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February 16, 2006

Attn: CELRN-EC-R-M (Linda Ingram)  
U.S. Army Corps of Engineers  
Nashville District  
110 Ninth Ave. South, Rm. 682 Annex  
Nashville, TN 37203

Subject: Contaminant Delineation Summary Report, Engineering Evaluation/Cost Analysis, Reservoir No. 2 Burning Ground, Plum Brook Ordnance Works

Dear Linda,

Enclosed find three (4) copies of the above referenced document. This report summarizes the results of the delineation sampling performed December 2005 at Reservoir No. 2 Burning Ground, as part of the Engineering Evaluation / Cost Analysis (EE/CA).

Additional material will be provided in the Draft EE/CA Report, such as data tables, spider diagrams, and the customary data quality reports.

No formal comments are expected for this summary report.

If you have any questions regarding this submittal, please contact me at 865-220-4874 or [doug.hodge@jacobs.com](mailto:doug.hodge@jacobs.com).

Sincerely yours,

Douglas S. Hodge, Ph.D.

#### Attachments

Cc: Rick Meadows-CELRH (3 copies)  
Paul Jayko-OEPA (2 copies)  
Laurie Moore-OEPA (1 copy)  
Robert Lallier-NASA (1 copy)  
Michael Filips-CENWO-CX (1 copy)  
Dennis Druck-USCHPPM (1 copy)  
Mark Bohne-PBOW RAB (1 copy)

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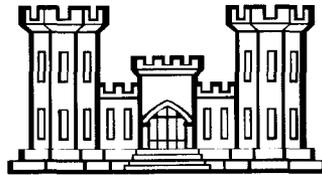
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# CONTAMINANT DELINEATION SUMMARY REPORT

## Engineering Evaluation/Cost Analysis, At Reservoir No. 2 Burning Ground Former Plum Brook Ordnance Works Sandusky, Ohio

*Prepared for:*



DEPARTMENT OF THE ARMY  
NASHVILLE DISTRICT, CORPS OF ENGINEERS  
NASHVILLE, TENNESSEE  
CONTRACT DACW62-03-D-0004-0007

*Prepared by:*



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**February 2006**

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## INTRODUCTION

The U.S. Army is conducting investigations of the environmental impact at previously owned U.S. Department of Defense (DOD) properties. This work is being performed by the U.S. Army Corps of Engineers (USACE) under the Defense Environmental Restoration Program (DERP). Chemical contamination related to DOD activities has been documented at the former Plum Brook Ordnance Works (PBOW) located near Sandusky, Ohio. The PBOW site is a formerly used defense site under DERP, currently being managed by the Corps of Engineers, Huntington District (CELRH) and technically overseen by the Corps of Engineers, Nashville District (CELRN).

PBOW was operated from 1941 to 1945 as a manufacturing plant for trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. The site is currently owned by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station (PBS) of the John Glenn Research Center, which is located at Lewis Field, Cleveland, Ohio.

A Remedial Investigation (RI) of the Reservoir No. 2 Burning Ground (2BG) was performed in 2004 and 2005 by Jacobs Engineering Group (Jacobs) under contract DACW62-03-D-0004, Delivery Order #2. The work included an investigation of soil, sediment, and groundwater. The RI identified soil contamination, which exceeds the USEPA Region 9 PRGs for PCBs, explosives, PAHs, and lead. An Engineering Evaluation/Cost Analysis (EE/CA) of the Reservoir No. 2 Burning Ground (2BG) is being conducted by Jacobs Engineering Group (Jacobs) under contract DACW62-03-D-0004, Delivery Order #7. This work includes engineering services to conduct additional delineation sampling for surface soil contamination, treatability studies using various treatment technologies for soil contamination, and evaluation and cost estimating for various remedial alternatives. This report addresses the findings of the remedial investigation and subsequent delineation studies conducted at 2BG during the period May 2004 through December 2005.

Data collected during May 2004 show an area of surface soil contamination west of the burn area that exceeds the USEPA Region 9 PRGs for PCBs, nitroaromatics, PAHs, and lead. Ten additional surface soil samples were collected April 2005 to further define this area of contamination. Data from the April 2005 sampling event show that contamination continues toward the north and south and that additional data was needed to fully delineate the area (Figure 1). Additional information regarding site background, previous investigations, and environmental setting for 2BG are provided in the Final Site Characterization Report (Jacobs, 2006).

The objectives of this delineation study are to further define the boundary of surface soil contamination exceeding the USEPA Region 9 PRGs. This information is needed to determine the volume of impacted soil which directly affects the cost for the various remedial alternatives being evaluated as part of the EE/CA.

## INVESTIGATION PROCEDURES

The delineation study was conducted December 6 and 7, 2005. All field work was performed in accordance with the Final Site-Wide Sampling and Analysis Plan (SWSAP) (Jacobs, 2004a)

and the Final Site-Specific Field Sampling Plan (SWFSP) (Jacobs, 2004b), except as noted in the SWFSP Addendum, which was prepared by Jacobs November 2005. All work was performed in accordance with the Final Site-Wide Safety and Health Plan (Jacobs, 2004c) and the Final Site-Specific Safety and Health Plan Addendum for 2BG (Jacobs 2004d). Modified Level D PPE was used for soil sampling activities, which included hard hats, safety glasses, steel-toed boots, nitrile gloves, and tyvek coveralls.

Surface soil samples were collected from locations north, south, and southwest of the burn area, as proposed in the SWFSP Addendum. Samples were collected from 15 locations, from a depth of 0" – 6". Soil sampling was performed utilizing a hand auger equipped with dedicated disposable stainless steel sleeves. Samples were extruded from the sleeve and homogenized in a dedicated disposable glass bowl using a stainless steel spoon. Dedicated disposable spoons and bowls were used for each sample.

All sampling equipment was cleaned prior to use; first with an alqinox wash, then a potable rinse, and a final ASTM Type 2 DI rinse. Equipment was then individually wrapped in aluminum foil to ensure no contaminants were introduced. The hand auger was decontaminated between each sample using the same procedure.

All soil sampling locations were surveyed using conventional methods. The northing, easting, and ground elevation correspond to Ohio State Plane North NAD83.

Sample packaging, shipping, and documentation procedures described in the Site-Wide Sampling and Analysis Plan (SAP) (Jacobs 2004a) were followed during the field investigation of the 2BG site. Samples were packaged and shipped to the analytical laboratories via Federal Express. Chain of custodies were completed and maintained throughout the collection, shipping and laboratory analysis phase.

No IDW soil waste was collected, since all remaining soil was returned to the borehole after collection of an environmental sample. Decontamination fluid was containerized and sampled at the conclusion of the sampling event. One partially filled 55-gallon drum was staged at an indoor temperature-controlled facility. IDW characterization was performed on 8 December 2005. Liquid IDW was analyzed for VOCs, SVOCs, metals, ignitability, corrosivity, and reactivity. Analysis of the liquid IDW samples will be used to determine any hazardous characteristics prior to transportation off-base to a treatment/disposal facility.

## **ANALYTICAL LABORATORY ANALYSIS AND DATA EVALUATION**

All soil samples were analyzed for PCBs, PAHs, nitroaromatics, and TAL metals. Two duplicate samples were collected and submitted as Quality Assurance (QA) samples and were analyzed for the same parameters as the regular samples. Empirical Laboratories (formerly ELAB of Tennessee) performed the nitroaromatic, PAH, PCB, and TAL metals analyses for the primary samples. GPL Laboratories performed the nitroaromatic, PAH, PCB, and TAL metals QA analyses.

Both laboratories provided complete data packages including the laboratory quality control documentation and raw data required by the SAP (Jacobs 2004b). Each data package included a case narrative describing the analytical methods used and documenting any quality control

problems encountered. Jacobs evaluated 100 percent of the primary sample data collected in support of the 2BG RI. The data evaluations were performed in accordance with the requirements of the SAP (Jacobs 2004), the guidance in "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (USEPA 1999), and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (USEPA 1994).

A Chemical Data Quality Report will be prepared which will summarize the Jacobs' data evaluation in terms of precision, accuracy, representativeness, comparability, and completeness, and will be included in the Draft EE/CA Report. The qualifiers applied as part of the data evaluation will be defined in the Chemical Data Quality Report and the limitations implied by the qualification should be considered when reviewing the data.

QA samples were collected at a frequency of ten percent and analyzed for the same parameters as the primary samples. Jacobs Denver office will serve as the independent third party performing the evaluation of the QA sample data and comparison of the QA data to the corresponding primary results. A Chemical Quality Assurance Report will be prepared in accordance with the requirements of the SAP (Jacobs 2004b) and the guidance of "Chemical Quality Assurance for HTRW Projects" (USAEC HTRW-CX 1997) and will be provided in the Final EE/CA Report.

The PCB results for the December 2005 sampling event are definitive and are acceptable for the intended data usages. The primary laboratory reporting limits were below the Region 9 PRG values for all samples with non-detect results.

The explosive results for the December 2005 sampling event are definitive and are acceptable for the intended data usages. The primary laboratory reporting limits were below the Region 9 PRG values for all samples with non-detect results.

## **SOIL INVESTIGATION RESULTS**

A total of 104 soil samples have been collected from the site dating back to the 1996 SI and including the 2004 -2005 RI. Fifteen of these samples were collected from the surface soil for additional delineation purposes during December 2005. Five of these samples were collected from locations north of the contamination boundary (BH-35 through BH-39) (Figure 1). The remaining ten samples were collected from locations south and west of the contamination boundary (BH-40 through BH-49) (Figure 1). Eleven of the 15 additional surface soil locations had PRG exceedances for one or more compounds. Specific compounds exceeding the USEPA Region 9 Residential PRGs (October 2004) and established background values for inorganics include the following:

- PCB-1260 (Arochlor 1260) – 11 of 15 locations
- Benzo(a)pyrene – 4 of 15 locations
- 2,4,6-Trinitrotoluene – 1 of 15 locations
- 2,4-Dinitrotoluene – 1 of 15 locations

- 2,6-Dinitrotoluene – 1 of 15 locations
- 2-Nitrotoluene – 1 of 15 locations
- Nitrobenzene – 1 of 15 locations
- Lead – 1 of 15 locations

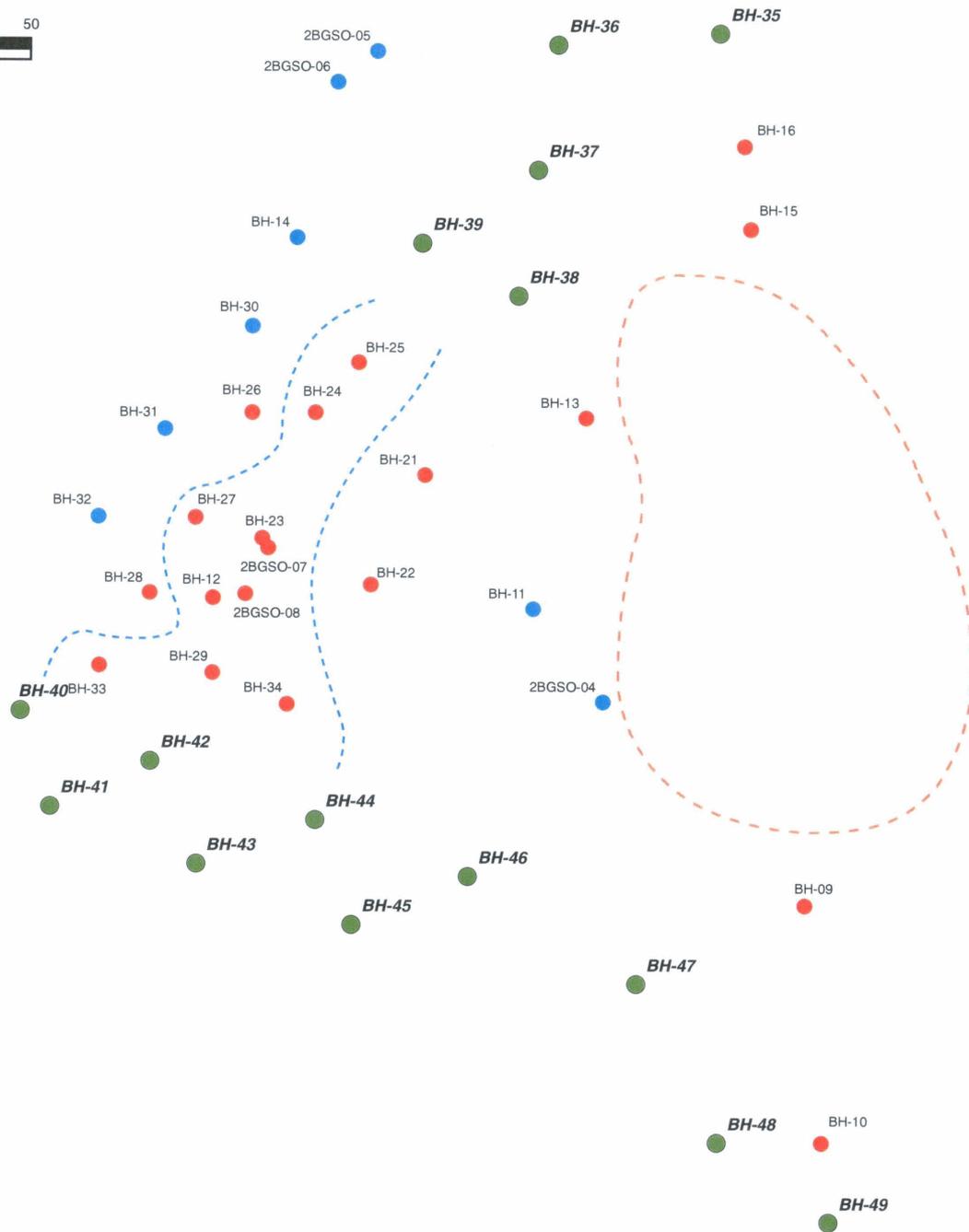
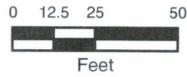
Distributions and concentrations of PCBs, lead, explosives, and benzo(a)pyrene exceeding the PRGs in surface soil are presented on Figures 2 through 5, respectively.

## **CONCLUSIONS AND RECOMMENDATIONS**

The results of this investigation indicate that the zone of contamination extends slightly to the north and is continuous along the southern boundary (Figure 2). The contaminated zone on the south side of the site has not been fully delineated.

Further sampling would be required to accurately define this area of contamination, however sufficient delineation has been performed to evaluate remedial alternatives and to estimate remediation costs. The interpreted area of contamination on the south side of the site will be used to calculate the volume of impacted soil needing remediation. This interpreted area on the south side is roughly twice the width of the area defined on the west and north sides of the site, which should allow for a conservative estimate.

Further delineation could be performed using screening level field kits during future delineation of PCB contamination at Acid Areas 2 & 3 or could be performed as part of the confirmation sampling that would be customary during future remedial actions at the site.



**Legend**

-  Proposed Surface Soil Samples — December 2005
-  Surface Soil Sample Above PRG's
-  Surface Soil Sample Below PRG's
-  Boundary of Surface Soil Exceeding Region 9 PRG's
-  Interpreted Burn Pit Boundary Based on Trenching Data



**JE JACOBS**

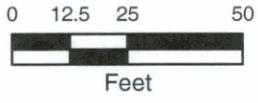
**Delineation of Surface Soil Contamination At Reservoir 2 Burning Ground**

Plum Brook Ordnance Works  
Sandusky, Ohio

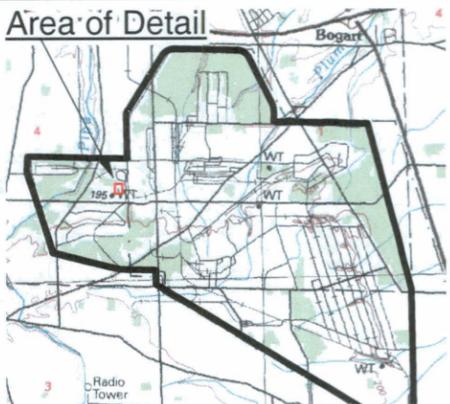
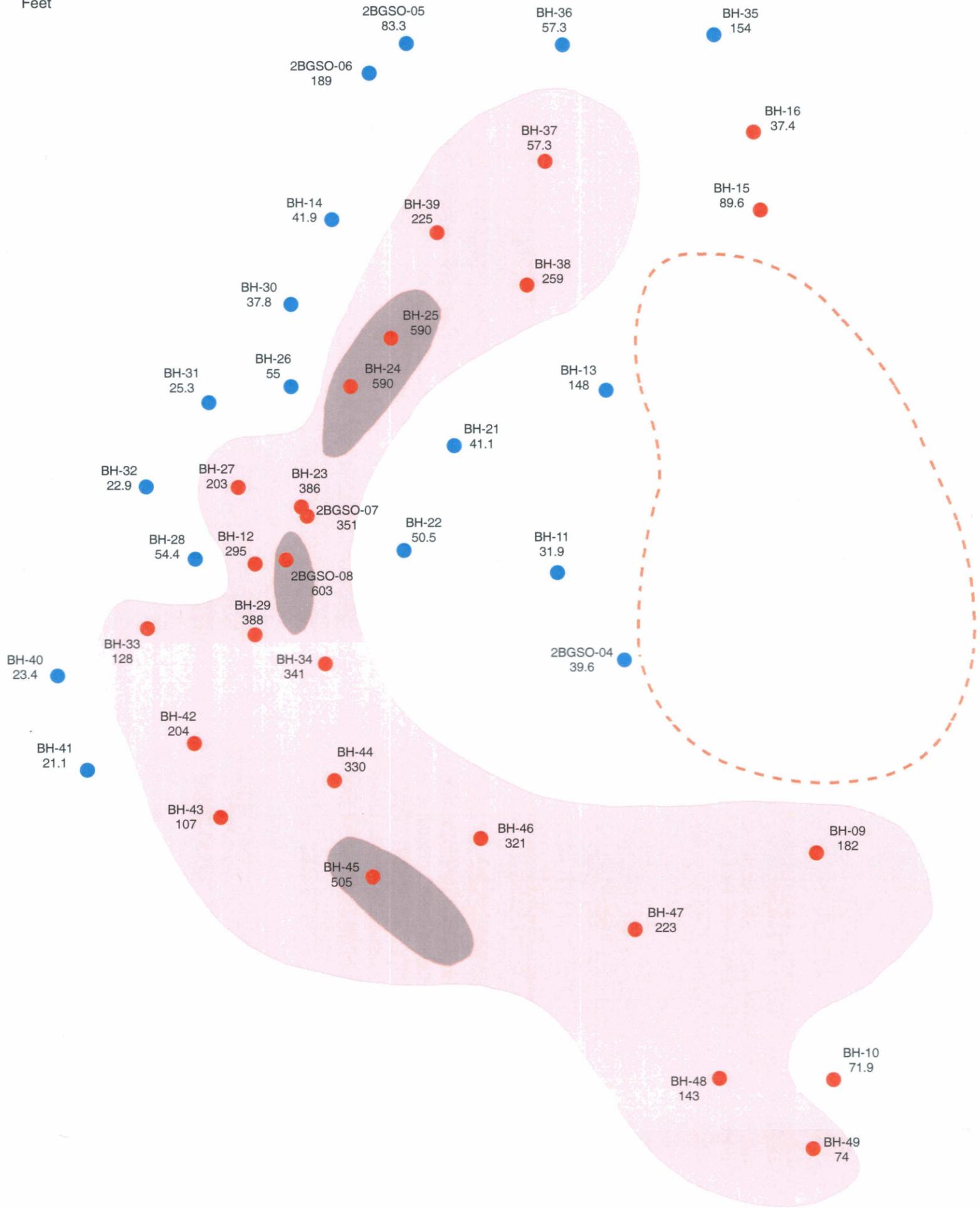
02/03/06 NZ GIS/Plumbrook/Projects/  
RES2BG\_Addendum\_1\_06/ArcGIS/  
Proposed\_Samples.mxd

**Figure 1**





Feet



**Legend**

- BH-45 505 Surface Soil Sample Above PRG's — Result (mg/Kg)
- Surface Soil Sample Below PRG's
- Boundary of Surface Soil Exceeding Region 9 PRG's for Lead (PRG for Lead = 400 mg/Kg)
- Boundary of Surface Soil Exceeding Region 9 PRG's for PCB's
- Interpreted Burn Pit Boundary Based on Trenching Data



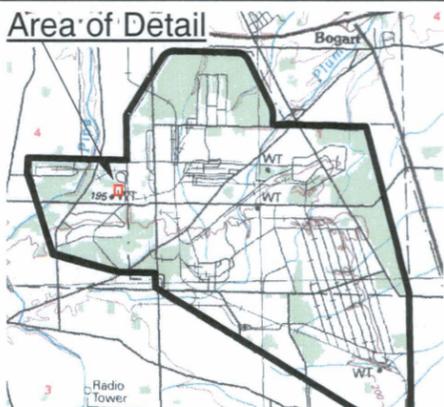
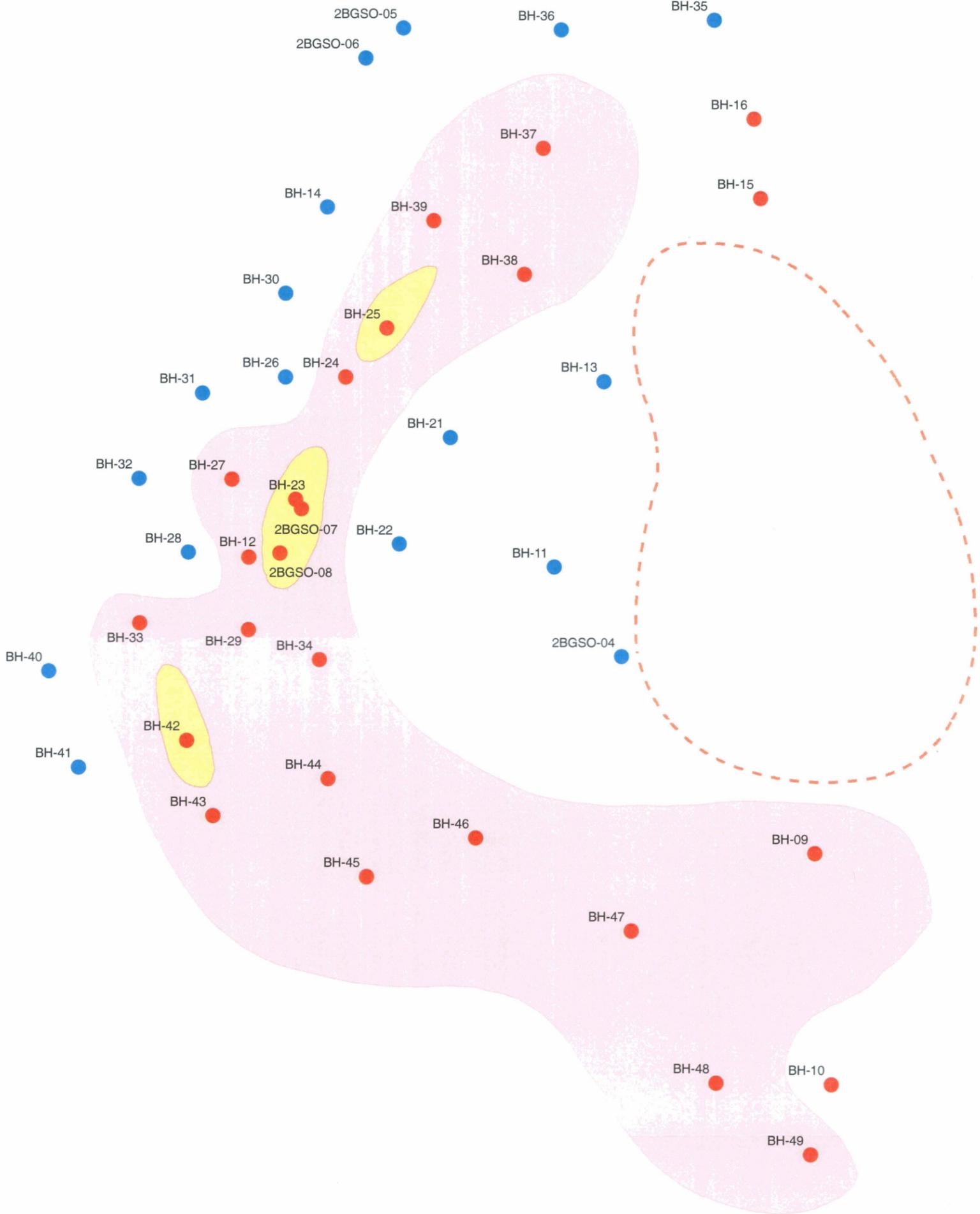
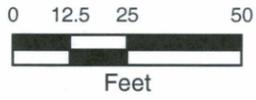
**JE JACOBS**

**Delineation of Lead Contamination in Surface Soil At Reservoir 2 Burning Ground**

Plum Brook Ordnance Works  
Sandusky, Ohio

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RES2BG\_Addendum\_1\_06/ArcGIS/  
LEAD.mxd

**Figure 3**



**Legend**

- Surface Soil Sample Above PRG's
- Surface Soil Sample Below PRG's
- Boundary of Surface Soil Exceeding Region 9 PRG's for Explosives (multiple compounds)
- Boundary of Surface Soil Exceeding Region 9 PRG's for PCB's
- Interpreted Burn Pit Boundary Based on Trenching Data



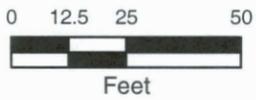
**JE JACOBS**

**Delineation of Explosives Contamination in Surface Soil At Reservoir 2 Burning Ground**

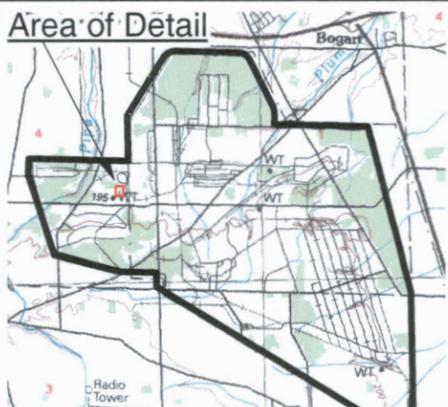
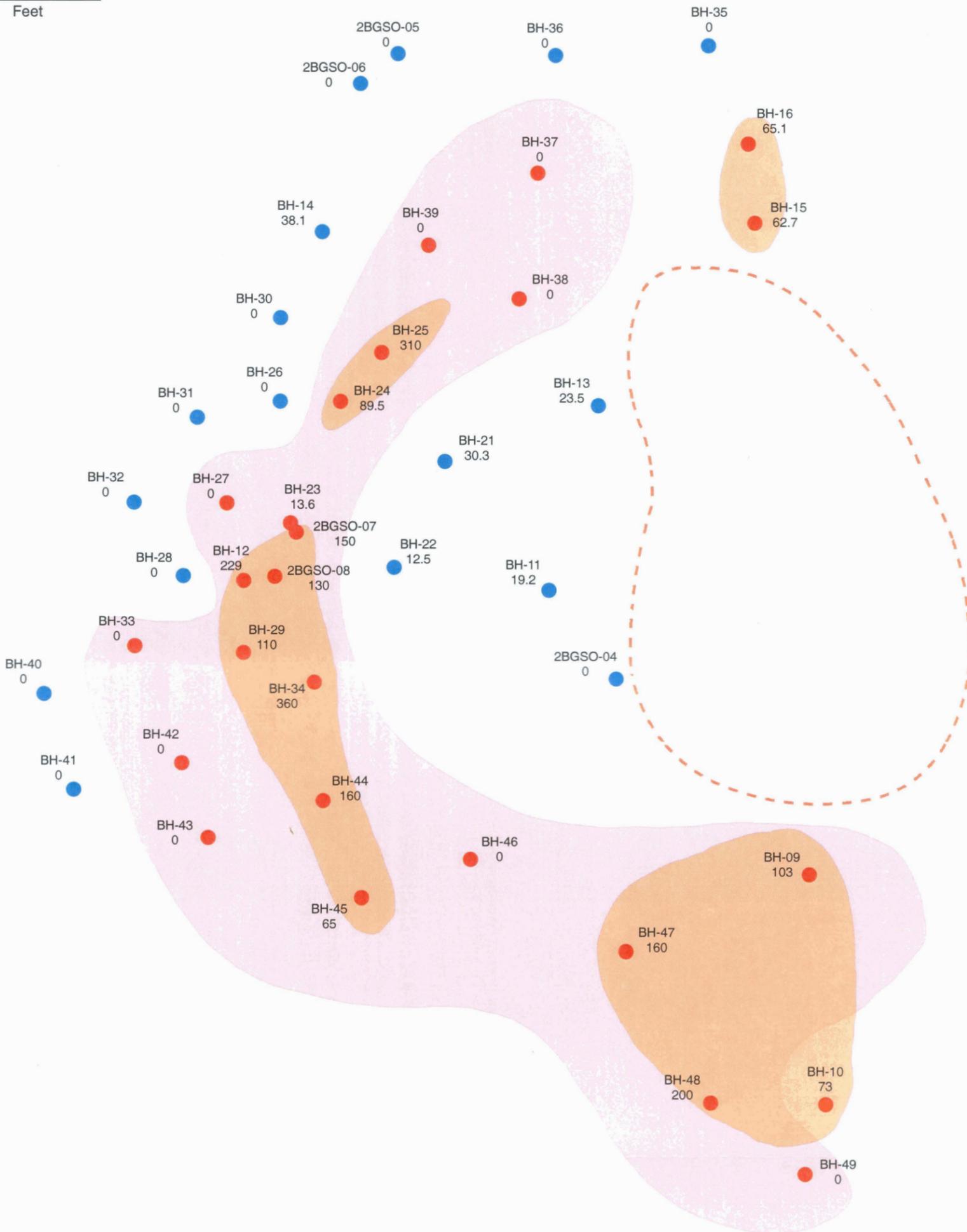
Plum Brook Ordnance Works  
Sandusky, Ohio

02/15/06 NZ GIS/Plumbrook/Projects/  
RES2BG\_Addendum\_1\_06/ArcGIS/  
EXPLOSIVES.mxd

**Figure 4**



Feet



**Legend**

- BH-45 65 Surface Soil Sample Above PRG's — Result (µg/Kg)
- Surface Soil Sample Below PRG's
- Boundary of Surface Soil Exceeding Region 9 PRG's for Benzo(a) pyrene  
PRG for Benzo(a) pyrene = 62 µg/Kg
- Boundary of Surface Soil Exceeding Region 9 PRG's for PCB's
- - - - - Interpreted Burn Pit Boundary Based on Trenching Data



**JE JACOBS**

**Delineation of Benzo(a) Pyrene Contamination in Surface Soil At Reservoir 2 Burning Ground**

Plum Brook Ordnance Works  
Sandusky, Ohio

02/15/06 NZ GIS/Plumbrook/Projects/  
RES2BG\_Addendum\_1\_06/ArcGIS/  
BENZOPYRENE.mxd

**Figure 5**