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January 12, 2009

U.S. Army Engineer District, Nashville
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**Submittal of the Final Work Plan for the Remedial Investigation**
**Ash Pit 2**
**Former Plum Brook Ordnance Works, Sandusky, Ohio**
**Contract No. W912QR-08-D-0013: Shaw Project Number 133422**

Dear Ms. McClanahan:

In accordance with the requirements of Delivery Order No. DX05 of Contract No. W912QR-08-D-0013 Shaw is pleased to submit the final Work Plan for the Remedial Investigation to be conducted at Ash Pit 2 of the Former Plum Brook Ordnance Works located in Sandusky, Ohio.

Enclosed are four copies of this final work plan. Control copies of the report have been distributed as shown on the attached page, with an electronic copy being sent to the Center for Expertise.

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

Sincerely,

Steven T. Downey, PE
Project Manager

Enclosures

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Project Description: Remedial Investigation of the Locomotive Building Area
Former Plum Brook Ordnance Works, Sandusky, Ohio

Contract No. W912QR-08-D-0013

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# Attachment III

# Site-Specific Sampling and Analysis Plan
# Remedial Investigation
# Ash Pit 2

# Former Plum Brook Ordnance Works, Sandusky, Ohio

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## *List of Acronyms*

| | |
|---|---|
| AOC | area of concern |
| ASTM | American Society for Testing and Materials |
| bgs | below ground surface |
| $^{o}C$ | degrees Celsius |
| DNT | dinitrotoluene |
| DQO | data quality objective |
| Eh | oxygen-reduction potential |
| EPA | U.S. Environmental Protection Agency |
| FADL | field activity daily log |
| IDW | investigation-derived waste |
| IT | IT Corporation |
| LEL | lower explosive limit |
| mL/min | milliliters per minute |
| NASA | National Aeronautics and Space Administration |
| NTU | nephelometric turbidity unit |
| ODNR | Ohio Department of Natural Resources |
| OEPA | Ohio Environmental Protection Agency |
| PARCCS | precision, accuracy, completeness, comparability, and sensitivity |
| PBOW | Plum Brook Ordnance Works |
| PCB | polychlorinated biphenyl |
| PID | photoionization detector |
| PPE | personal protective equipment |
| PRG | preliminary remediation goal |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QAPP | quality assurance project plan |
| QC | quality control |
| RBC | risk-based concentration |
| RBSC | risk-based screening concentration |
| RI | remedial investigation |
| SI | site investigation |
| Shaw | Shaw Environmental, Inc. |
| SSAP | site-specific sampling and analysis plan |
| SVOC | semivolatile organic compound |

## *List of Acronyms* *(Continued)*

| | |
|---|---|
| SWSAP | site-wide sampling and analysis plan |
| TAL | target analyte list |
| TCL | target compound list |
| TOC | total organic carbon |
| TNTA | TNT Area A |
| USACE | U.S. Army Corps of Engineers |
| VOC | volatile organic compound |

# 1.0 Project Description

The U.S. Army is conducting studies of the environmental impact of suspected hazardous waste sites at previously owned U.S. Department of Defense properties. The former Plum Brook Ordnance Works (PBOW) is located in Sandusky, Erie County, Ohio (Figure 1-1). PBOW is being investigated under the Defense Environmental Restoration Program for Formerly Used Defense Sites. The investigation is being managed and technically overseen by the Nashville District of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station of the John Glenn Research Center at Lewis Field.

This site-specific sampling and analysis plan (SSAP) has been prepared by Shaw Environmental, Inc. (Shaw) for the fieldwork to be carried out in support of the remedial investigation (RI) for Ash Pit 2, which is located west of Campbell Street and east of Pipe Creek. This SSAP was developed in accordance with the PBOW site-wide sampling and analysis plan (SWSAP) (Shaw, 2008a) and the quality assurance project plan (QAPP) (Shaw, 2008b) to ensure that work performed at the subject site will be of the quality required to satisfy the overall and site-specific project objectives. This SSAP is Attachment III to the SWSAP. A site-wide accident prevention/sitewide safety and health plan (Shaw, 2008c) has also been prepared for this investigation to help provide a safe work environment.

## 1.1 Plum Brook Ordnance Works Facility History

The PBOW site was built in early 1941 and manufactured 2,4,6- trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives began in December 1941 and continued until 1945. After the plant was shut down, decontamination of TNT, acid, pentolite, and DNT processing lines began; decontamination was completed by the Army during the last quarter of 1945. The property was under the supervision of the Army Ordnance Department. The War Assets Administration accepted custody of the property (3,230 acres) except for the retained area, which is known as the magazine area (2,800 acres), in 1946. The Department of the Army reacquired the 3,230 acres in 1954 and performed cleanup efforts during the 1950s through 1963. Two property use agreements were entered into by the National Advisory Committee of Aeronautics, the predecessor of NASA, and the Army in 1956 and 1958, respectively. In 1963, accountability and custody of the entire PBOW property (6,030 acres) was transferred to NASA by the Department of the Army. NASA has operated and maintained

PBOW since 1963, and it is currently the NASA Glenn Research Center, Plum Brook Station. Figure 1-2 shows the various PBOW areas of concern, including Ash Pit 2.

### *1.2 Summary of Existing Site Data*

The most recent environmental investigation concerning Ash Pit 2 was presented in *Site Investigations of the Reservoir No. 2 Burning Ground, Additional Burning Ground, Wastewater Disposal Plant No. 2, and Power House No. 2 Ash Pit, Former Plum Brook Ordnance Works* (IT Corporation [IT], 1997).

As noted above, PBOW was built in early 1941 and manufactured 2,4,6-TNT, DNT, and pentolite until 1945. Three power stations, Power House 1, Power House 2, and Power House 3, were constructed and utilized to support the TNT manufacturing process. Each power station consisted of a main power house, a coal storage area, and an aboveground fuel storage tank. The fuel storage tank was surrounded by a berm to contain any potential spills or leaks. Each power house building consisted of a boiler house, compressor room, electrical room, filter room, and locker room. The buildings also contained two to four large coal-burning boilers, a turboelectric generator, a feed water treatment system, and several steam-driven or electric air compressors. The generated steam was used for space heating, driving compressors, and generating electrical power. Coal ash generated from each of the boilers in the power house was collected in pits. Water was added to the ash, producing a slurry that flowed through a sluice trench to an ash sump located at the end of each power house. From the ash sump, the ash slurry traveled through a pipeline to a nearby surface water/ash impoundment (i.e., ash pit) (USACE, 2000). Based on topographical quadrangles (dated 1959 and 1969), aerial photographs, and a visual site survey conducted in 1999, the ash pit areas are noted to have essentially remained unchanged.

Ash Pit 2 is located west of Campbell Street in an area that appears to be an old surface impoundment. Historical drawings indicated that the surface impoundment was rectangular in shape, measuring approximately 400 feet long by 200 feet wide, and was surrounded by an earthen embankment (USACE, 1995). Ash from coal-fired boilers was reportedly dumped into the ash pit through a pipeline. During this investigation, the bermed area was observed and black to dark brown cinders were found within the bermed area at depths up to 4 feet. Environmental sampling was not conducted prior to the 1996 investigation.

During a site walk conducted in October 2008, the Ash Pit 2 area was observed to be overgrown with trees and nearly indistinguishable from surrounding forest. Several moss-covered concrete slabs approximately 7 feet long and 3 feet wide were observed partially buried in the underbrush northwest of the powerhouse and roughly 300 feet northeast of historical sample PH2SO-01.

This location appears to be substantially outside of the Ash Pit 2 study area. A small hole constructed of mortared shale/limestone blocks and approximately two feet in diameter was located near the concrete slabs. Based on the construction, this appears to be a hand-dug well. The depth of the hand-dug well was not determined. A strong sulfur odor was noted in the vicinity of the well and was thought to be emanating from it. The structure was nearly filled with water during a site visit in December 2008. The origin of these concrete structures is not known with certainty; however, they appear to be remnants associated with a historical farmstead. A review of historical drawings and other documents indicates that a farmstead was present south of the slabs and hand-dug well. Remnants of other concrete and stone foundations are present in the former farmstead area indicated on the historic drawings. It is likely that all of the concrete and stone foundations, concrete slabs, and hand-dug well are remnants associated with agricultural activities pre-dating the PBOW facility.

In September 1996, IT conducted a site investigation (SI) of Ash Pit 2 (IT, 1997). IT collected twelve (0-0.5 feet) surface soil samples and twelve (2-3 feet) subsurface soil samples, with one surface soil and one subsurface soil sample from each of twelve boreholes. The boring locations were selected using a systematic grid sampling strategy to minimize bias and to provide complete site coverage (Figure 1-3). The sampling area was an old ash pit receiving discharge from the nearby power house. The layer of ash in the pit (black or dark brown) is generally 1 to 2 feet in thickness. However, the ash layer is greater than 4 feet near the tail end of the 6-inch steel drain pipe in the center of the pit. The steel drain pipe appears to be in good shape and is 144 feet long as measured off Campbell Street to the tail end (8 feet per section by 18 sections). The characteristic soil samples were collected from the native soil underneath the ash layer. Limited soil contamination by organic chemicals has been identified in surface soils. Bedrock was not encountered in any of the boring locations.

Each sample was analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), target analyte list (TAL) metals, pesticides, polychlorinated biphenyls (PCB), and total cyanide. Three VOCs were detected in surface soil and four VOCs were detected in subsurface soil; none were detected above their risk-based concentrations (RBC). A total of 14 SVOCs were detected in surface soil. Of these, only benzo(a)pyrene was detected above the RBC. Neither of the two SVOCs in subsurface soil was detected above its RBC. PCBs were not detected in surface or subsurface soils. Three pesticides were detected in surface soil but at concentrations below their respective RBCs. Pesticides were not detected in any subsurface soils. Total cyanide, detected in three surface soil locations only, was below the established RBC. A total of 18 metals were present in surface soils at Ash Pit 2; 6 metals exceeded their RBCs. A total of 17 metals were present in subsurface soils; 6 metals exceeded

their RBCs. Because several metals and benzo(a)pyrene exceeded their RBCs, further investigation was recommended (IT, 1997).

### *1.3 Sitewide Hydrogeology*

Two hydrolithologic units are known to exist at PBOW. The overburden unit, composed of glacial outwash materials, has a thickness ranging from a few feet in the south to more than 40 feet in some locations in the north. Based on data from monitoring wells installed closest to the area of concern (AOC), the overburden thickness near Ash Pit 2 is expected to be approximately 21 feet, and the water table at 9 feet. Overall, the water-producing capacity of the overburden materials is strongly controlled by seasonal changes, and the overburden water-bearing zone is, therefore, not considered to be a source of potable water. The location of Ash Pit 2 is initially underlain by the Plum Brook Shale, followed by the Delaware Limestone. The shale bedrock is expected to be encountered at depths ranging from 21 to 25 feet at Ash Pit 2. Both the Plum Brook Shale and Devonian Limestone dip to the southeast at approximately 35 feet per mile.

In general, groundwater flows in a northerly direction, towards Lake Erie, in both the unconsolidated overburden material and the bedrock. However, on the western side of the installation, which includes Ash Pit 2, groundwater in the overburden water-bearing zone flows to the northwest, while groundwater in the bedrock aquifer flows to the northeast. The groundwater flow regime in the overburden unit shows a strong seasonal variation (IT, 1999).

# 2.0 Scope of Work and Objectives

## 2.1 Scope of Work

As specified in the scope of work (USACE, 2008), the Ash Pit 2 RI will be concluded with the preparation and submittal of a three-volume report.

RI field activities covered by this SSAP consist of the following tasks:

- Soil sampling (using direct-push technology)
- Installation of temporary piezometers and monitoring wells
- Groundwater sampling of piezometers and wells
- Surface water and sediment sampling
- Laboratory analysis of soil, groundwater, sediment, and surface water samples
- Management and disposal of investigation-derived waste (IDW)
- Preparation and submittal of a geographic information system deliverable
- Preparation of an electronic data deliverable.

The above activities, analytical data, and evaluation will be presented in a site characterization report, which will comprise Volume 1 of the RI report. This information will also be used in the baseline human health risk assessment and screening-level ecological risk assessment, which will comprise Volumes 2 and 3 of the RI report, respectively. A separate work plan will be submitted for Volumes 2 and 3.

## 2.2 Objectives

The primary objective of the Ash Pit 2 investigation is to determine the soil, sediment, surface water, and overburden and bedrock groundwater quality and the extent of contamination in these media. Specific objectives of the continued RI are summarized as follows:

- Evaluate and use existing data appropriate to Ash Pit 2.
- Define site physical features and characteristics.
- Determine nature and extent of U.S. Department of Defense-related contamination in soil, sediment, surface water, and groundwater at Ash Pit 2.
- Determine chemical characteristics of contamination.
- Evaluate fate and transport of contamination.

- Determine if overburden groundwater underlying the Ash Pit 2 is in sufficient volume and quality to be defined as a potential drinking water source in the state of Ohio.

- Obtain site data of quality, quantity, and distribution appropriate for site characterization, risk assessment, and feasibility study.

## *2.3 Site-Specific Data Quality Objectives*

### *2.3.1 Overview*

The data quality objectives (DQO) process followed during the planning stages of the RI evaluated data requirements needed to support the decision-making process and select the best action to satisfy these requirements. Incorporated components of the DQO process, described in EPA publication 9355.9-01, *Data Quality Objectives Process for Superfund* (EPA, 1993), are discussed in detail in Section 3.3 of the SWSAP. Determining factors for procedures necessary to satisfy investigative objectives and to establish the basis of future actions at PBOW are presented on Figure 2-2 of the SWSAP (Shaw, 2008a).

### *2.3.2 Data Users and Available Data*

A site-specific conceptual model developed using existing data helped to identify data gaps. During the project planning process, effective methodologies for filling the data gaps were designed and reviewed by the data users with the most efficient data collection design implemented. The SSAP records the rationale for the design, including the location, number, and type of samples necessary to fill the data gaps and to satisfy the DQOs. The SSAP, along with companion documents, provides the regulatory agencies with sufficient detail that they can conclude whether the investigative effort is adequate to satisfy the study objectives.

### *2.3.3 Conceptual Site Model*

Four factors considered in defining the conceptual model (USACE, 2008) for the RI are as follows:

- Potential contaminant sources
- Migration pathways
- Potential human health and ecological receptors
- Types of contaminant of an effected media

A source of contamination at PBOW is past TNT manufacturing activities, including the production and storage of raw materials. Sources at the proposed areas of investigation result from TNT and DNT disposal activities. The migration pathways for potential contaminants

include overburden/shale groundwater and/or bedrock groundwater, soil, sediment, and surface water runoff to creeks. The bedrock groundwater is of sufficient volume to be used as a potable water supply. Unless the RI shows otherwise, it is assumed that the overburden/shale groundwater is also of sufficient volume to be used as a potable source.

Exposure of site workers to potential contaminants under current land use at PBOW is unlikely, because this site is remote from regular site worker activity. Although Ash Pit 2 is on a secured NASA research station, NASA opens areas of the facility during hunting season to control the deer population. Areas opened to hunting include the vicinity of Ash Pit 2. Exposure to a hunter is possible but, given the limited area of Ash Pit 2, would be minimal. The assumption for future land use is unrestricted. Future off-site residents are assumed to be exposed to current groundwater concentrations via migration of contaminants in groundwater. Potential ecological receptors at Ash Pit 2 are wildlife communities, plant communities, and aquatic communities associated with creeks. Note that groundwater in the vicinity of the site is not used as a potable source. Chemicals of potential concern, based on past use of PBOW, should primarily be nitroaromatic explosives, but may also include VOCs, SVOCs, metals, and PCBs.

### *2.3.4 Decision-Making Process, Data Uses, and Needs*

The decision-making process that will be followed during the RI, presented in detail in Section 3.3.4 of the SWSAP (Shaw, 2008a), consists of a seven-step process. Data uses and needs are summarized in Table 2-1.

### *2.3.5 Risk-Based Evaluation*

Confirmation of contamination during the RI will be based upon a comparison of detected contaminants in samples from this and the previous investigation to the most current risk-based screening concentrations (RBSC). Groundwater RBSCs are currently derived from U.S. Environmental Protection Agency (EPA) (2004) preliminary remediation goal (PRG) tap water criteria, and soil RBSCs are derived from residential soil PRGs. For chemicals in surface water and sediment, tap water and residential soil PRGs, respectively, will be used. Definitive data will be used to determine whether the established guidance criteria are exceeded in the media. These definitive data will be adequate for confirming the presence of the contamination and for supporting a risk assessment and, if necessary, a feasibility study.

### *2.3.6 Data Quality, Types, and Quantities*

Groundwater, soil, surface water, and sediment samples will be collected and analyzed to meet the objectives of the RI. Quality assurance (QA)/quality control (QC) samples will be collected for all sample types, as described in Chapter 3.0 of this SSAP. All samples will be analyzed by

EPA-approved methods and will comply with EPA definitive data requirements. In addition to meeting the quality needs of the RI, data analyzed at this level of quality are appropriate for all phases of the RI and risk assessments.

### *2.3.7 Precision, Accuracy, Representiveness, Completeness, Comparability, and Sensitivity*

Laboratory requirements of precision, accuracy, completeness, comparability, and sensitivity (PARCCS) for all samples generated during the RI are provided in Chapter 3.0 of the QAPP (Shaw, 2008b). Tables 7-1 through 7-5 of the QAPP list the laboratory reporting limits (sensitivity). Table 9-1 of the QAPP addresses the laboratory requirements and laboratory QC parameters that effect PARCCS.

# 3.0 Field Activities

The continued RI approach will be consistent with work conducted previously at the PBOW facility. Twelve borings were sampled at depths of 0 to 0.5 feet below ground surface (bgs) and 2 to 3 feet bgs as part of the SI (IT, 1997). Direct-push soil samples will be collected from eight additional borings, as shown on Figure 3-1 (Section 3.1.1). A temporary piezometer will be installed in six of the eight soil borings (3.3.1). Proposed locations of soil borings and temporary piezometers have been selected using data and knowledge from the SI (IT, 1997). Three overburden/shale and three limestone monitoring wells will be installed after the review of the analytical results of the piezometers (Section 3.3.2). Surface water and sediment samples will also be collected to determine the nature and extent of contamination at Ash Pit 2 (Section 3.2). Thus, field activities under this SSAP will include the following:

- Collection of three soil samples at each of eight newly installed direct-push soil boring locations
- Collection of five sediment and five collocated surface water samples
- Installation of piezometers in six of the eight selected newly installed soil borings
- Sampling of groundwater from the piezometers
- Installation of three overburden/shale and three limestone monitoring wells
- Sampling of the monitoring wells (two rounds of sampling)
- Management and disposal of IDW.

All boring and well locations will be sketched and surveyed to the nearest 1 foot; land elevations will be surveyed to within $\pm$ 0.01 foot referenced to the National Geodetic Vertical Datum of 1929 (Section 3.4). A notch will be filed into the top of the well/piezometer riser, or the top of the riser will be otherwise marked to serve as a vertical and horizontal measuring point. Any site clearing that may be necessary for equipment access will be coordinated with NASA (Section 3.5).

## 3.1 Soil Remedial Investigation

Soil samples will be collected from each of eight soil borings. Table 3-1 summarizes the samples and analytical parameters.

A qualified geologist or geotechnical engineer will be on site for all excavation, drilling, and sampling operations. The geologist/geotechnical engineer will perform logging and collect other information, as described in Section 3.1.2.

### *3.1.1 Direct-Push Soil Samples*

A total of eight borings will be advanced at Ash Pit 2. Figure 3-1 shows the proposed soil boring locations. Three soil samples will be collected from each boring: one from 0 to 1 foot bgs (soil below fill material, if encountered), one from 3 to 5 feet bgs, and one from 8 to 10 feet bgs, for a total of 24 samples. If fill material is encountered in any of the borings, the 8- to 10-foot sample will still be collected at the respective depth below the current ground surface. These soil samples are being collected because of the age of the SI soil data (collected in 1996) and because soil samples were not collected at a depth of 3 to 5 or 8 to 10 feet bgs during the SI. Soil boring locations include those in the vicinity of the concrete structures noted in Section 1.2.

The 24 samples (and 3 duplicates) will be analyzed for nitroaromatics, target compound list (TCL) SVOCs, and TAL metals. PCBs will be analyzed in the surface soil samples and those collected from 3 to 5 feet bgs. One surface soil (0-1 foot) sample will be analyzed for total organic carbon (TOC). VOCs will not be analyzed because no source was present during former manufacturing operations. Table 3-1 summarizes the samples and analytical parameters.

### *3.1.2 Soil Sampling Procedures*

A qualified geologist or geotechnical engineer will be on site for all drilling and sampling operations. The geologist/geotechnical engineer will visually classify and log all borehole material according to the Unified Soil Classification System, EM 1110-1-4000 (USACE, 1998) on the hazardous, toxic, and radioactive waste drilling log (Figure 4-2 of the SWSAP).

Soil samples collected for chemical analysis will be documented by sample collection logs and analysis request/chain-of-custody record forms (Figures 4-7 and 6-2 of the SWSAP [Shaw, 2008a]), following field custody procedures specified in Section 5.1 of the QAPP (Shaw, 2008b). Any changes from this SSAP or the SWSAP will be recorded in chronological order in the variance log shown on Figure 9-1 of the SWSAP (Shaw, 2008a). All direct-push soil samples collected by Shaw field personnel will be documented through the use of drilling borelogs (USACE Eng. Forms 5056-R and 5056A-R).

Continuous logging performed by the geologist/geotechnical engineer will include detailed subsurface information from examining drill cuttings, recording samples/cores, and noting first-

encountered and static groundwater levels for each borehole. Daily field notes will be kept on a field activity daily log (FADL) and will include sufficient information to reconstruct the progress of excavation, drilling operations, problems encountered, temporary piezometer installation procedures (Section 3.3.3), etc. Figure 4-5 of the SWSAP shows a typical piezometer construction form that will be completed for all piezometers. After completion of database entry, all field forms and documents will be archived in the project files at the Shaw office in Knoxville, Tennessee. A copy of borelogs and well construction logs will be included in an appendix to the final RI report.

For soil intervals that are collected for analytical sample analysis, the samples will be collected in the appropriate jars prior to lithologic logging. If additional sample volume is required for the analysis, QA/QC requirements, or other purposes, the soil will be placed into a decontaminated stainless-steel bowl or new, gallon-size resealable plastic bag. In the case of direct-push samples, a second boring will be completed immediately adjacent to the original location. The surface soil sample (0- to 1-foot interval) from the adjacent boring will be combined with the original surface soil sample, homogenized, and transferred to appropriate sample jars. Upon filling a sample container, the jar will be placed on ice and the proper paperwork completed.

As mentioned in Section 3.1.1, borings will be advanced and soil samples will be collected using direct-push drilling technology. The direct-push unit uses a hydraulically powered percussion hammer to drive a decontaminated soil sampling device with retractable tip (point) to a required depth. Soil samples for chemical analysis will be handled and packaged as described in Chapter 5.0. All direct-push sampling equipment that will come in contact with the samples will be decontaminated prior to use and between each sample collected, in accordance with Section 4.3. Once the subsurface soil sample is collected, six of the borings will be advanced to bedrock (or refusal) and a piezometer will be installed, as described in Section 3.3.3. Continuous logging will be performed to the bottom of the borehole.

With respect to the two boreholes in which a piezometer will not be installed, these will be abandoned at the completion of soil sampling and piezometer installation activities. The abandonment will be performed by a licensed driller in accordance with Ohio Administrative Code 3745-9-10, *Abandoned Well Sealing*; OEPA (2005) *Sealing Abandoned Monitoring Wells and Boreholes* technical guidance; and Ohio Revised Code Section 1521.05 *Well Construction and Sealing Log*. A well sealing report will be submitted to the Ohio Department of Natural Resources (ODNR). The boreholes will be abandoned by pressure grouting with neat cement from the bottom to the top of the borehole using a tremie pipe. After 24 hours, the boreholes will be checked for settlement and additional grout added, if necessary. Well sealing reports will be

submitted to the ODNR Division of Water. The neat cement mixture used to seal the boreholes will be composed of a ratio of one 94-pound bag of Portland cement to no more than 6 gallons of water, and 2 to 8 percent bentonite powder.

At the completion of the direct-push soil sampling event, the remaining soil from the boring will be drummed. A composite soil sample of this drummed material will be analyzed for chemical parameters for disposal characterization, as described in Chapter 6.0.

### *3.2 Surface Water and Sediment Sampling*

A surface water and sediment sampling effort will be conducted for Ash Pit 2. Neither surface water nor sediment samples were collected during the SI (IT, 1997). Five sediment samples and five collocated surface water samples, if present, will be collected. Each sediment sample will be analyzed for TCL SVOCs, nitroaromatics, PCBs, and TAL metals. In addition, one sediment sample will be analyzed for TOC. Each surface water sample will be analyzed for TCL SVOCs, nitroaromatics, PCBs, TAL metals, and hardness. Sediment samples will be collected at a depth of 0 to 6 inches if sediment is present to this depth. If water is not present in sufficient quantity at any of these locations, professional judgment will be used to identify an appropriate alternative location, if it exists. Table 3-1 summarizes the samples and analytical parameters.

### *3.3 Groundwater Remedial Investigation*

Groundwater will be investigated in a phased approach. First, temporary piezometers will be installed in a total of six soil borings drilled at Ash Pit 2 (Figure 3-1). Each of these borings will be advanced to bedrock and a continuous lithologic log recorded. Based on the analytical results and groundwater flow patterns of the piezometer samples, three monitoring wells will be installed in the overburden/shale and three monitoring wells will be installed in the underlying limestone formation. Each piezometer and monitoring well will be sampled using the low-flow technique described in Section 3.3.7, unless the Ohio Environmental Protection Agency (OEPA) and USACE approve a variation. Table 3-1 summarizes the samples and analytical parameters.

If bedrock (or refusal) is encountered at less than 5 feet and the borehole is dry, then no piezometer or well will be installed at this location, as it is unlikely to produce measurable water. In this case, a suitable alternate location will be sought. In addition, previous investigations have shown a strong seasonal and topographic variation in water levels in the overburden at PBOW, which can result in dry boreholes. The water levels in the piezometers will be measured a minimum of 24 hours after installation of the last piezometer and periodically over the course of the field effort for this site. Water level measurements in the piezometers will be taken to the nearest 0.01 foot.

### *3.3.1 Piezometer Samples*

A piezometer will be installed at each of six soil boring locations described in Section 3.1.1. Once soil sampling is complete and the associated soil sample is collected (Section 3.1.1), the boring will be advanced to bedrock (or refusal). As described in Section 3.1.2, the boring will be continuously logged, with lithologic and hydrologic observations appropriately recorded. Piezometer installation is described in Section 3.3.3. Each piezometer water sample will be collected using a low-flow technique and analyzed for TCL SVOCs, nitroaromatics, TAL dissolved metals (filtered), and total metals (unfiltered). All sampling and purging equipment (pumps, tapes, discharge piping) will be decontaminated prior to use and after each successive use. The sample results should aid in the decision of whether the overburden groundwater is of quantity and quality to be considered a potable water supply in the state of Ohio or of quality requiring a risk assessment. The sample results should also indicate if groundwater in the overburden/shale may be impacted and whether there is a need for installation of monitoring wells and further investigation of the two groundwater zones (i.e., overburden/shale and underlying limestone). To expedite the overall schedule, these samples will be analyzed on a 7-day turnaround.

### *3.3.2 Monitoring Well Samples*

A total of six wells will be installed at Ash Pit 2, based on the analytical results of the piezometer samples. Three of these six monitoring wells will be installed in the overburden/shale and the other three wells will be installed in the limestone bedrock. The specific location of each well will be determined by the geologist/geotechnical engineer, based on the analytical results of the piezometer samples.

Each monitoring well sample will be sampled using a low-flow technique (Section 3.3.7) and analyzed for VOCs, TCL SVOCs, nitroaromatics, dissolved (filtered) metals, and total (unfiltered) metals. Two rounds of samples will be collected from each well at different times of the year (e.g., spring and fall) to allow for seasonal differences. All sampling and purging equipment (pumps, tapes, discharge piping) will be decontaminated prior to use and after each successive use. All monitoring wells for this investigation will be installed prior to the first sampling event; no monitoring wells currently exist for this site. During the second sampling event, the condition of all surface components of the monitoring wells sampled will be documented with the recommendation for repair, if necessary. The surface components will include the concrete pad, protective posts, protective casing, and well casing. In addition, the condition of the well locks and lock hasps will be documented.

### *3.3.3 Piezometer Installation*

Temporary piezometers are typically used to measure static water levels and collect groundwater quality samples in commonly slow recharging environments. The Ash Pit 2 piezometers will be made of new 1-inch outside diameter polyvinyl chloride (PVC) material and placed into the borehole through the direct-push tooling prior to removal or inserted into the borehole after the tooling is removed. These will be advanced to bedrock (or refusal), and continuous lithologic logging will be performed. The piezometer will be constructed with 5 to 10 feet of PVC screen (0.010 slot) and PVC casing. No filter pack material will be placed around the well screen. Because the sampling will occur reasonably quickly after the piezometers have been installed, semi-permanent seals are not necessary. A plastic seal will be used in the upper foot of the borehole annular space to prevent any solid material from entering the subsurface. The plastic seal will be covered with an additional sheet of plastic on the ground surface with bentonite placed over the top of this sheet. The bentonite on the ground surface will slope away from the piezometer to promote runoff and prevent any surface water from entering the borehole. The bentonite surface seal typically extends out approximately 1 foot around the piezometer and up to a foot in thickness. The size and thickness of the bentonite seal may vary depending on site conditions. Figure 4-5 of the SWSAP shows a typical piezometer construction form that will be completed for all piezometers. Upon an adequate water column in the piezometer to permit sample collection (i.e., greater than 24 inches), groundwater sampling will be conducted as described in Section 3.3.7.

Following the groundwater level measurement associated with the first round of monitoring well sampling (Section 3.3.2) and permission from USACE, the PVC material (PVC screen and casing) will be removed from all temporary piezometer boreholes. The boreholes will be abandoned by a licensed driller in accordance with OEPA and ODNR codes, regulations, and guidance, including the following: Ohio Administrative Code 3745-9-10, *Abandoned Well Sealing*; OEPA (2005) *Sealing Abandoned Monitoring Wells and Boreholes* technical guidance; and Ohio Revised Code Section 1521.05 *Well Construction and Sealing Log*. Pressure grouting from the bottom to the top of the boreholes with a tremie pipe will be used as the sealing technique. After 24 hours, the boreholes will be checked for settlement and additional grout added, if necessary. Well sealing reports will be submitted to the ODNR Division of Water. Neat cement grout, which uses a ratio of one 94-pound bag of Portland cement to no more than 6 gallons of water, and 2 to 8 percent bentonite powder, will be used as the sealant. Piezometer material will be cut into 5-foot manageable lengths, decontaminated using the procedure described in Section 4.3, and discarded into the local sanitary trash.

### 3.3.4 Monitoring Well Installation and Development

#### 3.3.4.1 Monitoring Well Installation

The geologist/geotechnical engineer will schedule and coordinate the locating of all underground utilities in the vicinity of the borehole site prior to drilling activities. The geologist/geotechnical engineer will assume one mobilization for activities related to installation of the six new monitoring wells.

The estimated depth for each of the three new overburden/shale wells is 15 feet, and the estimated depth for each of the three new limestone monitoring wells is 75 feet. The target depths of each new well are estimated based on well construction information from existing wells in the area. Actual installation depths will be adjusted in the field as necessary for collection of appropriate groundwater samples.

A qualified geologist/geotechnical engineer will be on site for all drilling, installation, development, and testing operations. Well installation will be performed by a licensed/certified driller, and drilling methods will be in accordance with the procedures and requirements described in EM 1110-1-4000, *Monitor Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites*, and applicable state regulations and requirements, including Ohio Administrative Code 3745-9-03, *Monitoring Well*. Where necessary, the geologist/geotechnical engineer will anticipate using "double casing" as described in Section 3-10 of EM 1110-1-4000 to install a well through a contaminated upper zone. A well log will be completed and filed on line with the Ohio Department on Natural Resources (http://www.dnr.state.oh.us/water/maptechs/submitlogs/). All monitoring well drill cuttings will be drummed, labeled, and handled as described in Chapter 6.0.

#### 3.3.4.2 Monitoring Well Development

Each monitoring well will be developed using a submersible pump or bailer as soon as practical, but no sooner then 48 hours nor longer than 7 calendar days after the placement of the internal mortar collar around the well. Prior to development, the static water level will be measured from the top of the casing and recorded. Static water levels will also be measured 24 hours after development. The well will be developed until discharging water is clear to the unaided eye and the sediment thickness remaining in the well is less than 5 percent of the screen length. If yields permit, the standing water volume in the well (calculated as the volume of water in the well screen and casing and saturated annulus) will be removed at least five times. In addition, if water is used during bedrock drilling, any volume lost will be recorded, and five times the amount will be removed during development. For each well, a sample of the last water removed

during development will be captured and retained for visual inspection and photographing. During development, field measurements of pH, specific conductance, and temperature will be made, and descriptions of the development technique and the physical characteristics of the water (clarity, color, turbidity, and odor) will be recorded by the geologist/ geotechnical engineer. Wells will be developed by pumping, bailing, and surging without using acids, flocculants, disinfectants, or dispersing agents. All purged water will be drummed at the well site. During development, the pump inlet will be moved through the entire screened interval or the bailer will be lifted from different depths in the well. The development procedure will continue until the following conditions are met:

- Water is clear to the unaided eye, free of sand, and free of drilling fluids.
- Thickness of the accumulated sediment in the well is less than 5 percent of the length of the well screen.
- Temperature, pH, specific conductance values stabilize.
- Three consecutive turbidity readings are less than 100 nephelometric turbidity units (NTU).
- A volume of water has been removed equal to five times standing water in the well, including the well casing and screen, and the saturated annular space assuming 30 percent porosity.

Water will not be added to the well once the well has been grouted and sealed. If heavy or caked sediments must be removed by washing, the water will be from a potable water source and a sample will be submitted for analysis.

If the groundwater is not clear and free of sand after four hours of well development, Shaw field personnel and the Shaw project geologist will develop a plan for proceeding and will discuss this plan with USACE. After final development of each well, approximately 1 liter of water from the well will be collected in a clear glass jar, labeled, and photographed in color with a quality digital or 35-millimeter camera. The photograph will be submitted as part of the well development log. The photograph will be a suitably back-lit close-up to show the clarity of the water. The development water sample will be archived until receipt of photographs. The well will not be sampled for a minimum of 14 days after development.

The following records will be kept in a well development log:

- Project name and location

- Well designation and location
- Date and time of well installation
- Date and time of well development
- Static water level from top of well casing before well development and 24 hours after well development
- Quantity of fluid in well prior to development:
  - Standing in well
  - Contained in saturated annulus, based on an assumed 30 percent porosity
- Field measurements of pH, conductivity, and temperature before, twice during, and after development at a minimum and until these values stabilize
- Field measurement of turbidity (NTU) until three consecutive measurements are less than 100 NTUs
- Depth from top of well casing to bottom of well
- Screen length
- Depth from top of well casing to top of sediment inside well, before and after development
- Physical character of removed water, including changes in clarity, color, particulate, and odor
- Type and size/capacity of pump and/or bailer used
- Description of surge technique
- Measured height of well casing above ground surface at time of development
- Typical pumping rate and estimated well yield
- Quantity of water/fluid removed during development, both incremental and total
- Disposal of development water.

### *3.3.5 Water Level Monitoring*

After the Ash Pit 2 piezometers have been installed for a minimum of 24 hours (and prior to groundwater sampling), groundwater levels will be measured and recorded for all six piezometers. Water elevation measurements will also be recorded for each piezometer immediately prior to sampling. The depth to water will be measured to the nearest 0.01 foot from the top of the PVC riser at the point which was marked during surveying (Section 3.0).

The water elevations of all six monitoring wells will be measured at once, prior to purging the first well (Section 3.3.7). The water levels of the six piezometers will also be taken at this time during the first monitoring well sampling event. This is done to provide more complete information concerning groundwater flow in the vicinity of the Ash Pit 2. The depth to water will be measured to the nearest 0.01 foot at the point on the riser (inner casing) which was marked during surveying. Note that the piezometers will be abandoned after this measurement, as described in Section 3.3.3. Therefore, the water levels of only the six monitoring wells will be measured as part of the second monitoring well sampling event.

### *3.3.6 Groundwater Sampling Equipment*

The equipment required for groundwater sampling includes the following:

- Water level indicator
- Low-flow submersible pump with Teflon®-lined tubing
- Oxygen-reduction potential (Eh), dissolved oxygen, pH, temperature, turbidity, and specific conductance meters
- Appropriate sample bottles and temperature-controlled container
- Plastic sheeting
- Five-gallon buckets with lids
- Photoionization detector (PID)/lower explosive limit (LEL) meter
- Mason jar for calculating purge rate
- Well construction diagrams.

If because of low water yield the well cannot be sampled using a low-flow technique, the following equipment will be required:

- Nylon rope

- Teflon, PVC, or stainless-steel bailer of appropriate size for the monitoring well fitted with a bottom-emptying device.

### *3.3.7 Groundwater Sampling Methodology and Procedures*

Piezometers will be sampled approximately 24 hours after installation in conjunction with the water level measurements. A water level will be recorded for all piezometers, just prior to the piezometer sampling event (Section 3.3.5). The monitoring wells will be purged and sampled a minimum of 14 days after development (Section 3.3.4.2), unless a variance is agreed to by USACE. Immediately prior to the first round of monitoring well groundwater sampling, the water levels of all piezometers and monitoring wells involved in this investigation will be measured. This will allow for more accurate groundwater flow mapping and flow direction determination. Before a sample is collected from each well, the water level will be measured again. This same protocol will be followed immediately prior to the second round of monitoring well sampling, except that the piezometers will have been removed (Section 3.3.3).

Two procedures are available for purging and sampling wells and piezometers: low-flow (minimal drawdown) and bailing. Low-flow is the preferred purging method where adequate recharge exists. If wells or piezometers do not recharge adequately to use low-flow sampling, bailing will be used depending on the static water level relative to the screened interval. Both of these methods are described in the following procedures:

- The well or piezometer will be checked for proper identification and structural integrity.

- After unlocking the well or piezometer and removing the cap, a PID/LEL meter will be used to measure the concentration of organic vapors and hydrogen sulfide at the top of casing and in the breathing zone. If readings are above background, safety precautions outlined in the sitewide safety and health plan will be followed.

- The depth to water will be measured using a decontaminated water level indicator. Then the volume of water in the casing and screen and annular volume will be calculated.

- Where recharge rates permit, the well or piezometer will be purged and sampled using a modified low-flow (minimal drawdown) sampling methodology. Either an electric submersible pump or a bladder pump will be used to complete the sampling. The pump will be inserted into the midportion of the screened interval or suspected water producing interval and operated at a rate that minimizes drawdown. Typically, purging rates are on the order of 200 milliliters per minute (mL/min) to 500 mL/min. The purge rate will be set such that drawdown is never

greater than 0.5 feet (6 inches), if possible. If drawdown is greater than 0.5 feet, it is critical that stability of the water level is reached and maintained, above the screened interval. Water chemistry parameters (pH, Eh, conductivity, temperature, dissolved oxygen and turbidity) will be monitored to confirm stability.

- If the pre-pumping (static) water level is above the top of the screened interval and drawdown exceeds 0.5 feet even at the lowest setting of the pump, low-flow sampling cannot be conducted. In this situation, iterative pumping and recovery cycles will be required to remove at least one volume of the standing water in the casing and annular space. In this instance, the water level must not be allowed to drop below the top of the screened interval. It is, however, acceptable to pump out the stagnant water in the casing at a higher purge rate but pumping must be stopped when the water level reaches the top of the screened interval. Once at least one volume is removed, the well or piezometer may be sampled. It should be noted, however, that attempts will be made to remove more than one volume of water.

- If the pre-pumping (static) water level is below the top of the screened interval and drawdown exceeds 0.5 feet even at the lowest setting of the pump, low-flow sampling cannot be conducted. In this situation, iterative pumping and recovery cycles will be required to remove at least one volume of the standing water in the casing and annular space. However, in some wells, recharge may be so low that adequate purging may not be achieved even over a period of days. In this case, the well or piezometer may be sampled without purging, after consultation with USACE.

- During purging, field measurement of pH, Eh, temperature, turbidity, dissolved oxygen, and conductivity will be performed. When using low-flow sampling, once these parameters are stable, samples can be collected. If stability is not achieved after 4 hours of purging, Shaw will notify USACE and discuss a plan for sampling the well or piezometer. Stability is defined as follows:

  - pH +/- 0.1 standard units
  - Eh +/- 10 millivolts
  - Temperature +/- 3% degrees Celsius ($^{o}$C)
  - Turbidity (three consecutive readings less than 100 NTUs)
  - Dissolved oxygen +/-1%
  - Conductivity +/-3% of reading.

- For slow recharging wells or piezometers, field parameters will be recorded after sampling to ensure adequate volume is available for the chemical analysis.

- Where possible, groundwater samples will be collected using a submersible sampling pump and in-line sampling. Where the use of inline sampling is not possible, a bottom-emptying Teflon bailer will be used.

- For slow recharging wells or piezometers, a second sample will be collected for field measurement of temperature, pH, Eh, dissolved oxygen, and conductivity immediately after collection of the sample for chemical analysis.

- Sample containers will be labeled with appropriate identifying information (location, date, time, condition, added preservatives, sample crew, and requested analysis). Preprinted labels will be provided by the field sampling crew leader. Each sample will be logged in a field notebook at the time of collection. Sample containers of appropriate volume and composition will be prepared in advance to ensure the collection of sufficient volumes for all specified analyses.

- The samples will be collected so as to minimize aeration as water enters the bottle. Pumping rates will not exceed 500 mL/min. Samples collected for nitroaromatic analysis will be collected first.

- Samples for metals analysis will be collected in two separate containers; one will be filtered and the other unfiltered. Filtered samples will be collected during groundwater sample collection using a disposable, inline 0.45-micron filter attached to the discharge tubing. The filter will be disposed after groundwater sample collection from each sample point.

- All filled sample containers will be transferred to a cooler chest (kept at 4 degrees $^{o}$C) and delivered to the laboratory in sufficient time so that specified holding times are not exceeded. Details of the sample preservation, packing, and shipping are provided in Chapter 5.0.

In addition to the primary water samples, certain field quality control samples will be prepared as described in succeeding paragraphs. The geologist/geotechnical engineer will coordinate with the primary and QA laboratories as to the volumes of sample necessary to satisfy all internal laboratory QC requirements. All samples will be collected and analyzed in conformance with applicable EPA and USACE requirements, using techniques and equipment described herein and in the SWSAP (Shaw, 2008a).

### *3.4 Land Surveying*

Following completion of soil sampling and temporary piezometer installation, Shaw will secure the services of an Ohio-registered professional land surveyor to determine the coordinates and elevations of confirmation soil borings and monitoring well locations. The horizontal coordinates will be to the closest 0.1 foot and referenced to the State Plane Coordinate System. Vertical coordinates (ground elevation and well riser, if applicable) will be to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. If the 1929 datum is not readily available, the existing local vertical datum will be used. All survey data will be tabulated. Loop closure for survey accuracy will be within the horizontal and vertical limits given above. Once

sample survey information is available, it will be entered on approved Shaw boring logs. Critical reference points, landmarks, and sample locations will be plotted on appropriate map figures with a scale large enough to show their locations relative to other structures at the site.

### *3.5 Utility Clearances*

Prior to beginning any intrusive investigation (i.e., soil boring, temporary piezometer installation), to fulfill Shaw standard operating procedures and USACE requirements, all sites will be marked for underground utilities by personnel from NASA, Plum Brook Station Health and Safety Division, or other appropriate department. Even after NASA has located underground utilities that may be present in the AOC, all direct-push locations will be hand dug, probed with an air knife, or screened with geophysical instrumentation to a depth of 5 feet before drilling begins.

### *3.6 Site Access*

All Shaw personnel and subcontractors will meet each morning at the NASA/Plum Brook Station, white/red barn area, or other "headquarters" type area for the morning tailgate safety/job safety analysis meeting, equipment calibration, gathering of needed material, and replenishing of water. At the end of each day, IDW generated during fieldwork will also be moved by the subcontractor back onto the Shaw IDW storage area located in the secured NASA staging area. Names of Shaw personnel and Shaw subcontractors will be provided by Shaw to Mr. Robert Lallier, NASA Environmental Coordinator, at least 72 hours in advance so that site access can be arranged. All personnel entering the NASA (former PBOW) facility will be appropriately trained and instructed by Plum Brook Station concerning site safety issues. All Shaw personnel and any subcontracted personnel involved must be a U.S. citizen.

### *3.7 Well Abandonment*

After the initial sampling of any monitoring well, if characteristics are similar to former monitor well BED-MW27 (off-gassing of hydrogen sulfide), abandonment may be conducted if requested by the USACE. Well abandonment procedures will follow the USACE guidelines and will be in accordance with OEPA and ODNR codes, regulations, and guidance, including the following: Ohio Administrative Code 3745-9-10, *Abandoned Well Sealing*; OEPA (2005) *Sealing Abandoned Monitoring Wells and Boreholes* technical guidance; and Ohio Revised Code Section 1521.05 *Well Construction and Sealing Log*. Well sealing reports will be submitted to the ODNR Division of Water. Abandonment will be performed by a licensed driller as follows:

- Groundwater will be bailed or pumped from the monitoring well, contained, and disposed of as IDW.

- Removal of well material will be attempted. If the well isolation casing and PVC well casing and screen can be removed, it will be cut into approximately 5-foot lengths and decontaminated using the approach described in Section 5.1 of the SWSAP. Surface completion material (guard posts, pad, protective steel casing) will be removed.

- If removal of the isolation casing and the well screen/casing is not possible, abandonment in place will be conducted. Steel isolation casing and PVC well material will be cut approximately 3 feet bgs.

- A concrete/grout mixture will be tremied from the bottom of the boring until undiluted grout flows from the borehole/well at the ground surface.

- After 24 hours, the borehole/well will be checked for settlement and additional grout added, if necessary. A tremie pipe will be used again if the depth of the unfilled portion of the borehole is more than 15 feet.

- Ground surface will be restored as originally found, which may include reseeding with grass seed and straw, repairing asphalt, or repairing concrete.

### *3.8 Historical Hand-Dug Well*

A hand-dug well that is apparently part of a farmstead which predates the PBOW facility was observed north of the Ash Pit 2 study area during an October 2008 site walk (refer to Section 1.2). Although this structure is not associated with any DOD activities, Shaw will perform the following to provide information to the project delivery team: 1) Confirm the approximate location of the well using handheld GPS, 2) measure the depth to water in the well; and 3) measure the depth of the well. This information will be used by the project delivery team to discuss how this well should be further addressed.

# 4.0 Sample Analysis and Decontamination Procedures

## 4.1 Sample Number System

Sample numbering system to be used during this investigation will conform to the USACE Nashville District's numbering convention. Specifically, each sample will be assigned a unique sample identification number that describes where the sample was collected. Each number consists of a group of letters and numbers, separated by hyphens. The sample media and numbering system are described as follows.

| Project Code | Year | Sample Type[a] | Site Identification | Location (Well ID) | Sample Number | Depth[b] |
|---|---|---|---|---|---|---|
| PBOW | 08 | XX | Ash Pit 2 | XXXX | XXXX | (XXXX) |

[a]Sample type:

SS – surface soil sample
SB – subsurface soil sample
SE – sediment sample
SW – surface water sample
GW – groundwater sample
MS – matrix spike
MD – matrix spike duplicate.

[b]Depth: Only required for soil samples.

The complete sample number will be recorded by the Shaw field geologist/geotechnical engineer in the FADL and/or in the boring log, and in the sample collection log as appropriate.

## 4.2 Analytical Program

The analytical program has been designed to acquire sufficient and defensible data to determine the extent of contamination in the investigated areas. Table 4-1 summarizes the analytical parameters required and associated laboratory methods to be used during this investigation.

A contract laboratory will analyze samples for nitroaromatics by EPA Method SW-846 8330. All applicable analyses will meet the recommended method guidance found in *Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition Update (EPA, 1996) and its subsequent updates. They will meet the QA/QC requirements outlined in EM-200-1-6, *Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects* (USACE, 1997). The analytical laboratory must comply with *Quality Systems Manual for Environmental Laboratories* (U.S. Department of Defense, 2006). Also, contract laboratories will adhere to QA/QC criteria set forth in the *Shell for Analytical Chemistry Requirements* (Appendix I of the USACE document EM-200-1-3 *Requirements for the Preparation of*

*Sampling and Analysis Plans* [USACE, 2001]). All other requested analyses must conform to their specified method(s).

### *4.3 Decontamination Procedures*

Decontamination requirements and procedures are specified in detail in Chapter 5.0 of the SWSAP (Shaw, 2008a) and will be followed during the current RI. The Shaw field coordinator must contact Plum Brook Station for access to a potable water source for decontamination use. The following text summarizes decontamination procedures for equipment before site entry, between borings, and before site departure:

Nonsampling equipment (direct-push rods, augers, drill rods, etc., that do not contact analytical samples) and abandoned well materials:

- Steam rinse with potable water, or wash and scrub using a brush with nonphosphate detergent and then rinse with potable water.

Equipment that may come in contact with samples for chemical analysis (stainless-steel homogenization bowls, mixing spoons, drill bit shoes, drill sleeves, etc.):

- Wash and scrub using a brush with nonphosphate detergent.
- Rinse with potable water.
- Rinse with American Society for Testing and Materials (ASTM) Type II water.
- Rinse with methanol (when sampling for metals).
- Rinse with ASTM Type II water.
- Rinse with hexane (when sampling for PCBs).
- Final rinse with ASTM Type II water; the volume of water used will be at least five times greater than the volume of hexane used.
- Air dry.
- Wrap in aluminum foil.

Decontamination wash water and rinse water will be managed for disposal as described in Section 6.2.

# 5.0 Sample Preservation, Packing, and Shipping

Sample containers and caps will be new, certified as precleaned, and made of materials recommended by the EPA in Title 40, Code of Federal Regulations, Part 136 and SW-846 (EPA, 1996 [3rd Edition, Update III]). Sample containers and preservatives/preservation methods are summarized in Table 5-1. Sample containers will be supplied and shipped to the job site by the designated primary laboratory.

Each sample container will be bagged before placement in the cooler. Sample holding times will be calculated from the date the sample is collected.

Samples for chemical analysis will be placed in coolers as soon as possible after collection and will be packed to minimize container breakage by using vermiculite, styrofoam peanuts, or bubble wrap to fill void spaces in the cooler. Coolers will be taped, marked, and sealed, and custody will be maintained, as described in Chapter 6.0 of the SWSAP. Samples will be cooled to a temperature of approximately 4$^{o}$C and maintained at that temperature by means of double-bagged ice until the cooler is received at the laboratory. Coolers will be shipped to the laboratory by a next-day delivery service. The temperature of each cooler will be taken with an infrared thermometer upon receipt. Notification of shipment, including air bill number, will be telephoned or faxed to the laboratory on the day of sample collection. If this is not possible, the laboratory will be notified the following morning.

Completed analytical request/chain-of-custody records will be secured and included with each shipment of coolers to:

ATTN: Melonia Harris
Analytical Management Labs, Inc.
15130 South Keeler
Olathe, Kansas 66062
Phone: (913) 829-0101 Ext. 23
Fax: (913) 829-1181
Email: mharris@amlabinc.com

# 6.0 Investigation-Derived Waste Management Plan

Anticipated IDW during field activities includes soil (drill cuttings), purge/development water, decontamination fluid, and disposable personal protective equipment (PPE). Detailed procedures for IDW management are provided in Chapter 8.0 of the SWSAP (Shaw, 2008a). The following is a brief summary of the procedures for handling IDW.

## 6.1 Soil and Groundwater

Residual subsurface soil will be placed in 55-gallon drums upon completion of field sampling. IDW drums will be labeled to indicate project name and date collected.

## 6.2 Decontamination Fluid

Limited quantities of decontamination fluid, including wash water, nonphosphate soapy water, and final rinse water will be kept in plastic tubs during the decontamination process and will be placed in 55-gallon drums upon completion of field sampling. Decontamination fluid containing small quantities of solvents such as isopropanol, methanol, and hexane will be collected in metal pans for evaporation.

## 6.3 Sampling Equipment and Personal Protective Equipment

Limited quantities of PPE and sampling equipment, including Tyvek® suits, latex/nitrile gloves, plastic, and disposable tubing used for groundwater sampling, will be generated during sampling. All sampling equipment and PPE will be double-bagged and disposed of in on-site dumpsters. If any of the sampling equipment and PPE appears to be grossly contaminated, it will be decontaminated prior to disposal.

## 6.4 Investigation-Derived Waste Sampling

All soil and water IDW will be sampled at the completion of field work. Table 4-1 summarizes the analytical parameters and methods for the IDW samples. For soils, one composite soil sample will be collected from drummed soil for each AOC. The composite sample will then be submitted to the identified laboratory for a full toxicity characteristic leaching procedure analysis and nitroaromatics. Seven-day turnaround time will be used, unless otherwise directed by the project manager.

When the analytical results are received, Shaw personnel will evaluate the results and make a determination of off-site disposal methods. Possible disposal facilities will be identified by Shaw; however, selection of the facility or facilities to receive the IDW will be the responsibility of USACE.

# 7.0 References


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IT Corporation, 1997, ***Site Investigations of the Reservoir No. 2 Burning Ground, Additional Burning Ground, Wastewater Disposal Plant No. 2, and Power House No. 2 Ash Pit, Former Plum Brook Ordnance Works, Sandusky, Ohio***, December.

Ohio Environmental Protection Agency (OEPA), 2005, ***Technical Guidance for Ground Water Investigations, Chapter 9, Sealing Abandoned Monitoring Wells and Boreholes***, Revision 1, Division of Drinking and Ground Waters, Columbus, Ohio, February.

Shaw Environmental, Inc. (Shaw), 2008a, ***Site-Wide Sampling and Analysis Plan, Plum Brook Ordnance Works, Sandusky, Ohio,*** July.

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U.S. Army Corps of Engineers (USACE), 1998, ***Monitoring Well Design, Installation, and Documentation of Hazardous and/or Toxic Waste Sites,*** USACE Engineering Manual, EM-1110-1-4000, November.

U.S. Army Corps of Engineers (USACE), 1997, ***Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects***, EM 200-1-6, October 1997.

U.S. Army Corps of Engineers (USACE), 1995, ***Statement of Work, Plum Brook Ordnance Works, Sandusky, Ohio,*** June.

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U.S. Environmental Protection Agency (EPA), 2004, ***Region 9 Preliminary Remediation Goals (PRG) Table,*** Region 9, San Francisco, California, October, http:www.epa.gov/region09/waste/sfund/prg/files/prgtable.pdf.

U.S. Environmental Protection Agency (EPA), 1996, ***Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods***, EPA Publications SW-0846, Third Edition, Update III, (http://www.epa.gov/sw-846/sw846.htm).

U.S. Environmental Protection Agency (EPA), 1993, ***Data Quality Objectives for Superfund: Interim Final Guidance***, OSWER Directive No. 9355.9-01, Office of Emergency and Remedial Response, Washington, D.C., EPA 540-R-93-071.

# TABLES

# Table 2-1

## Summary of Data Quality Objectives
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio

| Potential Data Users | Available Data | Conceptual Model | Media of Concern | Data Uses and Objectives | Data Types | Analytical Level |
|---|---|---|---|---|---|---|
| EPA<br><br>OEPA<br><br>DOD<br><br>USACE<br><br>NASA<br><br>Shaw<br><br>Other Contractors<br><br>Possible Future Land Users | Previous environmental investigations show varying degrees of contamination in the soil. | <u>Contaminant Source</u><br>Production of TNT, DNT, and pentolite. Past DOD operations.<br><br><u>Migration Pathways</u><br>Soil, sediment, surface water, and groundwater.<br><br><u>Potential receptors</u><br>Wildlife, human.<br><br><u>Potential Contaminants of Concern</u><br>SVOCs, metals, PCBs, and explosives. | Groundwater<br><br>Surface Water<br><br>Sediments<br><br>Soil | Define site physical features and characteristics.<br><br>Determine nature and extent of DOD-related contamination in soil, sediment, surface water, and groundwater.<br><br>Determine chemical characteristics of contamination.<br><br>Evaluate fate and transport of contamination.<br><br>Determine if overburden groundwater underlying Ash Pit 2 is sufficient in volume and quality to be defined as a potential drinking water source in the State of Ohio.<br><br>Obtain site data of quality, quantity and distribution appropriate for site.<br><br>Obtain site data of quality, quantity and distribution appropriate for site characterization, risk assessment, and feasibility study.<br><br>Evaluate and use existing data appropriate to Ash Pit 2. | <u>Groundwater</u><br>Metals<br>Explosives<br>SVOCs<br>VOCs<br>Water quality parameters<br><br><u>Surface Water</u><br>SVOCs<br>Explosives<br>Metals<br>Hardness<br><br><u>Soil</u><br>Metals<br>Explosives<br>PCBs<br>SVOCs<br>TOC<br><br><u>Sediments</u><br>Metals<br>Explosives<br>PCBs<br>SVOCs<br>TOC | Definitive |

DNT - Dinitrotoluene.
DOD - U.S. Department of Defense.
EPA - U.S. Environmental Protection Agency.
OEPA - Ohio Environmental Protection Agency.
USACE - U.S. Army Corps of Engineers.
NASA - National Aeronautics and Space Administration.
SVOC - Semivolatile organic compound.
TNT - Trinitrotoluene.
Shaw - Shaw Environmental, Inc.
TOC - Total organic carbon.
PCB - Polychlorinated biphenyls.
VOC - Volatile organic compound.

# Table 3-1

## Summary of Soil, Surface Water, Sediment, and Groundwater Analytical Samples
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio



| Direct-Push Soil Samples [a] | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Field Samples** | **QA/QC Samples** | **Rinsates** | **Source Water** | **Trip Blanks** | **Matrix Spike/Duplicates** |
| Nitroaromatics | 24 | 3 | 2 | 1 | NA | 3/3 |
| TCL SVOCs | 24 | 3 | 2 | 1 | NA | 3/3 |
| PCBs | 16 | 3 | 4 | 1 | NA | 2/2 |
| TAL Metals | 24 | 3 | 2 | 1 | NA | 1 |
| Total Organic Carbon | 1 | NA | NA | NA | NA | NA |
| **Sediment Samples [a]** | | | | | | |
| **Parameters** | **Field Samples** | **QA/QC Samples** | **Rinsates** | **Source Water** | **Trip Blanks** | **Matrix Spike/Duplicates** |
| Nitroaromatics | 5 | 1 | 1 | NA | NA | 1 |
| TCL SVOCs | 5 | 1 | 1 | NA | NA | 1 |
| PCBs | 5 | 1 | 1 | NA | NA | 1 |
| TAL Metals | 5 | 1 | 1 | NA | NA | 1 |
| Total Organic Carbon | 1 | NA | NA | NA | NA | NA |
| **Surface Water Samples [a]** | | | | | | |
| **Parameters** | **Field Samples** | **QA/QC Samples** | **Rinsates** | **Source Water** | **Trip Blanks** | **Matrix Spike/Duplicates** |
| Nitroaromatics | 5 | 1 | 1 | NA | NA | 1 |
| TCL SVOCs | 5 | 1 | 1 | NA | NA | 1 |
| TAL Metals | 5 | 1 | 1 | NA | NA | 1 |
| Hardness | 1 | NA | NA | NA | NA | NA |
| **Piezometer Samples [a]** | | | | | | |
| **Parameters** | **Field Samples** | **QA/QC Samples** | **Rinsates** | **Source Water** | **Trip Blanks** | **Matrix Spike/Duplicates** |
| Nitroaromatics | 6 | 1 | 1 | 1 | NA | 1 |
| TCL SVOCs | 6 | 1 | 1 | 1 | NA | 1 |
| TAL Metals (Filtered) | 6 | 1 | 1 | 1 | NA | 0 |
| TAL Metals (Total) | 6 | 1 | 1 | 1 | NA | 1 |
| Water Quality Parameters [a] | 6 | NA | NA | NA | NA | NA |

## Table 3-1

## Summary of Soil, Surface Water, Sediment, and Groundwater Analytical Samples
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio



| Monitoring Well Samples [a,b] | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Field Samples** | **QA/QC Samples** | **Rinsates** | **Source Water** | **Trip Blanks** | **Matrix Spike/Duplicates** |
| Nitroaromatics | 12 | 2 | 2 | 2 | NA | 2 |
| TCL VOCs | 12 | 2 | 2 | 2 | 2 | 2 |
| TCL SVOCs | 12 | 2 | 2 | 2 | NA | 2 |
| Metals (Filtered) | 12 | 2 | 2 | 2 | NA | 0 |
| Metals (Total) | 12 | 2 | 2 | 2 | NA | 2 |
| Water Quality Parameters [a] | 12 | NA | NA | NA | NA | NA |

TCL - Target compound list; VOC - Volatile organic compound; SVOC - Semivolatile organic compound; TAL - Target analyte list.
PCB - Polychlorinated biphenyl; QA - Quality assurance; QC - Quality control.

[a] Refer to Table 4-1 and footnotes for groundwater quality parameters.
[b] Two rounds of sampling--a total of 6 new wells.

## Table 4-1

## Summary of Analytical Parameters and Methods
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio

| Sample Matrix | Analytical Parameters | Analytical Method |
|---|---|---|
| Groundwater | TCL VOCs | SW-846 5030B/8260B[a] |
| | TCL SVOCs | SW-846 3510C/8270C[a] |
| | Nitroaromatics | SW-846 3535/8330[a] |
| | PCBs | SW-846 3510C/8082[a] |
| | Total TAL Metals | SW-846 3010A/6010B/7470A[a] |
| | Dissolved TAL Metals | SW-846 3010A/6010B/7470A[a] |
| | Turbidity[c] | MCAWW 180.1[b] |
| | Alkalinity[c] | MCAWW 310.1[b] |
| | Hardness[c] | MCAWW 130.2[b] |
| | Total Dissolved Solids[c] | MCAWW 160.1[b] |
| | Total Suspended Solids[c] | MCAWW 160.2[b] |
| | Chloride[c] | MCAWW 325.3[b] |
| | Cyanide, total[c] | SW-846 9010A/9012[a] |
| | Nitrate[c] | MCAWW 352.1[b] |
| | Oxidation-reduction potential[c] | ASTM D1498-08[d] |
| | Sulfate[c] | MCAWW 375.3[b] |
| Surface water | TCL SVOCs | SW-846 3510C/8270C[a] |
| | Nitroaromatics | SW-846 3535/8330[a] |
| | TAL Metals | SW-846 3005A/6010B/7470A[a] |
| | Hardness[c] | MCAWW 130.2[b] |
| Soil | TCL SVOCs | SW-846 3541/8270C[a] |
| | Nitroaromatics | SW-846 8330[a] |
| | PCBs | SW-846 3541/8082[a] |
| | TAL Metals | SW-846 3050B/6010B/7471A[a] |
| | Total Organic Carbon | Walkley-Black or Lloyd-Kahn |
| Sediments | TCL SVOCs | SW-846 3541/8270C[a] |
| | Nitroaromatics | SW-846 8330[a] |
| | PCBs | SW-846 3541/8082[a] |
| | TAL Metals | SW-846 3050B/6010B/7471A[a] |
| | Total Organic Carbon | SW-846 9060[a] |
| Liquid IDW | TCL VOCs | SW-846 5030B/8260B[a] |
| | TCL SVOCs | SW-846 3510C/8270C[a] |
| | Nitroaromatics | SW-846 3535/8330[a] |
| | TAL Metals | SW-846 3010A/6010B/7470A[a] |
| | Ignitability | SW-846 1010[a] |
| | Corrosivity | SW-846 1110[a] |
| | Reactivity | 7.3.3/7.3.4[a] |
| Solid IDW | TCL VOCs | SW-846 1311/5030B/8260B[a] |
| | TCL SVOCs | SW-846 1311/3510C/8270C[a] |
| | TCLP Metals | SW-846 1311/3010A/6010B/7470A[a] |
| | Ignitability | SW-846 1010[a] |
| | Corrosivity | SW-846 1110[a] |
| | Reactivity | 7.3.3/7.3.4[a] |

TCL - Target compound list; VOC - Volatile organic compound; SVOC - Semivolatile organic compound; TAL - Target analyte list; PCB - Polychlorinated biphenyl; TCLP - Toxicity characteristic leaching procedure; IDW - Investigation-derived waste.

[a]Analyses found in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* USEPA Publication, Third Edition.
[b]Analyses found in *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, March 1983 and subsequent revisions.
[c]Water quality parameter.
[d]American Society for Testing and Materials.

## Table 5-1

## Analytical Methods, Containers, Preservatives, and Holding Times
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio



| Matrix | Parameter | Analytical Method | Sample Container* | Preservation Requirements | Holding Time |
|---|---|---|---|---|---|
| Groundwater | TCL VOCs | SW-846 5030B/8260B | (3) 40 ml VOA vial | Cool to 4$^{o}$C, HCL to pH <2 | 14 days |
| | TCL SVOCs | SW-846 3510C/8270C | (2) 1 L amber glass | Cool to 4$^{o}$C | 7 days extraction/40 days |
| | Nitroaromatics | SW-846 3535/8330 | (2) 1 L amber glass | Cool to 4$^{o}$C | 7 days extraction/40 days |
| | PCBs | SW-846 3510C/8082 | (2) 1 L amber glass | Cool to 4$^{o}$C | 7 days extraction/40 days |
| | Total TAL Metals | SW-846 3005A/6010B/7470A | (1) 100 mL HDPE | Cool to 4$^{o}$C, $HNO_3$ to pH <2 | 6 months (28 days for Hg) |
| | Dissolved TAL Metals | SW-846 3005A/6010B/7470A | (1) 100 mL HDPE | Cool to 4$^{o}$C, $HNO_3$ to pH <2 | 6 months (28 days for Hg) |
| | Turbidity | MCAWW 180.1 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 48 hours |
| | Hardness | MCAWW 310.1 | (1) 250 mL HDPE | Cool to 4$^{o}$C, $HNO_3$ to pH <2 | 6 months |
| | TDS/TSS | MCAWW 160.1/160.2 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 7 days |
| | Alkalinity | MCAWW 310.1 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 14 days |
| | Chloride | MCAWW 325.3 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 28 days |
| | Total Cyanide | SW-846 9010A/9012 | (1) 250 mL HDPE | Cool to 4$^{o}$C, NaOH to pH >2 | 14 days |
| | Nitrate | MCAWW 352.1 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 48 hours |
| | Sulfate | MCAWW 375.3 | (1) 250 mL HDPE | Cool to 4$^{o}$C | 28 days |
| | ORP | ASTM D1498-08 | NA | NA | ASAP |
| Surface water | TCL SVOCs | SW-846 3510C/8270C | (2) 1 L amber glass | Cool to 4$^{o}$C | 7 days extraction/40 days |
| | Nitroaromatics | SW-846 3535/8330 | (2) 1 L amber glass | Cool to 4$^{o}$C | 7 days extraction/40 days |
| | TAL Metals | SW-846 3005A/6010B/7470A | (1) 100 mL HDPE | Cool to 4$^{o}$C, $HNO_3$ to pH <2 | 6 months (28 days for Hg) |
| | Hardness | EPA 130.2 | (1) 100 mL HDPE | Cool to 4$^{o}$C, $HNO_3$ to pH <2 | 6 months |
| Soil | TCL SVOCs | SW-846 3541/8270C | (1) 8 oz CWM glass with Teflon-lined lid | Cool to 4$^{o}$C | 14 days extraction/40 days |
| | Nitroaromatics | SW-846 8330 | | | 14 days extraction/40 days |
| | PCBs | SW-846 3541/8082 | | | 14 days extraction/40 days |
| | TAL Metals | SW-846 3050B/6010B/7471A | | | 6 months (28 days for Hg) |
| | TOC | SW-846 9060 | | | 28 days |
| Sediments | TCL SVOCs | SW-846 3541/8270C | (1) 8 oz CWM glass with Teflon-lined lid | Cool to 4$^{o}$C | 14 days extraction/40 days |
| | Nitroaromatics | SW-846 8330 | | | 14 days extraction/40 days |
| | PCBs | SW-846 3541/8082 | | | 14 days extraction/40 days |
| | TAL Metals | SW-846 3050B/6010B/7471A | | | 6 months (28 days for Hg) |
| | TOC | SW-846 9060 | | | 28 days |

## Table 5-1

## Analytical Methods, Containers, Preservatives, and Holding Times
## Ash Pit 2
## Remedial Investigation
## Former Plum Brook Ordnance Works, Sandusky, Ohio



| Matrix | Parameter | Analytical Method | Sample Container* | Preservation Requirements | Holding Time |
|---|---|---|---|---|---|
| Liquid IDW | TCL VOCs | SW-846 5030B/8260B | (3) 40 ml VOA vial | Cool to 4°C, HCL to pH <2 | 14 days |
| | TCL SVOCs | SW-846 3510C/8270C | (2) 1 L amber glass | Cool to 4°C | 7 days extraction/40 days |
| | Nitroaromatics | SW-846 3535/8330 | (1) 1 L amber glass | Cool to 4°C | 7 days extraction/40 days |
| | TAL Metals | SW-846 3005A/6010B/7470A | (1) 250 mL HDPE | Cool to 4°C, $HNO_3$ to pH <2 | 6 months (28 days for Hg) |
| | Ignitability | SW-846 1010 | (1) 1 L Amber | Cool to 4°C | ASAP |
| | pH | SW-846 9045B | | | |
| | Corrosivity | SW-846 1110 | | | |
| | Reactive Cyanide | 7.3.3/7.3.4 | | | |
| | Reactive Sulfide | 7.3.3/7.3.4 | | | |
| Solid IDW | TCLP VOCs | SW-846 1311/5030B/8260B | (1) 8 oz CWM glass with Teflon-lined lid | Cool to 4°C | 14 days extraction |
| | TCLP SVOCs | SW-846 1311/3510C/8270C | | | 14 days extraction/40 days |
| | TCLP Metals | SW-846 1311/3005A/6010B/7470A | | | 14 days /ext./6 months (28 days for Hg) |
| | Ignitability | SW-846 1010 | | | ASAP |
| | Corrosivity | SW-846 1110 | | | ASAP |
| | Reactivity | 7.3.3.2/7.3.4.2 | | | ASAP |

°C - Degrees Celsius.
CWM - Clear wide mouth.
$H_2S0_4$ - Sulfuric acid.
HCI - Hydrochloric acid.
HDPE - High-density polyethylene.
Hg - Mercury.
$HNO_3$ - Nitric acid.
L - Liter.
mL - Milliliter.
NA - Not applicable.
TDS - Total dissolved solids.
TSS - Total suspended solids.

NaOH - Sodium hydroxide.
ORP - Oxidation-reduction potential.
SVOC - Semivolatile organic compound.
TAL - Target analyte list.
TCL - Target compound list.
TOC - Total organic carbon.
VOC - Volatile organic compound.
IDW - Investigative-derived waste.
EPA - U.S. Environmental Protection Agency.
VOA - Volatile organic analysis.
OZ - Ounces.
Ext. - Extraction
ASAP - As soon as possible.

*Number of containers required in ( ).

# FIGURES

NOT TO SCALE

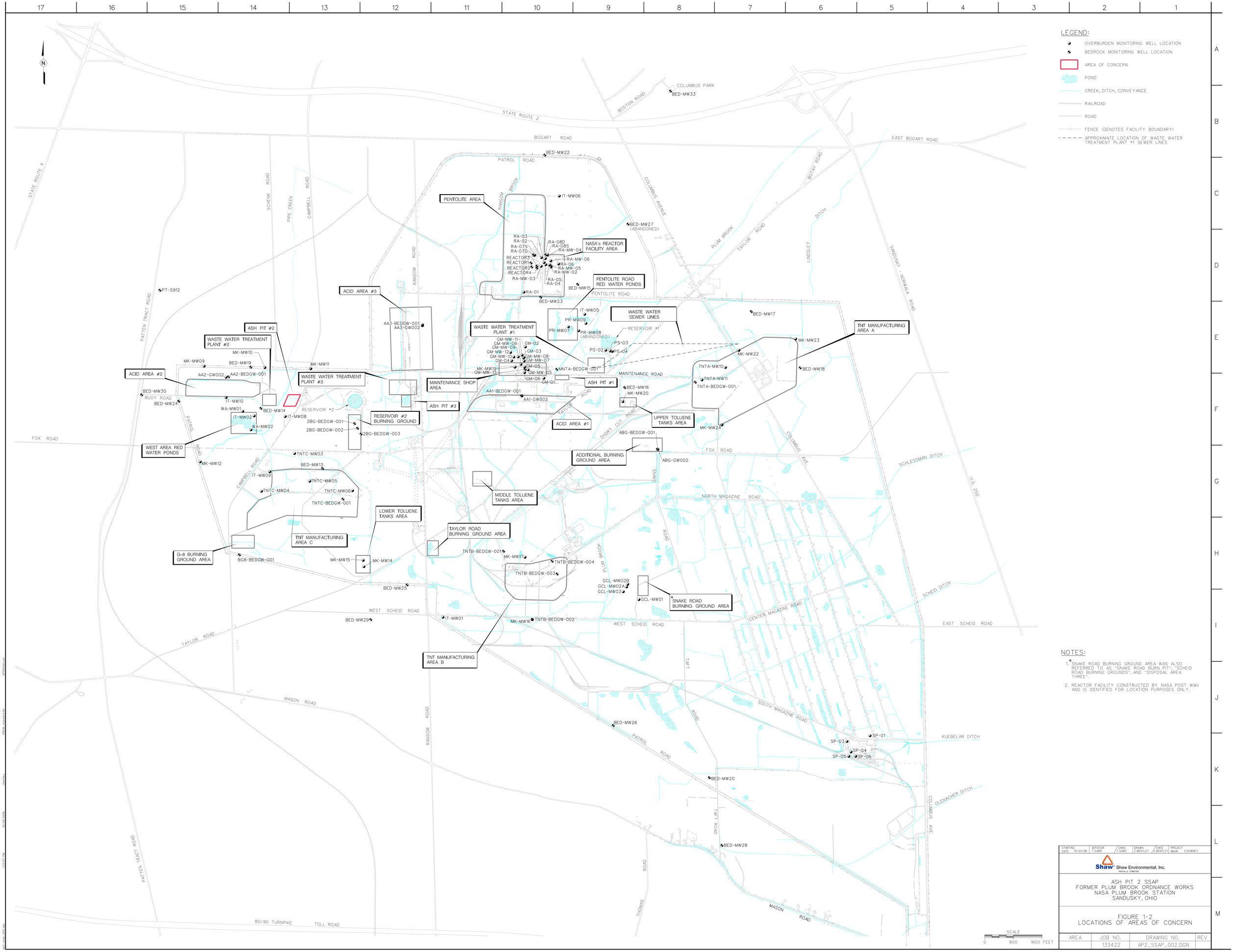
FIGURE 1-1
PBOW VICINITY MAP

*ASH PIT 2 SSAP*
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*SANDUSKY, OHIO*

Shaw® Shaw Environmental, Inc.

| | | | |
|---|---|---|---|
| STARTING DATE: 10/20/08 | DATE LAST REV.: | DRAFT. CHCK. BY: C. BENTLEY | INITIATOR: T. SIARD | ap2_ssap_001.dgn |
| DRAWN BY: C. BENTLEY | DRAWN BY: | ENGR. CHCK. BY: T. SIARD | PROJ. MGR.: S. DOWNEY | PROJ. NO.: 133422 |

PBOW_standard.tbl
cbentley
ap2_ssap_001.dgn
Canon-color-Letter.plt
1:23:44 PM
10/28/2008




NOTES:

1. *SNAKE ROAD BURNING GROUND AREA WAS ALSO REFERRED TO AS "SNAKE ROAD BURN PIT", "SCHEID ROAD BURNING GROUNDS", AND "DISPOSAL AREA THREE".
2. REACTOR FACILITY CONSTRUCTED BY NASA POST WWII AND IS IDENTIFIED FOR LOCATION PURPOSES ONLY.

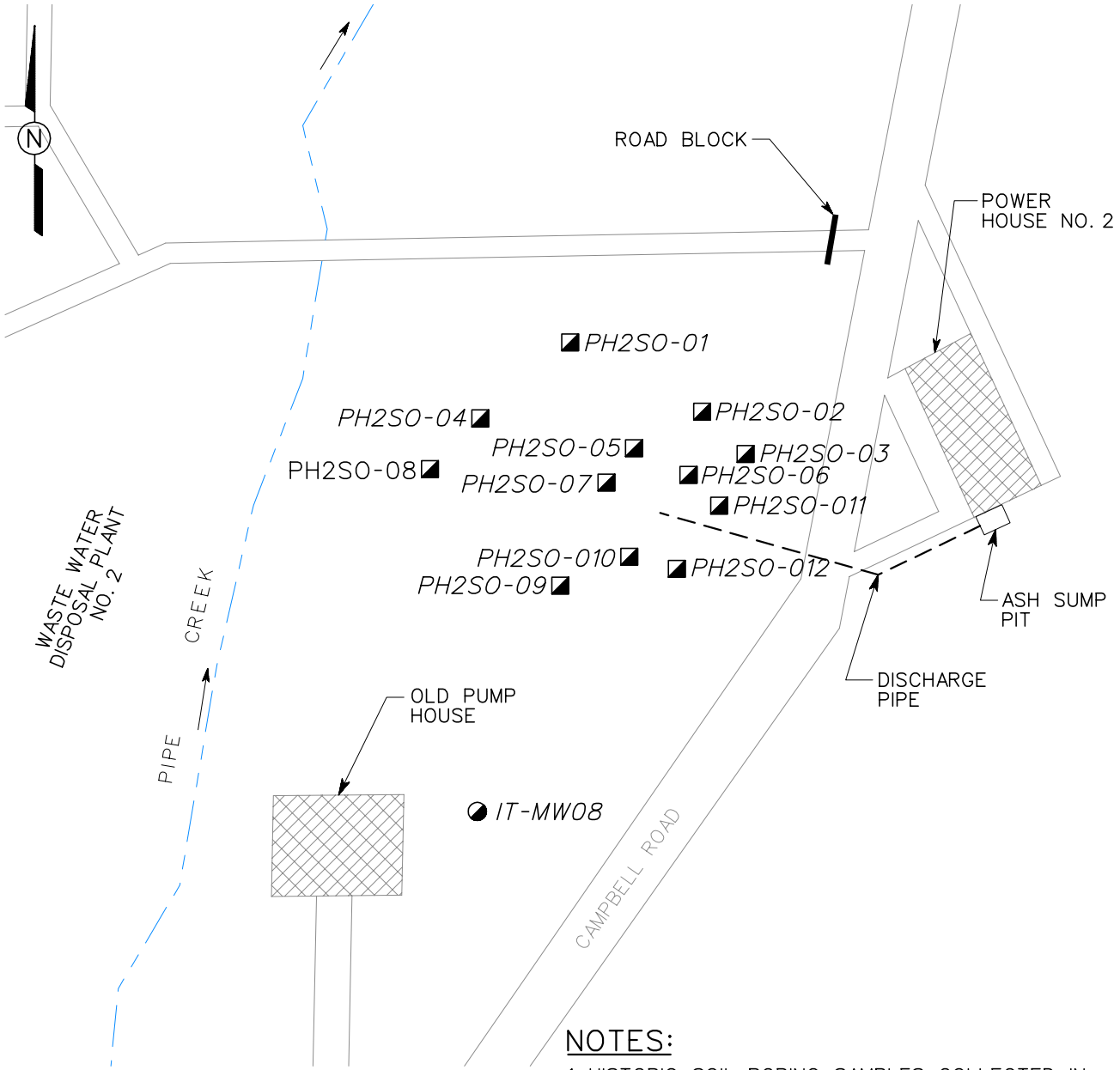
| STARTING DATE | INITIATOR | CHKD | DRAWN | CHKD | PROJECT MNGR |
|---|---|---|---|---|---|
| 10/20/08 | T.SIARD | T.SIARD | C.BENTLEY | C.BENTLEY | S.DOWNEY |

Shaw® Shaw Environmental, Inc.
KNOXVILLE, TENNESSEE

ASH PIT 2 SSAP
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

FIGURE 1-2
LOCATIONS OF AREAS OF CONCERN

| AREA | JOB NO. | DRAWING NO. | REV |
|---|---|---|---|
| | 133422 | AP2_SSAP_002.DGN | |




## NOTES:

1. HISTORIC SOIL BORING SAMPLES COLLECTED IN 1996 AS PART OF A SITE INVESTIGATION (IT, 1997). TWO SAMPLES WERE COLLECTED FROM EACH BORING, ONE 0-0.5 FT. AND ONE 2-3 FT. BELOW GROUND SURFACE.

## LEGEND:

- BUILDINGS
- DITCH
- HISTORIC SOIL BORING LOCATION (NOTE 1)
- EXISTING MONITORING WELL (OVERBURDEN)

SCALE

0 200 400 FEET

# FIGURE 1-3
# HISTORIC SOIL BORING LOCATIONS

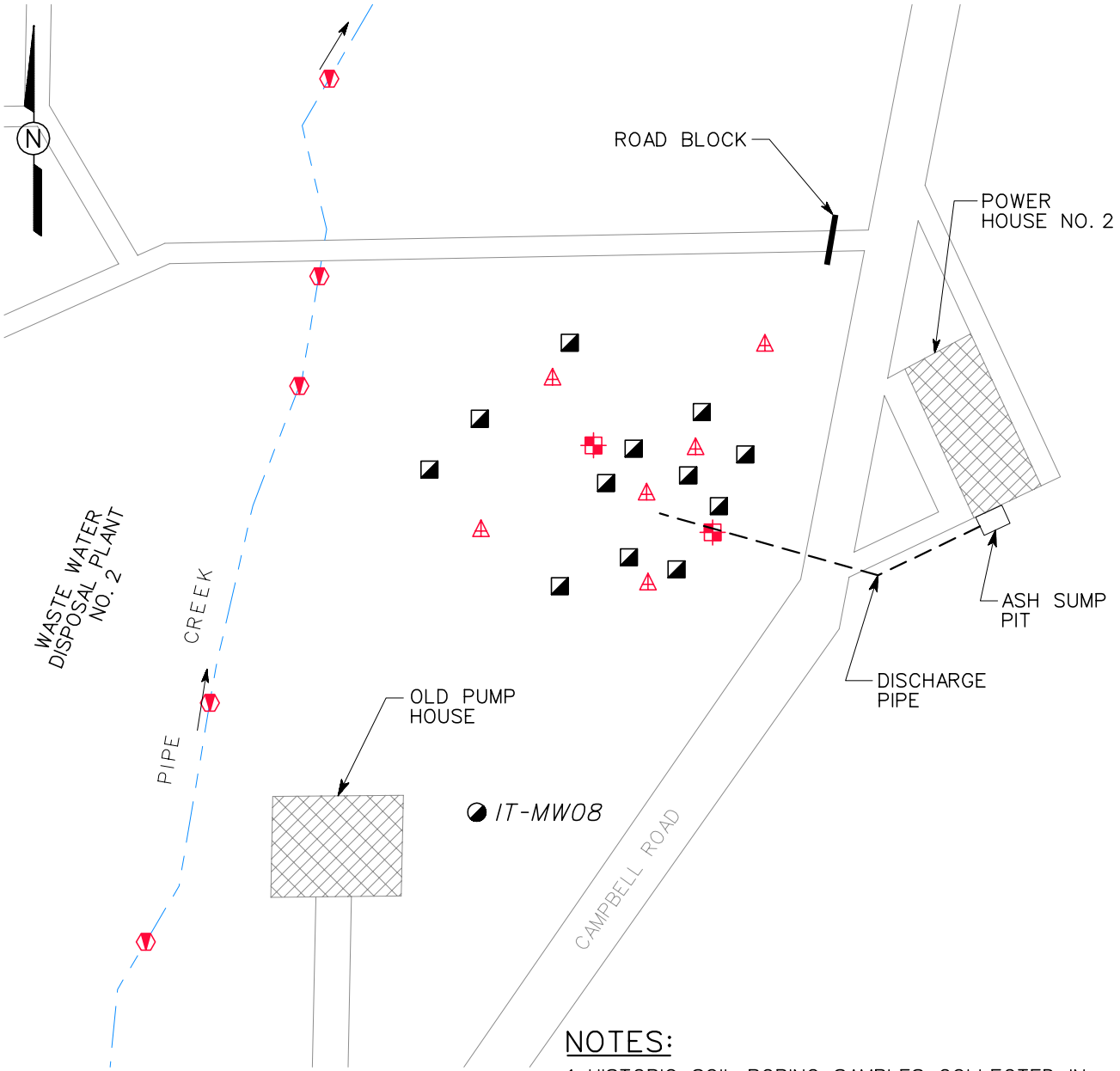
*ASH PIT 2 SSAP*
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*SANDUSKY, OHIO*

Shaw® Shaw Environmental, Inc.

| | | | |
|---|---|---|---|
| STARTING DATE: 10/27/08 | DATE LAST REV.: | DRAFT. CHCK. BY: C. BENTLEY | INITIATOR: T. SIARD | ap2_ssap_003.dgn |
| DRAWN BY: C. BENTLEY | DRAWN BY: | ENGR. CHCK. BY: T. SIARD | PROJ. MGR.: S. DOWNEY | PROJ. NO.: 133422 |

Canon-color-Letter.plt 1:29:43 PM 10/28/2008

PBOW_standard.tbl cbentley ap2_ssap_003.dgn




## NOTES:

1. HISTORIC SOIL BORING SAMPLES COLLECTED IN 1996 AS PART OF A SITE INVESTIGATION (IT, 1997).
2. THREE OVERBURDEN/SHALE AND THREE LIMESTONE BEDROCK MONITORING WELLS WILL BE INSTALLED BASED ON THE PIEZOMETER ANALYTICAL RESULTS.

## LEGEND:

- BUILDINGS
- DITCH
- HISTORIC SOIL BORING LOCATION (NOTE 1)
- EXISTING MONITORING WELL (OVERBURDEN)
- PROPOSED SEDIMENT/SURFACE WATER SAMPLE LOCATION
- PROPOSED SOIL BORING LOCATION
- PROPOSED SOIL BORING/ PIEZOMETER LOCATION

SCALE

0 200 400 FEET

# FIGURE 3-1
# PROPOSED SAMPLING LOCATIONS

*ASH PIT 2 SSAP*
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*SANDUSKY, OHIO*

Shaw® Shaw Environmental, Inc.

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| STARTING DATE: 10/20/08 | DATE LAST REV.: | DRAFT. CHCK. BY: C. BENTLEY | INITIATOR: T. SIARD | ap2_ssap_004.dgn |
| DRAWN BY: C. BENTLEY | DRAWN BY: | ENGR. CHCK. BY: T. SIARD | PROJ. MGR.: S. DOWNEY | PROJ. NO.: 133422 |

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# RESPONSE TO COMMENTS

**Response to Comments**
**Draft Site-Specific Sampling and Analysis Plan**
**Ash Pit 2**
**Former Plum Brook Ordnance Works Sandusky, Ohio**
**November 13, 2008**

*Review comments from J. Weatherington-Rice, Bennett & Williams, Inc., (Restoration Advisory Board TAPP Contractor), received December 2, 2008.*

**General Comments**

**Comment 1:** **This document is much better written than either of the two previously reviewed documents. The connection and linkages between the sections continues to be stronger, more references to topics that are discussed in more than one place. It is even easier to follow than the second document. A number of site-specific deficiencies that I noted in the earlier documents have been corrected in this text.**

**Response 1**: Comment noted.

**Specific Comments**

**Comment 1:** **1.1 Plum Brook Ordnance Works Facility History on Page 1-1. Second line from bottom of page "In 1963, *accountability* and custody of the entire PBOW property (6,030 acres) was transferred to NASA by the Department of the Army." Have we absolutely determined that NASA has "accountability" of the PBOW site since 1963? If so, the lawyers will read this as NASA having the sole responsibility of clean-up of the site from their budget only. The legal usage of the term "accountability" under CERCLA and other Federal applications is different from the everyday usage of this term. If this is not the intended legal understanding of the assignment of the "responsible party" for the PBOW clean-up effort, consider revising this term to something more neutral and recalling this draft page.**

**Response 1:** This language was taken directly from text attached to an April 1994 Department of the Army memorandum titled: DERP-FUDS Findings and Determination of Eligibility (FDE) for Plum Brook Ordnance Works, Sandusky, OH". Because PBOW was determined as eligible for the DERP-FUDS program based partly on this memorandum, this concern expressed by the review appears to be unfounded.

**Comment 2:** **1.2 Summary of Existing Site Data on Page 1-2. First paragraph shows good linkage to previous documents related to this site. For continuity, it would also be useful to add a sentence that would show linkage with the ongoing efforts at Ash Pits 1 & 3 as well. Unless there is some reason to**

**expect that conditions at Ash Pit 2 are unusual, these two documents should be similar.**

**Response 2:** The purpose of this section, as indicated by the title, is to summarize existing site data. The first sentence references only the site investigation that covers Ash Pit 2. Because this is a site-specific sampling and analysis plan, it does not include previous documents related to Ash Pits 1 and 3, which are a separate DERP-FUDS project from Ash Pit 2. Ash Pits 1 and 3 are being investigated under different site-specific sampling and analysis plans. Ash Pits 1 and 3 are neither geographically nor is their investigation logistically related to the investigation of Ash Pit 2. The inclusion of information on Ash Pits 1 and 3 would not prove useful for the investigation of Ash Pit 2 and may tend to obscure the issue as to what specific site is being investigated.

**Comment 3:** **<u>Last paragraph on page</u>. "…the Ash Pit 2 area was observed to be overgrown with trees and nearly indistinguishable from surrounding *forest*." The term "forest" may not be the best descriptive term to use to identify an area of grown-up succession revegetation in the area of a WWII pond. Unless the adjoining land use was that of an historic wood lot on the original farms from which the PBOW was developed, the term "forest" denotes a level of uniform treed vegetation of significant age that probably does not exist at this site. Consider revising the text to better describe existing conditions.**

**Response 3:** This comment seems to suggest that the term "forest" connotes a mature climax forested area, often referred to as "old-growth" forest. While such mature vegetation would certainly meet the definition of "forest," so do many other vegetation types with a closed or nearly closed tree canopy. Forests are composed of characteristic tree communities, or "associations" (e.g., oak-hickory, beech-maple) or more general vegetation types (mixed deciduous, coniferous), locality (e.g., upland, floodplain), and state of succession (e.g., early successional, climax). The area surrounding Ash Pit 2 is covered with what appears to be a mid-successional deciduous forest with a fairly open understory, and the forest vegetation (including the canopy, sub-canopy, shrubby, and herbaceous layers) present within Ash Pit 2 is indistinguishable from that of the adjacent area. The statement made in the SSAP accurately provides, as intended, a description of general site appearance. Further description of the vegetation will be included in the remedial investigation documents, especially the ecological risk assessment report.

**Comment 4:** **<u>Top of page 1-3</u>. "A small well-like hole constructed of exposed bricks and approximately two feet in diameter was located near the concrete slabs. The depth of the hole was not determined." It is important to determine the depth of the brick-lined hole and the presence of ground water in the hole. This may be a direct route for ground water contamination at the site. It needs to be properly abandoned and sealed.**

**Response 4:** Since submittal of the draft work plan, it has been confirmed that this brick-lined hole is a hand-dug well and is a few hundred feet north of the Ash Pit 2 study area boundary. The text will be revised to identify this structure as such. A statement will be added to the work plan that the depth of this hand-dug well will be measured and documented in the RI report. The ultimate disposition of this well will be determined after further discuss with NASA as this is not an Army-related problem.

**Comment 5:** **<u>Last paragraph page 1-3</u>. Listing of what the samples were screened for. Virtually all Ohio coals and their resulting coal ash are also radioactive. US ACE should be instructing their contractors to be checking all ash pits for radioactivity as well as the parameters listed. Please see the following Ohio Dept. of Natural Resources Division of Geological Survey publications for further information:**

**<u>RI 103</u>. Trace elements in Ohio coals, by Norman F. Knapp. 12 p., 2 figs., 8 tables, 1977. $3.00.**

**<u>IC 47</u>. Analyses of Ohio coals, by George Botoman and David A. Stith. 148 p. of tables and 8 folded tables, 1978. $8.00.**

**<u>IC 50</u>. Analyses of Ohio coals, 1977-1978, by George Botoman and David A. Stith. 51 p. of tables and 4 folded tables, 1981. $8.00.**

**<u>C 52</u>. Analyses of Ohio coals, 1979-1980, by George Botoman and David A. Stith. 26 p. of tables and four folded tables, 1986. $8.00.**

**<u>IC 55</u>. Analyses of Ohio coals, 1982-1984, by George Botoman and David A. Stith. 17 p. of tables and four folded tables, 1988. $8.00.**

**Response 5:** Just as coals, all soils and rock also have naturally occurring radioactivity. If the Ash Pit 2 soil were to be screened for radioactivity, that information, alone, would not reveal the origin of the radioactivity or whether this radioactivity would result in exposure to levels of radioactivity that exceeds naturally occurring conditions. This is because no background radioactivity investigation has been performed or recommended for PBOW.

Fly ash is a common additive to concrete building products. Its radioactivity is generally not higher than that of more conventional concrete additives or other building materials such as the granite, used in kitchens and bathrooms, and brick (U.S. Geological Survey [USGS], 1997). Naturally occurring radon has been estimated to contribute more radiation to the general public than any other source, resulting is approximately 55 percent of all radiation exposure; note that fly ash contains very little radon because combustion drives off radon in the gaseous phase. Certain radionuclides, such as radium (from which radon originates), may become more concentrated in fly ash than in the coal source. However, when houses or other wood-frame buildings are

constructed on fly ash structural fill, as opposed to native soil, the presence of radon or other alpha radiation emitters has not been demonstrated as higher inside the structures; in fact Sutton, et al., (2001) found that fly ash fill contained more radium but emitted less radon than did native soils. The USGS (1997) has concluded that fly ash is generally not significantly enriched in radioactivity beyond that naturally found in soils and rocks. Therefore, it is the position of the USACE that radiological investigation of Ash Pit 2 is not warranted.

References for the Response 5
Sutton, M.E., T. Schmaltz, E.C. Miller, and K.J. Harper, 2001, *Radon Emissions from a high Volume Fly Ash Structural Fill Site*, 2001 International Ash Utilization Symposium, Center for applied Energy Research, University of Kentucky, Paper No. 91.

U.S. Geological Survey (USGS), 1997, *Radioactive Elements in Coal and Fly Ash: Abundance, Forms, and Environmental Significance*, Central Region Energy Resources Team, Fact Sheet FS-163-97, October.

**Comment 6:** **3.1.1 Direct-Push Soil Samples on Page 3-2. Second paragraph lists analyses parameters. This list should also include radioactivity since this site is an investigation of coal ash.**

**Response 6:** The USACE disagrees. See response to Comment No. 5.

**Comment 7:** **3.1.2 Soil Sampling Procedures top of Page 3-4. "The neat cement mixture used to seal the boreholes will be composed of a ratio of one 94-pound bag of Portland cement to no more than 6 gallons of water, and 2 to 8 percent bentonite powder." Thank you for that information which I have requested earlier in this set of document reviews.**

**Response 7:** Comment noted.

**Comment 8:** **3.3.3 Piezometer Installation page 3-6. In discussing the installation and completion process for the piezometers, the following statements are made; "No filter pack material will be placed around the well screen. Because the sampling will occur reasonably quickly after the piezometers have been installed, semipermanent seals are not necessary. The top 1-2 feet of the borehole will be sealed with bentonite to prevent precipitation water or surface runoff from infiltrating the borehole". This language is an improvement from the previous documents. However, it DOES NOT go to the heart of the problem in piezometer (or well) construction that I have previously identified. Bentonite is being used to seal the top 1 to 2 feet of the hole. It's either being added dry as pellets or powdered clay or it is being added wet as some type of a slurry. This discussion identifies NO mechanism to prevent the bentonite from migrating down the inside of the boring, outside the piezometer casing and plugging the screen.**

**There is a reference to Figure 4-5 of the SWSAP that is supposed to show a "typical piezometer construction" but that figure in NOT here included in this document. If there is no separation between the added bentonite and the screen, there is a very real possibility that the screen may become plugged and the piezometer will not operate as intended. This lack of a separation may be the cause of historically "dry" piezometers and monitoring wells at the site. This issue needs to be fully addressed and/or piezometer installation and possibly monitoring well installation designs need to be modified to address this critical issue. See comments in the previous two reviews for additional details**

**Response 8:** The text will be revised to state that the annular space between the borehole wall and piezometer casing will be sealed with plastic and topped with a cardboard or plastic plate. Bentonite is then placed on top of this material, essentially mounded on the ground surface to provide a temporary seal. This plate and the plastic within the borehole will prevent any bentonite from entering the borehole.

*Paul Jayco, Ohio Environmental Protection Agency communicated via email on November 24, 2008, that the State had no substantive comments on this document.*