders, and thickets	1,2
**Rumex acetosella*	red sorrel	Occasional		Dry openings over shale	1
**Rumex crispus*	curly dock	Occasional		Roadsides and about buildings	1,2
**Saponaria officinalis*	soapwort	Frequent, occasional		Dry fields, roadsides, and about buildings	1

Appendix A

Vascular Plant Species Documented On Site
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works
Sandusky, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
**Setaria faberi*	nodding foxtail-grass	Occasional, common		Grassy roadsides in the bunker area	1,3
**Setaria viridis*	green foxtail-grass	Frequent, common		Dry roadsides and about buildings	1
**Solanum caroliniense*	horse-nettle	Occasional, common		Dry openings and roadsides	1,2
**Solanum dulcamara*	bittersweet-nightshade	Occasional		Roadsides, ditches, thickets, and about buildings	1
**Stellaria media*	chickweed	Common		Road berms and about buildings	1
**Taraxacum officinalis*	dandelion	Frequent, occasional		Roadsides and about buildings	1,3
**Tragopogon pratensis*	Yellow goatsbeard	Rare		Old fields	3
**Trifolium pratense*	red clover	Occasional		Grassy fields and roadsides	1,3
**Trifolium repens*	common white clover	Common		Grassy roadsides and about buildings	1,3
**Verbascum blattaria*	moth-mullein	Occasional, rare		Disturbed fields and roadsides	1,3
**Verbascum thapsus*	common mullein	Frequent, occasional		Disturbed fields	1
**Veronica officinalis*	common speedwell	Occasional		Dry openings on shale	1
**Veronica serpyllifolia*	thyme-leaved speedwell	Occasional		Roadsides and about buildings	1
Acalypha rhomboidea	Three-seeded mercury	NA		NA	3
Acer negundo	box-elder maple	Frequent		Stream banks, ditches, and moist woods	1,3
Acer rubrum	red maple	Common		Dry to moist woods	1,2
Acer saccharinum	Silver maple	Rare		Dry to moist woods	3
Acer saccharum	Sugar maple	Occasional		Dry to moist woods	3
Acorus calamus	Sweet flag	Rare		Wet ditches	2
Agalinis purpurea	purple false-foxglove	Frequent		Moist openings and ditches	1
Agrimonia parviflora	southern agrimony	Frequent		Moist fields and ditches	1,3
Agrostis hyemalis	Ticklegrass	Occasional		Dry, grassy fields and shaley openings	1
Agrostis perennans	autumn bent-grass	Frequent		Dry woods and borders on shale	1
Ailanthus altissima	tree of heaven	NA		NA	3
Alisma subcordatum	water-plantain	Occasional		Ponds and ditches	1,2
Allium canadense	Field garlic	NA		NA	3
Allium canadense	Wild garlic	Occasional		Successional woods	3
Ambrosia artemisiifolia	common ragweed	Frequent, occasional		Dry fields and roadsides	1,3
Ambrosia trifida	giant ragweed	Occasional		Dry fields and roadsides	1
Andropogon gerardii	big bluestem	Frequent, 0ccasional		Dry to moist fields and roadsides	1,3
Antennaria parlinii	pussy-toes	Occasional		Dry fields and openings, especially on shale	1
Apocynum cannabinum	Dogbane	Frequent		Dry to moist fields and roadsides	1,2
Arctium minus	lesser burdock	NA		NA	3
Arenaria lateriflora	grove sandwort	Rare	T	Woods along Ransom Brook north of reactor	1
Arisaema triphyllum	Jack-in-the-pulpit	Rare		Moist to dry woods	3
Aristida dichotoma	Churchmouse grass	Occasional		Dry fields and openings	1
Aristida longespica	slimspike triple-awned grass	Common		Dry fields and openings	1
Aristida oligantha	prairie triple-awned grass	Occasional		Dry openings and roadsides	1
Asclepias hirtella	prairie milkweed	Common		Dry to moist openings	1
Asclepias incarnata	Swamp milkweed	Occasional		Wet ditches	3
Asclepias sullivantii	Sullivant's milkweed	Rare		Moist field along Patrol Road south of Scheid Road	1
Asclepias syriaca	common milkweed	Frequent		Dry to moist fields and roadsides	1,3
Asclepias tuberosa	butterfly-weed	Occasional		Dry openings and roadsides	1
Asparagus officinalis	asparagus	NA		NA	3
Aster ericoides	white heath aster	Rare, frequent		Grassy strip along Patrol Road southeast of Taft Road	1
Aster laevis	smooth aster	Rare		White oak grove on Taft Road	1
Aster lateriflorus	calico aster	Common, frequent		Moist woods and thickets	1,3
Aster novae-angliae	New England aster	Occasional		Dry fields and roadsides	1,2
Aster pilosus	common white aster	Common		Dry fields, roadsides, and about buildings	1
Aster sagittifolius	Arrow-leaved aster	Frequent		Woods and fields	3
Aster umbellatus	flat-top aster	Frequent, rare		Dry to moist fields and roadsides	1
Baptisia lactea	prairie false indigo	Occasional	P	Dry openings in bunker area	1
Baptisia tinctoria	yellow false indigo	Occasional		Dry openings in bunker area	1
Bidens coronata	northern tickseed-sunflower	Common		Moist fields and ditches	1
Bidens frondosa	Beggar ticks	Rare		Ditches	3
Boehmeria cylindrica	false nettle	Occasional		Ponds and ditches	1,2
Botrychium virginianum	Rattlesnake fern	Occasional		Successional woods	3
Brassica nigra	Yellow rocket				2
Brassica nigra	mustard	NA		NA	3
Bromus pubescens	Brome	Occasional		Dry fields	3
Cacalia atriplicifolia	pale Indian-plantain	Occasional		Dry fields and roadsides; woods	1
Calamagrostis canadensis	blue-joint	Occasional		Moist fields and ditches	1
Callitriche heterophylla	water-starwort	Occasional		Pond margins and seasonally-moist depressions	1
Calystegia sepium	Hedge bindweed	Occasional		Fields	3
Carduus nutans	nodding musk thistle	NA			3
Carex aggregata	sedge	Occasional		Moist woods	2
Carex alata	broad-winged sedge	Rare	P	Grassy field along Patrol Road south of Scheid Road, also in grassy strip between Patrol Road and artificial pond southeast of Taft Road	1
Carex amphibola	NA	Occasional		Thickets and woods borders	1

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Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Carex amphibola var. turgida	Eastern narrowleaf sedge	NA		NA	2
Carex annectens var. annectens	NA	Occasional		Moist, grassy fields	1
Carex annectens var. xanthocarpa	yellow-fruited sedge	Occasional		Moist, grassy fields	1
Carex blanda	eastern woodland sedge	Frequent		Moist woods	1,2
Carex bromoides	Brome-like sedge	NA		NA	3
Carex cephaloidea	thin-leaf sedge	Rare	E	Woods border along Pentolite Road west of reactor	1
Carex complanata var. hirsutella	NA	Frequent		Dry fields and woods borders	1
Carex conoidea	field sedge	Rare	T	Grassy depression along Taft Road south of North Magazine Road	1
Carex cristatella	NA	Occasional		Moist fields and ditches	1
Carex festucacea	fescue sedge	Occasional		Moist, grassy fields	1
Carex frankii	Frank's sedge	NA		NA	2
Carex gracillima	NA	Occasional		Moist woods	1
Carex granularis	meadow sedge	Common		Moist, grassy fields and ditches	1
Carex hirtifolia	NA	Rare		Disturbed oak woods along angling road	1
Carex hystericina	Bottlebrush sedge	Rare		Moist depression along Taft Road	1
Carex pensylvanica	Pennsylvania sedge	Common		Dry woods	1
Carex radiata	Eastern star sedge	NA		NA	3
Carex rosea	NA	Frequent		Dry to moist woods	1
Carex scoparia	NA	Frequent		Moist, grassy fields	1
Carex stipata	NA	Frequent		Moist fields and ditches	1
Carex stricta	tussock sedge	Occasional		Moist fields and ditches	1
Carex swanii	Swan's sedge	Occasional		Dry, grassy fields	1
Carex tribuloides	NA	Occasional		Moist, grassy fields and ditches	1,3
Carex umbellata	NA	Occasional		Well-drained, grassy fields on sandy soil	1
Carex vulpinoidea	fox sedge	Common		Moist fields, ditches, and about ponds	1,2
Carya ovata	shagbark hickory	Rare		Sandy soil along fence at far southeast boundary	1,3
Catalpa speciosa	Catalpa	NA		NA	3
Celastrus orbiculatus	Bittersweet	Occasional		Thickets and woods borders	3
Celtis occidentalis	Hackberry	Occasional		dry to moist woods and borders	1,3
Cephalanthus occidentalis	Buttonbush	Occasional		Moist depressions and ditches	1,3
Cerastium arvense	field chickweed	Rare		White oak grove along Taft Road	1
Chamaecrista fasciculata	partridge-pea	Occasional		Dry openings on shale	1
Chenopodium album	lamb's quarters	NA			3
Cinna arundinacea	Wood reed grass	Occasional		Woods	3
Circaea lutetiana	Southern broad-leaved enchanter's nightshade	Frequent		Woods	3
Cirsium arvense	creeping thistle	NA		NA	2
Cirsium discolor	prairie thistle	Frequent, occasional		Grassy fields and roadsides	1
Clinopodium vulgaris	wild basil	Occasional		Dry roadsides and openings	1
Conyza canadensis	Horseweed	Frequent		Dry fields and roadsides	1,3
Cornus amomum	swamp dogwood	Frequent, occasional		Moist fields and thickets	1
Cornus drummondii	rough-leaved dogwood	Frequent		Moist borders, thickets, and roadsides	1,3
Cornus florida	flowering dogwood	Occasional		Woodland borders and roadsides	1
Cornus racemosa	gray dogwood	Frequent		Dry fields and roadsides	1,2
Crataegus mollis	downy hawthorn	Frequent		Thickets and woodland borders	1
Crataegus punctata	dotted hawthorn	Frequent		Thickets and woodland borders	1
Cryptotaenia canadensis	honewort	Occasional, rare		Dry to moist woods	1,2
Cuscuta gronovii	dodder	Frequent		Moist fields and ditches	1
Cyperus flavescens	Umbrella sedge	occasional		Old fields and waste places	3
Cyperus strigosus	umbrella-sedge	Frequent		Moist openings, ponds, and ditches	1,3
Danthonia spicata	poverty-grass	Occasional		Dry openings over shale	1
Datura stramonium	jimson-weed	Occasional		Disturbed openings and roadsides	1
Daucus carota	Queen Anne's lace	NA		NA	2
Desmodium canescens	Tick trefoil	Occasional		Fields	3
Dichanthelium dichotomum	cypress panic grass	NA		NA	2
Digitaria cognatum (Leptoloma cognatum)	NA	Occasional		Old fields	3
Digitaria ischaemum	smooth crabgrass	NA		NA	3
Diodia teres	buttonweed	Occasional		Dry openings over shale	1
Dipsacus sylvestris	teasel	NA			2
Dryopteris carthusiana	spinulose woodfern	Frequent		Moist woods and shaded borders	1
Echinochloa muricata	Barnyard grass	NA		NA	3
Eleocharis acicularis	needle spikerush	Frequent		Margins of artificial pond	1
Eleocharis erythropoda	red-footed spikerush	Occasional		Moist openings and ditches	1
Eleocharis obtusa	NA	Common		Moist openings and ditches	1,2
Eleocharis smallii	Small's spikerush	Frequent		Margins of artificial pond	1
Eleocharis tenuis	NA	Frequent		Moist openings and ditches	1
Elymus virginica	Wild rye	Occasional		Moist to dry woods	2

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Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Epilobium coloratum	purple-leaved willow herb	NA		NA	3
Equisetum arvense	horsetail	Frequent		Moist openings, roadsides, and ditches	1,2
Equisetum hyemale	scouring-rush	Occasional		Moist roadsides and ditches	1
Eragrostis frankii	NA	Occasional		Moist openings and ditches	1
Eragrostis spectabilis	showy lovegrass	Occasional		Dry to moist fields	1
Erechtites hieracifolia	Pilewort	Common		Disturbed woods, borders, and roadsides	1,3
Erigeron anuus	Fleabane	NA		NA	3
Erigeron philadelphicus	Philadelphia fleabane	Frequent, occasional		Roadsides and borders	1
Erigeron strigosus	smooth fleabane	Occasional		Dry openings and roadsides	1
Eupatorium perfoliatum	Boneset	Occasional, frequent		Moist fields, ponds, and ditches	1,2
Eupatorium purpureum	purple joe-pye-weed	Occasional		Borders of moist woods, fields	1,3
Eupatorium rugosum	White snake root	Common		Woods and fields	2
Euphorbia corollata	Flowering spurge	Occasional		Dry fields	1
Euphorbia maculata	Prostrate spurge	Occasional		Dry openings, road berms, and about buildings	1,3
Euphorbia supina	Milk purslane	NA		NA	3
Euthamia graminifolia	grass-leaved goldenrod	Common		Dry to moist fields and roadsides	1,2
Fragaria virginiana	wild strawberry	Frequent		Dry to moist fields and roadsides	1,2
Fraxinus americana	white ash	Frequent		Dry to moist woods and borders	1
Fraxinus pensylvanica	green ash	Frequent, common		Moist woods and stream banks	1,2
Galine aparine	Cleavers	Occasional		Moist woods and borders	1,2
Galium asperellum	Rough bedstraw	NA		NA	2
Galium circaezans	wild licorice	Rare		Dry woods	1
Galium tinctorium	Southern bedstraw	Rare		Moist depression along Taft Road	1
Gentianopsis crinita	Fringed gentian	Occasional	P	Old fields along ditch banks, small groups and scattered individuals in northeast portion of TNT area A	3
Geranium maculatum	Wild geranium	Occasional		Successional woods	3
Gerardia tenuifolia	Slender gerardia	Frequent		Disturbed fields	3
Geum laciniatum	Rough avens	NA		NA	2
Geum vernum	spring avens	Occasional		Moist woods and borders	1
Geum virginianum	white avens	Occasional		Woods borders and roadsides	1
Gleditsia triacanthos	honey-locust	Occasional, rare		Dry to moist woods and borders	1,3
Glyceria striata	manna-grass	Occasional		Moist woods and about ponds	1,2
Gnaphalium obtusifolium	Cudweed	Frequent, occasional		Dry openings on shale, fields	1,3
Gratiola virginiana	round-fruited hedge-hyssop	Rare	P	ca 20 plants; moist, shaded ground by pond west of Snake Road	1
Hackelia virginiana	Virginia stickseed	Rare		Woods	3
Hedyotis caerula	Bluets	Occasional		Dry openings and roadsides on shale	1
Helenium autumnale	Sneezeweed	Occasional		Disturbed fields	3
Helenium flexuosum	Southern sneezeweed	Occasional		Moist, open ground and ditches	1
Helianthus mollis	ashy sunflower	Rare	T	ca 200 plants in grassy field south and southwest of junction of Fox and Patrol Roads; the exact number of individuals in this population is uncertain since excessive browsing by deer has reduced the plants to leafy tufts.	1
Helianthus tuberosus	Jerusalem artichoke	Occasional		Old fields	3
Hemerocallus fulva	Daylily	NA		NA	3
Hesperis matronalis	Dame's rocket	NA		NA	3
Hibiscus moscheutos	rose-mallow	Rare		Moist swale along Ransom Road	1
Hypericum gentianoides	orange-grass	Frequent		Dry openings	1
Hypericum gymnanthum	least St. John's-wort	Rare	E	ca 50 plants; moist, open ground along Patrol Road south of Fox Road	1
Hypericum majus	tall St. John's-wort	Rare	P	Moist, shaded ground by pond west of Snake Road	1
Hypericum mutilum	little St. John's-wort	Frequent		Moist openings, ponds, and ditches	1
Hypericum perforatum	common St. John's wort	NA			3
Hypericum punctatum	St. Johns wort	Rare		Fields	2
Hypoxis hirsuta	yellow-eyed-grass	Occasional		Grassy fields	1
Hystrix patula	Bottlebrush grass	Occasional		Woods	3
Impatiens capensis	Jewelweed	NA		NA	3
Ipomoea pandurata	wild sweet-potato	Occasional		Dry openings over shale	1
Ipomoea purpurea	common morning glory	NA		NA	2
Iris versicolor	Northern blue flag	Occasional		Moist woods and ditches	1
Isanthus brachiatus	false pennyroyal	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
Juglans nigra	black walnut	Rare		A few young trees at edge of grassy field southwest of junction of Fox and Patrol Roads, woods (2b)	1
Juncus acuminatus	NA	Common		Moist openings and ditches	1
Juncus biflorus	NA	Occasional		Moist openings and ditches	1
Juncus brachycarpus	NA	Occasional		Moist openings	1
Juncus canadensis	Canada rush	Frequent		Moist openings	1
Juncus dudleyi	Dudley's rush	Frequent		Moist openings	1
Juncus effusus	Common rush	Frequent		Moist openings, ponds, and ditches	1,2

Appendix A

Vascular Plant Species Documented On Site
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works
Sandusky, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Juncus marginatus	NA	Occasional		Moist openings	1
Juncus nodosus	rush	Occasional		Old fields and ditches	3
Juncus tenuis	path rush	Frequent, occasional		Dry openings, road berms, and about buildings	1
Juncus torreyi	Torrey's rush	Occasional		Moist fields	2
Laportea Canadensis	Wood nettle	NA		NA	3
*Lathyrus latifolius**	Everlasting pea	Occasional		Old fields	3
Leersia oryzoides	rice cutgrass	Occasional		Moist fields and ditches	1,2
Leersia virginica	White grass	NA		NA	3
Lemna minor	little duckweed	Occasional		Ponds and standing water	1,3
Lepidium campestre	field peppergrass	NA		NA	3
Lepidium virginicum	poor man's pepper	Frequent		Roadsides, disturbed openings, and about buildings	1
Leptoloma cognatum	fall witch grass	NA		NA	3
Lespedeza capitata	bush-clover	Occasional		Dry fields	1
Leucospora multifida	NA	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
Liatris scariosa var. novae-angliae	northern blazing-star	Rare		Dry ground along Patrol Road at Olemacher Ditch	1
Liatris spicata	spiked blazing-star	Occasional		Moist openings	1
Lindernia dubia	false pimpernel	Occasional		Moist openings, ditches, and pond margins	1
Linum medium	wild flax	Frequent		Dry to moist openings	1
Linum virginianum	Virginia flax	Rare		About pond in northern bunker area	1
Lobelia siphilitica	Great lobelia	Frequent		Moist fields	3
Lonicera japonica	Japanese honeysuckle	Occasional		Fields and disturbed areas	3
Ludwigia alternifolia	rattlebox	Occasional		Ponds and ditches	1
Ludwigia palustris	water-purslane	Frequent, occasional		Ponds and ditches	1,2
Ludwigia polycarpa	NA	Rare		Moist, shaded ground by pond on Snake Road	1
Lycopus americanus	American water-horehound	Frequent		Ponds and ditches	1,2
Lycopus uniflorus	northern water-horehound	Frequent		Moist woods and shaded borders	1
Lycopus virginicus	Virginia bugleweed	NA		NA	2
Lysimachia ciliata	Fringed loosestrife	NA		NA	2
Lysimachia terrestris	swamp loosestrife	Occasional		Moist openings	1,3
Lythrum alatum	prairie loosestrife	Occasional		Moist openings	1
Maclura pomifera	osage-orange	Occasional		Disturbed woods and borders	1,3
Medicago lupulina	Black medick	NA		NA	2
Mentha piperita	peppermint	NA		NA	2
Mentha spicata	Spearmint	Occasional		Moist fields	3
Mimulus ringens	monkey-flower	Occasional, rare		Moist openings and ditches	1,2
Monarda fistulosa	bergamont	Occasional		Grassy fields	1
Monarda sp.	bee balm	NA		NA	3
Morus alba	Mulberry	Occasional		Fields and thickets	2
Muhlenbergia frondosa	muhly grass	Frequent		Moist fields and ditches	1
Myrica pensylvanica	Bayberry	Rare	E	One individual in old field in northern portion of area	3
Najas flexilis	northern naiad	Occasional		Artificial ponds	1
Nyssa sylvatica	blackgum	Occasional		Thickets and woods borders	1
Oenothera biennis	evening-primrose	Frequent		Dry fields, roadsides, and about buildings	1
Oenothera tetragona	northern sundrops	Frequent		Moist, grassy fields	1
Onoclea sensibilis	Sensitive fern	frequent		Wet areas	3
Osmunda cinnamomea	cinnamon fern	Rare		Depressions in moist woods along angling road	1
Osmunda regalis	royal fern	Occasional		Depressions in moist woods	1
Oxalis stricta	sorrel	NA		NA	2
Oxalis violacea	purple wood-sorrel	Occasional		Drier oak woods and borders on shale	1
Panicum capillare	witchgrass	NA		NA	3
Panicum clandestinum	deer tongue grass	NA		NA	2
Panicum dichotomiflorum	Panic grass	Frequent		Fields	3
Panicum flexile	wiry witch-grass	Rare		Moist opening on limestone, west of Snake Road and south of North Magazine Road	1
Panicum lanuginosum	hairy panic-grass	common		Dry, grassy fields and roadsides	1
Panicum oligosanthes	sand panic-grass	Occasional		Dry, grassy fields	1
Panicum rigidulum	stiff panic-grass	Frequent		Moist openings and ditches	1
Panicum virgatum	switch-grass	Occasional		Dry fields	1,2
Parietaria pensylvanica	pellitory	Occasional		Dry, disturbed wood lots and borders	1
Paronychia fastigata	forked chickweed	Occasional		Dry woods and borders on shale	1
Parthenocissus quinquefolia	Virginia-creeper	Occasional		Dry to moist woods borders and thickets	1,2
Parthenocissus vitacea	grape-woodbine	Rare		Dry opening north of Center Magazine Road	1
Penstemon digitalis	tall white beard-tongue	Frequent		Grassy fields and roadsides	1,2
Phalaris arundinacea	reed canary-grass	Common		Moist fields and ditches	1,2
Phragmites australis	reed-grass	Occasional, rare		Moist openings and ditches	1,3
Phryma leptostachya	lopseed	Rare		Edge of woods along Scheid Ditch near Columbus Avenue; successional woods	1
Phytolacca americana	pokeberry	Occasional, rare		Moist woods and borders	1,3
Pilea pumila	clearweed	NA		NA	3

Appendix A

Vascular Plant Species Documented On Site
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works
Sandusky, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Plantago major	common plantain	NA		NA	3
Platanthera lacera	ragged fringe-orchid	Rare		Ditch along south Patrol Road	1
Platanus occidentalis	sycamore	Occasional, frequent		Moist woods and stream banks, fields and waste areas	1,3
Poa pratensis	Kentucky bluegrass	NA			2
Podophyllum peltatum	may-apple	Occasional		Dry to moist woods	1,3
Polygala sanguinea	blood milkwort	Frequent		Moist openings	1
Polygala verticillata	whorled milkwort	Occasional		Moist openings	1
Polygonum hydropiperoides	false water-pepper	Occasional		Wet ditches and pond margins	1
Polygonum pennsylvanicum	Pennsylvania smartweed	NA		NA	3
Polygonum sagittatum	arrow-leaved tearthumb	Occasional		Moist thickets and ditches	1
Polygonum scandens	climbing false buckwheat	Occasional		Thickets and roadsides	1
Polygonum virginianum	Virginia knotweed	Common		Moist to dry woods	3
Populus deltoides	cottonwood	Frequent, common		Moist woods, borders, and stream banks	1,2
Potamogeton diversifolius	snailseed pondweed	Frequent		Artificial ponds	1
Potamogeton foliosus	leafy pondweed	Occasional		Artificial ponds	1
Potamogeton nodosus	longleaf pondweed	Occasional		Artificial ponds	1
Potamogeton pectinatus	Sago pondweed	NA		NA	3
Potentilla simplex	cinquefoil	Frequent		Dry openings and roadsides on shale	1,2
Prunella vulgaris	self-heal	Occasional, frequent		Roadsides and about buildings	1
Prunus americana	wild plum	Occasional		Thickets and roadsides	1
Prunus serotina	wild black cherry	Frequent, common		Dry to moist woods and borders	1
Pycnanthemum tenuifolium	narrow-leaved mountain-mint	Frequent, common		Moist openings, especially on shale, old fields	1
Pycnanthemum virginianum	Virginia mountain-mint	Occasional		Moist openings and ditches	1
Pyrus coronaria	crab-apple	Frequent		Thickets and borders	1,3
Quercus alba	white oak	Occasional		Dry woods and sandy ridges; a small grove on Taft Road has an unusually pure stand of this species	1
Quercus bicolor	swamp white oak	Frequent		Moist woodlands	1
Quercus imbricaria	shingle oak	Frequent, occasional		Moist to dry woodlands	1,3
Quercus macrocarpa	bur oak	Rare		ca 5 trees on sandy ridge in bunker area south of North Magazine Road; a few trees in area 2a	1
Quercus palustris	pin oak	Common, frequent		Moist woods	1,3
Ranunculus abortivus	Kidney-leaf buttercup	NA		NA	2
Ranunculus sceleratus	cursed crowfoot	NA		NA	3
Ratibida pinnata	green-headed coneflower	Occasional, frequent		Roadsides and dry fields	1
Rhexia virginica	Virginia meadow-beauty	Occasional	P	Moist openings and pond margins, south of North Magazine Road and along the angling roac	1
Ribes americanum	American currant	NA		NA	3
Ribes cynosbati	Gooseberry	Rare		Woods	3
Riccia sp.	liverwort	NA		NA	3
Robinia pseudoacacia	Black locust	Rare		Old fields and thickets	3
Rosa carolina	pasture rose	Occasional		Dry fields	1
Rosa setigera	prairie rose	Rare		Grassy roadside and thickets along Patrol Road at Olemacher Ditch	1,3
Rotala ramosior	toothcup	Occasional		Moist openings and about ponds	1
Rubus allegheniensis	blackberry	Common		Woods, fields, and borders	3
Rubus flagellaris	dewberry	Frequent, common		Dry openings and roadsides on shale, old fields	1,2
Rubus occidentalis	Black raspberry	common		Dry woods, and borders	2
Rudbeckia hirta	black-eyed susan	Frequent		Dry fields and roadsides	1
Rumex acetosella	sheep sorrel	NA		NA	3
Rumex verticillatus	Swamp dock	Rare		Ditches	3
Sagittaria latifolia	broad-leaved arrowhead	Occasional		Ponds and ditches	1
Salix amygdaloides	peachleaf willow	Occasional		Ditches and about ponds	1,2
Salix discolor	pussy willow	Occasional		Moist openings, ponds, and ditches	1
Salix exigua	sandbar willow	Frequent		Moist openings, stream banks, and ditches	1,3
Salix nigra	black willow	Common		Moist woods, stream banks, and ditches	1,3
Salix sp.	willow	NA		NA	2
Sambucus canadensis	elder-berry	Frequent, occasional		Moist openings, stream banks, and ditches	1,3
Sassafras albidum	sassafras	Occasional		Dry woods and borders	1
Schizachyrium scoparium	little bluestem	Frequent		Dry fields and roadsides	1
Scirpus acutus	hardstem bulrush	Rare		Moist depression west of Taft Road	1
Scirpus americanus	Three square	rare		Ditches	3
Scirpus atrovirens	dark green bulrush	Common, occasional		Moist openings, roadsides, and ditches	1,2
Scirpus cyperinus	woolgrass	Occasional		About artificial ponds	1
Scirpus fluviatilis	river bulrush	Rare		Moist depression west of Taft Road	1
Scirpus pendulus	NA	Occasional		Moist openings	1
Scirpus validus	softstem bulrush	Occasional		Moist openings, ponds, and ditches	1
Scleria triglomerata	tall nut-rush	Rare	P	Moist swale in northern bunker area	1
Scutellaria lateriflora	mad-dog skullcap	Occasional		Moist depressions and ditches	1,3
Senecio aureus	golden ragwort	Occasional		Moist woods borders	1
Setaria faberi	foxtail	NA		NA	3
Setaria glauca	Yellow foxtail-grass	NA		NA	2

Appendix A

Vascular Plant Species Documented On Site
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works
Sandusky, Ohio

Scientific Name	Common Name	Relative Frequency[a]	Rank[b]	Habitat	Observed On Site[c]
Silphium terebinthinaceum	prairie-dock	Rare		Dry openings at crossing of Patrol Road and Olemacher Ditch	1
Sisyrinchium albidum	prairie blue-eyed-grass	Frequent		Grassy fields	1
Sisyrinchium angustifolium	common blue-eyed-grass	Frequent		Grassy fields	1
Solanum nigrum	Black nightshade	Occasional		Fields and waste areas	3
Solidago canadensis	Canada goldenrod	Common		Grassy fields	1,3
Solidago juncea	early goldenrod	Frequent		Dry to moist fields and roadsides	1
Solidago nemoralis	gray goldenrod	Common		Dry fields and roadsides	1
Solidago riddellii	Riddell's goldenrod	Rare		Moist opening over limestone, west of Snake Road and south of North Magazine Road	1
Sparganium eurycarpum	giant bur-reed	Rare		Wet ditch along Ransom Road	1
Spartina pectinata	prairie cord-grass	Frequent, occasional		Moist depressions, fields, and ditches	1
Spenopholis intermedia	slender wedgescale	NA		NA	3
Spiranthes ochroleuca	creamy ladies'-tresses	Occasional, rare		Ditches and moist openings	1
Sporobolus asper	tall dropseed	Rare		A single stand in dry opening along angling road	1
Sporobolus neglectus	NA	Frequent		Dry openings and road berms	1
Stachys tenuifolia	Hedge nettle	Occasional		Fields	3
Stellaria longifolia	long-leaved stitchwort	Occasional		Moist, grassy fields	1
Symphoricarpos orbiculatus	coralberry	Occasional		Thickets, woods borders, and roadsides	1
Teucrium canadense	American germander	Occasional		Moist openings	1,2
Thelypteris palustris	marsh fern	Occasional, frequent		Moist depressions and roadsides	1
Toxicodendron radicans	Poison ivy	Frequent		Upland and facultative woods, old fields	2
Tradescantia ohioensis	Ohio spiderwort	Occasional		Old fields	3
Triadenum virgnianum	pink St. John's-wort	Rare		Moist swale in northern bunker area	1
Tridens flavus	purpletop	Occasional		Moist fields and roadsides	1
Trifolium hybridum	Alsike clover	Occasional		Fields	3
Trifolium repens	White clover	NA		NA	2
Triosteum perfoliatum	Wild coffee	Rare		Fields	3
Tussilago farfara	coltsfoot	NA		NA	3
Typha angustifolia	Narrow-leaved cattail	frequent		Ditches	3
Typha latifolia	broad-leaved cattail	Frequent		Moist openings, ponds, and ditches	1,2
Ulmus americana	American elm	Occasional		Moist woods and stream banks	1,3
Ulmus rubra	slippery elm	Occasional		Moist woods and stream banks	1
Urtica dioica var. procera	American stinging nettle	Occasional, common		Moist fields and openings	1
Urtica dioicia	stinging nettle	NA		NA	3
Verbascum thapsus	woolly mullein	NA		NA	3
Verbena hastata	purple vervain	Frequent		Moist fields, stream banks, and ditches	1,2
Verbena simplex	prairie vervain	Rare		A single stand in dry opening along angling road	1
Verbena stricta	Vervain	Occasional		Fields	3
Verbena urticifolia	white vervain	Occasional, frequent		Moist woods borders and roadsides	1,3
Verbesina alternifolia	wingstem	Frequent, occasional		Moist woods borders, stream banks, and ditches	1,2
Vernonia gigantea	tall ironweed	Occasional, frequent		Dry to moist fields	1
Viburnum lentago	nannyberry	Frequent		Moist thickets and borders	1
Vicia americana	American vetch	Rare		Old field	3
Viola canadensis	Canada violet	NA		NA	3
Viola cucullata	violet	NA		NA	2
Viola lanceolata	lance-leaved violet	Frequent	P	Ditches and moist openings	1
Viola sagittata	arrow-leaved violet	Frequent		Grassy fields and dry banks	1
Viola sororia	common blue violet	Common, occasional		Grassy fields, roadsides, and about buildings	1
Vitis aestivalis	summer grape	NA		NA	2
Vitis riparia	riverbank grape	Frequent		Woods borders, thickets, and stream banks	1,2
Vitis vulpina	fox grape	Occasional		Woods borders and thickets	1
Zanichellia palustris	horned pondweed	Rare		Artificial pond west of Snake Road	1
Zizia aurea	Golden alexanders	Rare		Old fields	3

[a] Common - Species which occur in large numbers throughout.
Frequent - Species regularly encountered, but occurring in lesser numbers than common ones.
Occasional - Species found in several places, but never present in large numbers.
Rare - Species found in few places and in low numbers.

[b] T - Ohio Threatened Species. P = Ohio Potentially Threatened Species. E = Ohio Endangered Species.

[c] 1 - Biological Inventory of Plum Brook Station (Ohio Department of Natural Resources, 1994).
2 - Shaw site reconnaissance October 16, 2008 and June 2, 2009.
3 - Observed during a site reconnaissance at another Plum Brook site.

NA – Not available.

* Non-native species.

APPENDIX B

ECOLOGICAL SCREENING VALUES

Table B-1

Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Inorganic Analytes							
Aluminum	7429-90-5	pH Dependent	NSV	NSV	NSV	50	pH Dependent
Antimony	7440-36-0	0.27	5	0.142	NSV	5	0.27
Arsenic	7440-38-2	18	9.9	5.7	60	10	18
Barium	7440-39-3	330	283	1.04	NSV	500	330
Beryllium	7440-41-7	21	10	1.06	NSV	10	21
Cadmium	7440-43-9	0.36	4	0.00222	20	4	0.36
Calcium	7440-70-2	NSV	NSV	NSV	NSV	NSV	Nutrient
Chromium	7440-47-3	26	0.4	0.4	0.4	1	26
Chromium, hexavalent	18540-29-9	81	NSV	NSV	NSV	NSV	81
Cobalt	7440-48-4	13	20	0.14	NSV	20	13
Copper	7440-50-8	28	60	5.4	50	100	28
Iron	7439-89-6	pH Dependent	NSV	NSV	NSV	NSV	Nutrient
Lead	7439-92-1	11	40.5	0.0537	500	50	11
Magnesium	7439-95-4	NSV	NSV	NSV	NSV	NSV	Nutrient
Manganese	7439-96-5	220	NSV	NSV	NSV	500	220
Mercury	7439-97-6	NSV	0.00051	0.1	0.1	0.3	0.00051
Nickel	7440-02-0	38	30	13.6	200	30	38
Potassium	7440-09-7	NSV	NSV	NSV	NSV	NSV	Nutrient
Selenium	7782-49-2	0.52	0.21	0.0276	70	1	0.52
Silver	7440-22-4	4.2	2	4.04	NSV	2	4.2
Sodium	7440-23-5	NSV	NSV	NSV	NSV	NSV	Nutrient
Thallium	7440-28-0	NSV	1	0.0569	NSV	1	1
Vanadium	7440-62-2	7.8	2	1.59	NSV	2	7.8
Zinc	7440-66-6	46	8.5	6.62	200	50	46
Cyanide							
Cyanide, Total	57-12-5	NSV	NSV	1.33	NSV	NSV	1.33
Polychlorinated Biphenyls							
Aroclor 1016	12674-11-2	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1221	11104-28-2	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1232	11141-16-5	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1242	53469-21-9	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1254	11097-69-1	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Aroclor 1260	11096-82-5	NSV	0.371 [f]	0.000332 [f]	NSV	40 [f]	0.371
Organochlorine Pesticides							
4,4'-DDE	72-55-9	0.021 [g]	NSV	0.596	NSV	NSV	0.021
4,4'-DDT	50-29-3	0.021 [g]	NSV	0.0035	NSV	NSV	0.021
Methoxychlor	72-43-5	NSV	NSV	0.0199	NSV	NSV	0.0199

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Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Nitroaromatics							
Amino-2,6-dinitrotoluene, 4-	19406-51-0	NSV	NSV	0.0328 [i]	NSV	NSV	0.0328
Amino-4,6-dinitrotoluene, 2-	35572-78-2	NSV	NSV	0.0328 [i]	NSV	NSV	0.0328
Dinitrobenzene, 1,3-	99-65-0	NSV	NSV	0.655	NSV	NSV	0.655
Dinitrotoluene, 2,4-	121-14-2	NSV	NSV	1.28	NSV	NSV	1.28
Dinitrotoluene, 2,6-	606-20-2	NSV	NSV	0.0328	NSV	NSV	0.0328
RDX	121-82-4	NSV	NSV	NSV	NSV	NSV	NSV
Tetryl	479-45-8	NSV	NSV	NSV	NSV	NSV	NSV
Trinitrobenzene, 1,3,5-	99-35-4	NSV	NSV	0.376	NSV	NSV	0.376
Trinitrotoluene, 2,4,6-	118-96-7	NSV	NSV	NSV	NSV	NSV	NSV
Semivolatile Organic Compounds							
Acenaphthene	83-32-9	29	20	682	NSV	20	29
Acenaphthylene	208-96-8	29	NSV	682	NSV	NSV	29
Anthracene	120-12-7	29	NSV	1480	NSV	NSV	29
Benzo(a)anthracene	56-55-3	1.1	NSV	5.21	NSV	NSV	1.1
Benzo(a)pyrene	50-32-8	1.1	NSV	1.52	NSV	NSV	1.1
Benzo(b)fluoranthene	205-99-2	1.1	NSV	59.8	NSV	NSV	1.1
Benzo(ghi)perylene	191-24-2	1.1	NSV	119	NSV	NSV	1.1
Benzo(k)fluoranthene	207-08-9	1.1	NSV	148	NSV	NSV	1.1
Benzoic acid	65-85-0	NSV	NSV	NSV	NSV	NSV	NSV
bis(2-Ethylhexyl)phthalate	117-81-7	NSV	NSV	0.925	NSV	NSV	0.925
Carbazole	86-74-8	NSV	NSV	NSV	NSV	NSV	NSV
Chrysene	218-01-9	1.1	NSV	4.73	NSV	NSV	1.1
Dibenz(a,h)anthracene	53-73-3	1.1	NSV	18.4	NSV	NSV	1.1
Dibenzofuran	132-64-9	NSV	NSV	NSV	NSV	NSV	NSV
Di-n-butyl phthalate	84-74-2	NSV	200	0.15	NSV	200	200
Fluoranthene	206-44-0	1.1	NSV	122	NSV	NSV	1.1
Fluorene	86-73-7	1.1	NSV	122	30	NSV	1.1
Indeno(1,2,3-cd)pyrene	193-39-5	1.1	NSV	109	NSV	NSV	1.1
Methylnaphthalene, 2-	91-57-6	29	NSV	3.24	NSV	NSV	3.24
Naphthalene	91-20-3	29	NSV	0.0994	NSV	NSV	29
Nitroaniline, 3-	99-09-2	NSV	NSV	3.16	NSV	NSV	3.16
Phenanthrene	85-01-8	29	NSV	45.7	NSV	NSV	29
Pyrene	129-00-0	1.1	NSV	78.5	NSV	NSV	1.1
Volatile Organic Compounds							
Acetone	67-64-1	NSV	NSV	2.5	NSV	NSV	2.5
Benzene	71-43-2	NSV	NSV	0.255	NSV	NSV	0.255
Bromomethane	74-83-9	NSV	NSV	0.235	NSV	NSV	0.235
Butanone, 2-	78-93-3	NSV	NSV	89.6	NSV	NSV	89.6

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Ecological Screening Values for Soil
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	EPA Eco-SSLs [a] (mg/kg)	Eco Endpoints PRGs [b] (mg/kg)	EPA Region V ESL [c] (mg/kg)	Tox. Benchmark [d] (earthworm only) (mg/kg)	Tox Benchmarks [e] Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Carbon disulfide	75-15-0	NSV	NSV	0.0941	NSV	NSV	0.0941
Dichloroethane, 1,1-	75-34-3	NSV	NSV	20.1	NSV	NSV	20.1
Dichloroethene, 1,1-	75-35-4	NSV	NSV	8.28	NSV	NSV	8.28
Dichloroethene, cis-1,2-	156-59-2	NSV	NSV	0.784 [h]	NSV	NSV	0.784
Methylene chloride	75-09-2	NSV	NSV	4.05	NSV	NSV	4.05
Toluene	108-88-3	NSV	200	5.45	NSV	200	200
Trichloroethane, 1,1,1-	79-00-5	NSV	NSV	29.8	NSV	NSV	29.8
Trichloroethene	79-01-6	NSV	NSV	12.4	NSV	NSV	12.4
Trimethylbenzene, 1,2,4-	95-63-6	NSV	NSV	NSV	NSV	NSV	NSV
Xylene, Total	1330-20-7	NSV	NSV	10	NSV	NSV	10

EPA - U.S. Environmental Protection Agency.
ESV - Ecological screening value.
mg/kg - Milligrams per kilogram.
NSV - No screening value available.

Priority for Selection of ESVs:
1) EPA Eco-SSL
2) PRG for Eco Endpoints, (Efroymson, et.al, 1997a)
3) EPA Region 5 Ecological Screening Levels
4) Efroymson, 1997b
5) Efroymson, 1997c

[a] EPA, 2008, Ecological Soil Screening Level (SSL) guidance. On-line at: http://www.epa.gov/ecotox/ecossl/index.html
[b] Efroymson, 1997a, *Preliminary Remediation Goals for Ecological Endpoints* . www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf .
[c] Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level (ESL)* , Website version last updated August 22, 2003: http://www.epa.gov/Region5/rcraca/edql.htm.
[d] Efroymson, R.A., M.E. Will, G.W. Suter, 1997b, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision, ES/ER/TM-126/R2 (microbial screening values are not included). http://www.esd.ornl.gov/programs/ecorisk/documents/tm126r21.pdf.
[e] Efroymson, R.A., M.E. Will, G.W. Suter, 1997c, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision, ES/ER/TM-85/R3. http://www.esd.ornl.gov/programs/ecorisk/documents/tm85r3.pdf
[f] Based on the screening value for total PCBs.
[g] Based on the screening value for DDT and metabolites.
[h] Based on the screening value for dichloroethylene [trans-1,2].
[i] Based on the screening value for 2,6-dinitrotoluene.

Table B-2

Ecological Screening Values for Surface Water
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	Ohio Water Quality Criteria [a] µg/L		Eco PRG [b] µg/L	EPA Region 5 ESV [c] µg/L	Selected Surface Water ESV [d] µg/L
Inorganic Analytes						
Aluminum	7429-90-5	NSV		87	NSV	87
Arsenic	7440-38-2	150	f	3.1	148	3.1
Barium	7440-39-3	220		4	220	4
Beryllium	7440-41-7	100	e	0.66	3.6	0.66
Calcium	7440-70-2	NSV		NSV	NSV	Nutrient
Chromium	7440-47-3	270	e,f	210	42	42
Cobalt	7440-48-4	24		23	24	23
Copper	7440-50-8	30	e,f	12	1.58	1.58
Iron	7439-89-6	NSV		1000	NSV	Nutrient
Lead	7439-92-1	37	e,f	3.2	1.17	1.17
Magnesium	7439-95-4	NSV		NSV	NSV	Nutrient
Manganese	7439-96-5	NSV		120	NSV	120
Nickel	7440-02-0	170	e,f	160	28.9	28.9
Potassium	7440-09-7	NSV		NSV	NSV	Nutrient
Selenium	7782-49-2	5	f	0.39	5	0.39
Sodium	7440-23-5	NSV		NSV	NSV	Nutrient
Vanadium	7440-62-2	44		20	12	12
Zinc	7440-66-6	390	e,f	110	65.7	65.7
Semivolatile Organic Compounds						
bis(2-Ethylhexyl)phthalate	117-81-7	8.4		0.12	0.3	0.12
3-Methylphenol and 4-Methylphenol	65794-96-9	53	g	NSV	NSV	53
Phenol	108-95-2	160		110	180	160
Volatile Organic Compounds						
Dichloroethane, 1,1-	75-34-3	410		47	47	47
Dichloroethene, cis-1,2-	156-59-2	970		590	970	590
Trichloroethane, 1,1,1-	71-55-6	76		11	76	11

COPEC - Chemical of potential ecological concern.
ESV - Ecological screening value.
µg/L - Microgram per liter.
NSV - No screening value available.

Table B-2

Ecological Screening Values for Surface Water
Plum Brook Ordnance Works, Sandusky, Ohio

[a] Ohio Environmental Protection Agency (OEPA, 2002), Division of Surface Water, Water Quality Standards, Chapter 3745-1 of the Ohic Administrative Code, Dec 30. http://www.epa.state.oh.us/dsw/rules/3745-1.html. Value is the Outside Mixing Zone Average value.

[b] *Preliminary Remediation Goals (PRG) for Ecological Endpoints*, (Efroymson et. al., 1997).

[c] Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level*, Website version last updated August 22, 2003: http://www.epa.gov/Region5/rcraca/edql.htm.

[d] Surface water ESVs are selected by choosing the minimum screening value based on the three sources provided

[e] Hardness dependent value (see Table 7-9 in the OAC Chapters 3741-1 and 3791-2). Screening values using a hardness of 400 mg/L $CaCO_3$ were selected, based on a site-specific water hardness of 464 mg/L $CaCO_3$.

[f] Total Recoverable (TR) value is used, per Ohio Administrative Code Chapter 3745-2-04

[g] The lower value was selected from Ohio EPA for 3-methylphenol and 4-methylphenol

Table B-3

Ecological Screening Values for Sediment
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	TEC [a] mg/kg	EPA Region 5 ESV [b] mg/kg	Ecological PRG [c] mg/kg	Ontario Sediment Quality Guidelines [d] mg/kg	Selected ESV mg/kg
Inorganic Analytes						
Aluminum	7429-90-5	NSV	NSV	NSV	NSV	NSV
Antimony	7440-36-0	NSV	NSV	NSV	NSV	NSV
Arsenic	7440-38-2	9.79	9.79	42	6	9.79
Barium	7440-39-3	NSV	NSV	NSV	NSV	NSV
Beryllium	7440-41-7	NSV	NSV	NSV	NSV	NSV
Cadmium	7440-43-9	0.99	0.99	4.2	0.6	0.99
Calcium	7440-70-2	NSV	NSV	NSV	NSV	Nutrient
Chromium	7440-47-3	43.4	43.4	159	26	43.4
Cobalt	7440-48-4	NSV	50	NSV	50	50
Copper	7440-50-8	31.6	31.6	77.7	16	31.6
Iron	7439-89-6	NSV	NSV	NSV	NSV	Nutrient
Lead	7439-92-1	35.8	35.8	110	31	35.8
Magnesium	7439-95-4	NSV	NSV	NSV	NSV	Nutrient
Manganese	7439-96-5	NSV	NSV	NSV	460	460
Mercury	7439-97-6	0.18	0.174	0.7	0.2	0.18
Nickel	7440-02-0	22.7	22.7	38.5	16	22.7
Potassium	7440-09-7	NSV	NSV	NSV	NSV	Nutrient
Selenium	7782-49-2	NSV	NSV	NSV	NSV	NSV
Silver	7440-22-4	NSV	0.5	1.8	0.5	0.5
Sodium	7440-23-5	NSV	NSV	NSV	NSV	Nutrient
Thallium	7440-28-0	NSV	NSV	NSV	NSV	NSV
Vanadium	7440-62-2	NSV	NSV	NSV	NSV	NSV
Zinc	7440-66-6	121	121	270	120	121
Nitroaromatics						
2,4,6-Trinitrotoluene	118-96-7	NSV	NSV	NSV	NSV	NSV
2,6-Dinitrotoluene	606-20-2	NSV	0.0398	NSV	NSV	0.0398
Polychlorinated Biphenyls						
Aroclor 1254	11097-69-1	0.0598	0.0598	72	0.07	0.0598
Aroclor 1260	11096-82-5	0.0598	0.0598	63	0.07	0.0598
Semivolatile Organic Compounds						
Acenaphthylene	208-96-8	NSV	0.00587	0.13	NSV	0.00587
Benzo(a)anthracene	56-55-3	0.108	0.108	0.69	0.32	0.108
Benzo(a)pyrene	50-32-8	0.15	0.15	0.394	0.37	0.15
Benzo(b)fluoranthene	205-99-2	NSV	10.4	NSV	NSV	10.4
Benzo(ghi)perylene	191-24-2	NSV	0.17	6.3	0.17	0.17

Table B-3

Ecological Screening Values for Sediment
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	CAS No.	TEC [a] mg/kg	EPA Region 5 ESV [b] mg/kg	Ecological PRG [c] mg/kg	Ontario Sediment Quality Guidelines [d] mg/kg	Selected ESV mg/kg
Benzo(k)fluoranthene	207-08-9	NSV	0.24	NSV	0.24	0.24
Chrysene	218-01-9	0.166	0.166	0.85	0.34	0.166
Dibenzofuran	132-64-9	NSV	0.449	0.42	NSV	0.449
Di-n-butyl phthalate	84-74-2	NSV	1.114	240	NSV	1.114
Fluoranthene	206-44-0	NSV	0.423	0.834	0.75	0.423
Indeno(1,2,3-cd)pyrene	193-39-5	NSV	0.2	0.837	0.2	0.2
Methylnaphthalene, 2-	91-57-6	NSV	0.0202	NSV	NSV	0.0202
Naphthalene	91-20-3	0.176	0.176	0.39	NSV	0.176
Phenanthrene	85-01-8	0.204	0.204	0.54	0.56	0.204
Pyrene	129-00-0	0.195	0.195	1.4	0.49	0.195
Volatiles Organic Compounds						
Acetone	67-64-1	NSV	0.0099	0.0091	NSV	0.0099
Carbon disulfide	75-15-0	NSV	0.0239	0.00086	NSV	0.0239
Methylene chloride	75-09-2	NSV	0.159	18	NSV	0.159

ESV - Ecological screening value.
mg/kg - Milligrams per kilogram.
NSV - No screening value available.

Priority for Selection of ESVs:

1. Threshold effect concentrations (MacDonald et al., 2000)
2. EPA Region 5 ESLs (EPA, 2003)
3. Sediment PRGs (Efroymson, 1997)
4. Sediment quality criteria (OME, 1993)

[a] Threshold Effect Concentrations (TECs), MacDonald, et al., 2000, *Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems,* Arch Environ Contam Toxicol 39:20-31.

[b] Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level*, Website version last updated August 22, 2003: http://www.epa.gov/Region5/rcraca/edql.htm.

[c] Efroymson,et. al., 1997, *Preliminary Remediation Goals for Ecological Endpoints*.

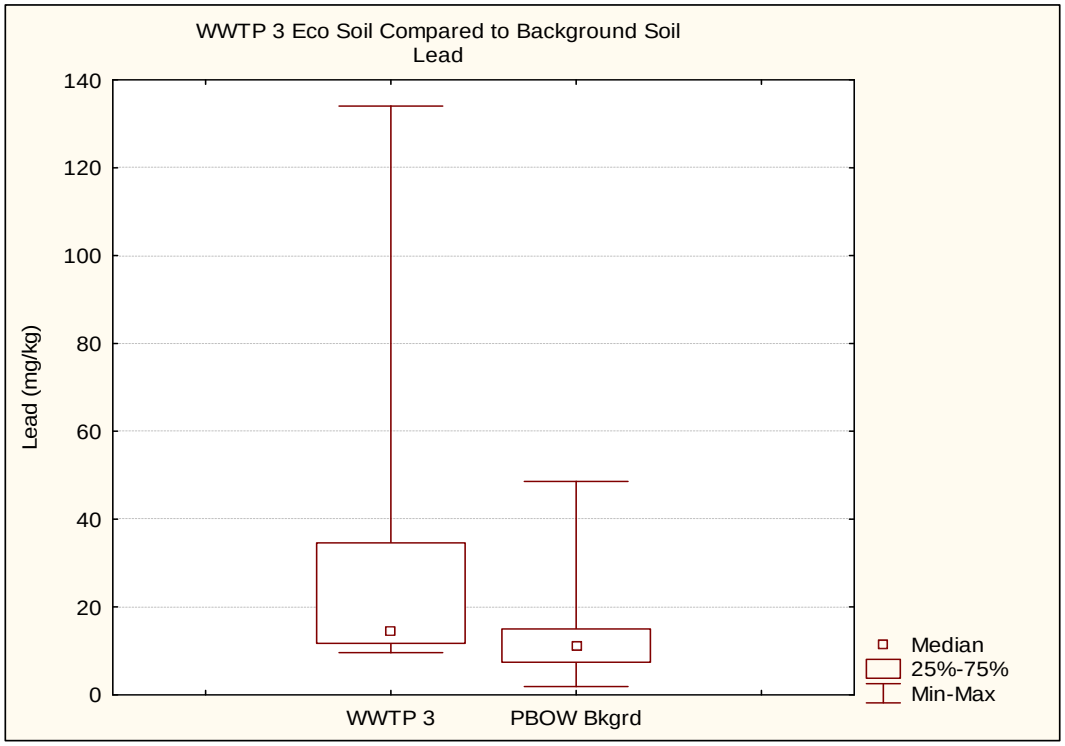
[d] Ontario Ministry of the Environment, 1993 (OME, 1993). Persaud, et al. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario,* August.

APPENDIX C

WILCOXON RANK SUM TEST RESULTS AND BOX PLOTS FOR LEAD AND NICKEL

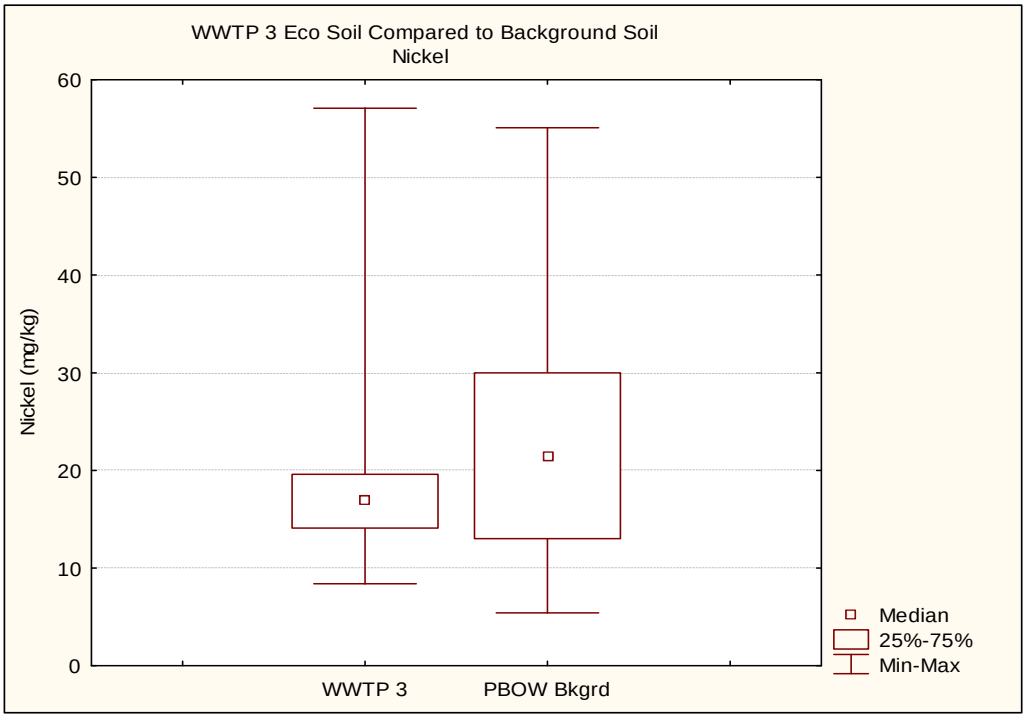
Appendix C

Wilcoxon Rank Sum Test Results and Box Plots for Soil Concentrations of Lead in Background Vs. Waste Water Treatment Plant No. 3 Samples



	Rank Sum	Rank Sum	U	Z	p-level	Z	p-level	Valid N	Valid N	2*1sided
Lead	732.0000	493.0000	142.0000	3.14525	0.001660	3.14589	0.001656	23	26	0.001324

Wilcoxon Rank Sum Test Results and Box Plots for Soil Concentrations of Nickel in Background Vs. Waste Water Treatment Plant No. 3 Samples



	Rank Sum	Rank Sum	U	Z	p-level	Z	p-level	Valid N	Valid N	2*1sided
Nickel	517.0000	708.0000	241.0000	-1.16194	0.245261	-1.16218	0.245165	23	26	0.251860

APPENDIX D

ASSESSMENT RECEPTOR PROFILES

Appendix D

Assessment Receptor Profiles

Eastern Cottontail (Sylvilagus floridanus). These medium-size grazing herbivores are found over most of the eastern half of the United States and southern Canada, and have been widely introduced into the western United States (U.S. Environmental Protection Agency [EPA], 1993). The eastern cottontail is unique to the genus because of the large variety of habitats that it occupies, including glades and woodlands, deserts, swamps, prairies, hardwood forests, rain forests, and boreal forests (EPA, 1993). Open grassy areas are generally used for grazing at night, whereas dense, heavy cover typically is used for shelter during the day (EPA, 1993). During the summer season, these rabbits consume herbaceous plants (e.g., grasses, clover, timothy, and alfalfa), whereas winter diet typically consists of woody vines, shrubs, and trees (e.g., birch, maple, and apple) (EPA, 1993). Home range is 3 to 20 acres, with larger ranges in the summer and smaller ranges in the winter (Burt and Grossenheider, 1980). Populations fluctuate from 1 to 4 cottontail per 4 acres to several per acre in winter conditions (Burt and Grossenheider, 1980). The eastern cottontail breeds from February through September and usually produces 3 to 4 litters per year of 1 to 9 young (usually 4 to 5); however, this rabbit's' death rate vies with its birth rate, and few rabbits live for more than one year (Whitaker, 1995). The average longevity is 1.25 years (EPA, 1993).

References:

Burt, W. H. and R. P. Grossenheider, 1980, ***A Field Guide to Mammals***, Peterson Field Guide Series, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Deer Mouse (Peromyscus maniculatus). This medium-sized mouse is found in the eastern United States from the Hudson Bay to Pennsylvania, the southern Appalachians, central Arkansas, and central Texas. In the west, it is found from Mexico to the south Yukon and north-west territories (Whitaker, 1995). Deer mice habitat includes nearly every dry land habitat within its range, including forest, grasslands, or a mixture of the two (Burt and Grossenheider, 1980). Nocturnal and active year-round, these mice construct nests in the ground, trees, stumps, and

buildings (Burt and Grossenheider, 1980). Omnivorous, the deer mouse feeds on nuts and seeds (e.g., jewel weed and black cherry pits), fruits, beetles, caterpillars, and other insects. Deer mice may cache their food during the fall and winter in the more northern parts of their range (EPA, 1993). Home range is 0.15 to 3 acres (Burt and Grossenheider, 1980; EPA, 1993). Density of populations is 4 to 12 mice per acre, and average life span is 2 years in the wild (Burt and Grossenheider, 1980). The breeding season is from February to November, depending on latitude. Three to five young are born in each of two to four litters per year (Burt and Grossenheider, 1980). They are greyish to reddish-brown with a white belly, with a distinctly short-haired, bicolor tail (Whitaker, 1995). Weight range is 14.8 grams (EPA, 1993) to 33 grams (Whitaker, 1995).

References:

Burt, W. H. and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Mallard Duck (Anas platyrhynchos). The mallard duck is widespread throughout most of the United States and is the most abundant of the United States ducks. It is large, migratory duck with an average body size of 58 centimeters from bill to tail tip. Wintering mallards prefer the natural bottom-land wetlands and rivers where water depths are 20 to 40 centimeters. The primary habitat requirement for nesting is thought to be dense grassy vegetation. Nests are generally located within a few kilometers of water (EPA, 1993).

In winter, mallards feed primarily on seeds, invertebrates, agricultural grains and, to a limited extent, leaves, stems, buds, rootlets, and tubers. In spring, females shift mostly to a diet of invertebrates to support molting and egg laying activities. Ducklings also feed mainly on invertebrates to help support their rapid growth rates. Mallards are serially monogamous and remate annually. Each pair of mallards establishes a territory and the drake defends it against other mallards. Average home range size varies, depending upon the type of habitat available. High rates of nest failure require the females to renest persistently, with average clutch size decreasing as the breeding season progresses. Annual adult mortality rates vary with year,

depending on location, hunting pressure, age, and sex. Females suffer greater natural mortality rates than do males (EPA, 1993).

The typical home range of the mallard is from 540 to 620 hectares (ha) for adult female and male birds, respectively, for wetlands and river habitat in Minnesota (EPA, 1993). For the current ERA, an average home range of 580 hectares was used. The typical migration schedule is from mid-March through mid-May for the spring migration. The fall migration typically starts in mid-October, and peaks in November (USEPA, 1993).

References:

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Red-Tailed Hawk (Buteo jamacensis). This carnivorous hawk is one of the most common and widespread members of the genus *Buteo* in the continental United States and Canada (Brown and Amadon, 1968). Red-tailed hawks live in a variety of habitats, such as farmlands, woodlands, mountains, and deserts, as long as there is open country interdispersed with woods, bluffs, or streamside trees. They are primarily carnivorous, feeding on (greater than 85 percent) small rodents, as well as fish. Other prey items include amphibians, reptiles, crayfish, and other birds (Adamcik, et al., 1979; Ehrlich, et al., 1988). Home range has been reported as approximately 66.8 acres, with a population density of 0.16 pairs per acre (Janes, 1984), although EPA (1993) reports an average territory size of 842 hectares (2,080 acres). Breeding population density is one nest per 0.009 acre or one individual per 0.004 acre. Body weight for male red-tails is 1,028.6 to 1,142.9 grams, and for females is 1,371.4 to 1,600 grams (Brown and Amadon, 1968), although EPA (1993) reports an average body weight of 957 grams. They typically mate for life or until one of the pair dies, with pairs clinging to territories year after year (Austing, 1964).

References:

Adamcik, R. S., A. W. Todd, and L. B. Keith, 1979, “Demographic and Dietary Responses of Red-Tailed Hawks During a Snowshoe Hare Fluctuation,” ***Canadian Field Naturalist***, Vol. 93, pp. 16-27.

Austing, G. R., 1964, ***The World of the Red-Tailed Hawk***, J. B. Lippincott Co., Philadelphia.

Brown, L. and D. Amadon, 1968, ***Eagles, Hawks, and Falcons of the World***, Vol. 1, McGraw-Hill Book Company, New York.

Ehrlich, P. R., D. S. Dobkin, and D. Wheye, 1988, ***The Birder's Handbook: A field guide to the Natural History of North American Birds***, Simon and Shuster, Inc., New York.

Janes, S. W., 1984, "Influences of Territory Composition and Interspecific Competition on Red-Tailed Hawk Reproductive Success," ***Ecology***, 65:862-870.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Raccoon (Procyon lotor). Raccoons are native only in the Americas. Their range extends from the southern edge of the southern provinces of Canada and most of the United States, except for portions of the Rocky Mountain states, central Nevada, and Utah (Whitaker, 1995). The raccoon weighs from 3 to 15 kilograms (Merritt, 1987; EPA, 1993) and has a head and body length of 46 to 71 centimeters and a tail length of 20 to 30 centimeters (Burt and Grossenheider, 1980). The raccoon is nocturnal and solitary, except when breeding or caring for its young. During particularly cold spells, the raccoon may sleep for several days at a time but does not hibernate (Whitaker, 1995). The raccoon is found along lakes near wooded areas or rock cliffs (Burt and Grossenheider, 1980), but prefers wooded streams (Whitaker, 1995). The raccoon is highly omnivorous and is an opportunistic feeder, consuming virtually any animal or plant matter that is available (Merritt, 1987; EPA, 1993). Animal matter predominates the diet during the spring and early summer; plant matter predominates during late summer, autumn, and winter (Merritt, 1987; EPA, 1993). The home range of the raccoon extends up to 3.2 kilometers across, but usually it is less than 1.6 kilometers. Population densities range from one per acre (highest) to one per 15 acres (considered high) (Burt and Grossenheider, 1980). Captive raccoons live for approximately 14 years (Burt and Grossenheider, 1980). Average body weight is 5.1 kilograms (EPA, 1993).

References:

Burt, W. H., and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

Merritt, J. F., 1987, ***Guide to the Mammals of Pennsylvania***, University of Pittsburgh Press, Pennsylvania.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook, Volume I of II***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

Short-Tailed Shrew (Blarina brevicauda). This shrew is the largest found in North America. It is solid grey above and below, with a short tail, and weighs between 15 and 29 grams (Whitaker, 1995). Total length of this shrew is 76 to 102 millimeters (Burt and Grossenheider, 1980). The range of this shrew extends from southeastern Canada and the northeastern U.S. to Nebraska, Missouri, Kentucky, and in the mountains to Alabama (Whitaker, 1995). Preferable habitat for the shrew includes forests, grasslands, marshes, and brushy areas. It will make a nest of dry leaves, grass, and hair beneath logs, stumps, rocks, or debris (Burt and Grossenheider, 1980). This underground tunneler may burrow as deep as 6 feet, and has a voracious appetite, eating one half of its own body weight per day of earthworms, other terrestrial vertebrates, and sometimes young mice (Whitaker, 1995). Mean population densities range from 5.7 in the winter, to 28 per acre in the summer (EPA, 1993). Their home range varies from 0.5 to 1 acre (Burt and Grossenheider, 1980). Longevity is typically around 20 months (EPA, 1993), with five to eight young born to each of two to three litters (Burt and Grossenheider, 1980).

References:

Burt, W. H. and R. P. Grossenheider, 1980, "A Field Guide to Mammals," ***Peterson Field Guide Series***, Hougton Mifflin Co., Boston.

U.S. Environmental Protection Agency (EPA), 1993, ***Wildlife Exposure Factors Handbook***, Office of Health and Environmental Assessment, Office of Research and Development, EPA/600/R93/187a.

Whitaker Jr., J. O., 1995, ***The Audubon Society Field Guide to North American Mammals***, Alfred A. Knopf, Inc., New York.

White-tailed Deer (Odocoileus virginianus). The white-tailed deer is a member of the family *Cervidae*. They are large, even-toed, hoofed mammals with long legs. Their coat is predominantly light brown or chestnut colored, with the underparts being white. Deer are primarily herbivorous grazers and browsers, constantly moving from one food source to the next. The deer's diet changes seasonally. When available, farm crops such as winter wheat, corn, alfalfa, soy beans, and hay are important components of the species diet. Other top food items include wild crab apples, sumac, grasses, green briar, clover, jewelweed, acorns, and dogwood. In regions where the climate varies from season to season, deer may make annual migrations of 10 to 20 miles in the search for food. However, in Ohio, deer typically have rather small home ranges (2 to 3 square miles) and are reluctant to leave this range. The average weight for the species is 88 kilograms for males and 61 kilograms for females. Breeding season ranges from November through February, with the young offspring born in May and early June. Virtually all

yearling and adult does conceive each year, and in Ohio usually carry twins. Triplets and quadruplets have also been recorded Gottschang (1981).

References:

Gottschang, J. L., 1981, ***A Guide to the Mammals of Ohio***, The Ohio State University Press, pp. 143-149.

Marsh Wren (Cistothorus palustris). The marsh wren is a small bird (4 to 4.5 inches in length) which inhabits freshwater cattail marshes and salt marshes. Nesting pairs are not likely to occupy other habitats and the species avoids the wet meadow and sedge meadow habitats preferred by sedge wrens. Marsh wrens breed throughout most of the northern half of the United States and in coastal areas as far south as Florida. The species eats mostly insects, and occasionally snails and other invertebrates. The average body weight is 0.01 kilograms, and the average home range for the species is 0.054 hectares. Because the species is polygamous, there may be more females than males inhabiting a breeding marsh. Densities as high as 120 birds per hectare have been recorded (EPA, 1993). Marsh wrens' nests are globular structures placed at heights of 2 to 5 feet in dense vegetation. The males commonly build dummy nests in addition to the one where the eggs will be laid (Peterjohn and Rice, 1991).

References:

U.S. Environmental Protection Agency (EPA), Office of Research and Development, 1993, ***Wildlife Exposure Factors Handbook***, EPA/600/R-93/187a.

Peterjohn, B. G., and Rice, D. L., 1991, ***The Ohio Breeding Bird Atlas***, The Ohio Department of Natural Resources.

Muskrat (Ondata zibethicus). The muskrat is a member of the Family Muridaee. Muskrats are the most aquatic of this family of rodents, and spend much of their lives in or near bogs, marshes, lakes or streams. Their diet consists primarily of aquatic vegetation (in particular the roots or basal portions of aquatic plants), although they can be omnivorous if other food sources are more common. Marsh grasses, sedges, and cattails are important muskrat food items. They are indigenous and common throughout most of the United States. Muskrats have relatively small home ranges that vary in configuration based on the physical attributes of their aquatic habitat. The average weight for the species is approximately 1.3 kilograms for males and 1.2 kilograms for females during the winter, and 0.9 kilogram for males and 0.8 kilogram for females during the spring. Muskrats typically breed during the first spring after birth, and typically produce 1 to 12 pups, with southern populations producing more litters, but fewer pups per litter compared with northern populations (EPA, 1993).

References:

U.S. Environmental Protection Agency (EPA), Office of Research and Development, 1993, ***Wildlife Exposure Factors Handbook***, EPA/600/R-93/187a.

APPENDIX E

FOOD CHAIN MODEL EXPOSURE DOSES AND HAZARD QUOTIENTS

Table E-1

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Deer Mouse
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							5.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.34E-01	1.93E+00	2.77E-01	1.93E+01	2.77E-02
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							1.07E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-03	1.26E-01	8.49E-03	1.26E+00	8.49E-04
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							1.56E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-02	5.10E+00	3.06E-03	1.98E+01	7.88E-04
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	1.17E-03	0.00E+00	0.00E+00	2.41E-01	0.00E+00	3.79E-02	0.00E+00	0.00E+00	2.80E-01	1.00E+00	2.80E-01	1.00E+01	2.80E-02
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							1.25E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-03	1.17E+01	1.07E-04	1.51E+01	8.25E-05
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	1.07E-03	0.00E+00	2.54E-01	0.00E+00	0.00E+00	1.77E+00	0.00E+00	3.24E-01	0.00E+00	0.00E+00	2.34E+00	8.00E+00	2.93E-01	8.00E+01	2.93E-02
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							2.94E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E-01	8.80E+01	3.34E-03	2.84E+02	1.04E-03
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	9.38E-04	0.00E+00	0.00E+00	5.04E-02	0.00E+00	2.00E-02	0.00E+00	0.00E+00	7.13E-02	1.32E+01	5.40E-03	1.32E+02	5.40E-04
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				6.84E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E-04	2.00E-01	3.42E-03	3.30E-01	2.07E-03
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	2.89E-03	0.00E+00	0.00E+00	8.79E-01	0.00E+00	1.76E-03	0.00E+00	0.00E+00	8.84E-01	1.37E+00	6.45E-01	3.43E+00	2.58E-01
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	2.04E-03	0.00E+00	0.00E+00	6.38E-01	0.00E+00	2.49E-04	0.00E+00	0.00E+00	6.40E-01	6.80E-02	9.41E+00	6.80E-01	9.41E-01
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-03	0.00E+00	0.00E+00	2.43E-01	0.00E+00	1.32E-01	0.00E+00	0.00E+00	3.76E-01	3.50E+01	1.07E-02	1.74E+02	2.17E-03
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	5.75E-04	0.00E+00	0.00E+00	1.12E-03	0.00E+00	5.87E-02	0.00E+00	0.00E+00	6.04E-02	9.00E+00	6.71E-03	4.80E+01	1.26E-03
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	5.98E-04	0.00E+00	0.00E+00	1.17E-03	0.00E+00	6.10E-02	0.00E+00	0.00E+00	6.28E-02	9.00E+00	6.97E-03	4.80E+01	1.31E-03
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.10E-02	0.00E+00	0.00E+00	3.51E-01	0.00E+00	2.69E-02	0.00E+00	0.00E+00	4.09E-01	1.70E-01	2.40E+00	8.50E-01	4.81E-01
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-02	0.00E+00	0.00E+00	2.36E-01	0.00E+00	9.74E-02	0.00E+00	0.00E+00	3.60E-01	1.00E+00	3.60E-01	1.00E+01	3.60E-02
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.54E-02	0.00E+00	0.00E+00	1.45E-01	0.00E+00	3.35E-01	0.00E+00	0.00E+00	5.15E-01	4.00E+00	1.29E-01	2.00E+01	2.57E-02
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.25E-03	0.00E+00	0.00E+00	9.02E-02	0.00E+00	1.31E-01	0.00E+00	0.00E+00	2.30E-01	7.20E+00	3.20E-02	7.20E+01	3.20E-03
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.35E-03	0.00E+00	0.00E+00	7.66E-02	0.00E+00	2.63E-02	0.00E+00	0.00E+00	1.11E-01	7.20E+00	1.55E-02	7.20E+01	1.55E-03
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E-03	0.00E+00	0.00E+00	7.63E-02	0.00E+00	5.10E-02	0.00E+00	0.00E+00	1.30E-01	2.30E-05	5.67E+03	2.30E-04	5.67E+02
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-02	0.00E+00	0.00E+00	2.90E-01	0.00E+00	2.48E-02	0.00E+00	0.00E+00	3.42E-01	1.70E-01	2.01E+00	8.50E-01	4.03E-01
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.23E-03	0.00E+00	0.00E+00	8.95E-02	0.00E+00	1.28E-02	0.00E+00	0.00E+00	1.06E-01	1.33E+00	7.93E-02	1.33E+01	7.93E-03
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	3.14E-03	0.00E+00	0.00E+00	8.83E-01	0.00E+00	8.06E-03	0.00E+00	0.00E+00	8.94E-01	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.42E-02	0.00E+00	0.00E+00	2.63E-01	0.00E+00	9.79E-01	0.00E+00	0.00E+00	1.31E+00	1.25E+01	1.04E-01	6.25E+01	2.09E-02
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E-03	0.00E+00	0.00E+00	1.94E-01	0.00E+00	4.24E-04	0.00E+00	0.00E+00	1.99E-01	1.25E+02	1.59E-03	6.25E+02	3.18E-04
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.10E-02	0.00E+00	0.00E+00	2.09E-01	0.00E+00	7.04E-02	0.00E+00	0.00E+00	3.00E-01	7.20E+00	4.17E-02	3.60E+01	8.34E-03
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.82E-02	0.00E+00	0.00E+00	4.23E-01	0.00E+00	1.06E+00	0.00E+00	0.00E+00	1.53E+00	7.50E+00	2.04E-01	3.75E+01	4.08E-02

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.61	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0.39	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.000056	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0028	kg/d
Body weight =	0.0148	kg
Home range =	0.153	acres
Water intake rate =	0.0022	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table E-2

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Short-Tailed Shrew
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Total Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							5.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-01	1.93E+00	2.85E-01	1.93E+01	2.85E-02
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							1.10E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-03	1.26E-01	8.76E-03	1.26E+00	8.76E-04
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							1.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-02	5.10E+00	3.16E-03	1.98E+01	8.13E-04
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.64E-01	mg/kg	1.00E+00			1.02E+01		9.84E-01	4.85E-01	4.85E-01	0.00E+00	0.00E+00	5.55E-03	0.00E+00	0.00E+00	5.44E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.49E-01	1.00E+00	5.49E-01	1.00E+01	5.49E-02
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							1.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-03	1.17E+01	1.10E-04	1.51E+01	8.51E-05
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	5.75E+01	mg/kg	1.00E+00	6.38E+01		3.68E-01		4.47E-02	1.13E-01	1.13E-01	1.10E-03	0.00E+00	8.78E-01	0.00E+00	0.00E+00	3.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.98E+00	8.00E+00	4.98E-01	8.00E+01	4.98E-02
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							3.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-01	8.80E+01	3.45E-03	2.84E+02	1.07E-03
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	1.91E-01	mg/kg	1.00E+00			3.28E+00		7.88E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.91E-03	0.00E+00	0.00E+00	9.18E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.47E-02	1.32E+01	7.18E-03	1.32E+02	7.18E-04
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				7.05E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.05E-04	2.00E-01	3.53E-03	3.30E-01	2.14E-03
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	3.21E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	4.90E-03	0.00E+00	0.00E+00	7.34E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.39E-01	1.37E+00	5.40E-01	3.43E+00	2.16E-01
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	4.09E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	6.24E-03	0.00E+00	0.00E+00	9.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.67E-01	6.80E-02	1.42E+01	6.80E-01	1.42E+00
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.31E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.52E-03	0.00E+00	0.00E+00	4.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-01	3.50E+01	1.19E-02	1.74E+02	2.40E-03
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.50E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.29E-03	0.00E+00	0.00E+00	2.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-03	9.00E+00	4.99E-04	4.80E+01	9.35E-05
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.54E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.35E-03	0.00E+00	0.00E+00	2.26E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E-03	9.00E+00	5.12E-04	4.80E+01	9.60E-05
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	2.82E+00	mg/kg	1.00E+00			5.80E-01		4.38E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.30E-02	0.00E+00	0.00E+00	2.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.83E-01	1.70E-01	1.67E+00	8.50E-01	3.33E-01
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	2.67E+00	mg/kg	1.00E+00			4.60E-01		1.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.08E-02	0.00E+00	0.00E+00	1.80E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E-01	1.00E+00	2.21E-01	1.00E+01	2.21E-02
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	3.29E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.01E-02	0.00E+00	0.00E+00	1.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-01	4.00E+00	3.78E-02	2.00E+01	7.57E-03
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	1.46E+00	mg/kg	1.00E+00			5.00E-01		4.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.23E-02	0.00E+00	0.00E+00	1.07E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-01	7.20E+00	1.80E-02	7.20E+01	1.80E-03
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.42E+00	mg/kg	1.00E+00			4.70E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.16E-02	0.00E+00	0.00E+00	9.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-01	7.20E+00	1.66E-02	7.20E+01	1.66E-03
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	3.35E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.11E-03	0.00E+00	0.00E+00	6.09E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.60E-02	2.30E-05	2.87E+03	2.30E-04	2.87E+02
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	2.58E+00	mg/kg	1.00E+00			5.50E-01		4.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-02	0.00E+00	0.00E+00	2.08E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.47E-01	1.70E-01	1.45E+00	8.50E-01	2.91E-01
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	6.40E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.76E-03	0.00E+00	0.00E+00	1.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-01	1.33E+00	1.08E-01	1.33E+01	1.08E-02
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	3.66E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	5.58E-03	0.00E+00	0.00E+00	7.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.79E-01	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	5.76E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-02	0.00E+00	0.00E+00	1.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-01	1.25E+01	2.12E-02	6.25E+01	4.25E-03
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	8.08E-01	mg/kg	1.00E+00			2.50E+00		5.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-02	0.00E+00	0.00E+00	2.96E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.09E-01	1.25E+02	2.47E-03	6.25E+02	4.94E-04
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	2.10E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-02	0.00E+00	0.00E+00	1.57E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-01	7.20E+00	2.62E-02	3.60E+01	5.24E-03
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	4.42E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.73E-02	0.00E+00	0.00E+00	2.91E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.59E-01	7.50E+00	4.78E-02	3.75E+01	9.57E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	1	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.0002288	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0022	kg/d
Body weight =	0.015	kg
Home range =	0.96	acres
Water intake rate =	0.0023	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table E-3

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Cottontail Rabbit
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							1.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-01	1.93E+00	7.08E-02	1.93E+01	7.08E-03
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							2.74E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-04	1.26E-01	2.17E-03	1.26E+00	2.17E-04
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							4.00E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E-03	5.10E+00	7.84E-04	1.98E+01	2.02E-04
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	6.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-02	0.00E+00	0.00E+00	1.15E-02	1.00E+00	1.15E-02	1.00E+01	1.15E-03
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							3.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.20E-04	1.17E+01	2.73E-05	1.51E+01	2.11E-05
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	2.74E-04	0.00E+00	1.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.31E-02	0.00E+00	0.00E+00	2.34E-01	8.00E+00	2.92E-02	8.00E+01	2.92E-03
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							7.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.54E-02	8.80E+01	8.56E-04	2.84E+02	2.65E-04
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.75E-03	0.00E+00	0.00E+00	6.27E-03	1.32E+01	4.75E-04	1.32E+02	4.75E-05
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				1.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-04	2.00E-01	8.75E-04	3.30E-01	5.30E-04
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	1.60E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-04	0.00E+00	0.00E+00	2.11E-03	1.37E+00	1.54E-03	3.43E+00	6.14E-04
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	1.13E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.17E-05	0.00E+00	0.00E+00	1.20E-03	6.80E-02	1.77E-02	6.80E-01	1.77E-03
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E-02	0.00E+00	0.00E+00	3.85E-02	3.50E+01	1.10E-03	1.74E+02	2.22E-04
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	3.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-02	0.00E+00	0.00E+00	1.72E-02	9.00E+00	1.91E-03	4.80E+01	3.59E-04
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	3.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-02	0.00E+00	0.00E+00	1.79E-02	9.00E+00	1.99E-03	4.80E+01	3.73E-04
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.74E-03	0.00E+00	0.00E+00	2.49E-02	1.70E-01	1.46E-01	8.50E-01	2.93E-02
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.80E-02	0.00E+00	0.00E+00	4.26E-02	1.00E+00	4.26E-02	1.00E+01	4.26E-03
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.63E-02	0.00E+00	0.00E+00	1.16E-01	4.00E+00	2.90E-02	2.00E+01	5.79E-03
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.12E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-02	0.00E+00	0.00E+00	4.28E-02	7.20E+00	5.94E-03	7.20E+01	5.94E-04
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.58E-03	0.00E+00	0.00E+00	1.22E-02	7.20E+00	1.69E-03	7.20E+01	1.69E-04
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-02	0.00E+00	0.00E+00	1.64E-02	2.30E-05	7.14E+02	2.30E-04	7.14E+01
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.13E-03	0.00E+00	0.00E+00	2.21E-02	1.70E-01	1.30E-01	8.50E-01	2.60E-02
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.69E-03	0.00E+00	0.00E+00	5.47E-03	1.33E+00	4.12E-03	1.33E+01	4.12E-04
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	1.74E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E-03	0.00E+00	0.00E+00	4.06E-03	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.55E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.82E-01	0.00E+00	0.00E+00	3.17E-01	1.25E+01	2.54E-02	6.25E+01	5.07E-03
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.22E-04	0.00E+00	0.00E+00	2.33E-03	1.25E+02	1.86E-05	6.25E+02	3.72E-06
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.03E-02	0.00E+00	0.00E+00	3.19E-02	7.20E+00	4.43E-03	3.60E+01	8.86E-04
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-01	0.00E+00	0.00E+00	3.31E-01	7.50E+00	4.41E-02	3.75E+01	8.83E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	1	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.006048	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.096	kg/d
Body weight =	1.132	kg
Home range =	7.66	acres
Water intake rate =	0.11	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.39164491	unitless
Exposure Frequency (EF) =	1	unitless

Table E-4

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Marsh Wren
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							9.69E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-01	1.10E+02	8.81E-03	1.10E+03	8.81E-04
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							1.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-03	5.14E+00	3.78E-04	1.28E+01	1.51E-04
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.84E-02	2.08E+01	1.36E-03	4.17E+01	6.80E-04
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	1.80E-03	0.00E+00	0.00E+00	9.47E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.48E-01	1.45E+00	6.54E-01	2.00E+01	4.74E-02
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							2.27E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-03	4.70E+01	4.83E-05	6.17E+01	3.68E-05
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	1.94E-03	0.00E+00	3.89E-01	0.00E+00	0.00E+00	6.94E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.33E+00	1.13E+00	6.49E+00	1.13E+01	6.49E-01
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							5.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.35E-01	9.77E+02	5.47E-04	9.77E+03	5.47E-05
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.44E-03	0.00E+00	0.00E+00	1.98E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-01	4.50E-01	4.43E-01	9.00E-01	2.21E-01
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				1.24E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-03	5.00E-01	2.48E-03	1.00E+00	1.24E-03
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	4.43E-03	0.00E+00	0.00E+00	3.46E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.46E+00	1.80E-01	1.92E+01	1.80E+00	1.92E+00
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	3.13E-03	0.00E+00	0.00E+00	2.51E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51E+00	1.80E-01	1.39E+01	1.80E+00	1.39E+00
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-03	0.00E+00	0.00E+00	9.55E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.57E-01	9.75E+00	9.81E-02	4.88E+01	1.96E-02
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	8.82E-04	0.00E+00	0.00E+00	4.41E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	9.75E+00	5.43E-04	4.88E+01	1.09E-04
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	9.16E-04	0.00E+00	0.00E+00	4.58E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.50E-03	9.75E+00	5.64E-04	4.88E+01	1.13E-04
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.76E-02	0.00E+00	0.00E+00	1.38E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E+00	7.00E-01	2.04E+00	3.50E+00	4.08E-01
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.04E-02	0.00E+00	0.00E+00	9.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.69E-01	1.00E+00	9.69E-01	5.00E+00	1.94E-01
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.42E-02	0.00E+00	0.00E+00	5.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.24E-01	1.40E-01	4.46E+00	7.00E-01	8.91E-01
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-02	0.00E+00	0.00E+00	3.55E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.69E-01	1.00E+00	3.69E-01	5.00E+00	7.37E-02
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-02	0.00E+00	0.00E+00	3.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.14E-01	1.00E+00	3.14E-01	5.00E+00	6.28E-02
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.84E-03	0.00E+00	0.00E+00	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E-01	NA	NA	NA	NA
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.15E-02	0.00E+00	0.00E+00	1.14E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+00	1.00E+00	1.18E+00	5.00E+00	2.37E-01
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.95E-03	0.00E+00	0.00E+00	3.52E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.57E-01	1.00E+00	3.57E-01	5.00E+00	7.13E-02
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	4.82E-03	0.00E+00	0.00E+00	3.47E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.48E+00	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.84E-02	0.00E+00	0.00E+00	1.03E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E+00	3.95E+01	2.86E-02	3.95E+02	2.86E-03
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.11E-03	0.00E+00	0.00E+00	7.63E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.70E-01	1.00E+00	7.70E-01	5.00E+00	1.54E-01
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-02	0.00E+00	0.00E+00	8.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.53E-01	1.00E+00	8.53E-01	5.00E+00	1.71E-01
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.38E-02	0.00E+00	0.00E+00	1.66E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.74E+00	3.95E+01	4.39E-02	3.95E+02	4.39E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	1	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.000058	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0029	kg/d
Body weight =	0.01	kg
Home range =	0.13	acres
Water intake rate =	0.0027	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table E-5

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the White-Tailed Deer
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Total Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							5.52E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.52E-04	1.93E+00	2.86E-04	1.93E+01	2.86E-05
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							1.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.11E-06	1.26E-01	8.78E-06	1.26E+00	8.78E-07
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							1.61E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-05	5.10E+00	3.16E-06	1.98E+01	8.15E-07
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.64E-01	mg/kg	1.00E+00			1.02E+01		9.84E-01	4.85E-01	4.85E-01	0.00E+00	0.00E+00	5.59E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E-05	0.00E+00	0.00E+00	2.81E-05	1.00E+00	2.81E-05	1.00E+01	2.81E-06
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							1.29E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-06	1.17E+01	1.10E-07	1.51E+01	8.53E-08
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	5.75E+01	mg/kg	1.00E+00	6.38E+01		3.68E-01		4.47E-02	1.13E-01	1.13E-01	1.11E-06	0.00E+00	8.84E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-04	0.00E+00	0.00E+00	2.87E-04	8.00E+00	3.59E-05	8.00E+01	3.59E-06
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							3.04E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-04	8.80E+01	3.46E-06	2.84E+02	1.07E-06
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	1.91E-01	mg/kg	1.00E+00			3.28E+00		7.88E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.94E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-05	0.00E+00	0.00E+00	1.19E-05	1.32E+01	8.98E-07	1.32E+02	8.98E-08
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				7.07E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.07E-07	2.00E-01	3.53E-06	3.30E-01	2.14E-06
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	3.21E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	4.93E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.93E-07	0.00E+00	0.00E+00	9.87E-07	1.37E+00	7.20E-07	3.43E+00	2.88E-07
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	4.09E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	6.29E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.26E-07	0.00E+00	0.00E+00	7.54E-07	6.80E-02	1.11E-05	6.80E-01	1.11E-06
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.31E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.55E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.51E-05	0.00E+00	0.00E+00	7.54E-05	3.50E+01	2.16E-06	1.74E+02	4.35E-07
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.50E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.31E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.86E-05	0.00E+00	0.00E+00	3.88E-05	9.00E+00	4.31E-06	4.80E+01	8.08E-07
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.54E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-05	0.00E+00	0.00E+00	3.98E-05	9.00E+00	4.43E-06	4.80E+01	8.30E-07
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	2.82E+00	mg/kg	1.00E+00			5.80E-01		4.38E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.49E-06	0.00E+00	0.00E+00	1.38E-05	1.70E-01	8.14E-05	8.50E-01	1.63E-05
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	2.67E+00	mg/kg	1.00E+00			4.60E-01		1.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.55E-05	0.00E+00	0.00E+00	2.96E-05	1.00E+00	2.96E-05	1.00E+01	2.96E-06
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	3.29E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.83E-05	0.00E+00	0.00E+00	8.33E-05	4.00E+00	2.08E-05	2.00E+01	4.17E-06
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	1.46E+00	mg/kg	1.00E+00			5.00E-01		4.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.74E-05	0.00E+00	0.00E+00	4.96E-05	7.20E+00	6.89E-06	7.20E+01	6.89E-07
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.42E+00	mg/kg	1.00E+00			4.70E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-05	0.00E+00	0.00E+00	1.42E-05	7.20E+00	1.97E-06	7.20E+01	1.97E-07
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	3.35E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-05	0.00E+00	0.00E+00	1.42E-05	2.30E-05	6.16E-01	2.30E-04	6.16E-02
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	2.58E+00	mg/kg	1.00E+00			5.50E-01		4.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E-06	0.00E+00	0.00E+00	1.30E-05	1.70E-01	7.62E-05	8.50E-01	1.52E-05
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	6.40E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.84E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.39E-06	0.00E+00	0.00E+00	7.38E-06	1.33E+00	5.55E-06	1.33E+01	5.55E-07
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	3.66E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	5.63E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-06	0.00E+00	0.00E+00	2.93E-06	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	5.76E+00	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.86E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E-04	0.00E+00	0.00E+00	2.30E-04	1.25E+01	1.84E-05	6.25E+01	3.68E-06
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	8.08E-01	mg/kg	1.00E+00			2.50E+00		5.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.54E-07	0.00E+00	0.00E+00	1.60E-06	1.25E+02	1.28E-08	6.25E+02	2.55E-09
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	2.10E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.22E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-05	0.00E+00	0.00E+00	2.09E-05	7.20E+00	2.91E-06	3.60E+01	5.81E-07
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	4.42E+00	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.79E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-04	0.00E+00	0.00E+00	2.51E-04	7.50E+00	3.35E-05	3.75E+01	6.69E-06

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	1	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.04	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	2	kg/d
Body weight =	61	kg
Home range =	1280	acres
Water intake rate =	4	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00234375	unitless
Exposure Frequency (EF) =	1	unitless

Table E-6

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Raccoon
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							2.36E-03	0.00E+00	0.00E+00	2.22E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.46E-02	1.93E+00	1.27E-02	1.93E+01	1.27E-03
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							4.73E-06	0.00E+00	0.00E+00	9.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-05	1.26E-01	1.17E-04	1.26E+00	1.17E-05
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							6.90E-05	0.00E+00	0.00E+00	1.22E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.91E-04	5.10E+00	3.74E-05	1.98E+01	9.64E-06
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	5.79E-06	0.00E+00	0.00E+00	3.89E-04	0.00E+00	2.74E-05	3.25E-06	0.00E+00	4.25E-04	1.00E+00	4.25E-04	1.00E+01	4.25E-05
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							5.52E-06	0.00E+00	0.00E+00	8.09E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.64E-05	1.17E+01	7.38E-06	1.51E+01	5.70E-06
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	4.73E-06	0.00E+00	1.25E-03	3.65E-06	0.00E+00	2.85E-03	0.00E+00	2.34E-04	1.38E-04	0.00E+00	4.48E-03	8.00E+00	5.60E-04	8.00E+01	5.60E-05
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							1.30E-03	0.00E+00	0.00E+00	3.89E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.19E-03	8.80E+01	5.89E-05	2.84E+02	1.83E-05
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.63E-06	0.00E+00	0.00E+00	8.13E-05	0.00E+00	1.45E-05	9.46E-07	0.00E+00	1.01E-04	1.00E+00	1.01E-04	5.00E+00	2.03E-05
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				3.02E-06	5.23E-05	0.00E+00	2.36E-05	1.26E-03	0.00E+00	1.32E-04	0.00E+00	0.00E+00	0.00E+00	1.47E-03	2.00E-01	7.35E-03	3.30E-01	4.45E-03
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	1.43E-05	0.00E+00	0.00E+00	1.42E-03	0.00E+00	1.27E-06	2.00E-08	0.00E+00	1.44E-03	1.37E+00	1.05E-03	3.43E+00	4.19E-04
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	1.01E-05	0.00E+00	0.00E+00	1.03E-03	0.00E+00	1.80E-07	1.42E-08	0.00E+00	1.04E-03	1.40E-01	7.43E-03	6.90E-01	1.51E-03
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.04E-06	0.00E+00	0.00E+00	3.93E-04	0.00E+00	9.53E-05	0.00E+00	0.00E+00	4.93E-04	3.50E+01	1.41E-05	1.74E+02	2.84E-06
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.84E-06	0.00E+00	0.00E+00	1.81E-06	0.00E+00	4.24E-05	2.19E-13	0.00E+00	4.71E-05	9.00E+00	5.23E-06	4.80E+01	9.81E-07
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.95E-06	0.00E+00	0.00E+00	1.88E-06	0.00E+00	4.41E-05	2.27E-13	0.00E+00	4.89E-05	9.00E+00	5.44E-06	4.80E+01	1.02E-06
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-04	0.00E+00	0.00E+00	5.67E-04	0.00E+00	1.94E-05	0.00E+00	0.00E+00	7.39E-04	1.70E-01	4.35E-03	8.50E-01	8.70E-04
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-04	0.00E+00	0.00E+00	3.82E-04	0.00E+00	7.04E-05	0.00E+00	0.00E+00	5.82E-04	1.00E+00	5.82E-04	1.00E+01	5.82E-05
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.75E-04	0.00E+00	0.00E+00	2.34E-04	0.00E+00	2.42E-04	0.00E+00	0.00E+00	6.51E-04	4.00E+00	1.63E-04	2.00E+01	3.25E-05
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.56E-05	0.00E+00	0.00E+00	1.46E-04	0.00E+00	9.46E-05	0.00E+00	0.00E+00	2.86E-04	7.20E+00	3.97E-05	7.20E+01	3.97E-06
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-05	0.00E+00	0.00E+00	1.24E-04	0.00E+00	1.90E-05	0.00E+00	0.00E+00	1.84E-04	7.20E+00	2.55E-05	7.20E+01	2.55E-06
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.56E-05	0.00E+00	0.00E+00	1.23E-04	0.00E+00	3.69E-05	0.00E+00	0.00E+00	1.76E-04	2.30E-05	7.64E+00	2.30E-04	7.64E-01
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.34E-04	0.00E+00	0.00E+00	4.69E-04	0.00E+00	1.79E-05	0.00E+00	0.00E+00	6.21E-04	1.70E-01	3.65E-03	8.50E-01	7.30E-04
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-05	0.00E+00	0.00E+00	1.45E-04	0.00E+00	9.26E-06	0.00E+00	0.00E+00	1.70E-04	1.33E+00	1.28E-04	1.33E+01	1.28E-05
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	1.55E-05	0.00E+00	0.00E+00	1.43E-03	0.00E+00	5.82E-06	1.82E-05	0.00E+00	1.47E-03	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.17E-04	0.00E+00	0.00E+00	4.24E-04	0.00E+00	7.07E-04	0.00E+00	0.00E+00	1.45E-03	1.25E+01	1.16E-04	6.25E+01	2.32E-05
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.97E-05	0.00E+00	0.00E+00	3.14E-04	0.00E+00	3.07E-07	0.00E+00	0.00E+00	3.34E-04	1.25E+02	2.67E-06	6.25E+02	5.34E-07
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-04	0.00E+00	0.00E+00	3.37E-04	0.00E+00	5.09E-05	0.00E+00	0.00E+00	4.92E-04	7.20E+00	6.83E-05	3.60E+01	1.37E-05
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.38E-04	0.00E+00	0.00E+00	6.83E-04	0.00E+00	7.65E-04	0.00E+00	0.00E+00	1.68E-03	7.50E+00	2.25E-04	3.75E+01	4.49E-05

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	0.21	unitless
Aquatic plant diet fraction =	0.21	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0.02	unitless
Aq. Invert diet fraction =	0.21	unitless
Terr. Invert diet fraction =	0.3	unitless
Mammal diet fraction =	0.05	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.01222	kg/d
Sediment ingestion rate =	0.01222	kg/d
Food ingestion rate =	0.26	kg/d
Body weight =	5.1	kg
Home range =	385	acres
Water intake rate =	0.43	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00779221	unitless
Exposure Frequency (EF) =	1	unitless

Table E-7

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Red-Tailed Hawk
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							3.08E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.08E-04	1.10E+02	2.80E-06	1.10E+03	2.80E-07
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							6.19E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.19E-07	5.14E+00	1.20E-07	1.28E+01	4.82E-08
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							9.02E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.02E-06	2.08E+01	4.34E-07	4.17E+01	2.16E-07
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	5.33E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E-05	3.37E-06	1.46E-05	1.45E+00	1.01E-05	2.00E+01	7.29E-07
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							7.22E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.22E-07	4.70E+01	1.54E-08	6.17E+01	1.17E-08
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	6.19E-07	0.00E+00	1.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.52E-04	1.43E-04	7.11E-04	3.85E+00	1.85E-04	3.85E+01	1.85E-05
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							1.70E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-04	9.77E+02	1.74E-07	9.77E+03	1.74E-08
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.26E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.11E-06	9.82E-07	4.52E-06	4.50E-01	1.00E-05	9.00E-01	5.02E-06
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				3.95E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.95E-07	4.40E-01	8.98E-07	1.50E+00	2.63E-07
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	1.31E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.58E-08	2.08E-08	1.40E-06	1.80E-01	7.77E-06	1.80E+00	7.77E-07
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	9.28E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.65E-08	1.47E-08	9.89E-07	1.80E-01	5.49E-06	1.80E+00	5.49E-07
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.64E-07	9.75E+00	4.76E-08	4.88E+01	9.52E-09
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.61E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.18E-13	2.27E-13	2.61E-07	9.75E+00	2.68E-08	4.88E+01	5.36E-09
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	2.71E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.47E-13	2.36E-13	2.71E-07	9.75E+00	2.78E-08	4.88E+01	5.57E-09
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E-05	7.00E-01	2.01E-05	3.50E+00	4.03E-06
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-05	1.00E+00	1.20E-05	5.00E+00	2.39E-06
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-05	1.40E-01	1.15E-04	7.00E-01	2.30E-05
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.20E-06	1.00E+00	4.20E-06	5.00E+00	8.40E-07
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E-06	1.00E+00	3.79E-06	5.00E+00	7.59E-07
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-06	NA	NA	NA	NA
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.23E-05	1.00E+00	1.23E-05	5.00E+00	2.46E-06
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.47E-06	1.00E+00	1.47E-06	5.00E+00	2.93E-07
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	1.43E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.97E-05	1.88E-05	8.00E-05	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.91E-05	3.95E+01	7.38E-07	3.95E+02	7.38E-08
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-06	1.00E+00	1.81E-06	5.00E+00	3.62E-07
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.53E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.53E-06	1.00E+00	9.53E-06	5.00E+00	1.91E-06
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-05	3.95E+01	5.54E-07	3.95E+02	5.54E-08

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\,x\,Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0.76	unitless
Bird diet fraction =	0.24	unitless
Soil ingestion rate =	0.00114	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.057	kg/d
Body weight =	0.957	kg
Home range =	2080	acres
Water intake rate =	0.057	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	0.00144231	unitless
Exposure Frequency (EF) =	1	unitless

Table E-8

Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Muskrat
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

Chemical	Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV_{NOAEL}	HQ_{NOAEL}	TRV_{LOAEL}	HQ_{LOAEL}
							----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Metals																													
Aluminum	3.59E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	7.80E+02							3.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E-01	1.93E+00	1.74E-01	1.93E+01	1.74E-02
Arsenic	7.20E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.74E+02							6.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-04	1.26E-01	5.35E-03	1.26E+00	5.35E-04
Barium	1.05E-01	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.46E+02							9.84E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.84E-03	5.10E+00	1.93E-03	1.98E+01	4.97E-04
Cadmium	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-01	mg/kg	1.00E+00			1.05E+01		1.06E+00	5.28E-01	5.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	1.00E+01	0.00E+00
Copper	8.40E-03	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	1.21E+03							7.87E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.87E-04	1.17E+01	6.73E-05	1.51E+01	5.20E-05
Lead	7.20E-03	mg/L	0.00E+00	mg/kg	6.70E+01	mg/kg	1.00E+00	6.38E+01		3.57E-01		4.18E-02	1.03E-01	1.03E-01	6.75E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-04	8.00E+00	8.43E-05	8.00E+01	8.43E-06
Manganese	1.98E+00	mg/L	0.00E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	2.47E+02							1.86E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-01	8.80E+01	2.11E-03	2.84E+02	6.53E-04
Mercury	0.00E+00	mg/L	0.00E+00	mg/kg	2.48E-01	mg/kg	1.00E+00			2.75E+00		6.99E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	5.00E+00	0.00E+00
Selenium	4.60E-03	mg/L	2.80E+00	mg/kg	0.00E+00	mg/kg	1.00E+00	6.45E+02	5.39E+00		5.66E-01				4.31E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-01	0.00E+00	0.00E+00	0.00E+00	4.75E-01	2.00E-01	2.38E+00	3.30E-01	1.44E+00
PCBs																													
Aroclor 1016	0.00E+00	mg/L	0.00E+00	mg/kg	7.64E-01	mg/kg	1.00E+00			1.56E+01		2.00E-02	1.32E-03	1.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E+00	0.00E+00	3.43E+00	0.00E+00
Aroclor 1254	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-01	mg/kg	1.00E+00			1.60E+01		4.00E-03	1.32E-03	1.32E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-01	0.00E+00	6.90E-01	0.00E+00
Nitroaromatics																													
2,4,6-Trinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			1.22E+01		4.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E+01	0.00E+00	1.74E+02	0.00E+00
2-Amino-4,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.52E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E+00	0.00E+00	4.80E+01	0.00E+00
4-Amino-2,6-dinitrotoluene	0.00E+00	mg/L	0.00E+00	mg/kg	1.58E-01	mg/kg	1.00E+00			1.00E-01		3.35E+00	7.24E-08	7.24E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E+00	0.00E+00	4.80E+01	0.00E+00
Semivolatile Organics																													
Benzo(a)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.20E+00	mg/kg	1.00E+00			5.80E-01		2.84E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01	0.00E+00	8.50E-01	0.00E+00
Benzo(a)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	6.96E+00	mg/kg	1.00E+00			4.60E-01		1.21E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	0.00E+00	1.00E+01	0.00E+00
Benzo(b)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	9.35E+00	mg/kg	1.00E+00			2.10E-01		3.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.00E+00	0.00E+00	2.00E+01	0.00E+00
Benzo(ghi)perylene	0.00E+00	mg/L	0.00E+00	mg/kg	2.45E+00	mg/kg	1.00E+00			5.00E-01		4.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E+00	0.00E+00	7.20E+01	0.00E+00
Benzo(k)fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	2.21E+00	mg/kg	1.00E+00			4.70E-01		1.03E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E+00	0.00E+00	7.20E+01	0.00E+00
Carbazole	0.00E+00	mg/L	0.00E+00	mg/kg	8.34E-01	mg/kg	1.00E+00			1.24E+00		5.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E-05	0.00E+00	2.30E-04	0.00E+00
Chrysene	0.00E+00	mg/L	0.00E+00	mg/kg	7.16E+00	mg/kg	1.00E+00			5.50E-01		3.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.70E-01	0.00E+00	8.50E-01	0.00E+00
Dibenz(a,h)anthracene	0.00E+00	mg/L	0.00E+00	mg/kg	8.54E-01	mg/kg	1.00E+00			1.42E+00		1.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E+00	0.00E+00	1.33E+01	0.00E+00
Dibenzofuran	0.00E+00	mg/L	0.00E+00	mg/kg	8.31E-01	mg/kg	1.00E+00			1.44E+01		8.40E-02	1.10E+00	1.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NA	NA	NA	NA
Fluoranthene	0.00E+00	mg/L	0.00E+00	mg/kg	1.70E+01	mg/kg	1.00E+00			2.10E-01		5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E+01	0.00E+00	6.25E+01	0.00E+00
Fluorene	0.00E+00	mg/L	0.00E+00	mg/kg	1.05E+00	mg/kg	1.00E+00			2.50E+00		3.49E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E+02	0.00E+00	6.25E+02	0.00E+00
Indeno(1,2,3-cd)pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	5.55E+00	mg/kg	1.00E+00			5.10E-01		1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E+00	0.00E+00	3.60E+01	0.00E+00
Pyrene	0.00E+00	mg/L	0.00E+00	mg/kg	1.27E+01	mg/kg	1.00E+00			4.50E-01		7.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.50E+00	0.00E+00	3.75E+01	0.00E+00

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi\, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF - Bioaccumulation Factor (may be BCF if this is the only value available).
EED - Estimated Exposure Dose.
EEQ - Ecological Effects Quotient.
L - LOAEL based; N - NOAEL based.
LOAEL - Lowest Observed Adverse Effect Level.
NOAEL - No Observed Adverse Effect Level.
NA - Not applicable/Not available.
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor).
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF - Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or N See appropriate text tables for equations.
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors		
Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	1	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.352	kg/d
Body weight =	1.174	kg
Home range =	0.3	acres
Water intake rate =	0.11	L/d
Site Area =	3	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

APPENDIX F

DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW301					PBOW99-SSW302					PBOW99-SSW303					PBOW99-SSW304				
SAMPLE_NO		PBOW99SSW301					PBOW99SSW302					PBOW99SSW303					PBOW99SSW304				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Dinitrobenzene, 1,3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Dinitrotoluene, 2,4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Dinitrotoluene, 2,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
HMX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U	
Nitrobenzene	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
RDX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U	
Tetryl	mg/kg	0.325	0.65	0.65	U		0.325	0.65	0.65	U		0.325	0.65	0.65	U		0.325	0.65	0.65	U	
Trinitrobenzene, 1,3,5-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Trinitrotoluene, 2,4,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
METALS (UNFILTERED)																					
Aluminum	mg/kg	8820	22.9	22.9			7860	21.8	21.8			7480	24	24			7540	22.4	22.4		
Antimony	mg/kg	3.45	6.9	6.9	U		3.3	6.6	6.6	U		3.6	7.2	7.2	U		3.35	6.7	6.7	U	
Arsenic	mg/kg	7.1	1.1	1.1			7.2	1.1	1.1			6.1	1.2	1.2			7.3	1.1	1.1		
Barium	mg/kg	67.3	22.9	22.9			62.5	21.8	21.8			49.6	24	24			50.3	22.4	22.4		
Beryllium	mg/kg	0.63	0.57	0.57			0.275	0.55	0.55	U		0.3	0.6	0.6	U		0.28	0.56	0.56	U	
Cadmium	mg/kg	0.285	0.57	0.57	U		0.275	0.55	0.55	U		0.3	0.6	0.6	U		0.28	0.56	0.56	U	
Calcium	mg/kg	4250	573	573			40000	546	546			60700	600	600			8070	559	559		
Chromium	mg/kg	13.2	1.1	1.1			14.9	1.1	1.1			12.7	1.2	1.2			11.1	1.1	1.1		
Cobalt	mg/kg	6.8	5.7	5.7			7	5.5	5.5			3	6	6	U		6.2	5.6	5.6		
Copper	mg/kg	13.9	2.9	2.9			15.2	2.7	2.7			15.4	3	3			14.1	2.8	2.8		
Iron	mg/kg	16300	11.5	11.5			16200	10.9	10.9			14200	12	12			16100	11.2	11.2		
Lead	mg/kg	11.6	0.34	0.34			72.7	0.33	0.33			33.9	0.36	0.36			60.1	0.34	0.34		
Magnesium	mg/kg	2250	573	573			8090	546	546			8100	600	600			3370	559	559		
Manganese	mg/kg	346	1.7	1.7			324	1.6	1.6			283	1.8	1.8			281	1.7	1.7		
Mercury	mg/kg	0.047	0.038	0.038			0.11	0.036	0.036			0.16	0.04	0.04			0.044	0.037	0.037		
Nickel	mg/kg	16.5	4.6	4.6			18	4.4	4.4			14.6	4.8	4.8			14.8	4.5	4.5		
Potassium	mg/kg	746	573	573			936	546	546			830	600	600			724	559	559		
Selenium	mg/kg	0.96	0.57	0.57			0.6	0.55	0.55			0.65	0.6	0.6			0.92	0.56	0.56		
Silver	mg/kg	0.55	1.1	1.1	U		0.55	1.1	1.1	U		0.6	1.2	1.2	U		0.55	1.1	1.1	U	
Sodium	mg/kg	286.5	573	573	U		273	546	546	U		300	600	600	U		279.5	559	559	U	
Thallium	mg/kg	1.1	1.1	1.1			1.1	1.1	1.1			0.6	1.2	1.2	U		0.55	1.1	1.1	U	
Vanadium	mg/kg	21.5	5.7	5.7			20.6	5.5	5.5			19.7	6	6			19.9	5.6	5.6		
Zinc	mg/kg	47.9	2.3	2.3			105	2.2	2.2			67.4	2.4	2.4			44	2.2	2.2		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg						0.09	0.18	0.18	U	UJ	0.0395	0.079	0.079	U						
Aroclor 1221	mg/kg						0.09	0.18	0.18	U	UJ	0.0395	0.079	0.079	U						
Aroclor 1232	mg/kg						0.09	0.18	0.18	U	UJ	0.0395	0.079	0.079	U						
Aroclor 1242	mg/kg						0.09	0.18	0.18	U	UJ	0.0395	0.079	0.079	U						
Aroclor 1248	mg/kg						0.09	0.18	0.18	U	UJ	0.0395	0.079	0.079	U						
Aroclor 1254	mg/kg						1	0.18	0.18	AP	J	0.25	0.079	0.079	AP						
Aroclor 1260	mg/kg						0.23	0.46	0.46	U,G	UJ	0.115	0.23	0.23	U,G						

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW301					PBOW99-SSW302					PBOW99-SSW303					PBOW99-SSW304				
SAMPLE_NO		PBOW99SSW301					PBOW99SSW302					PBOW99SSW303					PBOW99SSW304				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Acenaphthylene	mg/kg						0.18	0.36	0.36	U		1.1	0.4	0.4							
ACETOPHENONE	mg/kg																				
Anthracene	mg/kg						0.18	0.36	0.36	U		1.7	0.4	0.4							
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg						1.2	0.36	0.36			4.5	0.4	0.4							
Benzo(a)pyrene	mg/kg						1.3	0.36	0.36			4.2	0.4	0.4							
Benzo(b)fluoranthene	mg/kg						1.2	0.36	0.36			4.3	0.4	0.4							
Benzo(ghi)perylene	mg/kg						0.69	0.36	0.36			2.4	0.4	0.4							
Benzo(k)fluoranthene	mg/kg						1.1	0.36	0.36			3	0.4	0.4							
Benzoic acid	mg/kg																				
Benzyl alcohol	mg/kg																				
BIBENZENE	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Bis(2-chloroethyl)ether	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Bis(2-chloroisopropyl)ether	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Bis(2-ethylhexyl)phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Bromophenyl phenyl ether, 4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Butyl benzyl phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Caprolactam	mg/kg																				
Carbazole	mg/kg																				
Chloro-3-methylphenol, 4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Chloroaniline, 4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Chloronaphthalene, 2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Chlorophenol, 2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Chlorophenyl phenyl ether, 4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Chrysene	mg/kg						1.2	0.36	0.36			4	0.4	0.4							
Dibenz(a,h)anthracene	mg/kg						0.18	0.36	0.36	U		0.72	0.4	0.4							
Dibenzofuran	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dichlorobenzene, 1,2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dichlorobenzene, 1,3-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dichlorobenzene, 1,4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dichlorobenzidine, 3,3'-	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Dichlorophenol, 2,4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Diethyl phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dimethyl phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dimethylphenol, 2,4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Di-n-butyl phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dinitro-2-methylphenol, 4,6-	mg/kg						0.85	1.7	1.7	U	UJ	0.95	1.9	1.9	U						
Dinitrophenol, 2,4-	mg/kg						0.85	1.7	1.7	U	UJ	0.95	1.9	1.9	U						
Dinitrotoluene, 2,4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Dinitrotoluene, 2,6-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Di-n-octyl phthalate	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
DIPHENYLAMINE	mg/kg																				
Fluoranthene	mg/kg						2.1	0.36	0.36			8.9	0.79	0.79	D						

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW301					PBOW99-SSW302					PBOW99-SSW303					PBOW99-SSW304				
SAMPLE_NO		PBOW99SSW301					PBOW99SSW302					PBOW99SSW303					PBOW99SSW304				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg						0.18	0.36	0.36	U		0.61	0.4	0.4							
Hexachlorobenzene	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Hexachlorobutadiene	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Hexachlorocyclopentadiene	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Hexachloroethane	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Indeno(1,2,3-cd)pyrene	mg/kg						0.87	0.36	0.36			2.9	0.4	0.4							
Isophorone	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Methylnaphthalene, 2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Methylphenol, 2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Methylphenol, 4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Naphthalene	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Nitroaniline, 2-	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Nitroaniline, 3-	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Nitroaniline, 4-	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Nitrobenzene	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Nitrophenol, 2-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Nitrophenol, 4-	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
n-Nitrosodimethylamine	mg/kg																				
n-Nitroso-di-n-propylamine	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
n-Nitrosodiphenylamine	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Pentachlorophenol	mg/kg						0.85	1.7	1.7	U		0.95	1.9	1.9	U						
Phenanthrene	mg/kg						0.58	0.36	0.36			4.4	0.4	0.4							
Phenol	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Pyrene	mg/kg						1.9	0.36	0.36			8.2	0.79	0.79	D						
Trichlorobenzene, 1,2,4-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Trichlorophenol, 2,4,5-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
Trichlorophenol, 2,4,6-	mg/kg						0.18	0.36	0.36	U		0.2	0.4	0.4	U						
VOLATILES																					
Benzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Bromobenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Bromochloromethane	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Bromodichloromethane	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Bromoform	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Bromomethane	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Carbon tetrachloride	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Chlorobenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Chloroethane	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Chloroform	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Chloromethane	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Chlorotoluene, 2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Chlorotoluene, 4-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dibromo-3-chloropropane, 1,2-	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Dibromochloromethane	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dibromoethane, 1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dibromomethane	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichlorobenzene, 1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichlorobenzene, 1,3-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichlorobenzene, 1,4-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW301					PBOW99-SSW302					PBOW99-SSW303					PBOW99-SSW304				
SAMPLE_NO		PBOW99SSW301					PBOW99SSW302					PBOW99SSW303					PBOW99SSW304				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Dichloroethane, 1,1-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloroethane, 1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloroethene, 1,1-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloroethene, cis-1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloroethene, trans-1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloropropane, 1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloropropane, 1,3-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloropropane, 2,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Dichloropropene, 1,1-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Ethylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Hexachlorobutadiene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Isopropylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Methylene chloride	mg/kg						0.012	0.0055	0.0055			0.013	0.006	0.006							
Naphthalene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
n-Butylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
n-Propylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
p-Isopropyltoluene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
sec-Butylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Styrene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
tert-Butylbenzene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Tetrachloroethane, 1,1,1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Tetrachloroethane, 1,1,2,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Tetrachloroethene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Toluene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichlorobenzene, 1,2,3-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichlorobenzene, 1,2,4-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichloroethane, 1,1,1-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichloroethane, 1,1,2-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichloroethene	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trichlorofluoromethane	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Trichloropropane, 1,2,3-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trimethylbenzene, 1,2,4-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Trimethylbenzene, 1,3,5-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Vinyl chloride	mg/kg						0.0055	0.011	0.011	U		0.006	0.012	0.012	U						
Xylenes, m,p-	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						
Xylenes, total	mg/kg						0.00275	0.0055	0.0055	U		0.003	0.006	0.006	U						

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW305					PBOW99-SSW306					PBOW99-SSW307					PBOW99-SSW307				
SAMPLE_NO		PBOW99SSW305					PBOW99SSW306					PBOW99SSW307					PBOW99SSW308				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.26	0.25	0.25			0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.33	0.25	0.25			0.125	0.25	0.25	U	
Dinitrobenzene, 1,3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Dinitrotoluene, 2,4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Dinitrotoluene, 2,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
HMX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U	
Nitrobenzene	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Nitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
RDX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.25	0.5	0.5	U	
Tetryl	mg/kg	0.325	0.65	0.65	U		0.325	0.65	0.65	U		0.325	0.65	0.65	U		0.325	0.65	0.65	U	
Trinitrobenzene, 1,3,5-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.125	0.25	0.25	U	
Trinitrotoluene, 2,4,6-	mg/kg	0.125	0.25	0.25	U		0.88	0.25	0.25			0.125	0.25	0.25	U		0.125	0.25	0.25	U	
METALS (UNFILTERED)																					
Aluminum	mg/kg	7500	22.1	22.1			5130	20.9	20.9			5190	20.8	20.8			1020	27	27		
Antimony	mg/kg	3.3	6.6	6.6	U		3.15	6.3	6.3	U		3.1	6.2	6.2	U		4.05	8.1	8.1	U	
Arsenic	mg/kg	6.7	1.1	1.1			3.9	1	1			4	1	1			6.8	1.4	1.4		
Barium	mg/kg	63.6	22.1	22.1			29.7	20.9	20.9			31.4	20.8	20.8			75.3	27	27		
Beryllium	mg/kg	0.275	0.55	0.55	U		0.26	0.52	0.52	U		0.26	0.52	0.52	U		0.34	0.68	0.68	U	
Cadmium	mg/kg	0.275	0.55	0.55	U		0.26	0.52	0.52	U		0.26	0.52	0.52	U		0.34	0.68	0.68	U	
Calcium	mg/kg	40200	554	554			15000	524	524			5180	519	519			6880	676	676		
Chromium	mg/kg	12.3	1.1	1.1			8.6	1	1			10	1	1			16.5	1.4	1.4		
Cobalt	mg/kg	8.8	5.5	5.5			2.6	5.2	5.2	U		2.6	5.2	5.2	U		8.1	6.8	6.8		
Copper	mg/kg	13.1	2.8	2.8			7.1	2.6	2.6			7.3	2.6	2.6			15.9	3.4	3.4		
Iron	mg/kg	14500	11.1	11.1			10300	10.5	10.5			10500	10.4	10.4			18200	13.5	13.5		
Lead	mg/kg	12.6	0.33	0.33			9.6	0.31	0.31			11.6	0.31	0.31			16.8	0.41	0.41		
Magnesium	mg/kg	7610	554	554			4230	524	524			1860	519	519			3230	676	676		
Manganese	mg/kg	606	1.7	1.7			170	1.6	1.6			171	1.6	1.6			407	2	2		
Mercury	mg/kg	0.0185	0.037	0.037	U		0.0175	0.035	0.035	U		0.035	0.034	0.034			0.056	0.045	0.045		
Nickel	mg/kg	17.7	4.4	4.4			8.4	4.2	4.2			9.8	4.2	4.2			18.4	5.4	5.4		
Potassium	mg/kg	715	554	554			262	524	524	U		259.5	519	519	U		936	676	676		
Selenium	mg/kg	0.57	0.55	0.55			0.26	0.52	0.52	U		0.26	0.52	0.52	U		1.2	0.68	0.68		
Silver	mg/kg	0.55	1.1	1.1	U		0.5	1	1	U		0.5	1	1	U		0.7	1.4	1.4	U	
Sodium	mg/kg	277	554	554	U		262	524	524	U		259.5	519	519	U		338	676	676	U	
Thallium	mg/kg	1.1	1.1	1.1			0.5	1	1	U		0.5	1	1	U		0.7	1.4	1.4	U	
Vanadium	mg/kg	19.5	5.5	5.5			14.8	5.2	5.2			14.9	5.2	5.2			24	6.8	6.8		
Zinc	mg/kg	42.2	2.2	2.2			33.8	2.1	2.1			34.2	2.1	2.1			59.5	2.7	2.7		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg																				
Aroclor 1221	mg/kg																				
Aroclor 1232	mg/kg																				
Aroclor 1242	mg/kg																				
Aroclor 1248	mg/kg																				
Aroclor 1254	mg/kg																				
Aroclor 1260	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW305					PBOW99-SSW306					PBOW99-SSW307					PBOW99-SSW307				
SAMPLE_NO		PBOW99SSW305					PBOW99SSW306					PBOW99SSW307					PBOW99SSW308				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg																				
Acenaphthylene	mg/kg																				
ACETOPHENONE	mg/kg																				
Anthracene	mg/kg																				
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg																				
Benzo(a)pyrene	mg/kg																				
Benzo(b)fluoranthene	mg/kg																				
Benzo(ghi)perylene	mg/kg																				
Benzo(k)fluoranthene	mg/kg																				
Benzoic acid	mg/kg																				
Benzyl alcohol	mg/kg																				
BIBENZENE	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg																				
Bis(2-chloroethyl)ether	mg/kg																				
Bis(2-chloroisopropyl)ether	mg/kg																				
Bis(2-ethylhexyl)phthalate	mg/kg																				
Bromophenyl phenyl ether, 4-	mg/kg																				
Butyl benzyl phthalate	mg/kg																				
Caprolactam	mg/kg																				
Carbazole	mg/kg																				
Chloro-3-methylphenol, 4-	mg/kg																				
Chloroaniline, 4-	mg/kg																				
Chloronaphthalene, 2-	mg/kg																				
Chlorophenol, 2-	mg/kg																				
Chlorophenyl phenyl ether, 4-	mg/kg																				
Chrysene	mg/kg																				
Dibenz(a,h)anthracene	mg/kg																				
Dibenzofuran	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				
Dichlorobenzidine, 3,3'-	mg/kg																				
Dichlorophenol, 2,4-	mg/kg																				
Diethyl phthalate	mg/kg																				
Dimethyl phthalate	mg/kg																				
Dimethylphenol, 2,4-	mg/kg																				
Di-n-butyl phthalate	mg/kg																				
Dinitro-2-methylphenol, 4,6-	mg/kg																				
Dinitrophenol, 2,4-	mg/kg																				
Dinitrotoluene, 2,4-	mg/kg																				
Dinitrotoluene, 2,6-	mg/kg																				
Di-n-octyl phthalate	mg/kg																				
DIPHENYLAMINE	mg/kg																				
Fluoranthene	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW305					PBOW99-SSW306					PBOW99-SSW307					PBOW99-SSW307				
SAMPLE_NO		PBOW99SSW305					PBOW99SSW306					PBOW99SSW307					PBOW99SSW308				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg																				
Hexachlorobenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Hexachlorocyclopentadiene	mg/kg																				
Hexachloroethane	mg/kg																				
Indeno(1,2,3-cd)pyrene	mg/kg																				
Isophorone	mg/kg																				
Methylnaphthalene, 2-	mg/kg																				
Methylphenol, 2-	mg/kg																				
Methylphenol, 4-	mg/kg																				
Naphthalene	mg/kg																				
Nitroaniline, 2-	mg/kg																				
Nitroaniline, 3-	mg/kg																				
Nitroaniline, 4-	mg/kg																				
Nitrobenzene	mg/kg																				
Nitrophenol, 2-	mg/kg																				
Nitrophenol, 4-	mg/kg																				
n-Nitrosodimethylamine	mg/kg																				
n-Nitroso-di-n-propylamine	mg/kg																				
n-Nitrosodiphenylamine	mg/kg																				
Pentachlorophenol	mg/kg																				
Phenanthrene	mg/kg																				
Phenol	mg/kg																				
Pyrene	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichlorophenol, 2,4,5-	mg/kg																				
Trichlorophenol, 2,4,6-	mg/kg																				
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW305					PBOW99-SSW306					PBOW99-SSW307					PBOW99-SSW307				
SAMPLE_NO		PBOW99SSW305					PBOW99SSW306					PBOW99SSW307					PBOW99SSW308				
SAMPLE_DATE		2-Sep-99					2-Sep-99					2-Sep-99					2-Sep-99				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier
No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW309					PBOW99-SSW310					WWTP3-SB01					WWTP3-SB01				
SAMPLE_NO		PBOW99SSW309					PBOW99SSW310					WW0034					WW0035				
SAMPLE_DATE		2-Sep-99					2-Sep-99					10-Dec-08					10-Dec-08				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					_7 - 1_7 Ft					5 - 5_7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Dinitrobenzene, 1,3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Dinitrotoluene, 2,4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Dinitrotoluene, 2,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
HMX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Nitrobenzene	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Nitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Nitrotoluene, 3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Nitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
RDX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Tetryl	mg/kg	0.325	0.65	0.65	U		0.325	0.65	0.65	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U		0.1555	0.311	0.155	U	UJ	0.1335	0.267	0.133	U	U
METALS (UNFILTERED)																					
Aluminum	mg/kg	9470	23.5	23.5			8270	21.9	21.9			8510	1.74	0.87			7830	1.77	0.885		
Antimony	mg/kg	3.5	7	7	U		3.3	6.6	6.6	U		0.396	0.435	0.218	J	J	0.274	0.442	0.221	J	J
Arsenic	mg/kg	6.4	1.2	1.2			6.7	1.1	1.1			20.8	0.87	0.435			5.03	0.885	0.442		
Barium	mg/kg	74.7	23.5	23.5			57.6	21.9	21.9			52.2	0.174	0.087			47	0.177	0.0885		
Beryllium	mg/kg	0.59	0.59	0.59			0.275	0.55	0.55	U		8.44	0.174	0.087			5.32	0.177	0.0885		
Cadmium	mg/kg	0.295	0.59	0.59	U		0.275	0.55	0.55	U		0.247	0.435	0.218	J	J	0.221	0.442	0.221	U	U
Calcium	mg/kg	6090	587	587			13200	548	548			9040	4.35	2.18			23600	4.42	2.21		
Chromium	mg/kg	14.9	1.2	1.2			13.4	1.1	1.1			13.9	0.435	0.218			12.7	0.442	0.221		
Cobalt	mg/kg	7.2	5.9	5.9			7.5	5.5	5.5			9.78	0.174	0.087			6.2	0.177	0.0885		
Copper	mg/kg	14.5	2.9	2.9			14	2.7	2.7			22	0.435	0.218			19.4	0.442	0.221		
Iron	mg/kg	17000	11.7	11.7			16300	11	11			29000	3.48	1.74			15700	1.77	0.885		
Lead	mg/kg	14.6	0.35	0.35			11.7	0.33	0.33			21.5	0.435	0.218			10.2	0.442	0.221		
Magnesium	mg/kg	2910	587	587			4970	548	548			4420	1.74	0.87			8480	1.77	0.885		
Manganese	mg/kg	451	1.8	1.8			348	1.6	1.6			226	0.174	0.087			260	0.177	0.0885		
Mercury	mg/kg	0.048	0.039	0.039			0.036	0.036	0.036			0.597	0.0223	0.0112			0.0163	0.0249	0.0124	J	J
Nickel	mg/kg	17.5	4.7	4.7			17	4.4	4.4			24.1	0.261	0.131			17.5	0.265	0.133		
Potassium	mg/kg	833	587	587			780	548	548			494	21.8	10.9			458	22.1	11.1		
Selenium	mg/kg	1.1	0.59	0.59			1.1	0.55	0.55			0.628	0.87	0.435	J	J	0.4425	0.885	0.442	U	U
Silver	mg/kg	0.6	1.2	1.2	U		0.55	1.1	1.1	U		0.2175	0.435	0.218	U	U	0.221	0.442	0.221	U	U
Sodium	mg/kg	293.5	587	587	U		274	548	548	U		57	8.7	4.35			66.1	8.85	4.42		
Thallium	mg/kg	0.6	1.2	1.2	U		1.1	1.1	1.1			0.266	0.435	0.218	J	J	0.221	0.442	0.221	U	U
Vanadium	mg/kg	22	5.9	5.9			21.1	5.5	5.5			23.2	0.174	0.087			18.9	0.177	0.0885		
Zinc	mg/kg	55.5	2.3	2.3			46.4	2.2	2.2			74.4	2.18	1.09			51.1	2.21	1.11		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1221	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1232	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1242	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1248	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1254	mg/kg											0.0203	0.0406	0.00813	U	U	0.02065	0.0413	0.00827	U	U
Aroclor 1260	mg/kg											0.18	0.0406	0.00813	P	J	0.02065	0.0413	0.00827	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW309					PBOW99-SSW310					WWTP3-SB01					WWTP3-SB01				
SAMPLE_NO		PBOW99SSW309					PBOW99SSW310					WW0034					WW0035				
SAMPLE_DATE		2-Sep-99					2-Sep-99					10-Dec-08					10-Dec-08				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					_7 - 1_7 Ft					5 - 5_7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg											0.478	0.405	0.00729			0.2085	0.417	0.00751	U	U
Acenaphthylene	mg/kg											0.209	0.405	0.00486	J	J	0.2085	0.417	0.00501	U	U
ACETOPHENONE	mg/kg																				
Anthracene	mg/kg											1.5	0.405	0.00875			0.2085	0.417	0.00902	U	U
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg											3.25	0.405	0.0266			0.2085	0.417	0.0274	U	U
Benzo(a)pyrene	mg/kg											2.41	0.405	0.0266			0.2085	0.417	0.0274	U	U
Benzo(b)fluoranthene	mg/kg											3.58	0.405	0.0674			0.2085	0.417	0.0695	U	U
Benzo(ghi)perylene	mg/kg											1.54	0.405	0.0987			0.2085	0.417	0.102	U	U
Benzo(k)fluoranthene	mg/kg											1.08	0.405	0.123			0.2085	0.417	0.126	U	U
Benzoic acid	mg/kg											0.2025	0.405	0.0987	U	U	0.2085	0.417	0.102	U	U
Benzyl alcohol	mg/kg											0.2025	0.405	0.0987	U	U	0.2085	0.417	0.102	U	U
BIBENZENE	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg											0.2025	0.405	0.00851	U	U	0.2085	0.417	0.00877	U	U
Bis(2-chloroethyl)ether	mg/kg											0.2025	0.405	0.0103	U	U	0.2085	0.417	0.0106	U	U
Bis(2-chloroisopropyl)ether	mg/kg											0.2025	0.405	0.0176	U	U	0.2085	0.417	0.0182	U	U
Bis(2-ethylhexyl)phthalate	mg/kg											0.2025	0.405	0.0374	U	U	0.2085	0.417	0.0386	U	U
Bromophenyl phenyl ether, 4-	mg/kg											0.2025	0.405	0.0145	U	U	0.2085	0.417	0.0149	U	U
Butyl benzyl phthalate	mg/kg											0.2025	0.405	0.0164	U	U	0.2085	0.417	0.0169	U	U
Caprolactam	mg/kg																				
Carbazole	mg/kg											0.432	0.405	0.0405			0.2085	0.417	0.0417	U	U
Chloro-3-methylphenol, 4-	mg/kg											0.2025	0.405	0.00996	U	U	0.2085	0.417	0.0103	U	U
Chloroaniline, 4-	mg/kg											0.2025	0.405	0.0351	U	UJ	0.2085	0.417	0.0362	U	UJ
Chloronaphthalene, 2-	mg/kg											0.2025	0.405	0.00644	U	U	0.2085	0.417	0.00664	U	U
Chlorophenol, 2-	mg/kg											0.2025	0.405	0.00498	U	U	0.2085	0.417	0.00513	U	U
Chlorophenyl phenyl ether, 4-	mg/kg											0.2025	0.405	0.031	U	U	0.2085	0.417	0.0319	U	U
Chrysene	mg/kg											2.98	0.405	0.016			0.2085	0.417	0.0165	U	U
Dibenz(a,h)anthracene	mg/kg											0.397	0.405	0.0915	J	J	0.2085	0.417	0.0943	U	U
Dibenzofuran	mg/kg											0.436	0.405	0.00681			0.2085	0.417	0.00701	U	U
Dichlorobenzene, 1,2-	mg/kg											0.2025	0.405	0.00936	U	U	0.2085	0.417	0.00964	U	U
Dichlorobenzene, 1,3-	mg/kg											0.2025	0.405	0.0147	U	U	0.2085	0.417	0.0152	U	U
Dichlorobenzene, 1,4-	mg/kg											0.2025	0.405	0.0079	U	U	0.2085	0.417	0.00814	U	U
Dichlorobenzidine, 3,3'-	mg/kg											0.2025	0.405	0.0401	U	UJ	0.2085	0.417	0.0413	U	UJ
Dichlorophenol, 2,4-	mg/kg											0.2025	0.405	0.0145	U	U	0.2085	0.417	0.0149	U	U
Diethyl phthalate	mg/kg											0.2025	0.405	0.0164	U	U	0.2085	0.417	0.0169	U	U
Dimethyl phthalate	mg/kg											0.2025	0.405	0.0124	U	U	0.2085	0.417	0.0128	U	U
Dimethylphenol, 2,4-	mg/kg											0.2025	0.405	0.0107	U	U	0.2085	0.417	0.011	U	U
Di-n-butyl phthalate	mg/kg											0.2025	0.405	0.00875	U	U	0.2085	0.417	0.00902	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg											0.2025	0.405	0.0407	U	U	0.2085	0.417	0.042	U	U
Dinitrophenol, 2,4-	mg/kg											0.2025	0.405	0.0645	U	U	0.2085	0.417	0.0665	U	U
Dinitrotoluene, 2,4-	mg/kg											0.2025	0.405	0.0142	U	U	0.2085	0.417	0.0147	U	U
Dinitrotoluene, 2,6-	mg/kg											0.2025	0.405	0.00972	U	U	0.2085	0.417	0.01	U	U
Di-n-octyl phthalate	mg/kg											0.2025	0.405	0.0762	U	U	0.2085	0.417	0.0785	U	U
DIPHENYLAMINE	mg/kg											0.2025	0.405	0.0401	U	U	0.2085	0.417	0.0413	U	U
Fluoranthene	mg/kg											6.82	0.809	0.0175			0.2085	0.417	0.00902	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW309					PBOW99-SSW310					WWTP3-SB01					WWTP3-SB01				
SAMPLE_NO		PBOW99SSW309					PBOW99SSW310					WW0034					WW0035				
SAMPLE_DATE		2-Sep-99					2-Sep-99					10-Dec-08					10-Dec-08				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					_7 - 1_7 Ft					5 - 5_7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg											0.581	0.405	0.0171			0.2085	0.417	0.0177	U	U
Hexachlorobenzene	mg/kg											0.2025	0.405	0.0252	U	U	0.2085	0.417	0.0259	U	U
Hexachlorobutadiene	mg/kg											0.2025	0.405	0.0384	U	U	0.2085	0.417	0.0396	U	U
Hexachlorocyclopentadiene	mg/kg											0.2025	0.405	0.0129	U	UJ	0.2085	0.417	0.0133	U	UJ
Hexachloroethane	mg/kg											0.2025	0.405	0.0124	U	U	0.2085	0.417	0.0128	U	U
Indeno(1,2,3-cd)pyrene	mg/kg											2.14	0.405	0.131			0.2085	0.417	0.135	U	U
Isophorone	mg/kg											0.2025	0.405	0.00486	U	U	0.2085	0.417	0.00501	U	U
Methylnaphthalene, 2-	mg/kg											0.721	0.405	0.106			0.2085	0.417	0.109	U	U
Methylphenol, 2-	mg/kg											0.2025	0.405	0.00608	U	U	0.2085	0.417	0.00626	U	U
Methylphenol, 4-	mg/kg											0.2025	0.405	0.0126	U	U	0.2085	0.417	0.013	U	U
Naphthalene	mg/kg											0.677	0.405	0.0096			0.2085	0.417	0.00989	U	U
Nitroaniline, 2-	mg/kg											0.2025	0.405	0.0175	U	U	0.2085	0.417	0.018	U	U
Nitroaniline, 3-	mg/kg											0.2025	0.405	0.0137	U	U	0.2085	0.417	0.0142	U	U
Nitroaniline, 4-	mg/kg											0.2025	0.405	0.143	U	U	0.2085	0.417	0.148	U	U
Nitrobenzene	mg/kg											0.2025	0.405	0.0132	U	U	0.2085	0.417	0.0136	U	U
Nitrophenol, 2-	mg/kg											0.2025	0.405	0.0143	U	U	0.2085	0.417	0.0148	U	U
Nitrophenol, 4-	mg/kg											0.2025	0.405	0.0328	U	U	0.2085	0.417	0.0338	U	U
n-Nitrosodimethylamine	mg/kg											0.2025	0.405	0.0122	U	U	0.2085	0.417	0.0125	U	U
n-Nitroso-di-n-propylamine	mg/kg											0.2025	0.405	0.0145	U	U	0.2085	0.417	0.0149	U	U
n-Nitrosodiphenylamine	mg/kg											0.2025	0.405	0.00571	U	U	0.2085	0.417	0.00589	U	U
Pentachlorophenol	mg/kg											0.2025	0.405	0.0363	U	U	0.2085	0.417	0.0374	U	U
Phenanthrene	mg/kg											4.49	0.405	0.00984			0.2085	0.417	0.0101	U	U
Phenol	mg/kg											0.2025	0.405	0.00486	U	U	0.2085	0.417	0.00501	U	U
Pyrene	mg/kg											4.58	0.405	0.0162			0.2085	0.417	0.0167	U	U
Trichlorobenzene, 1,2,4-	mg/kg											0.2025	0.405	0.00996	U	U	0.2085	0.417	0.0103	U	U
Trichlorophenol, 2,4,5-	mg/kg											0.2025	0.405	0.0348	U	U	0.2085	0.417	0.0358	U	U
Trichlorophenol, 2,4,6-	mg/kg											0.2025	0.405	0.0273	U	U	0.2085	0.417	0.0282	U	U
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SSW309					PBOW99-SSW310					WWTP3-SB01					WWTP3-SB01				
SAMPLE_NO		PBOW99SSW309					PBOW99SSW310					WW0034					WW0035				
SAMPLE_DATE		2-Sep-99					2-Sep-99					10-Dec-08					10-Dec-08				
FK_DEPTH		0 - 0 Ft					0 - 0 Ft					_7 - 1_7 Ft					5 - 5_7 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB02					WWTP3-SB02					WWTP3-SB03					WWTP3-SB03				
SAMPLE_NO		WW0038					WW0039					WW0041					WW0042				
SAMPLE_DATE		10-Dec-08					10-Dec-08					10-Dec-08					10-Dec-08				
FK_DEPTH		_5 - 1_5 Ft					5 - 5_5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Dinitrobenzene, 1,3-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Dinitrotoluene, 2,4-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Dinitrotoluene, 2,6-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
HMX	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Nitrobenzene	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Nitrotoluene, 2-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Nitrotoluene, 3-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Nitrotoluene, 4-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
RDX	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Tetryl	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.1415	0.283	0.142	U	UJ	0.1465	0.293	0.146	U	U	0.1355	0.271	0.136	U	U	0.156	0.312	0.156	U	U
METALS (UNFILTERED)																					
Aluminum	mg/kg	7070	1.81	0.903			10500	1.79	0.894			7990	2	1			7740	1.94	0.97		
Antimony	mg/kg	0.296	0.451	0.226	J	J	0.324	0.447	0.224	J	J	0.25	0.5	0.25	U	U	0.287	0.485	0.243	J	J
Arsenic	mg/kg	14.4	0.903	0.451			9.56	0.894	0.447			4.64	1	0.5			6.32	0.97	0.485		
Barium	mg/kg	54.1	0.181	0.0903			197	0.179	0.0894			65.8	0.2	0.1			35.7	0.194	0.097		
Beryllium	mg/kg	8.44	0.181	0.0903			8.08	0.179	0.0894			5.35	0.2	0.1			5.13	0.194	0.097		
Cadmium	mg/kg	0.364	0.451	0.226	J	J	1.01	0.447	0.224			0.252	0.5	0.25	J	J	0.2425	0.485	0.243	U	U
Calcium	mg/kg	17200	4.51	2.26			3710	4.47	2.24			3290	5	2.5			14000	4.85	2.43		J
Chromium	mg/kg	11.5	0.451	0.226			17.8	0.447	0.224			11.1	0.5	0.25			9.22	0.485	0.243		
Cobalt	mg/kg	6.38	0.181	0.0903			22.1	0.179	0.0894			5.25	0.2	0.1			5.06	0.194	0.097		
Copper	mg/kg	24.5	0.451	0.226			28.4	0.447	0.224			15.9	0.5	0.25			13.9	0.485	0.243		
Iron	mg/kg	28000	3.61	1.81			28000	3.58	1.79			14200	2	1			14400	1.94	0.97		
Lead	mg/kg	34.6	0.451	0.226			15.9	0.447	0.224			13	0.5	0.25			9.51	0.485	0.243		
Magnesium	mg/kg	4160	1.81	0.903			3850	1.79	0.894			2010	2	1			5070	1.94	0.97		J
Manganese	mg/kg	428	0.181	0.0903			2520	0.179	0.0894			294	0.2	0.1			211	0.194	0.097		J
Mercury	mg/kg	0.074	0.0206	0.0103			0.0223	0.0234	0.0117	J	J	0.0511	0.0252	0.0126			0.0208	0.0246	0.0123	J	J
Nickel	mg/kg	17.5	0.271	0.135			57.1	0.268	0.134			13.3	0.3	0.15			14.3	0.291	0.146		
Potassium	mg/kg	422	22.6	11.3			735	22.4	11.2			522	25	12.5			371	24.3	12.1		
Selenium	mg/kg	0.695	0.903	0.451	J	J	0.447	0.894	0.447	U	U	0.602	1	0.5	J	J	0.485	0.97	0.485	U	U
Silver	mg/kg	0.2255	0.451	0.226	U	U	0.2235	0.447	0.224	U	U	0.25	0.5	0.25	U	U	0.2425	0.485	0.243	U	U
Sodium	mg/kg	47.7	9.03	4.51			48.9	8.94	4.47			25	10	5			40	9.7	4.85		J
Thallium	mg/kg	0.2255	0.451	0.226	U	U	0.292	0.447	0.224	J	J	0.25	0.5	0.25	U	U	0.2425	0.485	0.243	U	U
Vanadium	mg/kg	18.3	0.181	0.0903			28.5	0.179	0.0894			17.7	0.2	0.1			17.7	0.194	0.097		
Zinc	mg/kg	90.1	2.26	1.13			78.5	2.24	1.12			51	2.5	1.25			44	2.43	1.21		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg	1.22	0.0402	0.00804	P	J	0.1	0.0399	0.008		J	0.142	0.0429	0.0086	P	J	0.01985	0.0397	0.00794	U	U
Aroclor 1221	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U
Aroclor 1232	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U
Aroclor 1242	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U
Aroclor 1248	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U
Aroclor 1254	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U
Aroclor 1260	mg/kg	0.0201	0.0402	0.00804	U	U	0.01995	0.0399	0.008	U	U	0.02145	0.0429	0.0086	U	U	0.01985	0.0397	0.00794	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB02					WWTP3-SB02					WWTP3-SB03					WWTP3-SB03				
SAMPLE_NO		WW0038					WW0039					WW0041					WW0042				
SAMPLE_DATE		10-Dec-08					10-Dec-08					10-Dec-08					10-Dec-08				
FK_DEPTH		_5 - 1_5 Ft					5 - 5_5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg	0.643	2	0.0361	J	J	0.0592	0.392	0.00706	J	J	0.2125	0.425	0.00766	U	U	0.199	0.398	0.00717	U	U
Acenaphthylene	mg/kg	3.23	2	0.024			0.0788	0.392	0.0047	J	J	0.2125	0.425	0.00511	U	U	0.199	0.398	0.00478	U	U
ACETOPHENONE	mg/kg																				
Anthracene	mg/kg	4.53	2	0.0433			0.263	0.392	0.00847	J	J	0.2125	0.425	0.00919	U	U	0.199	0.398	0.0086	U	U
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg	11.9	2	0.132			0.309	0.392	0.0258	J	J	0.2125	0.425	0.028	U	U	0.199	0.398	0.0262	U	U
Benzo(a)pyrene	mg/kg	10	2	0.132			0.306	0.392	0.0258	J	J	0.2125	0.425	0.028	U	U	0.199	0.398	0.0262	U	U
Benzo(b)fluoranthene	mg/kg	13.9	2	0.334			0.409	0.392	0.0653			0.2125	0.425	0.0709	U	U	0.199	0.398	0.0663	U	U
Benzo(ghi)perylene	mg/kg	5.57	2	0.488			0.18	0.392	0.0955	J	J	0.2125	0.425	0.104	U	U	0.199	0.398	0.097	U	U
Benzo(k)fluoranthene	mg/kg	4.49	2	0.607			0.136	0.392	0.119	J	J	0.2125	0.425	0.129	U	U	0.199	0.398	0.121	U	U
Benzoic acid	mg/kg	1	2	0.488	U	U	0.196	0.392	0.0955	U	U	0.2125	0.425	0.104	U	U	0.199	0.398	0.097	U	U
Benzyl alcohol	mg/kg	1	2	0.488	U	U	0.196	0.392	0.0955	U	U	0.2125	0.425	0.104	U	U	0.199	0.398	0.097	U	U
BIBENZENE	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg	1	2	0.0421	U	U	0.196	0.392	0.00823	U	U	0.2125	0.425	0.00894	U	U	0.199	0.398	0.00836	U	U
Bis(2-chloroethyl)ether	mg/kg	1	2	0.0511	U	U	0.196	0.392	0.01	U	U	0.2125	0.425	0.0109	U	U	0.199	0.398	0.0102	U	U
Bis(2-chloroisopropyl)ether	mg/kg	1	2	0.0871	U	U	0.196	0.392	0.0171	U	U	0.2125	0.425	0.0185	U	U	0.199	0.398	0.0173	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	1	2	0.185	U	U	0.196	0.392	0.0362	U	U	0.2125	0.425	0.0393	U	U	0.041	0.398	0.0368	J	J
Bromophenyl phenyl ether, 4-	mg/kg	1	2	0.0715	U	U	0.196	0.392	0.014	U	U	0.2125	0.425	0.0152	U	U	0.199	0.398	0.0142	U	U
Butyl benzyl phthalate	mg/kg	1	2	0.0811	U	U	0.196	0.392	0.0159	U	U	0.2125	0.425	0.0172	U	U	0.199	0.398	0.0161	U	U
Caprolactam	mg/kg																				
Carbazole	mg/kg	1.12	2	0.2	J	J	0.0443	0.392	0.0392	J	J	0.2125	0.425	0.0425	U	U	0.199	0.398	0.0398	U	U
Chloro-3-methylphenol, 4-	mg/kg	1	2	0.0493	U	U	0.196	0.392	0.00964	U	U	0.2125	0.425	0.0105	U	U	0.199	0.398	0.0098	U	U
Chloroaniline, 4-	mg/kg	1	2	0.174	U	UJ	0.196	0.392	0.034	U	UJ	0.2125	0.425	0.0369	U	UJ	0.199	0.398	0.0345	U	UJ
Chloronaphthalene, 2-	mg/kg	1	2	0.0319	U	U	0.196	0.392	0.00623	U	U	0.2125	0.425	0.00677	U	U	0.199	0.398	0.00633	U	U
Chlorophenol, 2-	mg/kg	1	2	0.0246	U	U	0.196	0.392	0.00482	U	U	0.2125	0.425	0.00524	U	U	0.199	0.398	0.0049	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	1	2	0.153	U	U	0.196	0.392	0.03	U	U	0.2125	0.425	0.0326	U	U	0.199	0.398	0.0305	U	U
Chrysene	mg/kg	10.3	2	0.0793			0.276	0.392	0.0155	J	J	0.2125	0.425	0.0169	U	U	0.199	0.398	0.0158	U	U
Dibenz(a,h)anthracene	mg/kg	1.46	2	0.453	J	J	0.196	0.392	0.0885	U	U	0.2125	0.425	0.0961	U	U	0.199	0.398	0.09	U	U
Dibenzofuran	mg/kg	1.35	2	0.0337	J	J	0.078	0.392	0.00659	J	J	0.2125	0.425	0.00715	U	U	0.199	0.398	0.00669	U	U
Dichlorobenzene, 1,2-	mg/kg	1	2	0.0463	U	U	0.196	0.392	0.00905	U	U	0.2125	0.425	0.00983	U	U	0.199	0.398	0.0092	U	U
Dichlorobenzene, 1,3-	mg/kg	1	2	0.0727	U	U	0.196	0.392	0.0142	U	U	0.2125	0.425	0.0155	U	U	0.199	0.398	0.0145	U	U
Dichlorobenzene, 1,4-	mg/kg	1	2	0.0391	U	U	0.196	0.392	0.00764	U	U	0.2125	0.425	0.0083	U	U	0.199	0.398	0.00777	U	U
Dichlorobenzidine, 3,3'-	mg/kg	1	2	0.198	U	UJ	0.196	0.392	0.0388	U	UJ	0.2125	0.425	0.0421	U	UJ	0.199	0.398	0.0394	U	UJ
Dichlorophenol, 2,4-	mg/kg	1	2	0.0715	U	U	0.196	0.392	0.014	U	U	0.2125	0.425	0.0152	U	U	0.199	0.398	0.0142	U	U
Diethyl phthalate	mg/kg	1	2	0.0811	U	U	0.196	0.392	0.0159	U	U	0.2125	0.425	0.0172	U	U	0.199	0.398	0.0161	U	U
Dimethyl phthalate	mg/kg	1	2	0.0613	U	U	0.196	0.392	0.012	U	U	0.2125	0.425	0.013	U	U	0.199	0.398	0.0122	U	U
Dimethylphenol, 2,4-	mg/kg	1	2	0.0529	U	U	0.196	0.392	0.0103	U	U	0.2125	0.425	0.0112	U	U	0.199	0.398	0.0105	U	U
Di-n-butyl phthalate	mg/kg	1	2	0.0433	U	U	0.196	0.392	0.00847	U	U	0.2125	0.425	0.00919	U	U	0.199	0.398	0.0086	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	1	2	0.201	U	U	0.196	0.392	0.0394	U	U	0.2125	0.425	0.0428	U	U	0.199	0.398	0.04	U	U
Dinitrophenol, 2,4-	mg/kg	1	2	0.319	U	U	0.196	0.392	0.0624	U	U	0.2125	0.425	0.0678	U	U	0.199	0.398	0.0634	U	U
Dinitrotoluene, 2,4-	mg/kg	1	2	0.0703	U	U	0.196	0.392	0.0138	U	U	0.2125	0.425	0.0149	U	U	0.199	0.398	0.014	U	U
Dinitrotoluene, 2,6-	mg/kg	1	2	0.0481	U	U	0.196	0.392	0.00941	U	U	0.2125	0.425	0.0102	U	U	0.199	0.398	0.00956	U	U
Di-n-octyl phthalate	mg/kg	1	2	0.377	U	U	0.196	0.392	0.0737	U	U	0.2125	0.425	0.0801	U	U	0.199	0.398	0.0749	U	U
DIPHENYLAMINE	mg/kg	1	2	0.198	U	U	0.196	0.392	0.0388	U	U	0.2125	0.425	0.0421	U	U	0.199	0.398	0.0394	U	U
Fluoranthene	mg/kg	24.8	2	0.0433			0.816	0.392	0.00847			0.2125	0.425	0.00919	U	U	0.0402	0.398	0.0086	J	J

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB02					WWTP3-SB02					WWTP3-SB03					WWTP3-SB03				
SAMPLE_NO		WW0038					WW0039					WW0041					WW0042				
SAMPLE_DATE		10-Dec-08					10-Dec-08					10-Dec-08					10-Dec-08				
FK_DEPTH		_5 - 1_5 Ft					5 - 5_5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg	1.78	2	0.0847	J	J	0.114	0.392	0.0166	J	J	0.2125	0.425	0.018	U	U	0.199	0.398	0.0168	U	U
Hexachlorobenzene	mg/kg	1	2	0.124	U	U	0.196	0.392	0.0243	U	U	0.2125	0.425	0.0264	U	U	0.199	0.398	0.0247	U	U
Hexachlorobutadiene	mg/kg	1	2	0.19	U	U	0.196	0.392	0.0372	U	U	0.2125	0.425	0.0403	U	U	0.199	0.398	0.0378	U	U
Hexachlorocyclopentadiene	mg/kg	1	2	0.0637	U	UJ	0.196	0.392	0.0125	U	UJ	0.2125	0.425	0.0135	U	UJ	0.199	0.398	0.0127	U	UJ
Hexachloroethane	mg/kg	1	2	0.0613	U	U	0.196	0.392	0.012	U	U	0.2125	0.425	0.013	U	U	0.199	0.398	0.0122	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	8.1	2	0.649			0.436	0.392	0.127			0.2125	0.425	0.138	U	U	0.199	0.398	0.129	U	U
Isophorone	mg/kg	1	2	0.024	U	U	0.196	0.392	0.0047	U	U	0.2125	0.425	0.00511	U	U	0.199	0.398	0.00478	U	U
Methylnaphthalene, 2-	mg/kg	1.57	2	0.525	J	J	0.196	0.392	0.103	U	U	0.2125	0.425	0.112	U	U	0.199	0.398	0.104	U	U
Methylphenol, 2-	mg/kg	1	2	0.03	U	U	0.196	0.392	0.00588	U	U	0.2125	0.425	0.00638	U	U	0.199	0.398	0.00597	U	U
Methylphenol, 4-	mg/kg	1	2	0.0625	U	U	0.196	0.392	0.0122	U	U	0.2125	0.425	0.0133	U	U	0.199	0.398	0.0124	U	U
Naphthalene	mg/kg	1.38	2	0.0475	J	J	0.196	0.392	0.00929	U	U	0.2125	0.425	0.0101	U	U	0.199	0.398	0.00944	U	U
Nitroaniline, 2-	mg/kg	1	2	0.0865	U	U	0.196	0.392	0.0169	U	U	0.2125	0.425	0.0184	U	U	0.199	0.398	0.0172	U	U
Nitroaniline, 3-	mg/kg	1	2	0.0679	U	U	0.196	0.392	0.0133	U	U	0.2125	0.425	0.0144	U	U	0.199	0.398	0.0135	U	U
Nitroaniline, 4-	mg/kg	1	2	0.709	U	U	0.196	0.392	0.139	U	U	0.2125	0.425	0.151	U	U	0.199	0.398	0.141	U	U
Nitrobenzene	mg/kg	1	2	0.0655	U	U	0.196	0.392	0.0128	U	U	0.2125	0.425	0.0139	U	U	0.199	0.398	0.013	U	U
Nitrophenol, 2-	mg/kg	1	2	0.0709	U	U	0.196	0.392	0.0139	U	U	0.2125	0.425	0.0151	U	U	0.199	0.398	0.0141	U	U
Nitrophenol, 4-	mg/kg	1	2	0.162	U	U	0.196	0.392	0.0318	U	U	0.2125	0.425	0.0345	U	U	0.199	0.398	0.0323	U	U
n-Nitrosodimethylamine	mg/kg	1	2	0.0601	U	U	0.196	0.392	0.0118	U	U	0.2125	0.425	0.0128	U	U	0.199	0.398	0.0119	U	U
n-Nitroso-di-n-propylamine	mg/kg	1	2	0.0715	U	U	0.196	0.392	0.014	U	U	0.2125	0.425	0.0152	U	U	0.199	0.398	0.0142	U	U
n-Nitrosodiphenylamine	mg/kg	1	2	0.0282	U	U	0.196	0.392	0.00553	U	U	0.2125	0.425	0.006	U	U	0.199	0.398	0.00562	U	U
Pentachlorophenol	mg/kg	1	2	0.18	U	U	0.196	0.392	0.0352	U	U	0.2125	0.425	0.0382	U	U	0.199	0.398	0.0357	U	U
Phenanthrene	mg/kg	13.9	2	0.0487			0.845	0.392	0.00953			0.2125	0.425	0.0103	U	U	0.199	0.398	0.00968	U	U
Phenol	mg/kg	1	2	0.024	U	U	0.196	0.392	0.0047	U	U	0.2125	0.425	0.00511	U	U	0.199	0.398	0.00478	U	U
Pyrene	mg/kg	18.1	2	0.0799			0.584	0.392	0.0156			0.2125	0.425	0.017	U	U	0.199	0.398	0.0159	U	U
Trichlorobenzene, 1,2,4-	mg/kg	1	2	0.0493	U	U	0.196	0.392	0.00964	U	U	0.2125	0.425	0.0105	U	U	0.199	0.398	0.0098	U	U
Trichlorophenol, 2,4,5-	mg/kg	1	2	0.172	U	U	0.196	0.392	0.0336	U	U	0.2125	0.425	0.0365	U	U	0.199	0.398	0.0342	U	U
Trichlorophenol, 2,4,6-	mg/kg	1	2	0.135	U	U	0.196	0.392	0.0265	U	U	0.2125	0.425	0.0287	U	U	0.199	0.398	0.0269	U	U
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB02					WWTP3-SB02					WWTP3-SB03					WWTP3-SB03				
SAMPLE_NO		WW0038					WW0039					WW0041					WW0042				
SAMPLE_DATE		10-Dec-08					10-Dec-08					10-Dec-08					10-Dec-08				
FK_DEPTH		_5 - 1_5 Ft					5 - 5_5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB03					WWTP3-SB03					WWTP3-SB05					WWTP3-SB05				
SAMPLE_NO		WW0043					WW0068					WW0048					WW0049				
SAMPLE_DATE		10-Dec-08					10-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		3 - 5 Ft					3 - 5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		FD					FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.03	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	UJ
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.031	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	UJ
Dinitrobenzene, 1,3-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.029	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Dinitrotoluene, 2,4-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.029	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Dinitrotoluene, 2,6-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.028	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
HMX	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.048	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Nitrobenzene	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.028	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Nitrotoluene, 2-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.037	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Nitrotoluene, 3-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.03	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Nitrotoluene, 4-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.045	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
RDX	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.031	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Tetryl	mg/kg	0.1435	0.287	0.144	U	U	0.15	0.3	0.095	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.024	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.1435	0.287	0.144	U	U	0.1	0.2	0.033	U	U	0.154	0.308	0.154	U	UJ	0.1465	0.293	0.146	U	U
METALS (UNFILTERED)																					
Aluminum	mg/kg	7020	1.98	0.989			8430	24.8	11.9			6490	1.7	0.849			6650	1.85	0.925		
Antimony	mg/kg	0.2475	0.495	0.247	U	U	3.7	7.4	0.48	U	U	0.413	0.424	0.212	J	J	0.367	0.449	0.225	J	J
Arsenic	mg/kg	4.51	0.989	0.495			7.2	1.2	0.37			6.29	0.849	0.424			9.18	0.898	0.449		
Barium	mg/kg	46.8	0.198	0.0989			57.6	24.8	0.088			48.4	0.339	0.17			42.5	0.37	0.185		
Beryllium	mg/kg	5.05	0.198	0.0989			0.31	0.62	0.053	U	U	4.59	0.17	0.0849		J	5.73	0.185	0.0925		J
Cadmium	mg/kg	0.2475	0.495	0.247	U	U	0.31	0.62	0.045	U	U	0.244	0.424	0.212	J	J	0.317	0.449	0.225	J	J
Calcium	mg/kg	37200	4.95	2.47		J	32300	619	19.8			28900	4.24	2.12		J	35200	4.63	2.31		J
Chromium	mg/kg	10.2	0.495	0.247			13.3	1.2	0.25			9.68	0.424	0.212			9.86	0.463	0.231		
Cobalt	mg/kg	7.13	0.198	0.0989			8.8	6.2	0.2			6.31	0.17	0.0849		J	8.44	0.185	0.0925		J
Copper	mg/kg	17.7	0.495	0.247			21.7	3.1	0.92			18.9	0.424	0.212			20.7	0.463	0.231		
Iron	mg/kg	15000	1.98	0.989			20400	12.4	6.1			13800	1.7	0.849		J	18500	1.85	0.925		J
Lead	mg/kg	10.2	0.495	0.247			11.7	0.37	0.24			134	0.424	0.212		J	82.9	0.449	0.225		J
Magnesium	mg/kg	11700	1.98	0.989		J	10000	619	6.3			8750	3.39	1.7		J	11800	3.7	1.85		J
Manganese	mg/kg	423	0.198	0.0989		J	439	1.9	0.092			322	0.339	0.17		J	466	0.37	0.185		J
Mercury	mg/kg	0.0331	0.0209	0.0105			0.06	0.12	0.019	U	U	0.0698	0.0224	0.0112		J	0.18	0.0235	0.0117		J
Nickel	mg/kg	17.1	0.297	0.148			21.4	5	0.33			15.4	0.255	0.127		J	23.9	0.278	0.139		J
Potassium	mg/kg	448	24.7	12.4			942	619	7.7			642	21.2	10.6			491	23.1	11.6		
Selenium	mg/kg	0.4945	0.989	0.495	U	U	0.31	0.62	0.56	U	U	0.4245	0.849	0.424	U	UJ	0.449	0.898	0.449	U	UJ
Silver	mg/kg	0.2475	0.495	0.247	U	U	0.6	1.2	0.12	U	U	0.212	0.424	0.212	U	U	0.2315	0.463	0.231	U	U
Sodium	mg/kg	69.8	9.89	4.95		J	309.5	619	81.7	U	U	64.6	8.49	4.24			79.5	9.25	4.63		
Thallium	mg/kg	0.2475	0.495	0.247	U	U	0.6	1.2	0.68	U	U	0.212	0.424	0.212	U	U	0.2245	0.449	0.225	U	U
Vanadium	mg/kg	18.6	0.198	0.0989			20.9	6.2	0.15			17.8	0.17	0.0849			20.3	0.185	0.0925		
Zinc	mg/kg	43.7	2.47	1.24			52.4	2.5	1.2			75.9	2.12	1.06			62	2.31	1.16		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.026	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1221	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.02	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1232	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.017	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1242	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.016	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1248	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.021	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1254	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.021	U	U	0.1015	0.203	0.0406	U	U	0.102	0.204	0.0409	U	U
Aroclor 1260	mg/kg	0.02005	0.0401	0.00803	U	U	0.0205	0.041	0.021	U	U	0.229	0.203	0.0406			0.0667	0.204	0.0409	P,J	J

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB03					WWTP3-SB03					WWTP3-SB05					WWTP3-SB05				
SAMPLE_NO		WW0043					WW0068					WW0048					WW0049				
SAMPLE_DATE		10-Dec-08					10-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		3 - 5 Ft					3 - 5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		FD					FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg	0.201	0.402	0.00725	U	U	0.205	0.41	0.0016	U	U	0.2015	0.403	0.00726	U	U	0.205	0.41	0.00739	U	U
Acenaphthylene	mg/kg	0.201	0.402	0.00483	U	U	0.205	0.41	0.0015	U	U	0.0541	0.403	0.00484	J	J	0.205	0.41	0.00493	U	U
ACETOPHENONE	mg/kg						0.041	0.082	0.011	U	U										
Anthracene	mg/kg	0.0902	0.402	0.0087	J	J	0.205	0.41	0.0016	U	U	0.0504	0.403	0.00872	J	J	0.205	0.41	0.00887	U	U
Atrazine	mg/kg						0.205	0.41	0.026	U	U										
Benzaldehyde	mg/kg						0.205	0.41	0.026	U	U										
Benzo(a)anthracene	mg/kg	0.254	0.402	0.0265	J	J	0.205	0.41	0.0012	U	U	0.276	0.403	0.0265	J	J	0.0398	0.41	0.027	J	J
Benzo(a)pyrene	mg/kg	0.193	0.402	0.0265	J	J	0.205	0.41	0.0016	U	U	0.289	0.403	0.0265	J	J	0.205	0.41	0.027	U	U
Benzo(b)fluoranthene	mg/kg	0.307	0.402	0.0671	J	J	0.205	0.41	0.0015	U	U	0.438	0.403	0.0672			0.205	0.41	0.0684	U	U
Benzo(ghi)perylene	mg/kg	0.108	0.402	0.0981	J	J	0.205	0.41	0.0016	U	U	0.178	0.403	0.0983	J	J	0.205	0.41	0.1	U	U
Benzo(k)fluoranthene	mg/kg	0.201	0.402	0.122	U	U	0.205	0.41	0.0021	U	U	0.127	0.403	0.122	J	J	0.205	0.41	0.124	U	U
Benzoic acid	mg/kg	0.201	0.402	0.0981	U	U						0.2015	0.403	0.0983	U	UJ	0.205	0.41	0.1	U	UJ
Benzyl alcohol	mg/kg	0.201	0.402	0.0981	U	U						0.2015	0.403	0.0983	U	U	0.205	0.41	0.1	U	UJ
BIBENZENE	mg/kg						0.205	0.41	0.028	U	U										
Bis(2-chloroethoxy)methane	mg/kg	0.201	0.402	0.00846	U	U	0.205	0.41	0.027	U	U	0.2015	0.403	0.00848	U	U	0.205	0.41	0.00862	U	U
Bis(2-chloroethyl)ether	mg/kg	0.201	0.402	0.0103	U	U	0.205	0.41	0.0025	U	U	0.2015	0.403	0.0103	U	U	0.205	0.41	0.0105	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.201	0.402	0.0175	U	U	0.205	0.41	0.032	U	U	0.2015	0.403	0.0176	U	U	0.205	0.41	0.0179	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.201	0.402	0.0372	U	U	0.205	0.41	0.022	U	U	0.2015	0.403	0.0373	U	U	0.205	0.41	0.0379	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.201	0.402	0.0144	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.0144	U	U	0.205	0.41	0.0147	U	U
Butyl benzyl phthalate	mg/kg	0.201	0.402	0.0163	U	U	0.205	0.41	0.024	U	U	0.2015	0.403	0.0163	U	U	0.205	0.41	0.0166	U	U
Caprolactam	mg/kg						0.205	0.41	0.046	U	U										
Carbazole	mg/kg	0.201	0.402	0.0402	U	U	0.205	0.41	0.024	U	U	0.2015	0.403	0.0403	U	U	0.205	0.41	0.041	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.201	0.402	0.00991	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.00993	U	U	0.205	0.41	0.0101	U	U
Chloroaniline, 4-	mg/kg	0.201	0.402	0.0349	U	UJ	0.205	0.41	0.021	U	U	0.2015	0.403	0.035	U	UJ	0.205	0.41	0.0356	U	UJ
Chloronaphthalene, 2-	mg/kg	0.201	0.402	0.0064	U	U	0.205	0.41	0.027	U	U	0.2015	0.403	0.00642	U	U	0.205	0.41	0.00653	U	U
Chlorophenol, 2-	mg/kg	0.201	0.402	0.00495	U	U	0.205	0.41	0.032	U	U	0.2015	0.403	0.00496	U	U	0.205	0.41	0.00505	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.201	0.402	0.0308	U	U	0.205	0.41	0.03	U	U	0.2015	0.403	0.0309	U	U	0.205	0.41	0.0314	U	U
Chrysene	mg/kg	0.243	0.402	0.016	J	J	0.205	0.41	0.0011	U	U	0.282	0.403	0.016	J	J	0.205	0.41	0.0163	U	U
Dibenz(a,h)anthracene	mg/kg	0.201	0.402	0.091	U	U	0.205	0.41	0.0016	U	U	0.2015	0.403	0.0912	U	U	0.205	0.41	0.0927	U	U
Dibenzofuran	mg/kg	0.201	0.402	0.00677	U	U	0.205	0.41	0.025	U	U	0.2015	0.403	0.00678	U	U	0.205	0.41	0.0069	U	U
Dichlorobenzene, 1,2-	mg/kg	0.201	0.402	0.00931	U	U						0.2015	0.403	0.00932	U	U	0.205	0.41	0.00948	U	U
Dichlorobenzene, 1,3-	mg/kg	0.201	0.402	0.0146	U	U						0.2015	0.403	0.0147	U	U	0.205	0.41	0.0149	U	U
Dichlorobenzene, 1,4-	mg/kg	0.201	0.402	0.00786	U	U						0.2015	0.403	0.00787	U	U	0.205	0.41	0.00801	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.201	0.402	0.0399	U	UJ	1	2	0.022	U	U	0.2015	0.403	0.04	U	UJ	0.205	0.41	0.0406	U	UJ
Dichlorophenol, 2,4-	mg/kg	0.201	0.402	0.0144	U	U	0.205	0.41	0.025	U	U	0.2015	0.403	0.0144	U	U	0.205	0.41	0.0147	U	U
Diethyl phthalate	mg/kg	0.201	0.402	0.0163	U	U	0.205	0.41	0.024	U	U	0.2015	0.403	0.0163	U	U	0.205	0.41	0.0166	U	U
Dimethyl phthalate	mg/kg	0.201	0.402	0.0123	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.0123	U	U	0.205	0.41	0.0126	U	U
Dimethylphenol, 2,4-	mg/kg	0.201	0.402	0.0106	U	U	0.205	0.41	0.025	U	U	0.2015	0.403	0.0107	U	U	0.205	0.41	0.0108	U	U
Di-n-butyl phthalate	mg/kg	0.201	0.402	0.0087	U	U	0.205	0.41	0.024	U	U	0.2015	0.403	0.00872	U	U	0.205	0.41	0.00887	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.201	0.402	0.0405	U	U	1	2	0.016	U	U	0.2015	0.403	0.0406	U	U	0.205	0.41	0.0413	U	U
Dinitrophenol, 2,4-	mg/kg	0.201	0.402	0.0642	U	U	1	2	0.1	U	U	0.2015	0.403	0.0643	U	UJ	0.205	0.41	0.0654	U	UJ
Dinitrotoluene, 2,4-	mg/kg	0.201	0.402	0.0141	U	U	0.205	0.41	0.022	U	U	0.2015	0.403	0.0142	U	U	0.205	0.41	0.0144	U	U
Dinitrotoluene, 2,6-	mg/kg	0.201	0.402	0.00967	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.00969	U	U	0.205	0.41	0.00985	U	U
Di-n-octyl phthalate	mg/kg	0.201	0.402	0.0758	U	U	0.205	0.41	0.022	U	U	0.2015	0.403	0.0759	U	U	0.205	0.41	0.0772	U	U
DIPHENYLAMINE	mg/kg	0.201	0.402	0.0399	U	U						0.2015	0.403	0.04	U	U	0.205	0.41	0.0406	U	U
Fluoranthene	mg/kg	0.604	0.402	0.0087		J	0.205	0.41	0.0015	U	U	0.4	0.403	0.00872	J	J	0.0505	0.41	0.00887	J	J

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB03					WWTP3-SB03					WWTP3-SB05					WWTP3-SB05				
SAMPLE_NO		WW0043					WW0068					WW0048					WW0049				
SAMPLE_DATE		10-Dec-08					10-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		3 - 5 Ft					3 - 5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		FD					FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg	0.201	0.402	0.017	U	U	0.205	0.41	0.0015	U	U	0.2015	0.403	0.0171	U	U	0.205	0.41	0.0174	U	U
Hexachlorobenzene	mg/kg	0.201	0.402	0.025	U	U	0.205	0.41	0.0026	U	U	0.2015	0.403	0.0251	U	U	0.205	0.41	0.0255	U	U
Hexachlorobutadiene	mg/kg	0.201	0.402	0.0382	U	U	0.205	0.41	0.032	U	U	0.2015	0.403	0.0383	U	U	0.205	0.41	0.0389	U	U
Hexachlorocyclopentadiene	mg/kg	0.201	0.402	0.0128	U	UJ	1	2	0.02	U	U	0.2015	0.403	0.0128	U	UJ	0.205	0.41	0.0131	U	UJ
Hexachloroethane	mg/kg	0.201	0.402	0.0123	U	U	0.205	0.41	0.035	U	U	0.2015	0.403	0.0123	U	U	0.205	0.41	0.0126	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.369	0.402	0.131	J	J	0.205	0.41	0.0019	U	U	0.45	0.403	0.131			0.205	0.41	0.133	U	U
Isophorone	mg/kg	0.201	0.402	0.00483	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.00484	U	U	0.205	0.41	0.00493	U	U
Methylnaphthalene, 2-	mg/kg	0.201	0.402	0.106	U	U	0.205	0.41	0.0019	U	U	0.2015	0.403	0.106	U	U	0.205	0.41	0.108	U	U
Methylphenol, 2-	mg/kg	0.201	0.402	0.00604	U	U	0.205	0.41	0.035	U	U	0.2015	0.403	0.00605	U	U	0.205	0.41	0.00616	U	U
Methylphenol, 4-	mg/kg	0.201	0.402	0.0126	U	U	0.205	0.41	0.027	U	U	0.2015	0.403	0.0126	U	U	0.205	0.41	0.0128	U	U
Naphthalene	mg/kg	0.201	0.402	0.00955	U	U	0.205	0.41	0.002	U	U	0.2015	0.403	0.00956	U	U	0.205	0.41	0.00973	U	U
Nitroaniline, 2-	mg/kg	0.201	0.402	0.0174	U	U	1	2	0.027	U	U	0.2015	0.403	0.0174	U	U	0.205	0.41	0.0177	U	U
Nitroaniline, 3-	mg/kg	0.201	0.402	0.0137	U	U	1	2	0.02	U	U	0.2015	0.403	0.0137	U	U	0.205	0.41	0.0139	U	UJ
Nitroaniline, 4-	mg/kg	0.201	0.402	0.143	U	U	1	2	0.032	U	U	0.2015	0.403	0.143	U	U	0.205	0.41	0.145	U	U
Nitrobenzene	mg/kg	0.201	0.402	0.0132	U	U	0.205	0.41	0.0027	U	U	0.2015	0.403	0.0132	U	U	0.205	0.41	0.0134	U	U
Nitrophenol, 2-	mg/kg	0.201	0.402	0.0143	U	U	0.205	0.41	0.024	U	U	0.2015	0.403	0.0143	U	U	0.205	0.41	0.0145	U	U
Nitrophenol, 4-	mg/kg	0.201	0.402	0.0326	U	U	1	2	0.14	U	U	0.2015	0.403	0.0327	U	U	0.205	0.41	0.0333	U	U
n-Nitrosodimethylamine	mg/kg	0.201	0.402	0.0121	U	U						0.2015	0.403	0.0121	U	U	0.205	0.41	0.0123	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.201	0.402	0.0144	U	U	0.205	0.41	0.028	U	U	0.2015	0.403	0.0144	U	U	0.205	0.41	0.0147	U	U
n-Nitrosodiphenylamine	mg/kg	0.201	0.402	0.00568	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.00569	U	U	0.205	0.41	0.00579	U	U
Pentachlorophenol	mg/kg	0.201	0.402	0.0361	U	U	0.205	0.41	0.1	U	U	0.2015	0.403	0.0362	U	U	0.205	0.41	0.0368	U	U
Phenanthrene	mg/kg	0.35	0.402	0.00979	J	J	0.205	0.41	0.0025	U	U	0.0722	0.403	0.00981	J	J	0.205	0.41	0.00998	U	U
Phenol	mg/kg	0.201	0.402	0.00483	U	U	0.205	0.41	0.031	U	U	0.2015	0.403	0.00484	U	U	0.205	0.41	0.00493	U	U
Pyrene	mg/kg	0.416	0.402	0.0161			0.205	0.41	0.0014	U	U	0.35	0.403	0.0161	J	J	0.0406	0.41	0.0164	J	J
Trichlorobenzene, 1,2,4-	mg/kg	0.201	0.402	0.00991	U	U						0.2015	0.403	0.00993	U	U	0.205	0.41	0.0101	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.201	0.402	0.0346	U	U	0.205	0.41	0.031	U	U	0.2015	0.403	0.0346	U	U	0.205	0.41	0.0352	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.201	0.402	0.0272	U	U	0.205	0.41	0.026	U	U	0.2015	0.403	0.0272	U	U	0.205	0.41	0.0277	U	U
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB03					WWTP3-SB03					WWTP3-SB05					WWTP3-SB05				
SAMPLE_NO		WW0043					WW0068					WW0048					WW0049				
SAMPLE_DATE		10-Dec-08					10-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		3 - 5 Ft					3 - 5 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		FD					FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier

No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB06					WWTP3-SB06					WWTP3-SB07					WWTP3-SB07				
SAMPLE_NO		WW0051					WW0052					WW0054					WW0055				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		0 - 1 Ft					3 - 3_7 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Dinitrobenzene, 1,3-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Dinitrotoluene, 2,4-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Dinitrotoluene, 2,6-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
HMX	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Nitrobenzene	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Nitrotoluene, 2-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Nitrotoluene, 3-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Nitrotoluene, 4-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
RDX	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Tetryl	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.142	0.284	0.142	U	U	0.157	0.314	0.157	U	U	0.1315	0.263	0.132	U	UJ	0.1415	0.283	0.142	U	U
METALS (UNFILTERED)																					
Aluminum	mg/kg	4950	2	1			7230	1.81	0.904			5870	1.9	0.949			7800	1.76	0.879		
Antimony	mg/kg	0.275	0.5	0.25	J	J	0.261	0.452	0.226	J	J	0.321	0.475	0.237	J	J	0.378	0.44	0.22	J	J
Arsenic	mg/kg	4.35	1	0.5			5.64	0.904	0.452			5.18	0.949	0.475			10.4	0.879	0.44		
Barium	mg/kg	32.1	0.4	0.2			56.7	0.362	0.181			35.9	0.38	0.19			56.6	0.352	0.176		
Beryllium	mg/kg	3.88	0.2	0.1		J	4.72	0.181	0.0904		J	4.25	0.19	0.0949		J	6.22	0.176	0.0879		J
Cadmium	mg/kg	0.25	0.5	0.25	U	U	0.252	0.452	0.226	J	J	0.2375	0.475	0.237	U	U	0.248	0.44	0.22	J	J
Calcium	mg/kg	8960	5	2.5		J	12000	4.52	2.26		J	24700	4.75	2.37		J	16200	4.4	2.2		J
Chromium	mg/kg	6.9	0.5	0.25			9.49	0.452	0.226			8.34	0.475	0.237			11.8	0.44	0.22		
Cobalt	mg/kg	3.97	0.2	0.1		J	5.69	0.181	0.0904		J	5.14	0.19	0.0949		J	9.75	0.176	0.0879		J
Copper	mg/kg	11.4	0.5	0.25			12.9	0.452	0.226			13.8	0.475	0.237			23.2	0.44	0.22		
Iron	mg/kg	10200	2	1		J	13000	1.81	0.904		J	12100	1.9	0.949		J	19200	1.76	0.879		J
Lead	mg/kg	21.6	0.5	0.25		J	39.4	0.452	0.226		J	19.2	0.475	0.237		J	12.4	0.44	0.22		J
Magnesium	mg/kg	3190	4	2		J	4010	3.62	1.81		J	5900	3.8	1.9		J	7450	3.52	1.76		J
Manganese	mg/kg	192	0.4	0.2		J	241	0.362	0.181		J	287	0.38	0.19		J	485	0.352	0.176		J
Mercury	mg/kg	0.061	0.024	0.012		J	0.0305	0.0243	0.0121		J	0.12	0.0231	0.0116		J	0.0237	0.0237	0.0119		J
Nickel	mg/kg	9.37	0.3	0.15		J	13.5	0.271	0.136		J	12.4	0.285	0.142		J	22.1	0.264	0.132		J
Potassium	mg/kg	363	25	12.5			321	22.6	11.3			443	23.7	11.9			394	22	11		
Selenium	mg/kg	0.5	1	0.5	U	UJ	0.452	0.904	0.452	U	UJ	0.483	0.949	0.475	J	J	0.4395	0.879	0.44	U	UJ
Silver	mg/kg	0.25	0.5	0.25	U	U	0.226	0.452	0.226	U	U	0.2375	0.475	0.237	U	U	0.22	0.44	0.22	U	U
Sodium	mg/kg	40.8	10	5			53.5	9.04	4.52			45.8	9.49	4.75			162	8.79	4.4		
Thallium	mg/kg	0.25	0.5	0.25	U	U	0.226	0.452	0.226	U	U	0.277	0.475	0.237	J	J	0.22	0.44	0.22	U	U
Vanadium	mg/kg	13.8	0.2	0.1			19	0.181	0.0904			16.6	0.19	0.0949			23.5	0.176	0.0879		
Zinc	mg/kg	41.9	2.5	1.25			45	2.26	1.13			41.9	2.37	1.19			56.2	2.2	1.1		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1221	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1232	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1242	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1248	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1254	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U
Aroclor 1260	mg/kg	0.1025	0.205	0.041	U	U	0.0995	0.199	0.04	U	U	0.0985	0.197	0.0394	U	U	0.1005	0.201	0.0402	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB06					WWTP3-SB06					WWTP3-SB07					WWTP3-SB07				
SAMPLE_NO		WW0051					WW0052					WW0054					WW0055				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		0 - 1 Ft					3 - 3_7 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg	0.2055	0.411	0.0074	U	U	0.2	0.4	0.00721	U	U	0.2	0.4	0.00721	U	U	0.2	0.4	0.00721	U	U
Acenaphthylene	mg/kg	0.0942	0.411	0.00494	J	J	0.0577	0.4	0.00481	J	J	0.2	0.4	0.00481	U	U	0.2	0.4	0.00481	U	U
ACETOPHENONE	mg/kg																				
Anthracene	mg/kg	0.183	0.411	0.00888	J	J	0.0617	0.4	0.00865	J	J	0.2	0.4	0.00865	U	U	0.2	0.4	0.00865	U	U
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg	0.607	0.411	0.027			0.238	0.4	0.0263	J	J	0.101	0.4	0.0263	J	J	0.2	0.4	0.0263	U	U
Benzo(a)pyrene	mg/kg	0.538	0.411	0.027			0.209	0.4	0.0263	J	J	0.0909	0.4	0.0263	J	J	0.2	0.4	0.0263	U	U
Benzo(b)fluoranthene	mg/kg	0.756	0.411	0.0685			0.3	0.4	0.0667	J	J	0.14	0.4	0.0667	J	J	0.2	0.4	0.0667	U	U
Benzo(ghi)perylene	mg/kg	0.321	0.411	0.1	J	J	0.12	0.4	0.0976	J	J	0.2	0.4	0.0976	U	U	0.2	0.4	0.0976	U	U
Benzo(k)fluoranthene	mg/kg	0.291	0.411	0.125	J	J	0.2	0.4	0.121	U	U	0.2	0.4	0.121	U	U	0.2	0.4	0.121	U	U
Benzoic acid	mg/kg	0.2055	0.411	0.1	U	UJ	0.2	0.4	0.0976	U	UJ	0.2	0.4	0.0976	U	UJ	0.2	0.4	0.0976	U	UJ
Benzyl alcohol	mg/kg	0.2055	0.411	0.1	U	U	0.2	0.4	0.0976	U	U	0.2	0.4	0.0976	U	U	0.2	0.4	0.0976	U	U
BIBENZENE	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg	0.2055	0.411	0.00864	U	U	0.2	0.4	0.00841	U	U	0.2	0.4	0.00841	U	U	0.2	0.4	0.00841	U	U
Bis(2-chloroethyl)ether	mg/kg	0.2055	0.411	0.0105	U	U	0.2	0.4	0.0102	U	U	0.2	0.4	0.0102	U	U	0.2	0.4	0.0102	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.2055	0.411	0.0179	U	U	0.2	0.4	0.0174	U	U	0.2	0.4	0.0174	U	U	0.2	0.4	0.0174	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.2055	0.411	0.038	U	U	0.2	0.4	0.037	U	U	0.2	0.4	0.037	U	U	0.2	0.4	0.037	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.2055	0.411	0.0147	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U
Butyl benzyl phthalate	mg/kg	0.2055	0.411	0.0167	U	U	0.2	0.4	0.0162	U	U	0.2	0.4	0.0162	U	U	0.2	0.4	0.0162	U	U
Caprolactam	mg/kg																				
Carbazole	mg/kg	0.2055	0.411	0.0411	U	U	0.2	0.4	0.04	U	U	0.2	0.4	0.04	U	U	0.2	0.4	0.04	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.2055	0.411	0.0101	U	U	0.2	0.4	0.00986	U	U	0.2	0.4	0.00985	U	U	0.2	0.4	0.00986	U	U
Chloroaniline, 4-	mg/kg	0.2055	0.411	0.0357	U	UJ	0.2	0.4	0.0347	U	UJ	0.2	0.4	0.0347	U	UJ	0.2	0.4	0.0347	U	UJ
Chloronaphthalene, 2-	mg/kg	0.2055	0.411	0.00654	U	U	0.2	0.4	0.00637	U	U	0.2	0.4	0.00637	U	U	0.2	0.4	0.00637	U	U
Chlorophenol, 2-	mg/kg	0.2055	0.411	0.00506	U	U	0.2	0.4	0.00493	U	U	0.2	0.4	0.00493	U	U	0.2	0.4	0.00493	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.2055	0.411	0.0315	U	U	0.2	0.4	0.0307	U	U	0.2	0.4	0.0306	U	U	0.2	0.4	0.0307	U	U
Chrysene	mg/kg	0.556	0.411	0.0163			0.228	0.4	0.0159	J	J	0.0925	0.4	0.0159	J	J	0.2	0.4	0.0159	U	U
Dibenz(a,h)anthracene	mg/kg	0.2055	0.411	0.0929	U	U	0.2	0.4	0.0905	U	U	0.2	0.4	0.0905	U	U	0.2	0.4	0.0905	U	U
Dibenzofuran	mg/kg	0.2055	0.411	0.00691	U	U	0.2	0.4	0.00673	U	U	0.2	0.4	0.00673	U	U	0.2	0.4	0.00673	U	U
Dichlorobenzene, 1,2-	mg/kg	0.2055	0.411	0.0095	U	U	0.2	0.4	0.00926	U	U	0.2	0.4	0.00925	U	U	0.2	0.4	0.00926	U	U
Dichlorobenzene, 1,3-	mg/kg	0.2055	0.411	0.0149	U	U	0.2	0.4	0.0145	U	U	0.2	0.4	0.0145	U	U	0.2	0.4	0.0145	U	U
Dichlorobenzene, 1,4-	mg/kg	0.2055	0.411	0.00802	U	U	0.2	0.4	0.00781	U	U	0.2	0.4	0.00781	U	U	0.2	0.4	0.00781	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.2055	0.411	0.0407	U	UJ	0.2	0.4	0.0397	U	UJ	0.2	0.4	0.0397	U	UJ	0.2	0.4	0.0397	U	UJ
Dichlorophenol, 2,4-	mg/kg	0.2055	0.411	0.0147	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U
Diethyl phthalate	mg/kg	0.2055	0.411	0.0167	U	U	0.2	0.4	0.0162	U	U	0.2	0.4	0.0162	U	U	0.2	0.4	0.0162	U	U
Dimethyl phthalate	mg/kg	0.2055	0.411	0.0126	U	U	0.2	0.4	0.0123	U	U	0.2	0.4	0.0123	U	U	0.2	0.4	0.0123	U	U
Dimethylphenol, 2,4-	mg/kg	0.2055	0.411	0.0109	U	U	0.2	0.4	0.0106	U	U	0.2	0.4	0.0106	U	U	0.2	0.4	0.0106	U	U
Di-n-butyl phthalate	mg/kg	0.2055	0.411	0.00888	U	U	0.2	0.4	0.00865	U	U	0.2	0.4	0.00865	U	U	0.2	0.4	0.00865	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.2055	0.411	0.0413	U	U	0.2	0.4	0.0403	U	U	0.2	0.4	0.0403	U	U	0.2	0.4	0.0403	U	U
Dinitrophenol, 2,4-	mg/kg	0.2055	0.411	0.0655	U	UJ	0.2	0.4	0.0638	U	UJ	0.2	0.4	0.0638	U	UJ	0.2	0.4	0.0638	U	UJ
Dinitrotoluene, 2,4-	mg/kg	0.2055	0.411	0.0144	U	U	0.2	0.4	0.0141	U	U	0.2	0.4	0.0141	U	U	0.2	0.4	0.0141	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2055	0.411	0.00987	U	U	0.2	0.4	0.00962	U	U	0.2	0.4	0.00961	U	U	0.2	0.4	0.00962	U	U
Di-n-octyl phthalate	mg/kg	0.2055	0.411	0.0774	U	U	0.2	0.4	0.0754	U	U	0.2	0.4	0.0753	U	U	0.2	0.4	0.0754	U	U
DIPHENYLAMINE	mg/kg	0.2055	0.411	0.0407	U	U	0.2	0.4	0.0397	U	U	0.2	0.4	0.0397	U	U	0.2	0.4	0.0397	U	U
Fluoranthene	mg/kg	1.12	0.411	0.00888			0.464	0.4	0.00865			0.187	0.4	0.00865	J	J	0.2	0.4	0.00865	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB06					WWTP3-SB06					WWTP3-SB07					WWTP3-SB07				
SAMPLE_NO		WW0051					WW0052					WW0054					WW0055				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		0 - 1 Ft					3 - 3_7 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg	0.2055	0.411	0.0174	U	U	0.2	0.4	0.0169	U	U	0.2	0.4	0.0169	U	U	0.2	0.4	0.0169	U	U
Hexachlorobenzene	mg/kg	0.2055	0.411	0.0255	U	U	0.2	0.4	0.0249	U	U	0.2	0.4	0.0249	U	U	0.2	0.4	0.0249	U	U
Hexachlorobutadiene	mg/kg	0.2055	0.411	0.039	U	U	0.2	0.4	0.038	U	U	0.2	0.4	0.038	U	U	0.2	0.4	0.038	U	U
Hexachlorocyclopentadiene	mg/kg	0.2055	0.411	0.0131	U	UJ	0.2	0.4	0.0127	U	UJ	0.2	0.4	0.0127	U	UJ	0.2	0.4	0.0127	U	UJ
Hexachloroethane	mg/kg	0.2055	0.411	0.0126	U	U	0.2	0.4	0.0123	U	U	0.2	0.4	0.0123	U	U	0.2	0.4	0.0123	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.62	0.411	0.133			0.388	0.4	0.13	J	J	0.305	0.4	0.13	J	J	0.2	0.4	0.13	U	U
Isophorone	mg/kg	0.2055	0.411	0.00494	U	U	0.2	0.4	0.00481	U	U	0.2	0.4	0.00481	U	U	0.2	0.4	0.00481	U	U
Methylnaphthalene, 2-	mg/kg	0.2055	0.411	0.108	U	U	0.2	0.4	0.105	U	U	0.2	0.4	0.105	U	U	0.2	0.4	0.105	U	U
Methylphenol, 2-	mg/kg	0.2055	0.411	0.00617	U	U	0.2	0.4	0.00601	U	U	0.2	0.4	0.00601	U	U	0.2	0.4	0.00601	U	U
Methylphenol, 4-	mg/kg	0.2055	0.411	0.0128	U	U	0.2	0.4	0.0125	U	U	0.2	0.4	0.0125	U	U	0.2	0.4	0.0125	U	U
Naphthalene	mg/kg	0.2055	0.411	0.00975	U	U	0.2	0.4	0.0095	U	U	0.2	0.4	0.00949	U	U	0.2	0.4	0.0095	U	U
Nitroaniline, 2-	mg/kg	0.2055	0.411	0.0178	U	U	0.2	0.4	0.0173	U	U	0.2	0.4	0.0173	U	U	0.2	0.4	0.0173	U	U
Nitroaniline, 3-	mg/kg	0.2055	0.411	0.0139	U	U	0.2	0.4	0.0136	U	U	0.2	0.4	0.0136	U	U	0.2	0.4	0.0136	U	U
Nitroaniline, 4-	mg/kg	0.2055	0.411	0.146	U	U	0.2	0.4	0.142	U	U	0.2	0.4	0.142	U	U	0.2	0.4	0.142	U	U
Nitrobenzene	mg/kg	0.2055	0.411	0.0134	U	U	0.2	0.4	0.0131	U	U	0.2	0.4	0.0131	U	U	0.2	0.4	0.0131	U	U
Nitrophenol, 2-	mg/kg	0.2055	0.411	0.0146	U	U	0.2	0.4	0.0142	U	U	0.2	0.4	0.0142	U	U	0.2	0.4	0.0142	U	U
Nitrophenol, 4-	mg/kg	0.2055	0.411	0.0333	U	U	0.2	0.4	0.0325	U	U	0.2	0.4	0.0324	U	U	0.2	0.4	0.0325	U	U
n-Nitrosodimethylamine	mg/kg	0.2055	0.411	0.0123	U	U	0.2	0.4	0.012	U	U	0.2	0.4	0.012	U	U	0.2	0.4	0.012	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.2055	0.411	0.0147	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U	0.2	0.4	0.0143	U	U
n-Nitrosodiphenylamine	mg/kg	0.2055	0.411	0.0058	U	U	0.2	0.4	0.00565	U	U	0.2	0.4	0.00565	U	U	0.2	0.4	0.00565	U	U
Pentachlorophenol	mg/kg	0.2055	0.411	0.0369	U	U	0.2	0.4	0.0359	U	U	0.2	0.4	0.0359	U	U	0.2	0.4	0.0359	U	U
Phenanthrene	mg/kg	0.363	0.411	0.00999	J	J	0.293	0.4	0.00974	J	J	0.0677	0.4	0.00973	J	J	0.2	0.4	0.00974	U	U
Phenol	mg/kg	0.2055	0.411	0.00494	U	U	0.2	0.4	0.00481	U	U	0.2	0.4	0.00481	U	U	0.2	0.4	0.00481	U	U
Pyrene	mg/kg	0.865	0.411	0.0164			0.337	0.4	0.016	J	J	0.157	0.4	0.016	J	J	0.2	0.4	0.016	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.2055	0.411	0.0101	U	U	0.2	0.4	0.00986	U	U	0.2	0.4	0.00985	U	U	0.2	0.4	0.00986	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.2055	0.411	0.0353	U	U	0.2	0.4	0.0344	U	U	0.2	0.4	0.0344	U	U	0.2	0.4	0.0344	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.2055	0.411	0.0278	U	U	0.2	0.4	0.027	U	U	0.2	0.4	0.027	U	U	0.2	0.4	0.027	U	U
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB06					WWTP3-SB06					WWTP3-SB07					WWTP3-SB07				
SAMPLE_NO		WW0051					WW0052					WW0054					WW0055				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		0 - 1 Ft					3 - 3_7 Ft					0 - 1 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier
No data

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB09					WWTP3-SB09					WWTP3-SB09					WWTP3-SB09				
SAMPLE_NO		WW0060					WW0061					WW0063					WW0065				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		_2 - 1_6 Ft					3 - 5 Ft					3 - 5 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					FD					FS				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.03	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.031	U	U
Dinitrobenzene, 1,3-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.029	U	U
Dinitrotoluene, 2,4-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.029	U	U
Dinitrotoluene, 2,6-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.028	U	U
HMX	mg/kg	0.1515	0.303	0.152	U	U	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.048	U	U
Nitrobenzene	mg/kg	0.1515	0.303	0.152	U	U	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.028	U	U
Nitrotoluene, 2-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.037	U	U
Nitrotoluene, 3-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.03	U	U
Nitrotoluene, 4-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.045	U	U
RDX	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.031	U	U
Tetryl	mg/kg	0.1515	0.303	0.152	U	U	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.15	0.3	0.095	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.1515	0.303	0.152	U	UJ	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.024	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.1515	0.303	0.152	U	U	0.1375	0.275	0.138	U	UJ	0.151	0.302	0.151	U	U	0.1	0.2	0.033	U	U
METALS (UNFILTERED)																					
Aluminum	mg/kg	7780	1.95	0.973			8410	1.89	0.946			9940	1.79	0.894			7070	24.4	11.7		
Antimony	mg/kg	0.303	0.434	0.217	J	J	0.457	0.473	0.236	J	J	0.371	0.447	0.223	J	J	3.65	7.3	0.48	U	U
Arsenic	mg/kg	7.23	0.868	0.434			6.49	0.946	0.473			6.06	0.894	0.447			7.1	1.2	0.37		
Barium	mg/kg	52.6	0.195	0.0973			50.1	0.378	0.189			59.7	0.357	0.179			45.1	24.4	0.087		
Beryllium	mg/kg	5.75	0.195	0.0973		J	7.14	0.189	0.0946		J	6.45	0.179	0.0894		J	0.305	0.61	0.053	U	U
Cadmium	mg/kg	0.224	0.434	0.217	J	J	0.2365	0.473	0.236	U	U	0.2235	0.447	0.223	U	U	0.305	0.61	0.044	U	U
Calcium	mg/kg	29600	4.87	2.43		J	5270	4.73	2.36		J	6090	4.47	2.23		J	4460	611	19.5		
Chromium	mg/kg	12	0.487	0.243			14.4	0.473	0.236			15.5	0.447	0.223			11.5	1.2	0.24		
Cobalt	mg/kg	7.21	0.195	0.0973			6.67	0.189	0.0946		J	7.35	0.179	0.0894		J	3.05	6.1	0.2	U	U
Copper	mg/kg	20.5	0.487	0.243			19.8	0.473	0.236			19.3	0.447	0.223			19.6	3.1	0.9		
Iron	mg/kg	17100	1.95	0.973		J	21600	1.89	0.946		J	19400	1.79	0.894		J	20700	12.2	6		
Lead	mg/kg	13.3	0.434	0.217			11.7	0.473	0.236		J	11.7	0.447	0.223		J	8.2	0.37	0.23		
Magnesium	mg/kg	8750	1.95	0.973			3330	3.78	1.89		J	3790	3.57	1.79		J	2820	611	6.2		
Manganese	mg/kg	377	0.195	0.0973			277	0.378	0.189		J	430	0.357	0.179		J	270	1.8	0.09		
Mercury	mg/kg	0.02	0.0212	0.0106	J	J	0.0241	0.0214	0.0107		J	0.0312	0.0236	0.0118		J	0.06	0.12	0.018	U	U
Nickel	mg/kg	19.6	0.292	0.146			21.4	0.284	0.142		J	23.3	0.268	0.134		J	17.2	4.9	0.33		
Potassium	mg/kg	567	24.3	12.2			414	23.6	11.8			463	22.3	11.2			305.5	611	7.6	U	U
Selenium	mg/kg	0.434	0.868	0.434	U	UJ	0.531	0.946	0.473	J	J	0.447	0.894	0.447	U	UJ	0.305	0.61	0.55	U	U
Silver	mg/kg	0.2435	0.487	0.243	U	U	0.2365	0.473	0.236	U	U	0.2235	0.447	0.223	U	U	0.6	1.2	0.12	U	U
Sodium	mg/kg	60.1	9.73	4.87			79	9.46	4.73			78.5	8.94	4.47			305.5	611	80.6	U	U
Thallium	mg/kg	0.221	0.434	0.217	J	J	0.269	0.473	0.236	J	J	0.2235	0.447	0.223	U	U	0.6	1.2	0.67	U	U
Vanadium	mg/kg	19.1	0.195	0.0973			25.5	0.189	0.0946			23.2	0.179	0.0894			20.1	6.1	0.15		
Zinc	mg/kg	58.8	2.43	1.22			58.7	2.36	1.18			59.3	2.23	1.12			39.4	2.4	1.2		
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.026	U	U
Aroclor 1221	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.02	U	U
Aroclor 1232	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.017	U	U
Aroclor 1242	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.016	U	U
Aroclor 1248	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.021	U	U
Aroclor 1254	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.021	U	U
Aroclor 1260	mg/kg	0.099	0.198	0.0397	U	U	0.1	0.2	0.04	U	U	0.0995	0.199	0.0398	U	U	0.02	0.04	0.021	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB09					WWTP3-SB09					WWTP3-SB09					WWTP3-SB09				
SAMPLE_NO		WW0060					WW0061					WW0063					WW0065				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		_2 - 1_6 Ft					3 - 5 Ft					3 - 5 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					FD					FS				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
SEMIVOLATILES																					
Acenaphthene	mg/kg	0.995	1.99	0.0359	U	U	0.201	0.402	0.00725	U	U	0.198	0.396	0.00714	U	U	0.2	0.4	0.0016	U	U
Acenaphthylene	mg/kg	0.995	1.99	0.0239	U	U	0.201	0.402	0.00483	U	U	0.198	0.396	0.00476	U	U	0.2	0.4	0.0015	U	U
ACETOPHENONE	mg/kg																0.0405	0.081	0.011	U	U
Anthracene	mg/kg	0.995	1.99	0.043	U	U	0.201	0.402	0.0087	U	U	0.198	0.396	0.00857	U	U	0.2	0.4	0.0016	U	U
Atrazine	mg/kg																0.2	0.4	0.026	U	U
Benzaldehyde	mg/kg																0.2	0.4	0.026	U	U
Benzo(a)anthracene	mg/kg	0.995	1.99	0.131	U	U	0.201	0.402	0.0265	U	U	0.198	0.396	0.0261	U	U	0.2	0.4	0.0012	U	U
Benzo(a)pyrene	mg/kg	0.995	1.99	0.131	U	U	0.201	0.402	0.0265	U	U	0.198	0.396	0.0261	U	U	0.2	0.4	0.0016	U	U
Benzo(b)fluoranthene	mg/kg	0.995	1.99	0.332	U	U	0.201	0.402	0.067	U	U	0.198	0.396	0.066	U	U	0.2	0.4	0.0015	U	U
Benzo(ghi)perylene	mg/kg	0.995	1.99	0.485	U	U	0.201	0.402	0.0981	U	U	0.198	0.396	0.0966	U	U	0.2	0.4	0.0016	U	U
Benzo(k)fluoranthene	mg/kg	0.995	1.99	0.604	U	U	0.201	0.402	0.122	U	U	0.198	0.396	0.12	U	U	0.2	0.4	0.0021	U	U
Benzoic acid	mg/kg	0.995	1.99	0.485	U	UJ	0.201	0.402	0.0981	U	UJ	0.198	0.396	0.0966	U	UJ					
Benzyl alcohol	mg/kg	0.995	1.99	0.485	U	U	0.201	0.402	0.0981	U	U	0.198	0.396	0.0966	U	U					
BIBENZENE	mg/kg																0.2	0.4	0.028	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.995	1.99	0.0418	U	U	0.201	0.402	0.00846	U	U	0.198	0.396	0.00833	U	U	0.2	0.4	0.027	U	U
Bis(2-chloroethyl)ether	mg/kg	0.995	1.99	0.0508	U	U	0.201	0.402	0.0103	U	U	0.198	0.396	0.0101	U	U	0.2	0.4	0.0024	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.995	1.99	0.0866	U	U	0.201	0.402	0.0175	U	U	0.198	0.396	0.0173	U	U	0.2	0.4	0.032	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.995	1.99	0.184	U	U	0.201	0.402	0.0372	U	U	0.198	0.396	0.0366	U	U	0.2	0.4	0.022	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.995	1.99	0.0711	U	U	0.201	0.402	0.0144	U	U	0.198	0.396	0.0142	U	U	0.2	0.4	0.026	U	U
Butyl benzyl phthalate	mg/kg	0.995	1.99	0.0807	U	U	0.201	0.402	0.0163	U	U	0.198	0.396	0.0161	U	U	0.2	0.4	0.023	U	U
Caprolactam	mg/kg																0.2	0.4	0.045	U	U
Carbazole	mg/kg	0.995	1.99	0.199	U	U	0.201	0.402	0.0402	U	U	0.198	0.396	0.0396	U	U	0.2	0.4	0.023	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.995	1.99	0.049	U	U	0.201	0.402	0.0099	U	U	0.198	0.396	0.00976	U	U	0.2	0.4	0.026	U	U
Chloroaniline, 4-	mg/kg	0.995	1.99	0.173	U	UJ	0.201	0.402	0.0349	U	UJ	0.198	0.396	0.0344	U	UJ	0.2	0.4	0.021	U	U
Chloronaphthalene, 2-	mg/kg	0.995	1.99	0.0317	U	U	0.201	0.402	0.0064	U	U	0.198	0.396	0.00631	U	U	0.2	0.4	0.027	U	U
Chlorophenol, 2-	mg/kg	0.995	1.99	0.0245	U	U	0.201	0.402	0.00495	U	U	0.198	0.396	0.00488	U	U	0.2	0.4	0.032	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.995	1.99	0.152	U	U	0.201	0.402	0.0308	U	U	0.198	0.396	0.0303	U	U	0.2	0.4	0.029	U	U
Chrysene	mg/kg	0.995	1.99	0.0789	U	U	0.201	0.402	0.0159	U	U	0.198	0.396	0.0157	U	U	0.2	0.4	0.0011	U	U
Dibenz(a,h)anthracene	mg/kg	0.995	1.99	0.45	U	U	0.201	0.402	0.091	U	U	0.198	0.396	0.0896	U	U	0.2	0.4	0.0016	U	U
Dibenzofuran	mg/kg	0.995	1.99	0.0335	U	U	0.201	0.402	0.00676	U	U	0.198	0.396	0.00666	U	U	0.2	0.4	0.024	U	U
Dichlorobenzene, 1,2-	mg/kg	0.995	1.99	0.046	U	U	0.201	0.402	0.0093	U	U	0.198	0.396	0.00916	U	U					
Dichlorobenzene, 1,3-	mg/kg	0.995	1.99	0.0723	U	U	0.201	0.402	0.0146	U	U	0.198	0.396	0.0144	U	U					
Dichlorobenzene, 1,4-	mg/kg	0.995	1.99	0.0388	U	U	0.201	0.402	0.00785	U	U	0.198	0.396	0.00773	U	U					
Dichlorobenzidine, 3,3'-	mg/kg	0.995	1.99	0.197	U	UJ	0.201	0.402	0.0399	U	UJ	0.198	0.396	0.0393	U	UJ	1	2	0.022	U	U
Dichlorophenol, 2,4-	mg/kg	0.995	1.99	0.0711	U	U	0.201	0.402	0.0144	U	U	0.198	0.396	0.0142	U	U	0.2	0.4	0.024	U	U
Diethyl phthalate	mg/kg	0.995	1.99	0.0807	U	U	0.201	0.402	0.0163	U	U	0.198	0.396	0.0161	U	U	0.2	0.4	0.023	U	U
Dimethyl phthalate	mg/kg	0.995	1.99	0.0609	U	U	0.201	0.402	0.0123	U	U	0.198	0.396	0.0121	U	U	0.2	0.4	0.026	U	U
Dimethylphenol, 2,4-	mg/kg	0.995	1.99	0.0526	U	U	0.201	0.402	0.0106	U	U	0.198	0.396	0.0105	U	U	0.2	0.4	0.024	U	U
Di-n-butyl phthalate	mg/kg	0.995	1.99	0.043	U	U	0.201	0.402	0.0087	U	U	0.198	0.396	0.00857	U	U	0.2	0.4	0.023	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.995	1.99	0.2	U	U	0.201	0.402	0.0405	U	U	0.198	0.396	0.0399	U	U	1	2	0.016	U	U
Dinitrophenol, 2,4-	mg/kg	0.995	1.99	0.317	U	UJ	0.201	0.402	0.0641	U	UJ	0.198	0.396	0.0632	U	UJ	1	2	0.1	U	U
Dinitrotoluene, 2,4-	mg/kg	0.995	1.99	0.0699	U	U	0.201	0.402	0.0141	U	U	0.198	0.396	0.0139	U	U	0.2	0.4	0.022	U	U
Dinitrotoluene, 2,6-	mg/kg	0.995	1.99	0.0478	U	U	0.201	0.402	0.00966	U	U	0.198	0.396	0.00952	U	U	0.2	0.4	0.026	U	U
Di-n-octyl phthalate	mg/kg	0.995	1.99	0.375	U	U	0.201	0.402	0.0757	U	U	0.198	0.396	0.0746	U	U	0.2	0.4	0.022	U	U
DIPHENYLAMINE	mg/kg	0.995	1.99	0.197	U	U	0.201	0.402	0.0399	U	U	0.198	0.396	0.0393	U	U					
Fluoranthene	mg/kg	0.995	1.99	0.043	U	U	0.201	0.402	0.0087	U	U	0.198	0.396	0.00857	U	U	0.2	0.4	0.0015	U	U

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB09					WWTP3-SB09					WWTP3-SB09					WWTP3-SB09				
SAMPLE_NO		WW0060					WW0061					WW0063					WW0065				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		_2 - 1_6 Ft					3 - 5 Ft					3 - 5 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					FD					FS				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Fluorene	mg/kg	0.995	1.99	0.0843	U	U	0.201	0.402	0.017	U	U	0.198	0.396	0.0168	U	U	0.2	0.4	0.0015	U	U
Hexachlorobenzene	mg/kg	0.995	1.99	0.124	U	U	0.201	0.402	0.025	U	U	0.198	0.396	0.0246	U	U	0.2	0.4	0.0026	U	U
Hexachlorobutadiene	mg/kg	0.995	1.99	0.189	U	U	0.201	0.402	0.0382	U	U	0.198	0.396	0.0376	U	U	0.2	0.4	0.032	U	U
Hexachlorocyclopentadiene	mg/kg	0.995	1.99	0.0633	U	UJ	0.201	0.402	0.0128	U	UJ	0.198	0.396	0.0126	U	UJ	1	2	0.02	U	U
Hexachloroethane	mg/kg	0.995	1.99	0.0609	U	U	0.201	0.402	0.0123	U	U	0.198	0.396	0.0121	U	U	0.2	0.4	0.034	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.995	1.99	0.645	U	U	0.201	0.402	0.13	U	U	0.198	0.396	0.128	U	U	0.2	0.4	0.0018	U	U
Isophorone	mg/kg	0.995	1.99	0.0239	U	U	0.201	0.402	0.00483	U	U	0.198	0.396	0.00476	U	U	0.2	0.4	0.026	U	U
Methylnaphthalene, 2-	mg/kg	0.995	1.99	0.522	U	U	0.201	0.402	0.106	U	U	0.198	0.396	0.104	U	U	0.2	0.4	0.0018	U	U
Methylphenol, 2-	mg/kg	0.995	1.99	0.0299	U	U	0.201	0.402	0.00604	U	U	0.198	0.396	0.00595	U	U	0.2	0.4	0.034	U	U
Methylphenol, 4-	mg/kg	0.995	1.99	0.0621	U	U	0.201	0.402	0.0126	U	U	0.198	0.396	0.0124	U	U	0.2	0.4	0.027	U	U
Naphthalene	mg/kg	0.995	1.99	0.0472	U	U	0.201	0.402	0.00954	U	U	0.198	0.396	0.0094	U	U	0.2	0.4	0.002	U	U
Nitroaniline, 2-	mg/kg	0.995	1.99	0.086	U	U	0.201	0.402	0.0174	U	U	0.198	0.396	0.0171	U	U	1	2	0.027	U	U
Nitroaniline, 3-	mg/kg	0.995	1.99	0.0675	U	U	0.201	0.402	0.0136	U	U	0.198	0.396	0.0134	U	U	1	2	0.02	U	U
Nitroaniline, 4-	mg/kg	0.995	1.99	0.705	U	U	0.201	0.402	0.143	U	U	0.198	0.396	0.14	U	U	1	2	0.032	U	U
Nitrobenzene	mg/kg	0.995	1.99	0.0651	U	U	0.201	0.402	0.0132	U	U	0.198	0.396	0.013	U	U	0.2	0.4	0.0027	U	U
Nitrophenol, 2-	mg/kg	0.995	1.99	0.0705	U	U	0.201	0.402	0.0143	U	U	0.198	0.396	0.014	U	U	0.2	0.4	0.023	U	U
Nitrophenol, 4-	mg/kg	0.995	1.99	0.161	U	U	0.201	0.402	0.0326	U	U	0.198	0.396	0.0321	U	U	1	2	0.13	U	U
n-Nitrosodimethylamine	mg/kg	0.995	1.99	0.0598	U	U	0.201	0.402	0.0121	U	U	0.198	0.396	0.0119	U	U					
n-Nitroso-di-n-propylamine	mg/kg	0.995	1.99	0.0711	U	U	0.201	0.402	0.0144	U	U	0.198	0.396	0.0142	U	U	0.2	0.4	0.028	U	U
n-Nitrosodiphenylamine	mg/kg	0.995	1.99	0.0281	U	U	0.201	0.402	0.00568	U	U	0.198	0.396	0.00559	U	U	0.2	0.4	0.026	U	U
Pentachlorophenol	mg/kg	0.995	1.99	0.179	U	U	0.201	0.402	0.0361	U	U	0.198	0.396	0.0356	U	U	0.2	0.4	0.1	U	U
Phenanthrene	mg/kg	0.995	1.99	0.0484	U	U	0.201	0.402	0.00978	U	U	0.198	0.396	0.00964	U	U	0.2	0.4	0.0024	U	U
Phenol	mg/kg	0.995	1.99	0.0239	U	U	0.201	0.402	0.00483	U	U	0.198	0.396	0.00476	U	U	0.2	0.4	0.031	U	U
Pyrene	mg/kg	0.995	1.99	0.0795	U	U	0.201	0.402	0.0161	U	U	0.198	0.396	0.0158	U	U	0.2	0.4	0.0013	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.995	1.99	0.049	U	U	0.201	0.402	0.0099	U	U	0.198	0.396	0.00976	U	U					
Trichlorophenol, 2,4,5-	mg/kg	0.995	1.99	0.171	U	U	0.201	0.402	0.0345	U	U	0.198	0.396	0.034	U	U	0.2	0.4	0.031	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.995	1.99	0.134	U	U	0.201	0.402	0.0272	U	U	0.198	0.396	0.0268	U	U	0.2	0.4	0.026	U	U
VOLATILES																					
Benzene	mg/kg																				
Bromobenzene	mg/kg																				
Bromochloromethane	mg/kg																				
Bromodichloromethane	mg/kg																				
Bromoform	mg/kg																				
Bromomethane	mg/kg																				
Carbon tetrachloride	mg/kg																				
Chlorobenzene	mg/kg																				
Chloroethane	mg/kg																				
Chloroform	mg/kg																				
Chloromethane	mg/kg																				
Chlorotoluene, 2-	mg/kg																				
Chlorotoluene, 4-	mg/kg																				
Dibromo-3-chloropropane, 1,2-	mg/kg																				
Dibromochloromethane	mg/kg																				
Dibromoethane, 1,2-	mg/kg																				
Dibromomethane	mg/kg																				
Dichlorobenzene, 1,2-	mg/kg																				
Dichlorobenzene, 1,3-	mg/kg																				
Dichlorobenzene, 1,4-	mg/kg																				

Table F-1

Soil Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SB09					WWTP3-SB09					WWTP3-SB09					WWTP3-SB09				
SAMPLE_NO		WW0060					WW0061					WW0063					WW0065				
SAMPLE_DATE		11-Dec-08					11-Dec-08					11-Dec-08					11-Dec-08				
FK_DEPTH		_2 - 1_6 Ft					3 - 5 Ft					3 - 5 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					FD					FS				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorodifluoromethane	mg/kg																				
Dichloroethane, 1,1-	mg/kg																				
Dichloroethane, 1,2-	mg/kg																				
Dichloroethene, 1,1-	mg/kg																				
Dichloroethene, cis-1,2-	mg/kg																				
Dichloroethene, trans-1,2-	mg/kg																				
Dichloropropane, 1,2-	mg/kg																				
Dichloropropane, 1,3-	mg/kg																				
Dichloropropane, 2,2-	mg/kg																				
Dichloropropene, 1,1-	mg/kg																				
Ethylbenzene	mg/kg																				
Hexachlorobutadiene	mg/kg																				
Isopropylbenzene	mg/kg																				
Methylene chloride	mg/kg																				
Naphthalene	mg/kg																				
n-Butylbenzene	mg/kg																				
n-Propylbenzene	mg/kg																				
p-Isopropyltoluene	mg/kg																				
sec-Butylbenzene	mg/kg																				
Styrene	mg/kg																				
tert-Butylbenzene	mg/kg																				
Tetrachloroethane, 1,1,1,2-	mg/kg																				
Tetrachloroethane, 1,1,2,2-	mg/kg																				
Tetrachloroethene	mg/kg																				
Toluene	mg/kg																				
Trichlorobenzene, 1,2,3-	mg/kg																				
Trichlorobenzene, 1,2,4-	mg/kg																				
Trichloroethane, 1,1,1-	mg/kg																				
Trichloroethane, 1,1,2-	mg/kg																				
Trichloroethene	mg/kg																				
Trichlorofluoromethane	mg/kg																				
Trichloropropane, 1,2,3-	mg/kg																				
Trimethylbenzene, 1,2,4-	mg/kg																				
Trimethylbenzene, 1,3,5-	mg/kg																				
Vinyl chloride	mg/kg																				
Xylenes, m,p-	mg/kg																				
Xylenes, total	mg/kg																				

FD - Field duplicate
LQ - Laboratory qualifier
MDL - Method detection limit
mg/kg - Milligrams per kilogram.
REG - Regular Sample
RL - Reporting limit
VQ - Validation qualifier
No data

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SDW301					PBOW99-SDW302					WWTP3-SD01					WWTP3-SD01				
SAMPLE_NO		PBOW99SDW301					PBOW99SDW302					WW1004					WW1005				
SAMPLE_DATE		2-Sep-99					2-Sep-99					23-May-09					23-May-09				
FK_DEPTH		_5 - 1 Ft					_5 - 1 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Dinitrobenzene, 1,3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Dinitrotoluene, 2,4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Dinitrotoluene, 2,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
HMX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U											
Nitrobenzene	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Nitrotoluene, 2-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Nitrotoluene, 3-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Nitrotoluene, 4-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
RDX	mg/kg	0.25	0.5	0.5	U		0.25	0.5	0.5	U											
Tetryl	mg/kg	0.325	0.65	0.65	U		0.325	0.65	0.65	U											
Trinitrobenzene, 1,3,5-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
Trinitrotoluene, 2,4,6-	mg/kg	0.125	0.25	0.25	U		0.125	0.25	0.25	U											
METALS (UNFILTERED)																					
Aluminum	mg/kg	8410	24.2	24.2			9580	25.4	25.4												
Antimony	mg/kg	3.65	7.3	7.3	U		3.8	7.6	7.6	U											
Arsenic	mg/kg	7.2	1.2	1.2			6.4	1.3	1.3												
Barium	mg/kg	58.6	24.2	24.2			66.1	25.4	25.4												
Beryllium	mg/kg	0.305	0.61	0.61	U		0.315	0.63	0.63	U											
Cadmium	mg/kg	0.305	0.61	0.61	U		0.315	0.63	0.63	U											
Calcium	mg/kg	33000	605	605			7240	635	635												
Chromium	mg/kg	14.1	1.2	1.2			14.3	1.3	1.3												
Cobalt	mg/kg	8.2	6.1	6.1			7.1	6.3	6.3												
Copper	mg/kg	17.9	3	3			18.9	3.2	3.2												
Iron	mg/kg	18500	12.1	12.1			18300	12.7	12.7												
Lead	mg/kg	9.4	0.36	0.36			18.6	0.38	0.38												
Magnesium	mg/kg	11000	605	605			3780	635	635												
Manganese	mg/kg	390	1.8	1.8			142	1.9	1.9												
Mercury	mg/kg	0.02	0.04	0.04	U		0.047	0.042	0.042												
Nickel	mg/kg	20.5	4.8	4.8			19.1	5.1	5.1												
Potassium	mg/kg	998	605	605			877	635	635												
Selenium	mg/kg	0.71	0.61	0.61			0.99	0.63	0.63												
Silver	mg/kg	0.6	1.2	1.2	U		0.65	1.3	1.3	U											
Sodium	mg/kg	302.5	605	605	U		317.5	635	635	U											
Thallium	mg/kg	1.2	1.2	1.2			0.65	1.3	1.3	U											
Vanadium	mg/kg	22	6.1	6.1			24.5	6.3	6.3												
Zinc	mg/kg	52.6	2.4	2.4			65.2	2.5	2.5												
PESTICIDES/PCBS																					
Aroclor 1016	mg/kg											0.0165	0.033	0.016	U	U	0.0175	0.035	0.017	U	U
Aroclor 1221	mg/kg											0.0165	0.033	0.026	U	U	0.0175	0.035	0.028	U	U
Aroclor 1232	mg/kg											0.0165	0.033	0.026	U	U	0.0175	0.035	0.028	U	U
Aroclor 1242	mg/kg											0.0165	0.033	0.016	U	U	0.0175	0.035	0.017	U	U
Aroclor 1248	mg/kg											0.0165	0.033	0.016	U	U	0.0175	0.035	0.017	U	U

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SDW301					PBOW99-SDW302					WWTP3-SD01					WWTP3-SD01				
SAMPLE_NO		PBOW99SDW301					PBOW99SDW302					WW1004					WW1005				
SAMPLE_DATE		2-Sep-99					2-Sep-99					23-May-09					23-May-09				
FK_DEPTH		_5 - 1 Ft					_5 - 1 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Aroclor 1254	mg/kg											0.0165	0.033	0.016	U	U	0.0175	0.035	0.017	U	U
Aroclor 1260	mg/kg											0.0165	0.033	0.016	U	U	0.0175	0.035	0.017	U	U
SEMIVOLATILES																					
3-Methylphenol and 4-Methylphenol	mg/kg																				
Acenaphthene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Acenaphthylene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Anthracene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzo(a)anthracene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzo(a)pyrene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzo(b)fluoranthene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzo(ghi)perylene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzo(k)fluoranthene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Benzoic acid	mg/kg																				
Benzyl alcohol	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Bis(2-chloroethyl)ether	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Bis(2-chloroisopropyl)ether	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Bis(2-ethylhexyl)phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Bromophenyl phenyl ether, 4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Butyl benzyl phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Carbazole	mg/kg																				
Chloro-3-methylphenol, 4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Chloroaniline, 4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Chloronaphthalene, 2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Chlorophenol, 2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Chlorophenyl phenyl ether, 4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Chrysene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dibenz(a,h)anthracene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dibenzofuran	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dichlorobenzene, 1,2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dichlorobenzene, 1,3-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dichlorobenzene, 1,4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dichlorobenzidine, 3,3'-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Dichlorophenol, 2,4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Diethyl phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dimethyl phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dimethylphenol, 2,4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Di-n-butyl phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dinitro-2-methylphenol, 4,6-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Dinitrophenol, 2,4-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Dinitrotoluene, 2,4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Dinitrotoluene, 2,6-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Di-n-octyl phthalate	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Fluoranthene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Fluorene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		PBOW99-SDW301					PBOW99-SDW302					WWTP3-SD01					WWTP3-SD01				
SAMPLE_NO		PBOW99SDW301					PBOW99SDW302					WW1004					WW1005				
SAMPLE_DATE		2-Sep-99					2-Sep-99					23-May-09					23-May-09				
FK_DEPTH		_5 - 1 Ft					_5 - 1 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		REG					REG					REG					FD				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Hexachlorobenzene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Hexachlorobutadiene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Hexachlorocyclopentadiene	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Hexachloroethane	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Isophorone	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Methylnaphthalene, 2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Methylphenol, 2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Methylphenol, 4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Naphthalene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Nitroaniline, 2-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Nitroaniline, 3-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Nitroaniline, 4-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Nitrobenzene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Nitrophenol, 2-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Nitrophenol, 4-	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
n-Nitroso-di-n-propylamine	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
n-Nitrosodiphenylamine	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Pentachlorophenol	mg/kg	0.95	1.9	1.9	U		1	2	2	U											
Phenanthrene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Phenol	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Pyrene	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Trichlorobenzene, 1,2,4-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Trichlorophenol, 2,4,5-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											
Trichlorophenol, 2,4,6-	mg/kg	0.2	0.4	0.4	U		0.21	0.42	0.42	U											

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.
No data.

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SD01					WWTP3-SD02					WWTP3-SD03				
SAMPLE_NO		WW1006					WW1007					WW1008				
SAMPLE_DATE		23-May-09					23-May-09					23-May-09				
FK_DEPTH		0 - _5 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																
Amino-2,6-dinitrotoluene, 4-	mg/kg											0.1	0.2	0.05	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg											0.1	0.2	0.11	U	U
Dinitrobenzene, 1,3-	mg/kg											0.1	0.2	0.053	U	U
Dinitrotoluene, 2,4-	mg/kg											0.1	0.2	0.06	U	U
Dinitrotoluene, 2,6-	mg/kg											0.1	0.2	0.053	U	U
HMX	mg/kg											0.1	0.2	0.086	U	U
Nitrobenzene	mg/kg											0.1	0.2	0.066	U	U
Nitrotoluene, 2-	mg/kg											0.1	0.2	0.05	U	U
Nitrotoluene, 3-	mg/kg											0.1	0.2	0.084	U	U
Nitrotoluene, 4-	mg/kg											0.1	0.2	0.062	U	U
RDX	mg/kg											0.1	0.2	0.085	U	U
Tetryl	mg/kg											0.1	0.2	0.051	U	U
Trinitrobenzene, 1,3,5-	mg/kg											0.1	0.2	0.05	U	U
Trinitrotoluene, 2,4,6-	mg/kg											0.1	0.2	0.05	U	U
METALS (UNFILTERED)																
Aluminum	mg/kg											9000	21	1.2		
Antimony	mg/kg											3.15	6.3	0.48	U	U
Arsenic	mg/kg											6.8	0.85	0.38		
Barium	mg/kg											82.5	21	0.53		
Beryllium	mg/kg											0.64	0.53	0.11		
Cadmium	mg/kg											0.86	0.42	0.11		
Calcium	mg/kg											31300	530	11		
Chromium	mg/kg											15.1	1.1	0.17		
Cobalt	mg/kg											11.4	5.3	0.088		
Copper	mg/kg											26.4	2.6	0.22		
Iron	mg/kg											19300	11	2.4		
Lead	mg/kg											16.1	11	0.21		
Magnesium	mg/kg											10400	530	11		
Manganese	mg/kg											1870	16	0.53		
Mercury	mg/kg											0.058	0.18	0.025	B	J
Nickel	mg/kg											23.7	4.2	0.24		
Potassium	mg/kg											1180	2200	11	B	B
Selenium	mg/kg											2.8	11	0.33	B	J
Silver	mg/kg											0.55	1.1	0.13	U	U
Sodium	mg/kg											172	2200	53	B	J
Thallium	mg/kg											2.2	4.4	1.44	U	U
Vanadium	mg/kg											24.3	5.3	0.07		
Zinc	mg/kg											71.9	2.1	0.4		
PESTICIDES/PCBS																
Aroclor 1016	mg/kg	0.034	0.068	0.043	U	U	0.0125	0.025	0.012	U	U	0.0175	0.035	0.018	U	U
Aroclor 1221	mg/kg	0.034	0.068	0.033	U	U	0.0125	0.025	0.02	U	U	0.0175	0.035	0.028	U	U
Aroclor 1232	mg/kg	0.034	0.068	0.029	U	U	0.0125	0.025	0.02	U	U	0.0175	0.035	0.028	U	U
Aroclor 1242	mg/kg	0.034	0.068	0.027	U	U	0.0125	0.025	0.012	U	U	0.0175	0.035	0.018	U	U
Aroclor 1248	mg/kg	0.034	0.068	0.035	U	U	0.0125	0.025	0.012	U	U	0.0175	0.035	0.018	U	U

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SD01					WWTP3-SD02					WWTP3-SD03				
SAMPLE_NO		WW1006					WW1007					WW1008				
SAMPLE_DATE		23-May-09					23-May-09					23-May-09				
FK_DEPTH		0 - _5 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Aroclor 1254	mg/kg	0.034	0.068	0.035	U	U	0.0125	0.025	0.012	U	U	0.0175	0.035	0.018	U	U
Aroclor 1260	mg/kg	0.034	0.068	0.035	U	U	0.0125	0.025	0.012	U	U	0.0175	0.035	0.018	U	U
SEMIVOLATILES																
3-Methylphenol and 4-Methylphenol	mg/kg											0.175	0.35	0.07	U	U
Acenaphthene	mg/kg											0.175	0.35	0.07	U	U
Acenaphthylene	mg/kg											0.175	0.35	0.07	U	U
Anthracene	mg/kg											0.175	0.35	0.07	U	U
Benzo(a)anthracene	mg/kg											0.175	0.35	0.07	U	U
Benzo(a)pyrene	mg/kg											0.12	0.35	0.07	J	J
Benzo(b)fluoranthene	mg/kg											0.191	0.35	0.07	J	J
Benzo(ghi)perylene	mg/kg											0.105	0.35	0.07	J	J
Benzo(k)fluoranthene	mg/kg											0.175	0.35	0.07	U	U
Benzoic acid	mg/kg											0.9	1.8	0.7	U	U
Benzyl alcohol	mg/kg											0.175	0.35	0.07	U	U
Bis(2-chloroethoxy)methane	mg/kg											0.175	0.35	0.07	U	U
Bis(2-chloroethyl)ether	mg/kg											0.175	0.35	0.07	U	U
Bis(2-chloroisopropyl)ether	mg/kg											0.175	0.35	0.07	U	U
Bis(2-ethylhexyl)phthalate	mg/kg											0.35	0.7	0.35	U	U
Bromophenyl phenyl ether, 4-	mg/kg											0.175	0.35	0.07	U	U
Butyl benzyl phthalate	mg/kg											0.35	0.7	0.14	U	U
Carbazole	mg/kg											0.175	0.35	0.07	U	U
Chloro-3-methylphenol, 4-	mg/kg											0.175	0.35	0.07	U	U
Chloroaniline, 4-	mg/kg											0.175	0.35	0.14	U	U
Chloronaphthalene, 2-	mg/kg											0.175	0.35	0.07	U	U
Chlorophenol, 2-	mg/kg											0.175	0.35	0.07	U	U
Chlorophenyl phenyl ether, 4-	mg/kg											0.175	0.35	0.07	U	U
Chrysene	mg/kg											0.103	0.35	0.07	J	J
Dibenz(a,h)anthracene	mg/kg											0.175	0.35	0.07	U	U
Dibenzofuran	mg/kg											0.175	0.35	0.07	U	U
Dichlorobenzene, 1,2-	mg/kg											0.175	0.35	0.092	U	U
Dichlorobenzene, 1,3-	mg/kg											0.175	0.35	0.092	U	U
Dichlorobenzene, 1,4-	mg/kg											0.175	0.35	0.085	U	U
Dichlorobenzidine, 3,3'-	mg/kg											0.35	0.7	0.14	U	U
Dichlorophenol, 2,4-	mg/kg											0.175	0.35	0.07	U	U
Diethyl phthalate	mg/kg											0.35	0.7	0.35	U	U
Dimethyl phthalate	mg/kg											0.35	0.7	0.14	U	U
Dimethylphenol, 2,4-	mg/kg											0.175	0.35	0.07	U	U
Di-n-butyl phthalate	mg/kg											0.35	0.7	0.14	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg											0.35	0.7	0.23	U	U
Dinitrophenol, 2,4-	mg/kg											0.9	1.8	0.7	U	UJ
Dinitrotoluene, 2,4-	mg/kg											0.175	0.35	0.07	U	U
Dinitrotoluene, 2,6-	mg/kg											0.175	0.35	0.07	U	U
Di-n-octyl phthalate	mg/kg											0.35	0.7	0.14	U	U
Fluoranthene	mg/kg											0.156	0.35	0.07	J	J
Fluorene	mg/kg											0.175	0.35	0.07	U	U

Table F-2

Sediment Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE		WWTP3-SD01					WWTP3-SD02					WWTP3-SD03				
SAMPLE_NO		WW1006					WW1007					WW1008				
SAMPLE_DATE		23-May-09					23-May-09					23-May-09				
FK_DEPTH		0 - _5 Ft					0 - _5 Ft					0 - _5 Ft				
SAMPLE_PURPOSE		FS					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Hexachlorobenzene	mg/kg											0.175	0.35	0.07	U	U
Hexachlorobutadiene	mg/kg											0.175	0.35	0.07	U	U
Hexachlorocyclopentadiene	mg/kg											0.175	0.35	0.07	U	U
Hexachloroethane	mg/kg											0.175	0.35	0.085	U	U
Indeno(1,2,3-cd)pyrene	mg/kg											0.11	0.35	0.07	J	J
Isophorone	mg/kg											0.175	0.35	0.07	U	U
Methylnaphthalene, 2-	mg/kg											0.175	0.35	0.07	U	U
Methylphenol, 2-	mg/kg											0.175	0.35	0.07	U	U
Methylphenol, 4-	mg/kg															
Naphthalene	mg/kg											0.175	0.35	0.07	U	U
Nitroaniline, 2-	mg/kg											0.35	0.7	0.14	U	U
Nitroaniline, 3-	mg/kg											0.35	0.7	0.14	U	U
Nitroaniline, 4-	mg/kg											0.35	0.7	0.14	U	U
Nitrobenzene	mg/kg											0.175	0.35	0.07	U	U
Nitrophenol, 2-	mg/kg											0.175	0.35	0.07	U	U
Nitrophenol, 4-	mg/kg											0.9	1.8	0.7	U	U
n-Nitroso-di-n-propylamine	mg/kg											0.175	0.35	0.07	U	U
n-Nitrosodiphenylamine	mg/kg											0.175	0.35	0.14	U	U
Pentachlorophenol	mg/kg											0.9	1.8	0.7	U	U
Phenanthrene	mg/kg											0.175	0.35	0.07	U	U
Phenol	mg/kg											0.175	0.35	0.07	U	U
Pyrene	mg/kg											0.138	0.35	0.07	J	J
Trichlorobenzene, 1,2,4-	mg/kg											0.175	0.35	0.07	U	U
Trichlorophenol, 2,4,5-	mg/kg											0.175	0.35	0.07	U	U
Trichlorophenol, 2,4,6-	mg/kg											0.175	0.35	0.07	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.
No data.

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

		LOCATION_CODE	WWTP3-SW01					WWTP3-SW02					WWTP3-SW03				
		SAMPLE_NO	WW2004					WW2005					WW2006				
		SAMPLE_DATE	23-May-09					23-May-09					23-May-09				
		FK_DEPTH	0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			REG					REG					REG				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES																	
Amino-2,6-dinitrotoluene, 4-	N	µg/L	0.095	0.19	0.048	U	U	0.095	0.19	0.048	U	U	0.095	0.19	0.049	U	U
Amino-4,6-dinitrotoluene, 2-	N	µg/L	0.095	0.19	0.074	U	U	0.095	0.19	0.074	U	U	0.095	0.19	0.075	U	U
Dinitrobenzene, 1,3-	N	µg/L	0.095	0.19	0.049	U	U	0.095	0.19	0.049	U	U	0.095	0.19	0.05	U	U
Dinitrotoluene, 2,4-	N	µg/L	0.095	0.19	0.062	U	U	0.095	0.19	0.062	U	U	0.095	0.19	0.063	U	U
Dinitrotoluene, 2,6-	N	µg/L	0.095	0.19	0.089	U	U	0.095	0.19	0.089	U	U	0.095	0.19	0.09	U	U
HMX	N	µg/L	0.095	0.19	0.1	U	U	0.095	0.19	0.1	U	U	0.095	0.19	0.11	U	U
Nitrobenzene	N	µg/L	0.095	0.19	0.048	U	U	0.095	0.19	0.048	U	U	0.095	0.19	0.049	U	U
Nitrotoluene, 2-	N	µg/L	0.095	0.19	0.062	U	U	0.095	0.19	0.062	U	U	0.095	0.19	0.062	U	U
Nitrotoluene, 3-	N	µg/L	0.095	0.19	0.093	U	U	0.095	0.19	0.093	U	U	0.095	0.19	0.094	U	U
Nitrotoluene, 4-	N	µg/L	0.095	0.19	0.073	U	U	0.095	0.19	0.073	U	U	0.095	0.19	0.074	U	U
RDX	N	µg/L	0.095	0.19	0.072	U	U	0.095	0.19	0.072	U	U	0.095	0.19	0.073	U	U
Tetryl	N	µg/L	0.095	0.19	0.075	U	U	0.095	0.19	0.075	U	U	0.095	0.19	0.076	U	U
Trinitrobenzene, 1,3,5-	N	µg/L	0.095	0.19	0.048	U	U	0.095	0.19	0.048	U	U	0.095	0.19	0.049	U	U
Trinitrotoluene, 2,4,6-	N	µg/L	0.095	0.19	0.066	U	U	0.095	0.19	0.066	U	U	0.095	0.19	0.067	U	U
FIELD TESTS																	
Dissolved Oxygen	N	mg/L	3.67	0.3				3.09	0.3								
Oxidation Reduction Potential	N	mV	70.7	0.02				61.4	0.02								
pH	N	pH_units	6.94	0				6.68	0								
Specific Conductivity	N	mS/cm	0.827	0				0.681	0								
Temperature	N	C	21.22	0				11.88	0								
Turbidity	N	NTU	199.7	10				12.4	10								
METALS (UNFILTERED)																	
Aluminum	N	µg/L	1420	200	11			1660	200	11			2940	200	11		J
Antimony	N	µg/L	3	6	4.5	U	U	3	6	4.5	U	U	3	6	4.5	U	U
Arsenic	N	µg/L	6.1	10	3.6	B	J	5	10	3.6	U	U	9.4	10	3.6	B	J
Barium	N	µg/L	65.4	200	5	B	J	47	200	5	B	J	106	200	5	B	J
Beryllium	N	µg/L	2	4	1	U	U	2	4	1	U	U	2	4	1	U	U
Cadmium	N	µg/L	2.5	5	1	U	U	2.5	5	1	U	U	2.5	5	1	U	U
Calcium	N	µg/L	110000	1000	100			91200	1000	100			123000	1000	100		
Chromium	N	µg/L	2.1	10	1.6	B	J	2.5	10	1.6	B	J	4.4	10	1.6	B	J
Cobalt	N	µg/L	2.1	50	0.83	B	J	1.6	50	0.83	B	J	6.2	50	0.83	B	J
Copper	N	µg/L	6.9	25	2.1	B	J	12.5	25	2.1	U	U	8.8	25	2.1	B	J
Iron	N	µg/L	2440	300	23			4190	300	23			10600	300	23		
Lead	N	µg/L	4.5	5	2	B	J	2.2	5	2	B	J	7.4	5	2		
Magnesium	N	µg/L	24100	5000	100			23600	5000	100			29900	5000	100		
Manganese	N	µg/L	788	15	0.5			134	15	0.5			2030	15	0.5		
Mercury	N	µg/L	0.5	1	0.14	U	U	0.5	1	0.14	U	U	0.5	1	0.14	U	U
Nickel	N	µg/L	20	40	2.3	U	U	20	40	2.3	U	U	3.4	40	2.3	B	J
Potassium	N	µg/L	776	20000	100	B	J	703	20000	100	B	J	1300	20000	100	B	J
Selenium	N	µg/L	5	10	3.1	U	U	5	10	3.1	U	U	4.3	10	3.1	B	J
Silver	N	µg/L	5	10	1.2	U	U	5	10	1.2	U	U	5	10	1.2	U	U

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

LOCATION_CODE			WWTP3-SW01					WWTP3-SW02					WWTP3-SW03				
SAMPLE_NO			WW2004					WW2005					WW2006				
SAMPLE_DATE			23-May-09					23-May-09					23-May-09				
FK_DEPTH			0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			REG					REG					REG				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Sodium	N	µg/L	4480	20000	500	B	J	3850	20000	500	B	J	4810	20000	500	B	J
Thallium	N	µg/L	5	10	3.4	U	U	5	10	3.4	U	U	5	10	3.4	U	U
Vanadium	N	µg/L	5	50	0.66	B	J	4.7	50	0.66	B	J	8.7	50	0.66	B	J
Zinc	N	µg/L	21.7	20	3.8		B	19.4	20	3.8	B	B	36.3	20	3.8		B
SEMIVOLATILES																	
3-Methylphenol and 4-Methylphenol	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Acenaphthene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Acenaphthylene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
ACETOPHENONE	N	µg/L															
Anthracene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Atrazine	N	µg/L															
Benzaldehyde	N	µg/L															
Benzo(a)anthracene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Benzo(a)pyrene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Benzo(b)fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Benzo(ghi)perylene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Benzo(k)fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Benzoic acid	N	µg/L	12	24	9.6	U	U	12	24	9.6	U	U	12	24	9.6	U	U
Benzyl alcohol	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
BIBENZENE	N	µg/L															
Bis(2-chloroethoxy)methane	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Bis(2-chloroethyl)ether	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Bis(2-chloroisopropyl)ether	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Bis(2-ethylhexyl)phthalate	N	µg/L	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U
Bromophenyl phenyl ether, 4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Butyl benzyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Caprolactam	N	µg/L															
Carbazole	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Chloro-3-methylphenol, 4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Chloroaniline, 4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Chloronaphthalene, 2-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Chlorophenol, 2-	N	µg/L	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U
Chlorophenyl phenyl ether, 4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Chrysene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dibenz(a,h)anthracene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dibenzofuran	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dichlorobenzene, 1,2-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dichlorobenzene, 1,3-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dichlorobenzene, 1,4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dichlorobenzidine, 3,3'-	N	µg/L	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U
Dichlorophenol, 2,4-	N	µg/L	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U
Diethyl phthalate	N	µg/L	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

		LOCATION_CODE	WWTP3-SW01					WWTP3-SW02					WWTP3-SW03				
		SAMPLE_NO	WW2004					WW2005					WW2006				
		SAMPLE_DATE	23-May-09					23-May-09					23-May-09				
		FK_DEPTH	0 - 0 Ft					0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			REG					REG					REG				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dimethyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dimethylphenol, 2,4-	N	µg/L	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U
Di-n-butyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dinitro-2-methylphenol, 4,6-	N	µg/L	4.8	9.6	3.8	U	U	4.8	9.6	3.8	U	U	4.8	9.6	3.8	U	U
Dinitrophenol, 2,4-	N	µg/L	12	24	9.6	U	U	12	24	9.6	U	U	12	24	9.6	U	U
Dinitrotoluene, 2,4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Dinitrotoluene, 2,6-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Di-n-octyl phthalate	N	µg/L	2.4	4.8	1.4	U	U	2.4	4.8	1.4	U	U	2.4	4.8	1.4	U	U
Fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Fluorene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Hexachlorobenzene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Hexachlorobutadiene	N	µg/L	2.4	4.8	2.4	U	U	2.4	4.8	2.4	U	U	2.4	4.8	2.4	U	U
Hexachlorocyclopentadiene	N	µg/L	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U
Hexachloroethane	N	µg/L	2.4	4.8	2.4	U	U	2.4	4.8	2.4	U	U	2.4	4.8	2.4	U	U
Indeno(1,2,3-cd)pyrene	N	µg/L	2.4	4.8	1.1	U	U	2.4	4.8	1.1	U	U	2.4	4.8	1.1	U	U
Isophorone	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Methylnaphthalene, 2-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Methylphenol, 2-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Methylphenol, 4-	N	µg/L															
Naphthalene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Nitroaniline, 2-	N	µg/L	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U
Nitroaniline, 3-	N	µg/L	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U
Nitroaniline, 4-	N	µg/L	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U	4.8	9.6	1.9	U	U
Nitrobenzene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Nitrophenol, 2-	N	µg/L	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U	2.4	4.8	1.2	U	U
Nitrophenol, 4-	N	µg/L	12	24	9.6	U	U	12	24	9.6	U	U	12	24	9.6	U	U
n-Nitroso-di-n-propylamine	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
n-Nitrosodiphenylamine	N	µg/L	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U	2.4	4.8	1.9	U	U
Pentachlorophenol	N	µg/L	12	24	9.6	U	U	12	24	9.6	U	U	12	24	9.6	U	U
Phenanthrene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Phenol	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Pyrene	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Trichlorobenzene, 1,2,4-	N	µg/L	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U	2.4	4.8	0.96	U	U
Trichlorophenol, 2,4,5-	N	µg/L	2.4	4.8	1.3	U	U	2.4	4.8	1.3	U	U	2.4	4.8	1.3	U	U
Trichlorophenol, 2,4,6-	N	µg/L	2.4	4.8	1.3	U	U	2.4	4.8	1.3	U	U	2.4	4.8	1.3	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
µg/L - Micrograms per liter.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

		LOCATION_CODE	WWTP3-SW03					WWTP3-SW03				
		SAMPLE_NO	WW2007					WW2008				
		SAMPLE_DATE	23-May-09					23-May-09				
		FK_DEPTH	0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			FD					FS				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
EXPLOSIVES												
Amino-2,6-dinitrotoluene, 4-	N	µg/L	0.095	0.19	0.048	U	U	0.1	0.2	0.019	U	U
Amino-4,6-dinitrotoluene, 2-	N	µg/L	0.095	0.19	0.073	U	U	0.1	0.2	0.017	U	U
Dinitrobenzene, 1,3-	N	µg/L	0.095	0.19	0.049	U	U	0.1	0.2	0.01	U	U
Dinitrotoluene, 2,4-	N	µg/L	0.095	0.19	0.062	U	U	0.1	0.2	0.022	U	U
Dinitrotoluene, 2,6-	N	µg/L	0.095	0.19	0.089	U	U	0.1	0.2	0.017	U	U
HMX	N	µg/L	0.095	0.19	0.1	U	U	0.25	0.5	0.034	U	U
Nitrobenzene	N	µg/L	0.095	0.19	0.048	U	U	0.1	0.2	0.019	U	U
Nitrotoluene, 2-	N	µg/L	0.095	0.19	0.061	U	U	0.1	0.2	0.031	U	U
Nitrotoluene, 3-	N	µg/L	0.095	0.19	0.092	U	U	0.1	0.2	0.024	U	U
Nitrotoluene, 4-	N	µg/L	0.095	0.19	0.072	U	U	0.1	0.2	0.036	U	U
RDX	N	µg/L	0.095	0.19	0.071	U	U	0.25	0.5	0.022	U	U
Tetryl	N	µg/L	0.095	0.19	0.074	U	U	0.1	0.2	0.033	U	U
Trinitrobenzene, 1,3,5-	N	µg/L	0.095	0.19	0.048	U	U	0.1	0.2	0.013	U	U
Trinitrotoluene, 2,4,6-	N	µg/L	0.095	0.19	0.066	U	U	0.1	0.2	0.017	U	U
FIELD TESTS												
Dissolved Oxygen	N	mg/L	8.98	0.3								
Oxidation Reduction Potential	N	mV	124.1	0.02								
pH	N	pH_units	7.39	0								
Specific Conductivity	N	mS/cm	0.855	0								
Temperature	N	C	11.88	0								
Turbidity	N	NTU	9.9	10								
METALS (UNFILTERED)												
Aluminum	N	µg/L	4240	200	11		J	12100	200	97		
Antimony	N	µg/L	3	6	4.5	U	U	30	60	1.8	U	U
Arsenic	N	µg/L	5	10	3.6	U	U	12.1	10	3.2		
Barium	N	µg/L	104	200	5	B	J	100	200	0.67	U	U
Beryllium	N	µg/L	2	4	1	U	U	2.5	5	0.46	U	U
Cadmium	N	µg/L	2.5	5	1	U	U	2.5	5	0.66	U	U
Calcium	N	µg/L	116000	1000	100			130000	5000	130		
Chromium	N	µg/L	6.9	10	1.6	B	J	16	10	2.2		
Cobalt	N	µg/L	5.7	50	0.83	B	J	25	50	1.7	U	U
Copper	N	µg/L	8	25	2.1	B	J	12.5	25	4.5	U	U
Iron	N	µg/L	12000	300	23			27500	100	81		
Lead	N	µg/L	7	5	2			13.9	3	1.9		
Magnesium	N	µg/L	28700	5000	100			34400	5000	34		
Manganese	N	µg/L	1930	15	0.5			2120	15	0.41		
Mercury	N	µg/L	0.5	1	0.14	U	U	0.1	0.2	0.12	U	U
Nickel	N	µg/L	4.8	40	2.3	B	J	20	40	3.2	U	U
Potassium	N	µg/L	1630	20000	100	B	J	2500	5000	72	U	U
Selenium	N	µg/L	4.9	10	3.1	B	J	2.5	5	4.1	U	U
Silver	N	µg/L	5	10	1.2	U	U	5	10	2.2	U	U

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

		LOCATION_CODE	WWTP3-SW03					WWTP3-SW03				
		SAMPLE_NO	WW2007					WW2008				
		SAMPLE_DATE	23-May-09					23-May-09				
		FK_DEPTH	0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			FD					FS				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Sodium	N	µg/L	5100	20000	500	B	J	7040	5000	590		
Thallium	N	µg/L	5	10	3.4	U	U	5	10	4.7	U	U
Vanadium	N	µg/L	10.6	50	0.66	B	J	25	50	0.64	U	U
Zinc	N	µg/L	38.5	20	3.8		B	82.9	20	5		
SEMIVOLATILES												
3-Methylphenol and 4-Methylphenol	N	µg/L	2.4	4.8	0.96	U	U					
Acenaphthene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Acenaphthylene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
ACETOPHENONE	N	µg/L						5	10	0.34	U	U
Anthracene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Atrazine	N	µg/L						5	10	0.34	U	U
Benzaldehyde	N	µg/L						5	10	0.39	U	U
Benzo(a)anthracene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Benzo(a)pyrene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Benzo(b)fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Benzo(ghi)perylene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Benzo(k)fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Benzoic acid	N	µg/L	12	24	9.6	U	U					
Benzyl alcohol	N	µg/L	2.4	4.8	0.96	U	U					
BIBENZENE	N	µg/L						5	10	0.8	U	U
Bis(2-chloroethoxy)methane	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.32	U	U
Bis(2-chloroethyl)ether	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Bis(2-chloroisopropyl)ether	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.4	U	U
Bis(2-ethylhexyl)phthalate	N	µg/L	2.4	4.8	1.9	U	U	5	10	0.8	U	U
Bromophenyl phenyl ether, 4-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Butyl benzyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Caprolactam	N	µg/L						5	10	0.8	U	U
Carbazole	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.28	U	U
Chloro-3-methylphenol, 4-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Chloroaniline, 4-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Chloronaphthalene, 2-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Chlorophenol, 2-	N	µg/L	2.4	4.8	1.2	U	U	5	10	0.29	U	U
Chlorophenyl phenyl ether, 4-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.3	U	U
Chrysene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Dibenz(a,h)anthracene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Dibenzofuran	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Dichlorobenzene, 1,2-	N	µg/L	2.4	4.8	0.96	U	U					
Dichlorobenzene, 1,3-	N	µg/L	2.4	4.8	0.96	U	U					
Dichlorobenzene, 1,4-	N	µg/L	2.4	4.8	0.96	U	U					
Dichlorobenzidine, 3,3'-	N	µg/L	4.8	9.6	1.9	U	U	25	50	0.37	U	U
Dichlorophenol, 2,4-	N	µg/L	2.4	4.8	1.2	U	U	5	10	0.8	U	U
Diethyl phthalate	N	µg/L	2.4	4.8	1.9	U	U	5	10	0.6	U	U

Table F-3

Surface Water Data Used in the Screening-Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio

		LOCATION_CODE	WWTP3-SW03					WWTP3-SW03				
		SAMPLE_NO	WW2007					WW2008				
		SAMPLE_DATE	23-May-09					23-May-09				
		FK_DEPTH	0 - 0 Ft					0 - 0 Ft				
SAMPLE_PURPOSE			FD					FS				
Parameter	Filtered	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dimethyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.29	U	U
Dimethylphenol, 2,4-	N	µg/L	2.4	4.8	1.2	U	U	5	10	0.8	U	U
Di-n-butyl phthalate	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.67	U	U
Dinitro-2-methylphenol, 4,6-	N	µg/L	4.8	9.6	3.8	U	U	25	50	2.4	U	U
Dinitrophenol, 2,4-	N	µg/L	12	24	9.6	U	U	25	50	2.4	U	U
Dinitrotoluene, 2,4-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.27	U	U
Dinitrotoluene, 2,6-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Di-n-octyl phthalate	N	µg/L	2.4	4.8	1.4	U	U	5	10	0.8	U	U
Fluoranthene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Fluorene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Hexachlorobenzene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Hexachlorobutadiene	N	µg/L	2.4	4.8	2.4	U	U	5	10	0.27	U	U
Hexachlorocyclopentadiene	N	µg/L	2.4	4.8	1.2	U	U	5	10	0.8	U	U
Hexachloroethane	N	µg/L	2.4	4.8	2.4	U	U	5	10	0.8	U	U
Indeno(1,2,3-cd)pyrene	N	µg/L	2.4	4.8	1.1	U	U	5	10	0.1	U	U
Isophorone	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.27	U	U
Methylnaphthalene, 2-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Methylphenol, 2-	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
Methylphenol, 4-	N	µg/L						5	10	0.8	U	U
Naphthalene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Nitroaniline, 2-	N	µg/L	4.8	9.6	1.9	U	U	25	50	0.8	U	U
Nitroaniline, 3-	N	µg/L	4.8	9.6	1.9	U	U	25	50	0.28	U	U
Nitroaniline, 4-	N	µg/L	4.8	9.6	1.9	U	U	25	50	0.8	U	U
Nitrobenzene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.04	U	U
Nitrophenol, 2-	N	µg/L	2.4	4.8	1.2	U	U	5	10	0.28	U	U
Nitrophenol, 4-	N	µg/L	12	24	9.6	U	U	25	50	2.4	U	U
n-Nitroso-di-n-propylamine	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.8	U	U
n-Nitrosodiphenylamine	N	µg/L	2.4	4.8	1.9	U	U	5	10	0.31	U	U
Pentachlorophenol	N	µg/L	12	24	9.6	U	U	5	10	2.4	U	U
Phenanthrene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Phenol	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.6	U	U
Pyrene	N	µg/L	2.4	4.8	0.96	U	U	5	10	0.1	U	U
Trichlorobenzene, 1,2,4-	N	µg/L	2.4	4.8	0.96	U	U					
Trichlorophenol, 2,4,5-	N	µg/L	2.4	4.8	1.3	U	U	5	10	0.3	U	U
Trichlorophenol, 2,4,6-	N	µg/L	2.4	4.8	1.3	U	U	5	10	0.8	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
µg/L - Micrograms per liter.

REG - Regular sar
RL - Reporting limi
VQ - Validation qu

RESPONSE TO COMMENTS

Response to Ohio Environmental Protection Agency Comments
Draft Baseline Human Health Risk Assessment and
Draft Screening Level Ecological Risk Assessment
Waste Water Treatment Plant No. 3
Plum Brook Ordnance Works, Sandusky, Ohio,
Dated August 10, 2012
FUDS Project No. G05OH001817

Comments by Janusz Byczkowski, Ph.D., Ohio Environmental Protection Agency (OEPA) Toxicologist, received January 30, 2013.

Comment 1: **Baseline Human Health Risk Assessment (BHHRA), ES. P. ES-2 L#13, Section. 2.4.3.1, P. 2-7 L# 26 and Screening Level Ecological Risk Assessment Section (SLERA) . 2.2.3.3 P. 2-12 L# 21, Section 2.2.1 P.2-9, L# 14. <u>This document states:</u> In BHHRA: "…*This background screening protocol, which is based on PBOW Project Delivery Team agreement, differs somewhat from the current Ohio environmental Protection Agency guidance*…" In both, BHHRA and SLERA: "…*This PBOW team agreement, which has been used for all PBOW risk assessments to date, takes precedence over OEPA (2009) guidance*…" and also in SLERA: "…*Potential source of background information include data from previous and current investigations as well as monitoring wells in areas unaffected by site activities*…"**

The issue of determining background and the "agreement" was already discussed in previous reviews. Please note that no legally binding agreement has been made with ACE or Shaw Environmental Inc., regarding risk assessment at the NASA Plum Brook Site. Recommendation: Please provide justification for not applying in BHHRA and SLERA the recommended OEPA-DERR (2009) methodology.

Response 1: A statement consistent with the following will be added to the first paragraph of Section 2.4.3.1 of the BHHRA and to the second paragraph of Section 2.2.3.3 of the SLERA: "*Use of this method for the development of BSCs and as part of the COPC screening process ensures consistency between all of the PBOW FUDS project sites.*"

The sentence referenced by the reviewer on Page 2-9 (beginning, "Potential sources of background…") will be deleted.

Comment 2: **BHHRA S. 9.0 P. 8-1 L# 6; S.9.0, P. 8-4 L# 27; S.9.0 P. 8-4 L#30 Table 3-2 P. 4, L# 11. This document states: "… http://www.oehha.co.gov/risk/ChemicalDB/index.asp …" Also "… http://www.epa.gov/superfund/programs/lead/products.htm …" and "… http://www.epa.gov/region09/waste/sfund/prg/files/04usersguide.pdf …" Some Internet links do not work. Recommendation: Please check and correct/update URLs.**

Response 2: The URLs will be updated as requested. Correct URLs are as follows:
http://oehha.ca.gov/risk/chemicaldb/index.asp
http://www.epa.gov/superfund/lead/pbrisk.htm
http://www.epa.gov/region9/superfund/prg/files/04usersguide.pdf