**MEETING MINUTES**

**RESTORATION ADVISORY BOARD**
**For**
**PLUM BROOK ORDNANCE WORKS**
**February 23, 2006**

## ATTENDEES

Mark Bohne, RAB Community Co-Chairperson
Peg Kingsley, RAB
Jan Bohne, RAB
Michael Parker, RAB
Bob Hermes, RAB
Starr Truscott, RAB
Julie Weatherington-Rice, TAPP
Paul Jayko, OEPA NWDO
Archie Lunsey, OEPA NWDO
Rick Meadows, RAB USACE Co-Chairperson
Lisa Humphreys, USACE Huntington
Kim Chambers, WTI
Linda Ingram, USACE Nashville
Lannae Long, USACE Nashville
Jim Beaujon, USACE Nashville
Victor Medina, USACE ERDC
Al Hardesty, Jacobs Engineering
Helen Owens, Streamborn

***Agenda***

- *Treatability Study – Reservoir No. 2 Burn Grounds*
- *Delineation Study – Reservoir No. 2 Burn Grounds*
- *Evaluation of Remedial Alternatives – Reservoir No. 2 Burn Grounds*
- *Update of TNT Area B Activities – Completed and Planned*

The RAB Meeting was conducted on February 23, 2006 at Firelands College. The meeting opened with the introductions of Paul Jayko with OEPA NWDO, Victor Medina with USACE ERDC, Kim Chambers with WTI and a reintroduction of Mike Parker, the newest RAB member. Paul Jayko will be taking over for Ron Nabors on the PBOW project. Victor Medina worked with Jacobs Engineering in conducting the treatability studies on the 2 BG soils, and Kim Chambers is a contractor for USACE Huntington on the TNT Area B remediation activities.

***Delineation Study – Reservoir No. 2 Burn Grounds***

Al Hardesty (Jacobs Engineering) provided a summary of the findings of the delineation study conducted at the 2BG. The most recent investigation did not identify the southern boundary of the contaminated soil, however, the contractor recommends proceeding with the EECA. The presentation is provided as an attachment to the meeting minutes.

***Treatability Study – Reservoir No. 2 Burn Grounds***

Victor Medina (USACE Engineer Research and Development Center) presented the findings of the Treatability study conducted on the 2BG soils. The presentation is provided as an attachment to the meeting minutes.

***Evaluation of Remedial Alternatives – Reservoir No. 2 Burn Grounds***
Al Hardesty (Jacobs Engineering) reviewed the components of the Engineering Evaluation Cost Analysis (EECA) – cost, effectiveness, and implementability. The presentation identified the alternatives to be considered for the remedial activities. The presentation is provided as an attachment to the meeting minutes.

***Update of TNT Area B Activities – Completed and Planned***
Kim Chambers (WTI) presented a summary of activities at TNT Area B that were initiated in 2003 and suspended due to insufficient funding. The presentation reviewed the areas that were excavated, composted and /or treated to stabilize lead and subsequently disposed off-site. With the availability of funding, USACE will continue activities at TNT Area B beginning in spring 2006. The presentation reviewed maps of the areas where the removal activities will resume. The presentation is provided as an attachment to the meeting minutes.

***Other Business***
- USACE discussed the renewal of the TAPP contract. Prior to the discussion, all contractors were asked to leave the room. The USACE and RAB agreed to renew the contract with a revised Scope of Work. USACE will review the TAPP efforts in 6 months to evaluate compliance with the contract.
- For the record, the RAB Community Co-Chair voiced his concern about disposing of material from the site in the Erie County Landfill. In order to transport material to an alternate landfill, the generator must obtain a waiver from Erie County Department of Environmental Services (DOES).
- The PBOW website provides public access to the PBOW project documents. If you have questions about the documents or if you experience difficulty in accessing the information please contact USACE at 800-822-8413. The website is http://www.lrh.usace.army.mil/projects/current/derp-fuds/pbow.
- The TAPP contractor pointed out the Geological Society of America – North Central Section Meeting will be held at the University of Akron, April 20-21, 2006. For more information go to http://www.geosociety.org/sectdiv/Northc/06ncmtg.htm.

***Meeting Schedule***
The next meeting is tentatively scheduled for May 18, 2006. For additional information, please contact Lisa Humphreys at (800) 822-8413 or Helen Owens, RAB Support Contractor at (937) 478-2322.

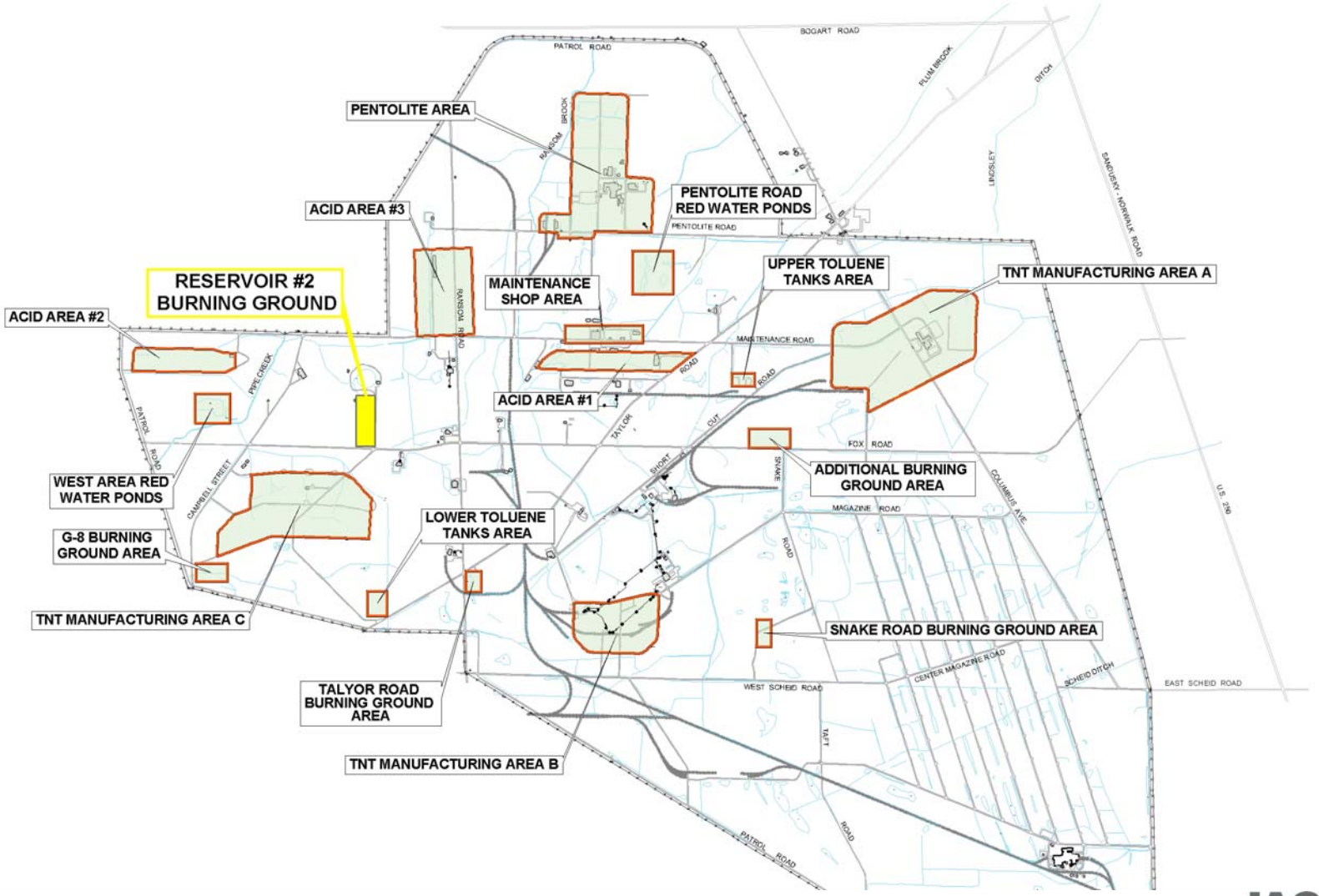
# Delineation Sampling
# Reservoir #2 Burning Grounds

Presented to:
Restoration Advisory Board

Presented by:
Al Hardesty
Jacobs

*February 23, 2006*

# Location Map

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# Investigation Activities

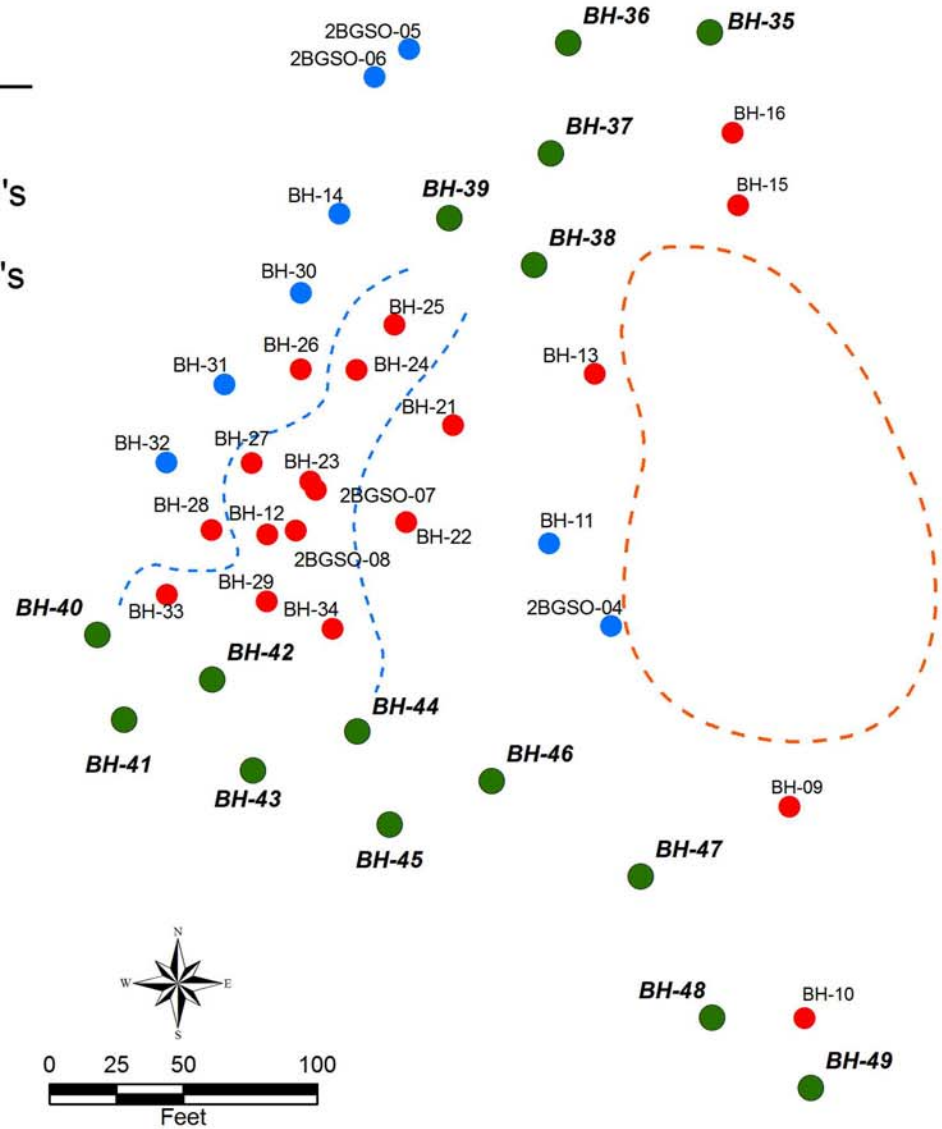
- Surface Soil Sampling West of Burn Area
- Laboratory Analysis (Target Analytes)
  - PCBs
  - Nitroaromatics (TNT, DNT)
  - PAHs (Benzo(a)pyrene)
  - TAL Metals (Lead)

# Sample Locations

- 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

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# Investigation Results

- 11 of 15 locations exceeded PRGs
- 11 exceedences for PCBs
- 4 exceedance for benzo(a)pyrene
- 1 exceedance for explosives
- 1 exceedance for lead

# PCB Contamination

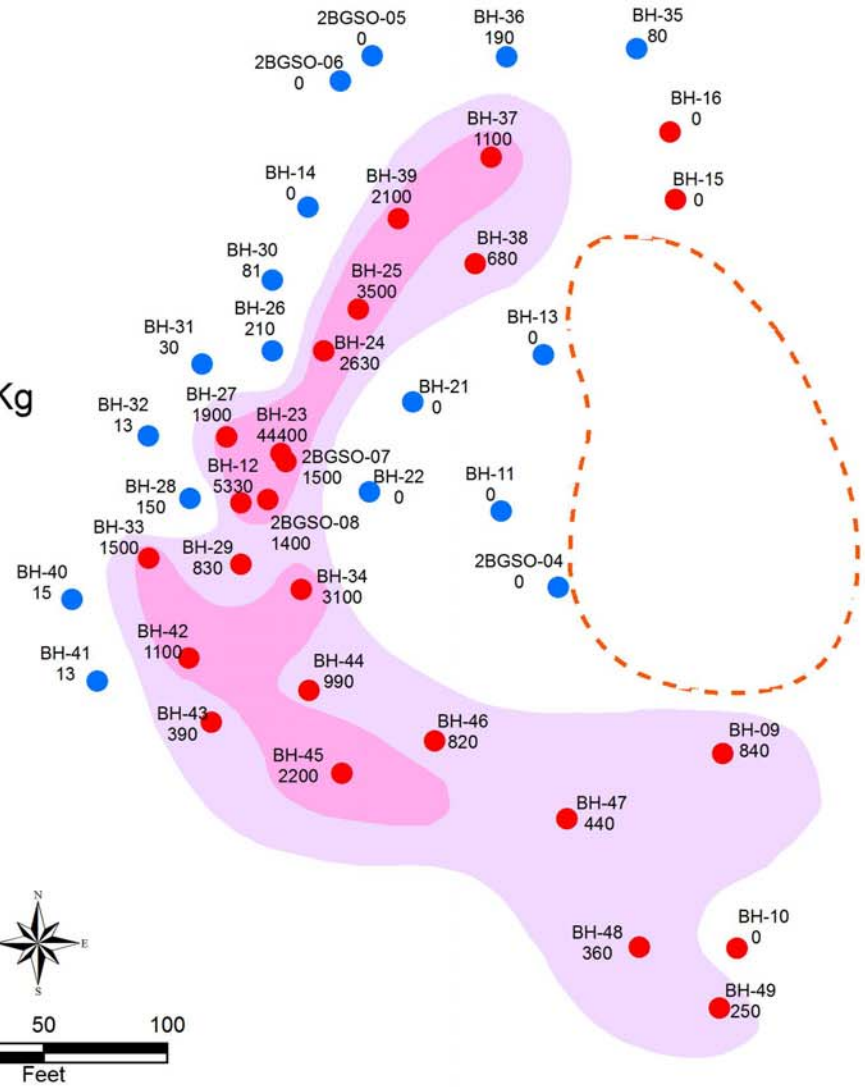
BH-45 2200 — Surface Soil Sample Above PRG's — Result (µg/Kg)

Surface Soil Sample Below PRG's

Boundary of Surface Soil Exceeding Region 9 PRG's for PCB's. PRG for PCB's = 220 µg/Kg

Surface Soil PCB's values > 1000 µg/Kg

Interpreted Burn Pit Boundary Based on Trenching Data

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# Lead Contamination

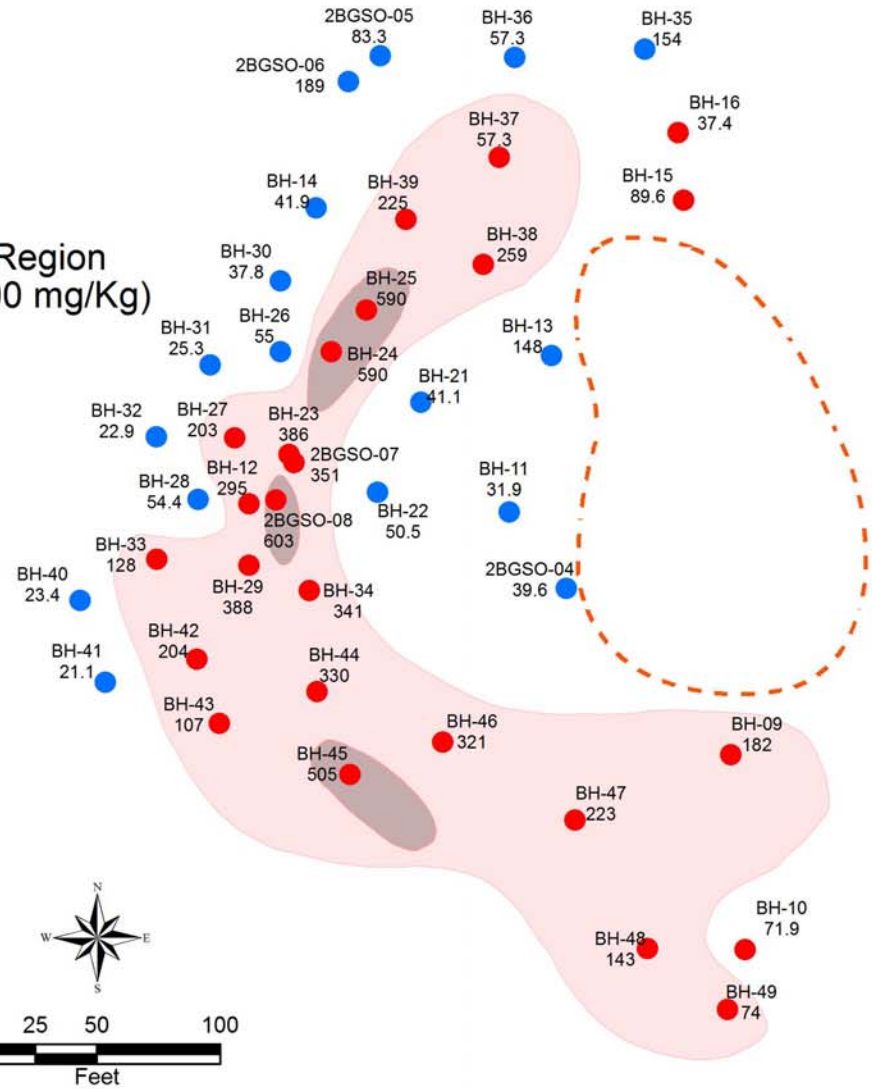
BH-45 505 — Surface Soil Sample Above PRG's — Result (mg/Kg)

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

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# Explosives Contamination

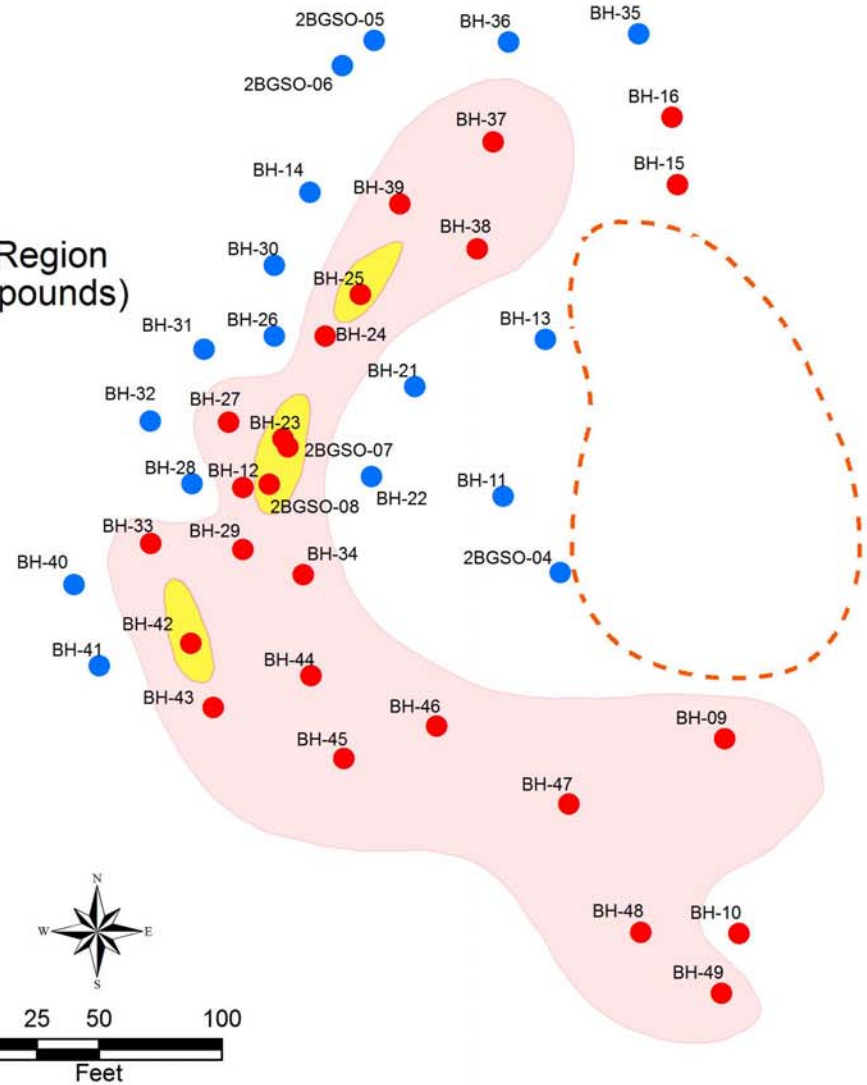
Surface Soil Sample Above PRG's

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

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# PAH Contamination

BH-45
65

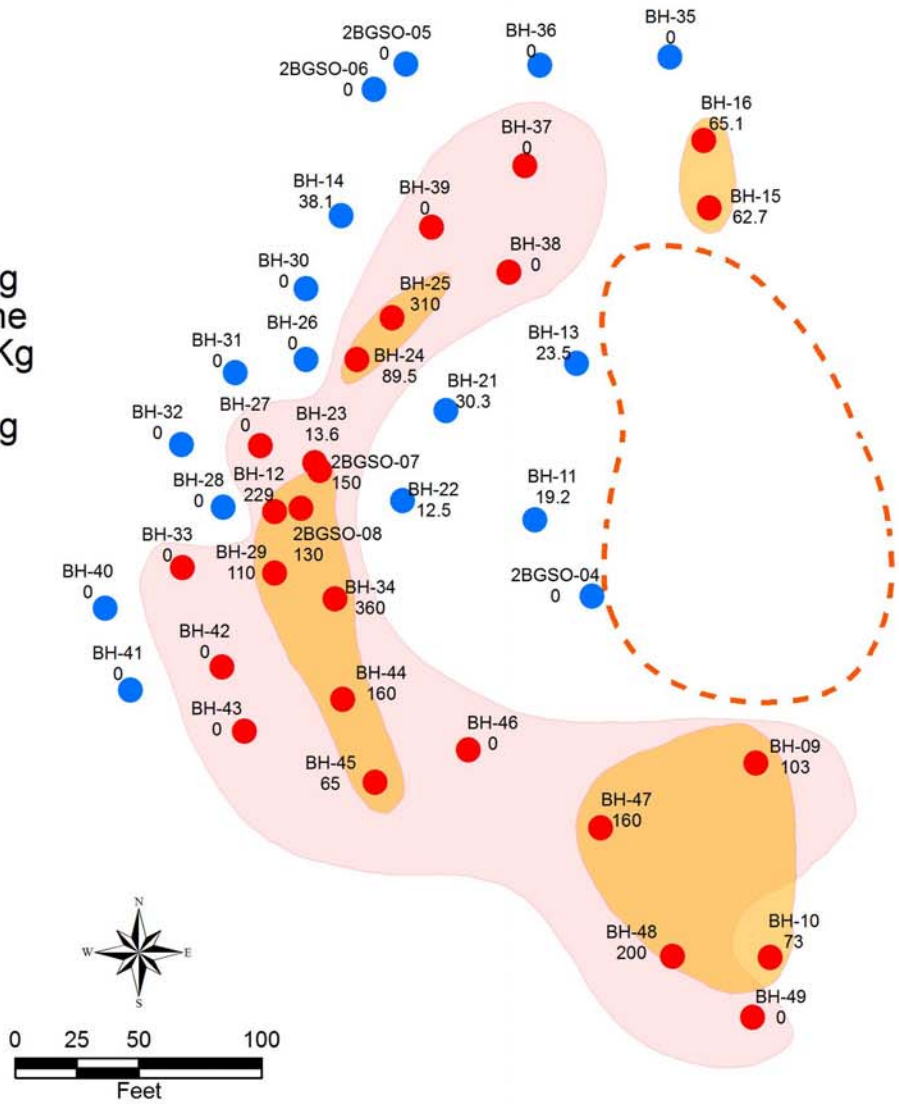
Surface Soil Sample Above PRG's — Result (µg/Kg)

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

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Environmental Engineering Branch

# Evaluation of Lime and Persulfate Treatment of Plum Brook Ordnance Works Soils


*Victor Medina, Ph.D., P.E.*

*United States Army Engineer Research & Development Center ERDC*

*Vicksburg, MS*

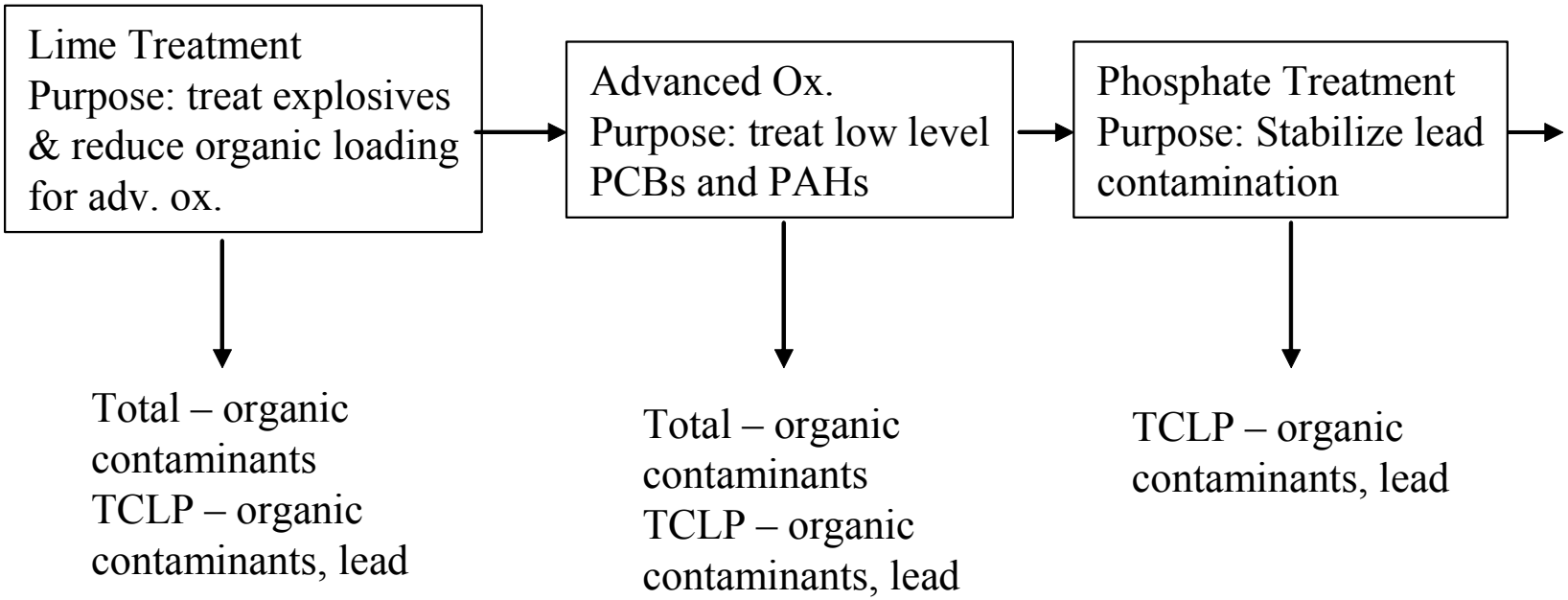
# Outline

- Purpose
- Approach: Treatment Train
- Preliminary Remediation Goals & Untreated Contaminant Levels
- Treatment of Organic Contaminants: Lime and Lime-Persulfate Combination
- Treatment of Lead
- Conclusions/Recommendations

# Background/Purpose

- **Background**
  - Challenging soil matrix
    - Explosives, PCBs, PAHs, and Lead.
    - Distinctive soil types (burn layer, west of burn area, surface above burn zone).
  - Short time frame
    - About 6 weeks
- **Purpose**
  - Evaluate chemical treatment as a means for treating the various soil contaminants.

# Approach: Treatment Train



# Preliminary Remediation Goals & Background Levels

| EPA Region 9 Preliminary Remediation Goals for Total Contaminants | | |
|---|---|---|
| Contaminant | PRG Residential (mg $kg^{-1}$) | PRG Industrial (mg $kg^{-1}$) |
| TNT | 16 | 57 |
| 2.4-DNT | 120 | 1200 |
| 2,6-DNT | 61 | 620 |
| PCBs | 0.22 | 0.74 |
| Benzo(a)pyrene | 0.062 | 0.21 |
| Lead | 400 | 800 |

| Measurements of Organic Compounds in Untreated Soils | | | | |
|---|---|---|---|---|
| Sample | TNT (mg $kg^{-1}$) | DNT (mg $kg^{-1}$) | PCB (mg $kg^{-1}$) | Benzo(a)pyrene* (μg/kg) |
| Surface 1 | 3.71 ± 29.2% | 4.51 ± 146% | **9.98 ± 17.5%** | 8.5 ± 25% |
| Surface 2 | 5.61 ± 86.0% | 0.00 ± 0% | **3.65 ± 6.8%** | -- |
| West 1 | 6.48 ± 40.3% | 2.62 ± 223% | **2.87 ± 21.7%** | 11.3 ± 39.6% |
| West 2 | 14.85 ± 8.6% | 8.35 ± 170% | **2.33 ± 6.0%** | -- |
| Burn 1 | **1548 ± 5.4%** | **243 ± 75%** | **22.6± 21.0%** | 44.4 ± 5.7% |
| Burn 2 | **237.8 ± 15.4%** | 26.6 ± 223% | **1.32 ± 24.1%** | -- |

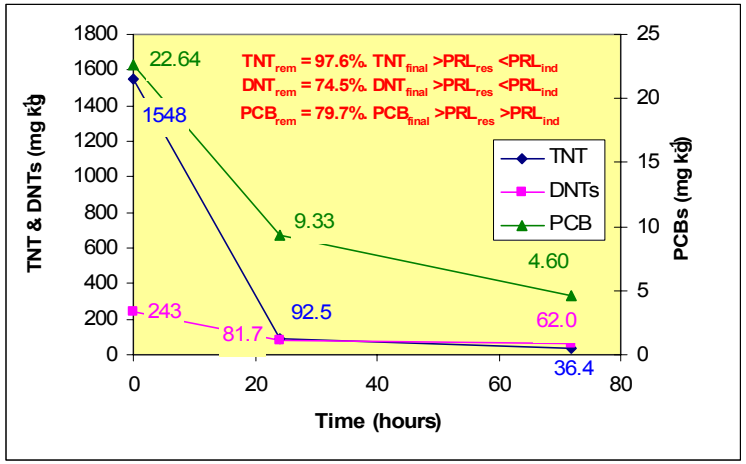
Bold numbers were above residential PRG.

*Other PAHs were also detected. All were below 62 μg/kg.

# Lime, and Lime-Persulfate Combination

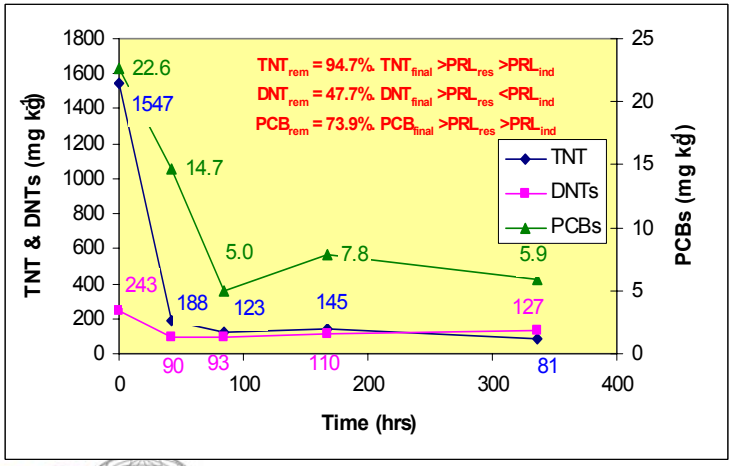
Environmental Engineering Branch

### Lime Treatment

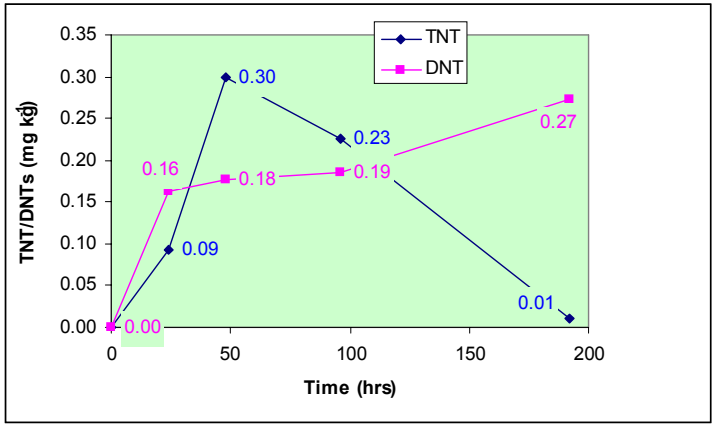



### Slurry Reactors

### Lime/Persulfate Treatment



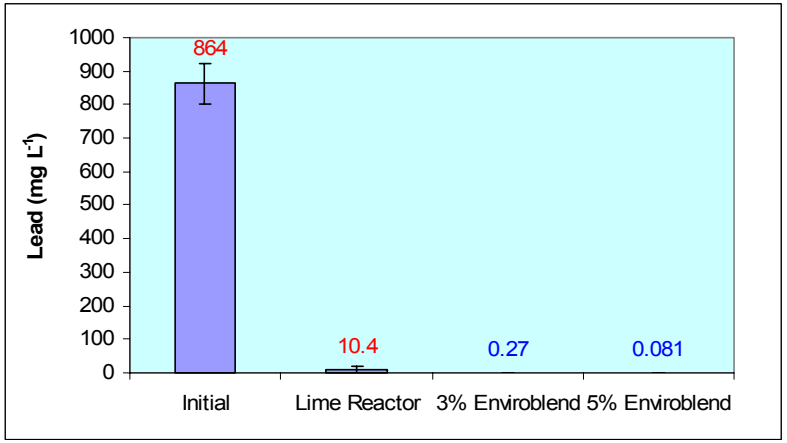

### Liquid Concentrations



# Lead Treatment & Cobbles



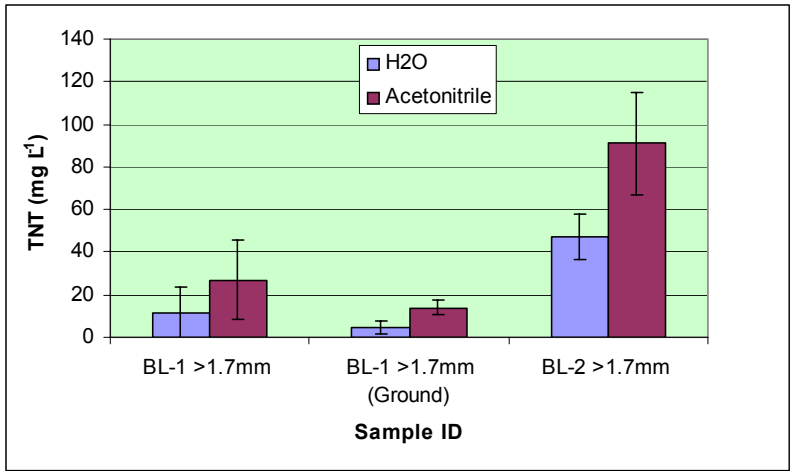
### Phosphate Treatment of Lead



### TCLP Extractions for Lead

### Cobbles & Ground Cobbles

### Cobble Study Results



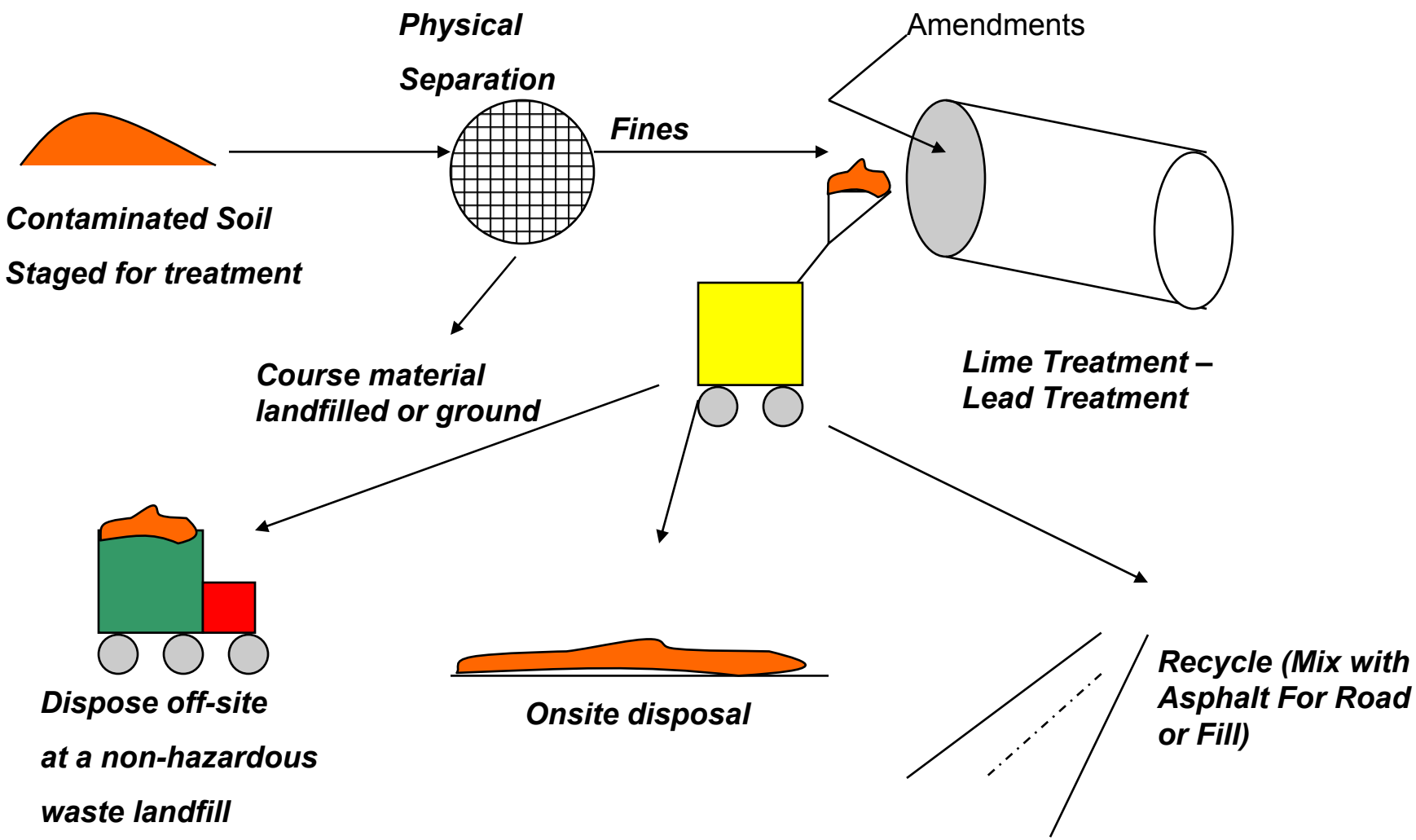
# Conclusions & Recommendations

- Treatments had similar levels of performance
  - Since Lime is the simplest and lowest cost.
  - Extractability of contaminant may limit treatment
- TNT
  - On the order of 93 to 97% removal
- DNT
  - On the order of 50 to 70% removal
- PCBs
  - 80 to 90% removal
- PAHs
  - Modest removal (low levels to start)
- Lead was effectively stabilized

# Summary of Organic Treatments

| Burn Layer. Initial Conc. (mg kg$^{-1}$): TNT = 1548, DNTs = 243, PCBs = 22.64, PAHs = 0.017 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment | TNT | | | DNTs | | | PCBs | | | PAH | | |
| | End Conc | % rem. | Ind PRG? | End Conc | % rem. | Ind PRG? | End Conc | % rem. | Ind PRG? | End Conc | % rem. | Ind PRG? |
| 1.5% Lime. 72 hr | 36.4 | 97.6 | Y | 62.0 | 74.5 | Y | 4.6 | 79.7 | N | 0.010 | 41.2 | Y |
| 5000 mg L$^{-1}$ Persulfate (40 C). 6 days. | 108 | 93.0 | N | 129 | | | 3.2 | 85.9 | N | 0.010 | 41.2 | Y |
| Lime Persulfate (room temp). 8 days | 81 | 94.7 | N | 127 | 47.7 | Y | 5.9 | 73.9 | N | -- | -- | -- |
| Lime Persulfate (40 C) 8 days | 87 | 94.4 | N | 157 | 35.3 | Y | 5.6 | 75.4 | N | -- | -- | -- |
| 10,000 mg L$^{-1}$ persulfate (50 C) 72 hr | 135 | 91.3 | N | 158 | 35.0 | Y | 4.3 | 81.0 | N | -- | -- | -- |
| Fenton's Chem. <1 hr | 231 | 85.1 | N | 138 | 43.2 | Y | 4.9 | 78.4 | N | -- | -- | -- |
| West Soil Initial (mg kg$^{-1}$): TNT = 14.9, DNTs = 25, PCBs = 2.87, PAHs = 0.089 | | | | | | | | | | | | |
| Treatment | TNT | | | DNTs | | | PCBs | | | PAH | | |
| | End TNT | % rem. | Ind PRG? | End DNT | % rem. | Ind PRG? | End PCB | % rem. | Ind PRG? | End PAH | % rem. | Ind PRG? |
| 1.5% Lime. 72 hr | 0.74 | 95.5 | Y | 1.15 | 83.4 | Y | 0.85 | 70.4 | N | 0.080 | 14.5 | Y |
| 5000 mg L$^{-1}$ Persulfate (40 C) | 3.46 | 76.0 | Y | 2.62 | 89.5 | Y | 1.96 | 31.7 | N | 0.070 | 26.5 | Y |

# Conceptual Application



# Remedial Alternatives Assessment Reservoir #2 Burning Grounds

Presented to:
Restoration Advisory Board

Presented by:
Al Hardesty
Jacobs

*February 23, 2006*

# Alternative Categories

- No Action
- Institutional Control
- Excavation & Disposal
- Ex-Situ Treatment
- In-Situ Treatment

# Land-Use Scenarios

- Continuation of NASA Activities (Industrial)
- Recreational Use (Hunters)
- Sale by GSA to other Parties(Unrestricted)
- Agricultural
- Residential
- Training Area for National Guard
- Construction Activities (Industrial)

# Institutional Control

- Fencing
- Capping
- Land Use Restrictions

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# Excavation & Disposal

- On-site Disposal
- Off-site Disposal
- Combination

# Ex-Situ Treatment

- Lime
- Persulfate
- Enviroblend
- Low Temperature Thermal Desorption
- Composting

# In-Situ Treatment

- Tilling (Lime or other)
- Bioremediation Injection
- ElectroChemical GeoOxidation
- Grouting / Chemical Stabilization
- Phytoremediation

# Recommended EE/CA Alternatives

- No Action
- Excavation & Off-site Disposal
- Ex-Situ Lime Treatment
- In-Situ Tilling with Lime
- Industrial & Residential Scenarios
- Phased Excavation / Multiple Disposal Scenarios

PCBs in Surface Soil
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| BH32 | 4/22/2005 | 11:45 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 13 | | 5.8 | 23 | ug/Kg |
| BH41 | 12/7/2005 | 11:36 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 13 | J | 11 | 22 | ug/Kg |
| BH40 | 12/7/2005 | 11:15 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 15 | J | 12 | 24 | ug/Kg |
| BH31 | 4/22/2005 | 11:30 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 30 | | 5.6 | 22 | ug/Kg |
| 2BGSO04 | 10/1/96 | 13:20 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 80 | | 42 | 42 | ug/Kg |
| BH30 | 4/22/2005 | 11:15 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 81 | | 5.3 | 21 | ug/Kg |
| BH28 | 4/22/2005 | 10:40 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 150 | | 5.2 | 21 | ug/Kg |
| 2BGSO05 | 10/1/96 | 13:30 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 170 | | 85 | 85 | ug/Kg |
| BH26 | 4/22/2005 | 10:00 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 200 | | 5.2 | 21 | ug/Kg |
| BH26 | 4/22/2005 | 10:00 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 210 | | 5.3 | 21 | ug/Kg |
| BH49 | 12/7/2005 | 15:20 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 250 | | 11 | 22 | ug/Kg |
| BH48 | 12/7/2005 | 15:00 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 360 | | 21 | 42 | ug/Kg |
| BH43 | 12/7/2005 | 13:35 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 390 | | 21 | 42 | ug/Kg |
| BH47 | 12/7/2005 | 14:45 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 440 | | 53 | 110 | ug/Kg |
| BH38 | 12/6/2005 | 15:30 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 680 | | 54 | 108 | ug/Kg |
| BH46 | 12/7/2005 | 14:20 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 820 | | 53 | 110 | ug/Kg |
| BH29 | 4/22/2005 | 10:50 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 830 | | 27 | 110 | ug/Kg |
| BH46 | 12/7/2005 | 14:20 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 830 | | 27 | 54 | ug/Kg |
| BH09 | 5/20/2004 | 14:25 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 840 | J | 452 | 915 | ug/Kg |
| BH44 | 12/7/2005 | 13:50 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 990 | | 52 | 100 | ug/Kg |
| BH37 | 12/6/2005 | 15:10 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 1100 | | 53 | 110 | ug/Kg |
| BH42 | 12/7/2005 | 11:55 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 1100 | | 100 | 200 | ug/Kg |
| 2BGSO08 | 10/1/96 | 13:50 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 1400 | | 400 | 400 | ug/Kg |
| 2BGSO07 | 10/1/96 | 13:45 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 1500 | | 410 | 410 | ug/Kg |
| BH33 | 4/22/2005 | 13:00 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 1500 | J | 53 | 210 | ug/Kg |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 1700 | | 400 | 400 | ug/Kg |
| BH27 | 4/22/2005 | 10:20 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 1900 | J | 52 | 210 | ug/Kg |
| BH39 | 12/6/2005 | 15:50 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 2100 | | 100 | 200 | ug/Kg |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 2200 | | 420 | 420 | ug/Kg |
| BH45 | 12/7/2005 | 14:05 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 2200 | | 210 | 420 | ug/Kg |
| BH24 | 5/22/2004 | 11:55 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 2630 | J | 1160 | 2350 | ug/Kg |
| BH34 | 4/22/2005 | 13:15 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 3100 | J | 120 | 470 | ug/Kg |
| 2BGSO01 | 10/1/96 | 12:45 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 3300 | | 830 | 830 | ug/Kg |
| BH25 | 4/22/2005 | 9:55 | ELAB | SW8082 | PCB-1260 (Aroclor 1260) | 3500 | J | 100 | 420 | ug/Kg |
| BH12 | 5/22/2004 | 13:15 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 5330 | | 1310 | 2660 | ug/Kg |
| 2BGSO03 | 10/1/96 | 13:10 | KNX | SW8081 | PCB-1260 (Aroclor 1260) | 6800 | | 2100 | 2100 | ug/Kg |
| BH19 | 5/21/2004 | 9:25 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 8140 | J | 5350 | 10800 | ug/Kg |
| BH18 | 5/21/2004 | 8:55 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 8940 | J | 5060 | 10200 | ug/Kg |
| BH17 | 5/20/2004 | 15:35 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 11600 | J | 7330 | 14800 | ug/Kg |
| BH23 | 5/22/2004 | 11:38 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 44400 | J | 28500 | 57600 | ug/Kg |

**Pre-treatment PCB concentration levels (ug/kg)**

| | | |
|---|---|---|
| | 220 | no action needed, below PRGs |
| | 1100 | 80% reduction, meets residential PRGs |
| | 2200 | 90% reduction, meets residential PRGs |
| | 3700 | 80% reduction, meets industrial PRGs |
| | 7400 | 90% reduction, meets industrial PRGs |
| | > 7400 | treatment will not meet industial PRGs |

PCBs in Burn Layer Material
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| TR07-1 | 5/19/2004 | 14:26 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 632 | J | 462 | 936 | ug/Kg |
| TR09-1 | 5/19/2004 | 16:35 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 1220 | J | 860 | 1740 | ug/Kg |
| TR06-1 | 5/19/2004 | 11:15 | ECEN | SW8082 | PCB-1254 (Aroclor 1254) | 1660 | J | 1440 | 2520 | ug/Kg |
| 2BGSO03 | 10/2/96 | 9:05 | KNX | SW8082 | PCB-1260 (Aroclor 1260) | 1800 | | 400 | 400 | ug/Kg |
| TR06-1 | 5/19/2004 | 11:15 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 1870 | | 872 | 1760 | ug/Kg |
| TR08-1 | 5/19/2004 | 15:45 | ECEN | SW8082 | PCB-1254 (Aroclor 1254) | 3670 | J | 3120 | 5480 | ug/Kg |
| TR08-1 | 5/19/2004 | 15:45 | ECEN | SW8082 | PCB-1260 (Aroclor 1260) | 4010 | | 1900 | 3840 | ug/Kg |

**Pre-treatment PCB concentration levels (ug/kg)**

| | |
|---|---|
| 220 | no action needed, below PRGs |
| 1100 | 80% reduction, meets residential PRGs |
| 2200 | 90% reduction, meets residential PRGs |
| 3700 | 80% reduction, meets industrial PRGs |
| 7400 | 90% reduction, meets industrial PRGs |
| > 7400 | treatment will not meet industial PRGs |

Lead in Surface Soil
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG | Type | | TCLP Est (Mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH32 | 4/22/05 | 11:45 | ELAB | SW6010B | Lead | 22.9 | | 0.43 | 0.85 | mg/Kg | 400 | 48.6 | N1 | 14.4 |
| BH31 | 4/22/05 | 11:30 | ELAB | SW6010B | Lead | 25.3 | | 0.41 | 0.82 | mg/Kg | 400 | 48.6 | N1 | 15.9 |
| BH11 | 5/20/04 | 11:55 | GEL | SW6010B | Lead | 31.9 | | 0.353 | 0.622 | mg/Kg | 400 | 48.6 | N1 | 20.1 |
| BH16 | 5/22/04 | 13:37 | GEL | SW6010B | Lead | 37.4 | J | 0.348 | 0.614 | mg/Kg | 400 | 48.6 | N1 | 23.6 |
| BH30 | 4/22/05 | 11:15 | ELAB | SW6010B | Lead | 37.8 | | 0.37 | 0.74 | mg/Kg | 400 | 48.6 | N1 | 23.8 |
| 2BGSO04 | 10/1/96 | 13:20 | KNX | SW6010 | Lead | 39.6 | | 0.38 | 0.38 | mg/Kg | 400 | 48.6 | N1 | 24.9 |
| BH21 | 5/21/04 | 15:00 | GEL | SW6010B | Lead | 41.1 | J | 0.353 | 0.622 | mg/Kg | 400 | 48.6 | N1 | 25.9 |
| BH14 | 5/21/04 | 11:20 | GEL | SW6010B | Lead | 41.9 | J | 0.353 | 0.622 | mg/Kg | 400 | 48.6 | N1 | 26.4 |
| BH22 | 5/22/04 | 11:20 | GEL | SW6010B | Lead | 50.5 | J | 0.359 | 0.632 | mg/Kg | 400 | 48.6 | N1 | 31.8 |
| BH28 | 4/22/05 | 10:40 | ELAB | SW6010B | Lead | 54.4 | | 0.4 | 0.8 | mg/Kg | 400 | 48.6 | N1 | 34.3 |
| BH26 | 4/22/05 | 10:00 | ELAB | SW6010B | Lead | 55 | | 0.38 | 0.76 | mg/Kg | 400 | 48.6 | N1 | 34.7 |
| BH21 | 5/21/04 | 15:00 | GEL | SW6010B | Lead | 61.6 | J | 0.366 | 0.646 | mg/Kg | 400 | 48.6 | FD1 | 38.8 |
| BH26 | 4/22/05 | 10:00 | ELAB | SW6010B | Lead | 68.3 | | 0.4 | 0.79 | mg/Kg | 400 | 48.6 | FD1 | 43.0 |
| BH10 | 5/20/04 | 13:55 | GEL | SW6010B | Lead | 71.9 | | 0.353 | 0.623 | mg/Kg | 400 | 48.6 | N1 | 45.3 |
| 2BGSO05 | 10/1/96 | 13:30 | KNX | SW6010 | Lead | 83.3 | | 0.39 | 0.39 | mg/Kg | 400 | 48.6 | N1 | 52.5 |
| BH15 | 5/21/04 | 14:10 | GEL | SW6010B | Lead | 89.6 | J | 0.355 | 0.625 | mg/Kg | 400 | 48.6 | N1 | 56.4 |
| BH15 | 5/21/04 | 14:10 | GEL | SW6010B | Lead | 116 | J | 0.34 | 0.599 | mg/Kg | 400 | 48.6 | FD1 | 73.1 |
| BH33 | 4/22/05 | 13:00 | ELAB | SW6010B | Lead | 128 | | 0.38 | 0.76 | mg/Kg | 400 | 48.6 | N1 | 80.6 |
| BH13 | 5/21/04 | 10:10 | GEL | SW6010B | Lead | 148 | J | 0.362 | 0.638 | mg/Kg | 400 | 48.6 | N1 | 93.2 |
| BH20 | 5/21/04 | 9:45 | GEL | SW6010B | Lead | 155 | J | 0.351 | 0.619 | mg/Kg | 400 | 48.6 | N1 | 97.7 |
| 2BGSO01 | 10/1/96 | 12:45 | KNX | SW6010 | Lead | 165 | | 0.38 | 0.38 | mg/Kg | 400 | 48.6 | N1 | 104.0 |
| BH09 | 5/20/04 | 14:25 | GEL | SW6010B | Lead | 182 | | 0.35 | 0.617 | mg/Kg | 400 | 48.6 | N1 | 114.7 |
| 2BGSO06 | 10/1/96 | 13:40 | KNX | SW6010 | Lead | 189 | | 0.36 | 0.36 | mg/Kg | 400 | 48.6 | N1 | 119.1 |
| BH27 | 4/22/05 | 10:20 | ELAB | SW6010B | Lead | 203 | | 0.41 | 0.82 | mg/Kg | 400 | 48.6 | N1 | 127.9 |
| BH12 | 5/22/04 | 13:15 | GEL | SW6010B | Lead | 295 | J | 0.379 | 0.668 | mg/Kg | 400 | 48.6 | N1 | 185.9 |
| BH34 | 4/22/05 | 13:15 | ELAB | SW6010B | Lead | 341 | | 0.42 | 0.85 | mg/Kg | 400 | 48.6 | N1 | 214.8 |
| 2BGSO07 | 10/1/96 | 13:45 | KNX | SW6010 | Lead | 351 | | 0.37 | 0.37 | mg/Kg | 400 | 48.6 | N1 | 221.1 |
| BH23 | 5/22/04 | 11:38 | GEL | SW6010B | Lead | 386 | J | 0.403 | 0.71 | mg/Kg | 400 | 48.6 | N1 | 243.2 |
| BH29 | 4/22/05 | 10:50 | ELAB | SW6010B | Lead | 388 | | 0.51 | 1 | mg/Kg | 400 | 48.6 | N1 | 244.4 |
| 2BGSO03 | 10/1/96 | 13:10 | KNX | SW6010 | Lead | 391 | | 0.38 | 0.38 | mg/Kg | 400 | 48.6 | N1 | 246.3 |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW6010 | Lead | 555 | | 0.38 | 0.38 | mg/Kg | **400** | 48.6 | FD1 | 349.7 |
| BH19 | 5/21/04 | 9:25 | GEL | SW6010B | Lead | 585 | J | 0.356 | 0.628 | mg/Kg | **400** | 48.6 | N1 | 368.6 |
| BH25 | 4/22/05 | 9:55 | ELAB | SW6010B | Lead | 590 | | 0.38 | 0.77 | mg/Kg | **400** | 48.6 | N1 | 371.7 |
| BH24 | 5/22/04 | 11:55 | GEL | SW6010B | Lead | 590 | J | 0.389 | 0.686 | mg/Kg | **400** | 48.6 | N1 | 371.7 |
| BH18 | 5/21/04 | 8:55 | GEL | SW6010B | Lead | 598 | J | 0.347 | 0.612 | mg/Kg | **400** | 48.6 | N1 | 376.7 |
| 2BGSO08 | 10/1/96 | 13:50 | KNX | SW6010 | Lead | 603 | | 0.37 | 0.37 | mg/Kg | **400** | 48.6 | N1 | 379.9 |
| BH17 | 5/20/04 | 15:35 | GEL | SW6010B | Lead | 730 | | 0.339 | 0.597 | mg/Kg | **400** | 48.6 | N1 | 459.9 |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW6010 | Lead | 1000 | | 0.37 | 0.37 | mg/Kg | **400** | 48.6 | N1 | 630.0 |

| | | |
|---|---|---|
| | 48.6 | background levels, no action |
| | 399 | below PRGs but TCLP conversion above RCRA |
| | 661 | Total Lead to TCLP conversion 63%, Lime treatment 98.8 % reduction in TCLP (meets RCRA TCLP) |
| | 82625 | Additional treatment w/Enviroblend, 99.2% reduction in TCLP |
| | > 82625 | will not meet RCRA TCLP |

Lead in Burn Layer Material
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG | Type | | TCLP Est (Mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2BGSO01 | 10/1/96 | 16:20 | KNX | SW6010 | Lead | 13.8 | | 0.36 | 0.36 | mg/Kg | 400 | 48.6 | N1 | 8.7 |
| 2BGSO02 | 10/1/96 | 17:00 | KNX | SW6010 | Lead | 16.2 | | 0.37 | 0.37 | mg/Kg | 400 | 48.6 | N1 | 10.2 |
| 2BGSO03 | 10/2/96 | 9:05 | KNX | SW6010 | Lead | 232 | | 0.36 | 0.36 | mg/Kg | **400** | 48.6 | N1 | 146.2 |
| TR09-1 | 5/19/2004 | 16:35 | GEL | SW6010B | Lead | 551 | | 0.372 | 0.655 | mg/Kg | **400** | 48.6 | N1 | 347.1 |
| TR08-1 | 5/19/2004 | 15:45 | GEL | SW6010B | Lead | 560 | | 0.36 | 0.634 | mg/Kg | **400** | 48.6 | N1 | 352.8 |
| TR07-1 | 5/19/2004 | 14:26 | GEL | SW6010B | Lead | 891 | | 0.338 | 0.596 | mg/Kg | **400** | 48.6 | N1 | 561.3 |
| TR06-1 | 5/19/2004 | 11:15 | GEL | SW6010B | Lead | 3640 | | 0.355 | 0.626 | mg/Kg | **400** | 48.6 | N1 | 2293.2 |
| TR05-1 | 5/19/2004 | 8:50 | GEL | SW6010B | Lead | 4510 | J | 0.345 | 0.607 | mg/Kg | **400** | 48.6 | N1 | 2841.3 |
| TR05-1 | 5/19/2004 | 8:50 | GEL | SW6010B | Lead | 11930 | J | 4.22 | 7.45 | mg/Kg | **400** | 48.6 | FD1 | 7515.9 |

| | |
|---|---|
| 48.6 | background levels, no action |
| 399 | below PRGs but TCLP conversion above RCRA |
| 661 | Total Lead to TCLP conversion 63%, Lime treatment 98.8 % reduction in TCLP (meets RCRA TCLP) |
| 82625 | Additional treatment w/Enviroblend, 99.2% reduction in TCLP |
| > 82625 | will not meet RCRA TCLP |

TNT in Surface Soil
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BH36 | 12/7/2005 | 10:45 | ELAB | 05-SO-2BG-BH36-D | 2,4,6-Trinitrotoluene | 0.14 | J | 0.1 | 0.5 | mg/Kg | 16 |
| BH26 | 4/22/2005 | 10:00 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 0.16 | J | 0.1 | 0.5 | mg/Kg | 16 |
| BH28 | 4/22/2005 | 10:40 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 0.16 | J | 0.087 | 0.43 | mg/Kg | 16 |
| BH21 | 5/21/2004 | 15:00 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 0.284 | J | 0.125 | 0.375 | mg/Kg | 16 |
| BH49 | 12/7/2005 | 15:20 | ELAB | 05-SO-2BG-BH49-A | 2,4,6-Trinitrotoluene | 0.29 | J | 0.1 | 0.5 | mg/Kg | 16 |
| 2BGSO05 | 10/1/96 | 13:30 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 0.5 | | 0.25 | 0.25 | mg/Kg | 16 |
| BH43 | 12/7/2005 | 13:35 | ELAB | 05-SO-2BG-BH43-A | 2,4,6-Trinitrotoluene | 0.62 | | 0.095 | 0.48 | mg/Kg | 16 |
| BH47 | 12/7/2005 | 14:45 | ELAB | 05-SO-2BG-BH47-A | 2,4,6-Trinitrotoluene | 1 | | 0.095 | 0.48 | mg/Kg | 16 |
| BH38 | 12/6/2005 | 15:30 | ELAB | 05-SO-2BG-BH38-A | 2,4,6-Trinitrotoluene | 1.1 | | 0.095 | 0.48 | mg/Kg | 16 |
| BH46 | 12/7/2005 | 14:20 | ELAB | 05-SO-2BG-BH46-D | 2,4,6-Trinitrotoluene | 1.8 | | 0.095 | 0.48 | mg/Kg | 16 |
| BH24 | 5/22/2004 | 11:55 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 1.97 | J | 0.125 | 0.375 | mg/Kg | 16 |
| BH44 | 12/7/2005 | 13:50 | ELAB | 05-SO-2BG-BH44-A | 2,4,6-Trinitrotoluene | 2 | | 0.095 | 0.48 | mg/Kg | 16 |
| BH48 | 12/7/2005 | 15:00 | ELAB | 05-SO-2BG-BH48-A | 2,4,6-Trinitrotoluene | 2 | | 0.1 | 0.5 | mg/Kg | 16 |
| BH37 | 12/6/2005 | 15:10 | ELAB | 05-SO-2BG-BH37A | 2,4,6-Trinitrotoluene | 2.9 | | 0.1 | 0.5 | mg/Kg | 16 |
| BH46 | 12/7/2005 | 14:20 | ELAB | 05-SO-2BG-BH46-A | 2,4,6-Trinitrotoluene | 3.3 | | 0.091 | 0.45 | mg/Kg | 16 |
| BH29 | 4/22/2005 | 10:50 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 4.6 | | 0.091 | 0.45 | mg/Kg | 16 |
| BH33 | 4/22/2005 | 13:00 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 4.7 | | 0.083 | 0.42 | mg/Kg | 16 |
| BH20 | 5/21/2004 | 9:45 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 4.75 | | 0.125 | 0.375 | mg/Kg | 16 |
| BH34 | 4/22/2005 | 13:15 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 5.2 | | 0.091 | 0.45 | mg/Kg | 16 |
| BH17 | 5/20/2004 | 15:35 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 6.54 | J | 0.125 | 0.375 | mg/Kg | 16 |
| BH45 | 12/7/2005 | 14:05 | ELAB | 05-SO-2BG-BH45-A | 2,4,6-Trinitrotoluene | 9.2 | | 0.091 | 0.45 | mg/Kg | 16 |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 9.5 | | 1.2 | 1.2 | mg/Kg | 16 |
| BH39 | 12/6/2005 | 15:50 | ELAB | 05-SO-2BG-BH39-A | 2,4,6-Trinitrotoluene | 10 | | 0.1 | 0.5 | mg/Kg | 16 |
| BH27 | 4/22/2005 | 10:20 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 14 | | 0.087 | 0.43 | mg/Kg | 16 |
| BH25 | 4/22/2005 | 9:55 | ELAB | SW8330 | 2,4,6-Trinitrotoluene | 23 | | 0.087 | 0.43 | mg/Kg | **16** |
| 2BGSO07 | 10/1/96 | 13:45 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 31 | | 5 | 5 | mg/Kg | **16** |
| 2BGSO01 | 10/1/96 | 12:45 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 48 | | 5 | 5 | mg/Kg | **16** |
| BH18 | 5/21/2004 | 8:55 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 60.3 | | 0.125 | 0.375 | mg/Kg | **16** |
| BH42 | 12/7/2005 | 11:55 | ELAB | 05-SO-2BG-BH42-A | 2,4,6-Trinitrotoluene | 110 | | 0.095 | 0.48 | mg/Kg | **16** |
| 2BGSO02 | 10/1/96 | 13:00 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 140 | | 12 | 12 | mg/Kg | **16** |
| 2BGSO08 | 10/1/96 | 13:50 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 210 | | 12 | 12 | mg/Kg | **16** |
| 2BGSO03 | 10/1/96 | 13:10 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 910 | | 50 | 50 | mg/Kg | **16** |
| BH23 | 5/22/2004 | 11:38 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 2270 | | 12.5 | 37.5 | mg/Kg | **16** |
| BH19 | 5/21/2004 | 9:25 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 3120 | | 12.5 | 37.5 | mg/Kg | **16** |

| | | |
|---|---|---|
| | 16 | no action needed, below PRGs |
| | 229 | 93% reduction, meets residential PRGs |
| | 533 | 97% reduction, meets residential PRGs |
| | 814 | 93% reduction, meets industrial PRGs |
| | 1900 | 97% reduction, meets industrial PRGs |
| | > 1900 | treatment will not meet industial PRGs |

TNT in Burn Layer Material
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2BGSO01 | 10/1/96 | 16:20 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 3.6 | | 0.25 | 0.25 | mg/Kg | 16 |
| TR06-1 | 5/19/2004 | 11:15 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 74.9 | | 0.125 | 0.375 | mg/Kg | **16** |
| 2BGSO03 | 10/2/96 | 9:05 | KNX | SW8330 | 2,4,6-Trinitrotoluene | 94 | | 12 | 12 | mg/Kg | **16** |
| TR05-1 | 5/19/2004 | 8:50 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 885 | | 1.25 | 3.75 | mg/Kg | **16** |
| TR05-1 | 5/19/2004 | 8:50 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 1120 | | 2.5 | 7.5 | mg/Kg | **16** |
| TR07-1 | 5/19/2004 | 14:26 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 9580 | | 25 | 75 | mg/Kg | **16** |
| TR09-1 | 5/19/2004 | 16:35 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 28700 | | 62.5 | 188 | mg/Kg | **16** |
| TR08-1 | 5/19/2004 | 15:45 | GEL | SW8330 | 2,4,6-Trinitrotoluene | 35400 | | 62.5 | 188 | mg/Kg | **16** |

| | | |
|---|---|---|
| | 16 | no action needed, below PRGs |
| | 229 | 93% reduction, meets residential PRGs |
| | 533 | 97% reduction, meets residential PRGs |
| | 814 | 93% reduction, meets industrial PRGs |
| | 1900 | 97% reduction, meets industrial PRGs |
| | > 1900 | treatment will not meet industial PRGs |

Benzo(a)pyrene in Surface Soil
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BH22 | 5/22/2004 | 11:20 | ECEN | SW8310 | Benzo(a)pyrene | 12.5 | NJ | 3.93 | 8.7 | ug/Kg | 62 |
| BH23 | 5/22/2004 | 11:38 | ECEN | SW8310 | Benzo(a)pyrene | 13.6 | NJ | 4.15 | 9.2 | ug/Kg | 62 |
| BH21 | 5/21/2004 | 15:00 | ECEN | SW8310 | Benzo(a)pyrene | 19.4 | NJ | 3.71 | 8.22 | ug/Kg | 62 |
| BH13 | 5/21/2004 | 10:10 | ECEN | SW8310 | Benzo(a)pyrene | 23.5 | NJ | 3.84 | 8.51 | ug/Kg | 62 |
| BH21 | 5/21/2004 | 15:00 | ECEN | SW8310 | Benzo(a)pyrene | 30.3 | NJ | 4.03 | 8.94 | ug/Kg | 62 |
| BH15 | 5/21/2004 | 14:10 | ECEN | SW8310 | Benzo(a)pyrene | 32.3 | J | 19.6 | 43.4 | ug/Kg | 62 |
| BH14 | 5/21/2004 | 11:20 | ECEN | SW8310 | Benzo(a)pyrene | 38.1 | NJ | 3.97 | 8.81 | ug/Kg | 62 |
| BH20 | 5/21/2004 | 9:45 | ECEN | SW8310 | Benzo(a)pyrene | 61.3 | NJ | 3.67 | 8.13 | ug/Kg | 62 |
| BH15 | 5/21/2004 | 14:10 | ECEN | SW8310 | Benzo(a)pyrene | 62.7 | NJ | 18.8 | 41.7 | ug/Kg | **62** |
| BH17 | 5/20/2004 | 15:35 | ECEN | SW8310 | Benzo(a)pyrene | 62.7 | NJ | 21.2 | 47.1 | ug/Kg | **62** |
| BH45 | 12/7/2005 | 14:05 | ELAB | SW8270 | Benzo(a)pyrene | 64 | | 25 | 62 | ug/Kg | **62** |
| BH16 | 5/22/2004 | 13:37 | ECEN | SW8310 | Benzo(a)pyrene | 65.1 | NJ | 10.8 | 23.8 | ug/Kg | **62** |
| BH24 | 5/22/2004 | 11:55 | ECEN | SW8310 | Benzo(a)pyrene | 89.5 | NJ | 3.86 | 8.56 | ug/Kg | **62** |
| BH18 | 5/21/2004 | 8:55 | ECEN | SW8310 | Benzo(a)pyrene | 108 | NJ | 18 | 39.9 | ug/Kg | **62** |
| BH29 | 4/22/2005 | 10:50 | ELAB | SW8270 | Benzo(a)pyrene | 110 | J | 27 | 67 | ug/Kg | **62** |
| 2BGSO08 | 10/1/96 | 13:50 | KNX | SW8270 | Benzo(a)pyrene | 130 | J | 130 | 400 | ug/Kg | **62** |
| 2BGSO07 | 10/1/96 | 13:45 | KNX | SW8270 | Benzo(a)pyrene | 150 | J | 150 | 410 | ug/Kg | **62** |
| BH44 | 12/7/2005 | 13:50 | ELAB | SW8270 | Benzo(a)pyrene | 160 | | 25 | 63 | ug/Kg | **62** |
| BH47 | 12/7/2005 | 14:45 | ELAB | SW8270 | Benzo(a)pyrene | 160 | | 25 | 64 | ug/Kg | **62** |
| BH48 | 12/7/2005 | 15:00 | ELAB | SW8270 | Benzo(a)pyrene | 200 | | 26 | 64 | ug/Kg | **62** |
| BH12 | 5/22/2004 | 13:15 | ECEN | SW8310 | Benzo(a)pyrene | 229 | NJ | 12 | 26.6 | ug/Kg | **62** |
| BH25 | 4/22/2005 | 9:55 | ELAB | SW8270 | Benzo(a)pyrene | 310 | J | 49 | 120 | ug/Kg | **62** |
| BH34 | 4/22/2005 | 13:15 | ELAB | SW8270 | Benzo(a)pyrene | 360 | J | 54 | 130 | ug/Kg | **62** |

Benzo(a)pyrene in Burn Layer Material
Reservoir No. 2 Burning Ground, PBOW

| Location | Date | Time Samp. | Lab ID | Test | Analyte | Result | Qual | DL | RL | Units | Adjusted Soil PRG |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TR06-1 | 5/19/2004 | 11:15 | ECEN | SW8310 | Benzo(a)pyrene | 108 | NJ | 38.2 | 84.6 | ug/Kg | **62** |

| | | |
|---|---|---|
| | | no action needed, below PRGs |
| | 103 | 40% reduction (meets residential PRGs) |
| | 350 | 40 % reduction (meets industrial PRGs) |
| | > 350 | treatment will not meet industial PRGs |

# Interim Soil Removal Action
# Plum Brook Ordnance Works
# Sandusky, Ohio

## Soil Excavation and Ex Situ Stabilization

## TNTB

U. S. Army Corps of Engineers

Huntington District

February 2006

# Location and History

- 9,009 acre former U.S. Army explosives manufacturing (1941-1945) site located approximately 4 miles south of Sandusky, OH and 59 miles west of Cleveland, OH
- Three separate manufacturing areas were used, TNTA, TNTB and TNTC
- Decontamination efforts were conducted by the Army and General Service Administration in 1945 and 1955
- NASA acquired the property in 1963, currently controls the major portion of the site and continues to conduct space research

# Background

- Contaminated Soil and groundwater remained after the 1945 and 1955 cleanups
- To help determine extent and future action, Remedial Investigation/Feasibility Studies were completed from1997-2002
  - Revealed contaminated soil which posed an unacceptable risk to human health and the environment
- Action Memorandums for Interim Soil Removal Action were finalized in 2003
  - Recommended Remedial Objectives and Preliminary Remediation Goals for Contaminants of Concern

# Remedial Objectives

- Specified in the U. S. Army Corps of Engineers, Huntington District, Final Action Memorandum
- Minimize the potential for human exposure via incidental ingestion, dermal contact, and the inhalation of soil contaminated with nitroaromatics, PCBs, PAHs and lead
- Minimize the potential for nitroaromatics, PCBs, PAHs and lead to migrate from the soil at the site to the groundwater

# Preliminary Remediation Goals Contaminants of Concern

| Contaminant of Concern | PRGs (mg/kg)[1] |
|---|---|
| **Nitroaromatics** | |
| 2-amino-4,6-DNT | 0.4 |
| 4-amino-2,6-DNT | 0.4 |
| 2,4-DNT | 7.5 |
| 2,6-DNT | 2.75 |
| 2-nitrotoluene | 74 |
| 2,4,6-TNT | 3.36 |
| **PCBs** | |
| Aroclor 1254 | 0.16 |
| Aroclor 1260 | 2.87 |
| **PAHs** | |
| Benzo(a)anthracene | 5.43 |
| Benzo(a)pyrene | 0.54 |
| Benzo(a)fluoranthene | 5.43 |
| Dibenz (a,h) anthracene | 0.65 |
| Indeno(1,2,3-cd)pyrene | 5.43 |

**mg/kg is equal to parts per million [1]**

# 13 Former Building Locations (30 Areas) Identified

**Nitroaromatic Contamination**

- Building 417 – Wastewater Settling Tanks;
- Building 453 – Fortifier House;
- Building 456 – Wash House;
- Building 462 – Bi-Tri House;
- Building 466 – Wash House;
- Northwest Nail House;
- Building 472 – Bi-Tri House;
- Building 473 – Fortifier House;
- Building 476 – Wash House

**Nitroaromatic and Lead Contamination**

- Building 412 – Sweating and Graining House;
- Building 452 – Bi-Tri House;
- Building 456 – Wash House Area B;
- Building 463 – Fortifier House;
- Northeast Nail House

# Excavation and Ex Situ Stabilization

- Chosen as the most efficient and cost effective way to meet the Remedial Objectives
- MACTITE treatment was used to stabilize lead
  - Lead was detected in Building 452 – Areas A and B were above the action level of 400 ppm
  - Analytical results of the MACTITE treated soil revealed that TCLP lead was non-detect
- Bioremediation (composting) was used to effectively reduce nitroaromatic contamination
  - Compost After Action Report (USACE ’06) gives overview and details of bioremediation activities

# Hazard Index

- Even though extensive over excavation was performed, confirmation sample results in some of the former building locations continued to exceed the PRG's established for 2,4,6-TNT, 2-amino-4,6 DNT and 4-amino-2,6 DNT
- Therefore, with the approval of the Ohio EPA, a risk based approach was used, a hazard index for all locations was calculated and those locations with a Hazard Index of 1.0 or less would pose no health threat
- Hazard Index calculations were performed on each area excavated; if there was no detection of contamination in the confirmation sampling the Hazard Index was not calculated (i.e. = 0)

# Summary and Conclusions

- 13 former building locations (30 Areas) were excavated as funds were available
  - 2,961 cubic yards were proposed to be removed by the Remedial Investigation/Feasibility Study
- It was discovered the amount of contaminated soil was greatly underestimated
  - 5,217 cubic yards were actually removed
- Building locations with nitroaromatic only contamination were excavated first
  - 8 were over excavated for closure having attained a Hazard Index of 1.0 or less

# Summary and Conclusions cont'd

- Due to limited funding limitations further excavation was halted
- Test pits were dug and confirmation sample results used to find the horizontal extent of contamination
- 5 building locations need further excavation due to remaining contaminated soil
  - 6,716 cubic yards of material still need to be removed
- No further action decision document will be requested for all 13 former building locations upon completion

# Recommendations

| Location | Hazard Index | Estimated Contaminated Soil to be Removed | Recommendation |
|---|---|---|---|
| **Building 417-Wastewater Settling Tanks** | | | |
| Area A | 0.2 | 0 | Closure |
| Area B | 0.7 | 0 | Closure |
| Area C | 0.8 | 0 | Closure |
| Area D | 0.6 | 0 | Closure |
| **Building 453-Fortifier House** | 0.1 | 0 | Closure |
| **Building 456-Wash House** | | | |
| Area A | *0 | 0 | Closure |
| Areas C, D, E, and F | 0.6 | 0 | Closure |
| Area G | *0 | 0 | Closure |
| **Building 462- Bi-Tri House** | *0 | 0 | Closure |
| **Building 466- Wash House** | | | |
| Area A | *0 | 0 | Closure |
| Area B | *0 | 0 | Closure |
| Area C | *0 | 0 | Closure |
| Area D | 0.5 | 0 | Closure |
| **Northwest Nail House** | *0 | 0 | Closure |
| **Building 472- Bi-Tri House** | | | Closure |
| Areas A and B | 0.1 | 0 | Closure |
| **Building 473-Fortifier House** | *0 | 0 | Closure |
| **Building 476-Wash House** | | | Closure |
| Area A | 0.1 | 0 | Closure |
| Area B | 0.1 | 0 | Closure |
| **Building 412—Sweating and Graining House** | | | |
| Area B and C | 0.0 and 0.2 | 0 | Closure |

* The hazard index for these building locations was not calculated to to Non Detect Result from Confirmation Sampling

# Recommendations cont'd

| Location | Hazard Index | Estimated Contaminated Soil for Removal | Recommendation |
|---|---|---|---|
| **Building 456-Wash House** | | | |
| Area B | *0 | 1,108.46 | Over-excavation for Closure |
| **Building 452-Bi-Tri House** | | | |
| Area A and B | *0 | 2,053.46 | Over-excavation for Closure |
| **Building 463- Fortifier House** | 0.2 | 2657.98 | Over-excavation for Closure |
| **Building 412—Sweating and Graining House** | | | |
| Area A | *0 | 646.52 | Over-excavation for Closure |
| **Northeast Nail House** | *0 | 250 | Over-excavation for Closure |

* The hazard index for these building locations was not calculated to to Non Detect Result from Confirmation Sampling

Note: The horizontal extent of contamination was identified and the hazard index was calculated using the confirmation sampling results from the perimeter of the future excavation

# Planned Action

- Excavation of remaining contaminated soil from 5 building locations:
  - Building 412 – Sweating and Graining House;
  - Building 452 – Bi-Tri House;
  - Building 456 – Wash House Area B;
  - Building 463 – Fortifier House;
  - Northeast Nail House

# Resource Contact Information

Lisa Humphreys
U. S. Army Corps of Engineers
Huntington District

304-399-5953 (office)
304-360-2558 (cell)

Lisa.A.Humphreys@lrh01.usace.army.mil

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 300.00 |
| | ACTUAL EXCAVATION | 1,531.86 |
| | FUTURE EXCAVATION | 0.00 |

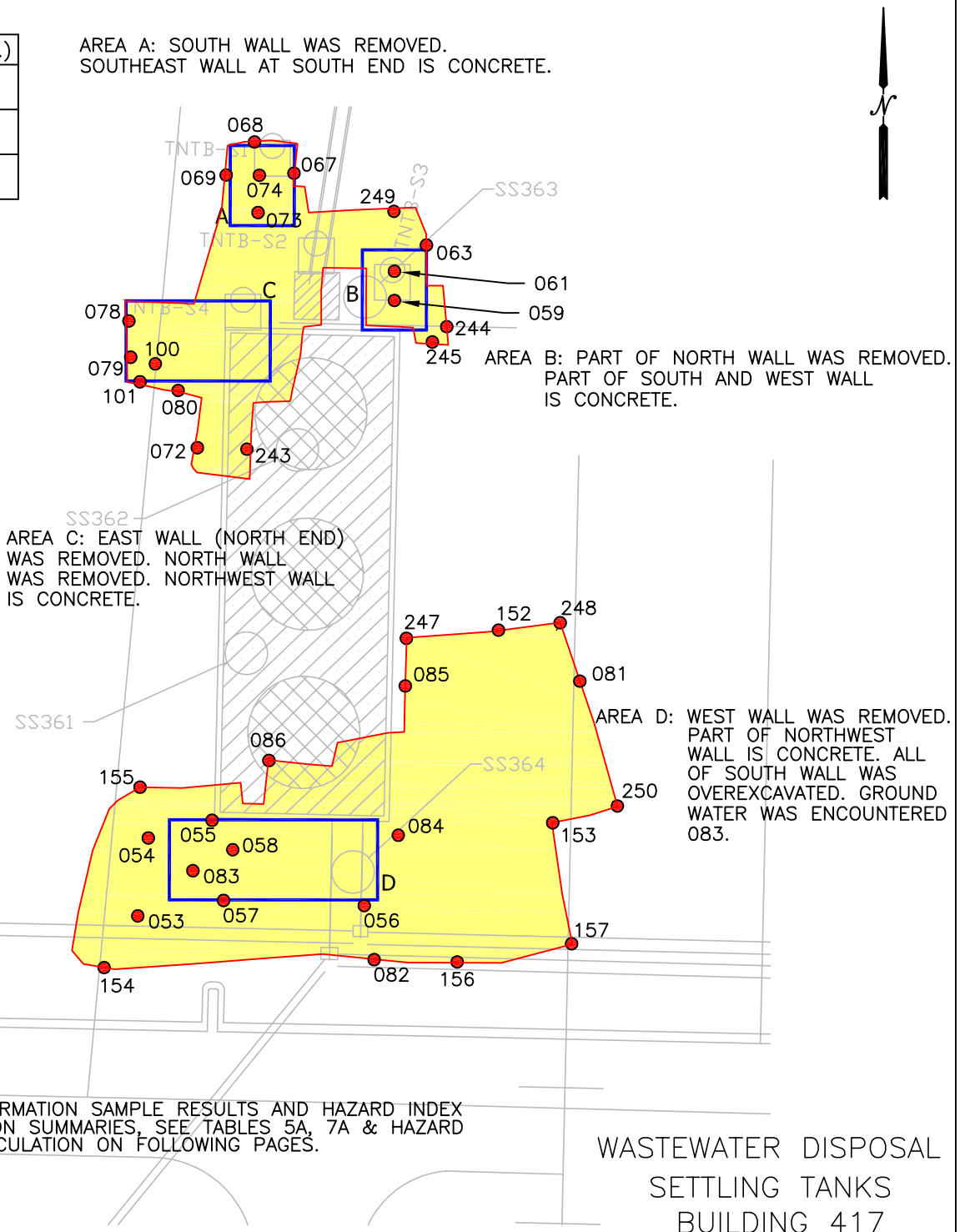
* INCLUDES AREAS A, B, C, & D

● SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 20' x 25' x 1.5' | 28.00 |
| B | 20' x 25' x 1.5' | 28.00 |
| C | 45' x 25' x 1.5' | 63.00 |
| D | 65' x 25' x 1.5' | 181.00 |




**US ARMY CORPS OF ENGINEERS**
HUNTINGTON DISTRICT
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*WASTEWATER DISPOSAL SETTLING TANKS BUILDING 417*
*ACTUAL EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

PREPARED BY:
Mountain State Company
P.O. BOX 0 • CEDAR GROVE, WV 25039
2318 E. DuPONT AVE. • BELLE, WEST VIRGINIA
PHONE (304) 949-4762 FAX (304) 949-4764
jimi_msc@charter.net

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 5A, 7A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.

DATE PREPARED: OCTOBER 2005

WASTEWATER DISPOSAL SETTLING TANKS BUILDING 417

\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_417-CUT.DWG, 2/13/2006 9:20:30 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 71.00 |
| | ACTUAL EXCAVATION | 61.53 |
| | FUTURE EXCAVATION | 0.00 |

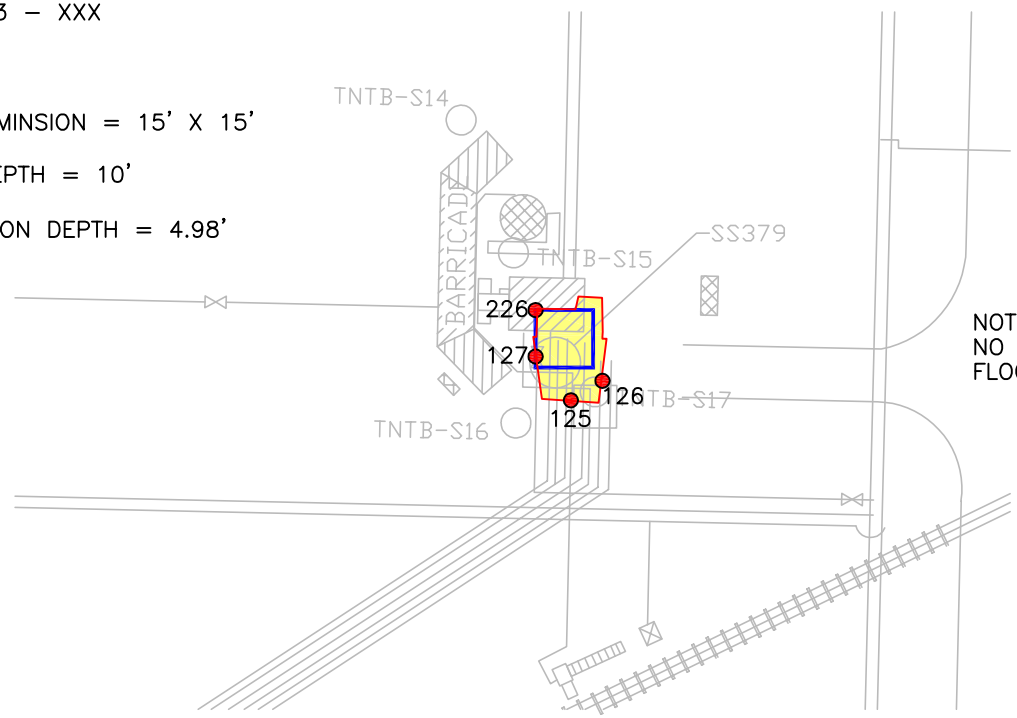
SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 15' X 15'

PROPOSED EXCAVATION DEPTH = 10'

ACTUAL AVERAGE EXCAVATION DEPTH = 4.98'




NOTE: NORTH WALL IS CONCRETE NO SAMPLE WAS COLLECTED OF FLOOR–HIT GROUNDWATER.

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 9A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.

*US ARMY CORPS OF ENGINEERS*
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*FORTIFIER HOUSE BUILDING 453*

*ACTUAL EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

PREPARED BY:
Mountain State Company
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DATE PREPARED: OCTOBER 2005

FORTIFIER HOUSE
BUILDING 453

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_453-CUT.DWG, 2/13/2006 9:22:52 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 141.00 |
| | ACTUAL EXCAVATION | 522.51 |
| | FUTURE EXCAVATION | 0.00 |

* INCLUDES AREAS A, C, D, E & F

SAMPLE NUMBER = 5393 – XXX

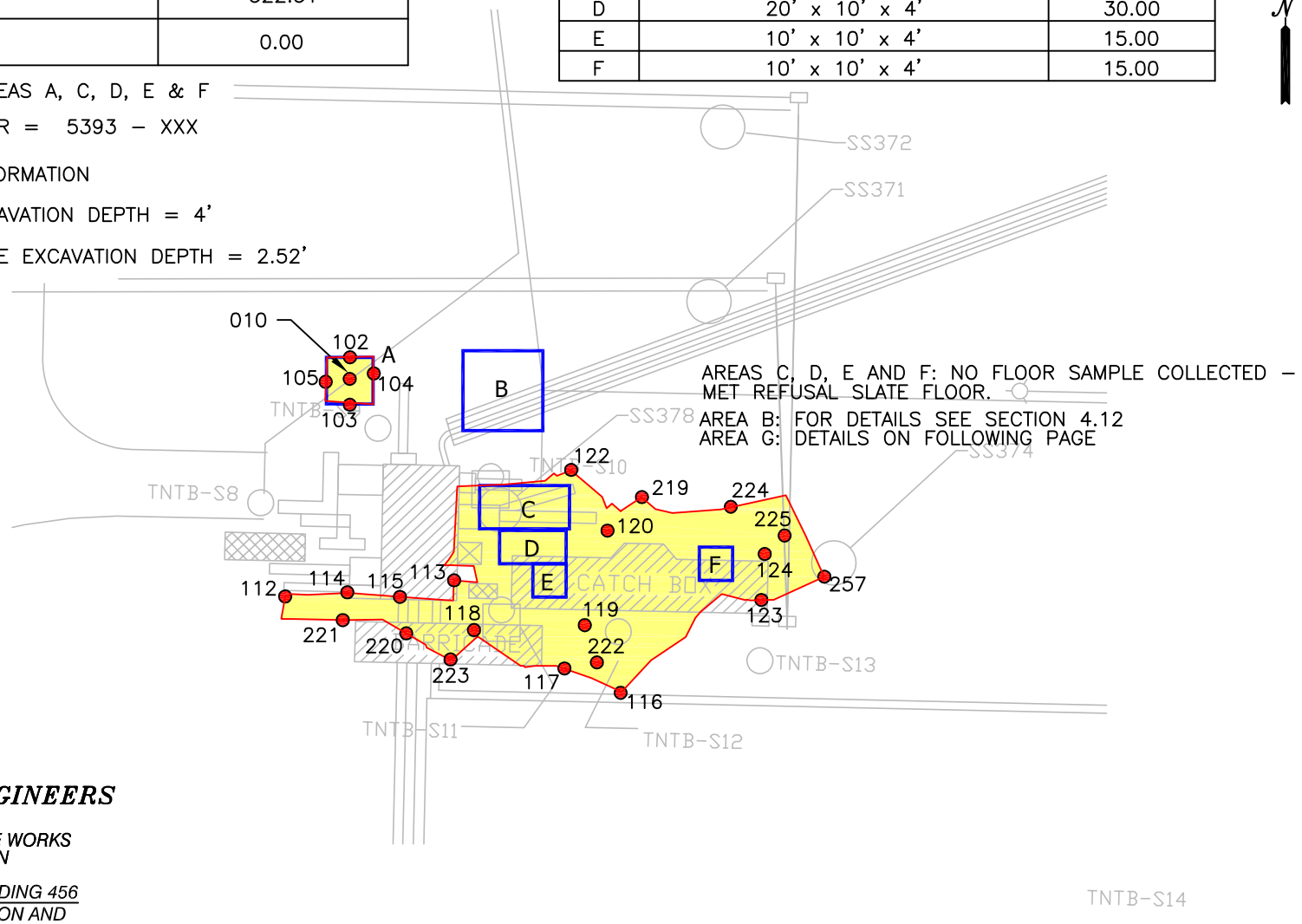
HISTORICAL INFORMATION

PROPOSED EXCAVATION DEPTH = 4'

ACTUAL AVERAGE EXCAVATION DEPTH = 2.52'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 14' x 14' x 4' | 29.00 |
| C | 27' x 13' x 4' | 52.00 |
| D | 20' x 10' x 4' | 30.00 |
| E | 10' x 10' x 4' | 15.00 |
| F | 10' x 10' x 4' | 15.00 |




AREAS C, D, E AND F: NO FLOOR SAMPLE COLLECTED – MET REFUSAL SLATE FLOOR.

AREA B: FOR DETAILS SEE SECTION 4.12

AREA G: DETAILS ON FOLLOWING PAGE

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 11A, 13A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.

***US ARMY CORPS OF ENGINEERS***

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*WASH HOUSE - AREA A,C,D,E,F BUILDING 456*

*ACTUAL EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

PREPARED BY: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DATE PREPARED: OCTOBER 2005

WASH HOUSE AREAS A,C,D,E,F
BUILDING 456

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_456-CUT.DWG, 2/13/2006 9:30:02 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 15.00 |
| | ACTUAL EXCAVATION | 14.71 |
| | FUTURE EXCAVATION | 0.00 |

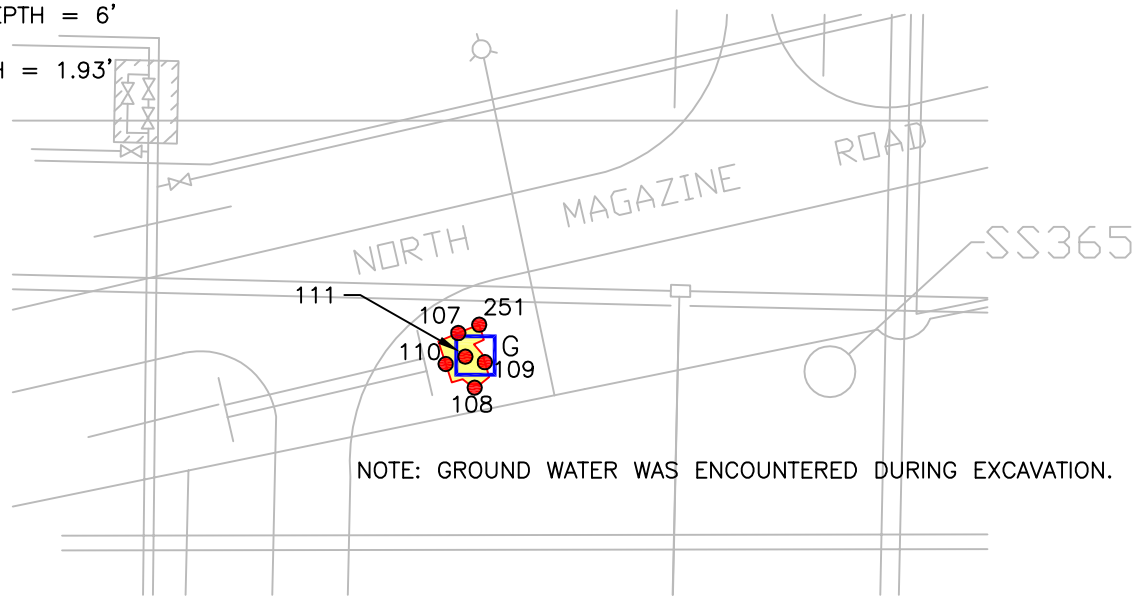
* INCLUDES AREAS A & B

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED AVERAGE EXCAVATION DEPTH = 6'

ACTUAL AVERAGE EXCAVATION DEPTH = 1.93'




NOTE: GROUND WATER WAS ENCOUNTERED DURING EXCAVATION.

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 5A, 7A & HI. TABLES 5HI & 7HI RESPECTIVELY ON FOLLOWING PAGES.

***US ARMY CORPS OF ENGINEERS***

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*BUILDING 456 AREA G*

*ACTUAL EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'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DATE PREPARED: OCTOBER 2005

WASH HOUSE AREA G
BUILDING 456

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_456G-CUT.DWG, 2/13/2006 9:30:53 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 67.00 |
| | ACTUAL EXCAVATION | 87.58 |
| | FUTURE EXCAVATION | 0.00 |

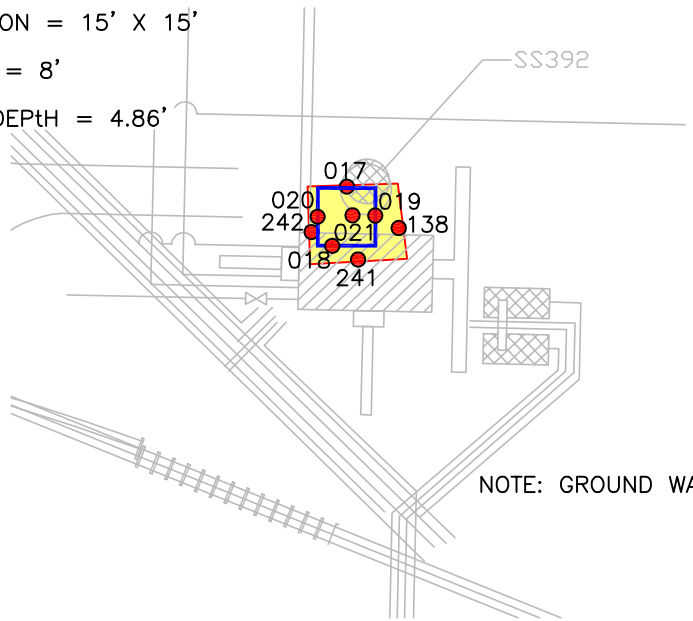
SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 15' X 15'

PROPOSED EXCAVATION DEPTH = 8'

ACTUAL AVERAGE EXCAVATION DEPtH = 4.86'




NOTE: GROUND WATER WAS ENCOUNTERED EXCAVATION.

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 17A & HAZARED INDEX CALCULATION ON FOLLOWING PAGES.

***US ARMY CORPS OF ENGINEERS***

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*BI-TRI HOUSE BUILDING 462*

*ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50

1"=50'


PREPARED BY:
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DATE PREPARED: OCTOBER 2005

BI–TRI HOUSE
BUILDING 462

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_462-CUT.DWG, 2/13/2006 9:31:36 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 753.00 |
| | ACTUAL EXCAVATION | 1,466.78 |
| | FUTURE EXCAVATION | 0.00 |

* INCLUDES AREAS A, B C & D

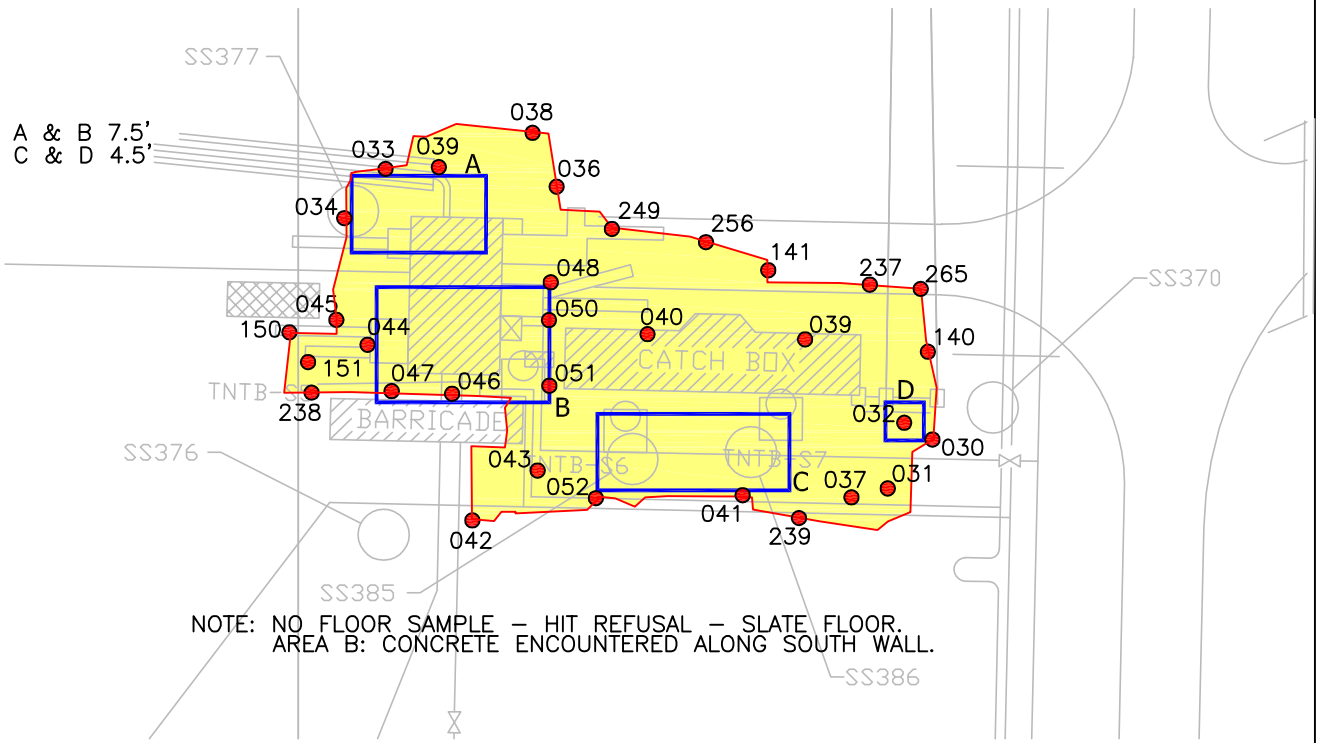
SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DEPTH = AREA A & B 7.5'
AREA C & D 4.5'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 35' x 20' x 7.5' | 194.00 |
| B | 45' x 30' x 7.5' | 378.00 |
| C | 50' x 20' x 4.5' | 167.00 |
| D | 10' x 10' x 4.5' | 17.00 |




NOTE: NO FLOOR SAMPLE – HIT REFUSAL – SLATE FLOOR.
AREA B: CONCRETE ENCOUNTERED ALONG SOUTH WALL.

***US ARMY CORPS OF ENGINEERS***
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*WASH HOUSE - LINE 6 BUILDING 466*
*ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 19A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.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DATE PREPARED: OCTOBER 2005

WASH HOUSE
BUILDING 466

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_466-CUT.DWG, 2/13/2006 9:33:33 AM, 1:50

LEGEND:

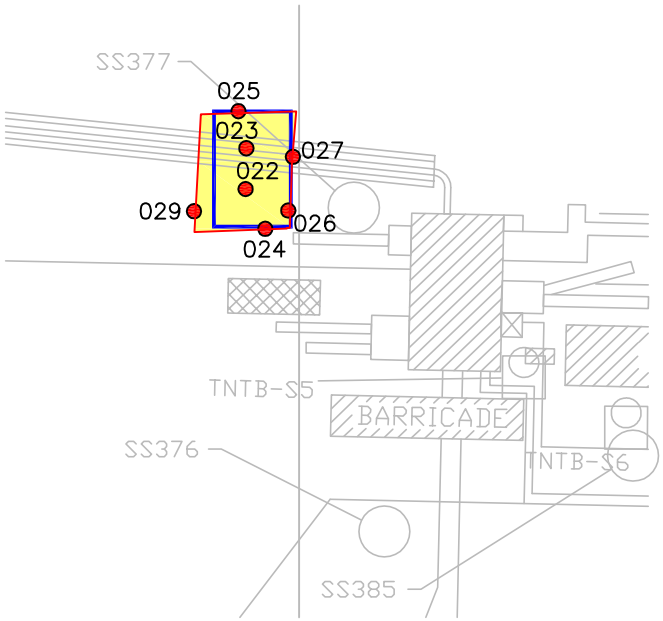
| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 78.00 |
| | ACTUAL EXCAVATION | 83.55 |
| | FUTURE EXCAVATION | 0.00 |

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 20' X 30'

PROPOSED EXCAVATION DEPTH = 3.5'




*US ARMY CORPS OF ENGINEERS*

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*NORTHWEST NAIL HOUSE*

*ACTUAL EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 21A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.


PREPARED BY:
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DATE PREPARED: OCTOBER 2005

NORTHWEST NAIL HOUSE

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_NORTHWEST_NAILHOUSE-CUT.DWG, 2/13/2006 9:38:42 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 190.00 |
| | ACTUAL EXCAVATION | 341.11 |
| | FUTURE EXCAVATION | 0.00 |

* INCLUDES AREAS A & B

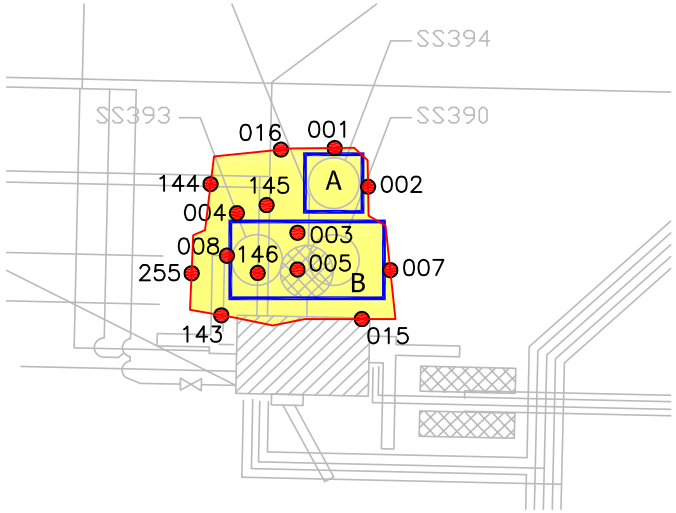
SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DEPTH = 5'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 15' x 15' x 5' | 42.00 |
| B | 20' x 40' x 5' | 148.00 |




*US ARMY CORPS OF ENGINEERS*
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*BI-TRI HOUSE BUILDING 472*
*ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 23A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.


PREPARED BY:
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jimi_msc@charter.net


DATE PREPARED: OCTOBER 2005

BI–TRI HOUSE
BUILDING 472

E:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_472-CUT.DWG, 2/13/2006 9:34:25 AM, 1:50

LEGEND:

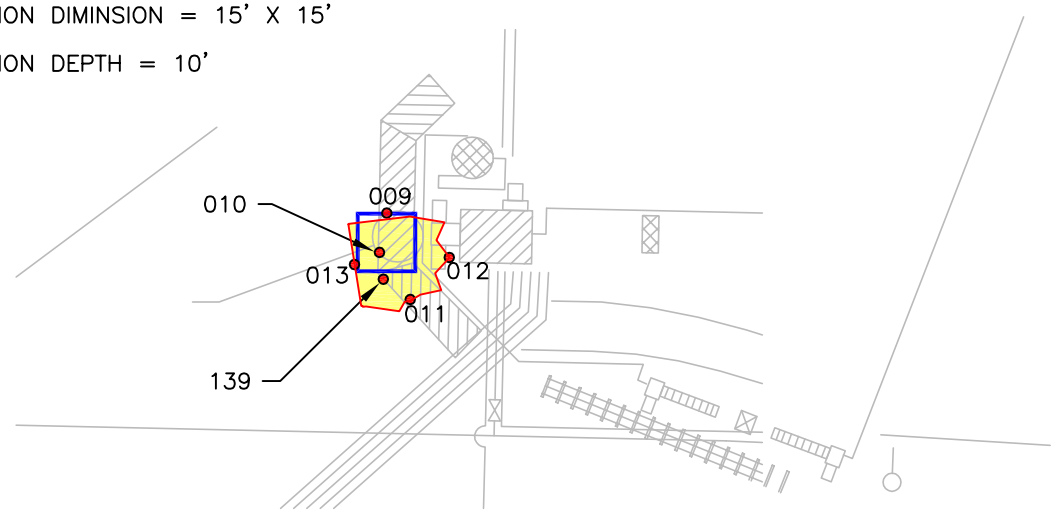
| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 83.00 |
| | ACTUAL EXCAVATION | 93.17 |
| | FUTURE EXCAVATION | 0.00 |

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 15' X 15'

PROPOSED EXCAVATION DEPTH = 10'




NOTES: THE EAST WALL OF THE PIT IS A CONCRETE WALL.
SAMPLE 5393–012 WAS COLLECTED BEHIND THE WALL.

*US ARMY CORPS OF ENGINEERS*
HUNTINGTON DISTRICT
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*FORTIFIER HOUSE BUILDING 473*
*ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 25A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.


PREPARED BY:
Mountain State Company
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jiml_msc@charter.net


DATE PREPARED: OCTOBER 2005

FORTIFIER HOUSE
BUILDING 473

F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_473-CUT.DWG, 2/13/2006 9:35:00 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 83.00 |
| | ACTUAL EXCAVATION | 96.09 |
| | FUTURE EXCAVATION | 0.00 |

* INCLUDES AREAS A & B

SAMPLE NUMBER = 5393 – XXX

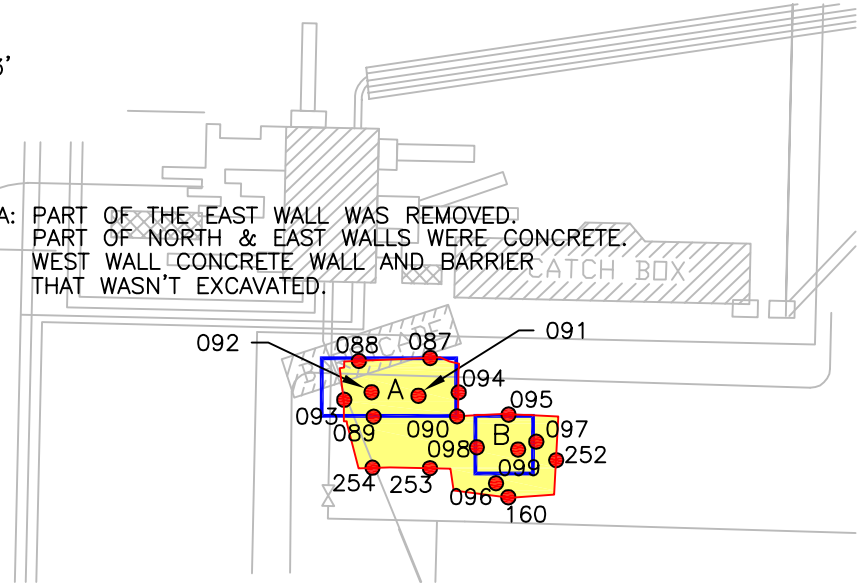
HISTORICAL INFORMATION

PROPOSED EXCAVATION DEPTH = 3'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 35' x 15' x 3' | 58.00 |
| B | 15' x 15' x 3' | 25.00 |

AREA A: PART OF THE EAST WALL WAS REMOVED.
PART OF NORTH & EAST WALLS WERE CONCRETE.
WEST WALL CONCRETE WALL AND BARRIER
THAT WASN'T EXCAVATED.




AREA B: WEST WALL WAS REMOVED.

*US ARMY CORPS OF ENGINEERS*
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*WASH HOUSE - LINE 7 BUILDING 476*
*ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 17A & HAZARD INDEX CALCULATION RESPECTIVELY ON FOLLOWING PAGES.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DATE PREPARED: OCTOBER 2005

WASH HOUSE – LINE 7
BUILDING 476


F:\AUGUST-REVISIONS\SANDUSKY-FINAL_BUILDING_476-CUT.DWG, 2/13/2006 9:35:43 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 266.00 |
| | ACTUAL EXCAVATION | 44.00 |
| | FUTURE EXCAVATION | 646.52 |

* INCLUDES AREAS A, B & C

SAMPLE NUMBER = 5393 – XXX

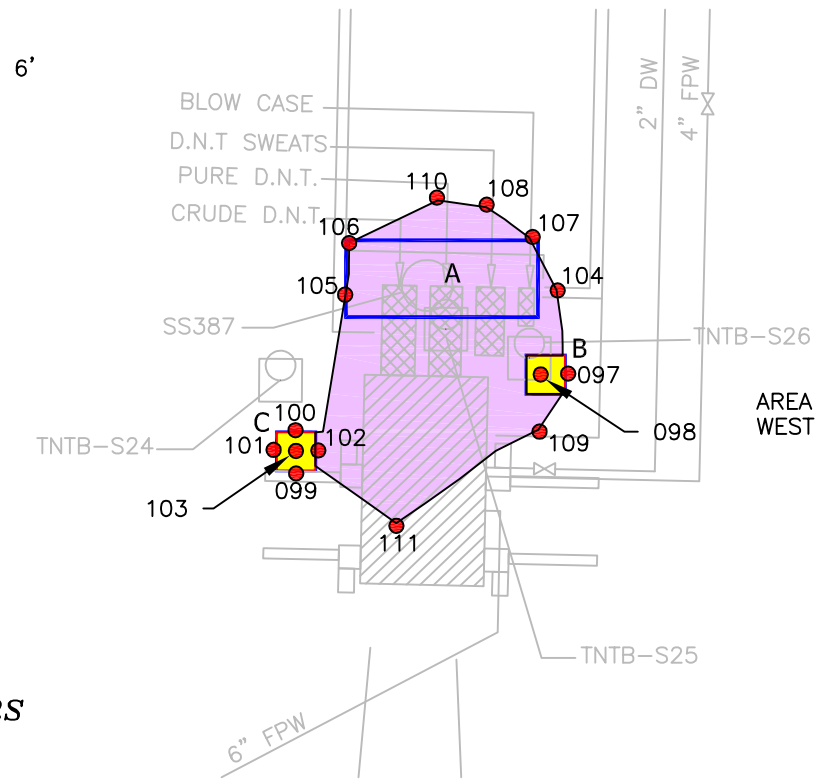
HISTORICAL INFORMATION

PROPOSED EXCAVATION DEPTH = 6'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 50' X 20' X 6' | 222.00 |
| B | 10' X 10' X 6' | 22.00 |
| C | 10' X 10' X 6' | 22.00 |

AREA A: OVER EXCAVATE TO CLEAN AREA OF AREA C




AREA B: NORTH WALL AND WEST WALL IS PART OF AREA A

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 54A, 57A, 60A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.

***US ARMY CORPS OF ENGINEERS***

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*D.N.T. SWEATING & GRAINING HOUSE BUILDING 412*

*FUTURE EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'


PREPARED BY:
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DATE PREPARED: OCTOBER 2005

# D. N. T. SWEATING & GRAINING HOUSE BUILDING 412

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LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 500.00 |
| | ACTUAL EXCAVATION | 409.77 |
| | FUTURE EXCAVATION | 2,053.46 |

* INCLUDES AREAS A & B

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

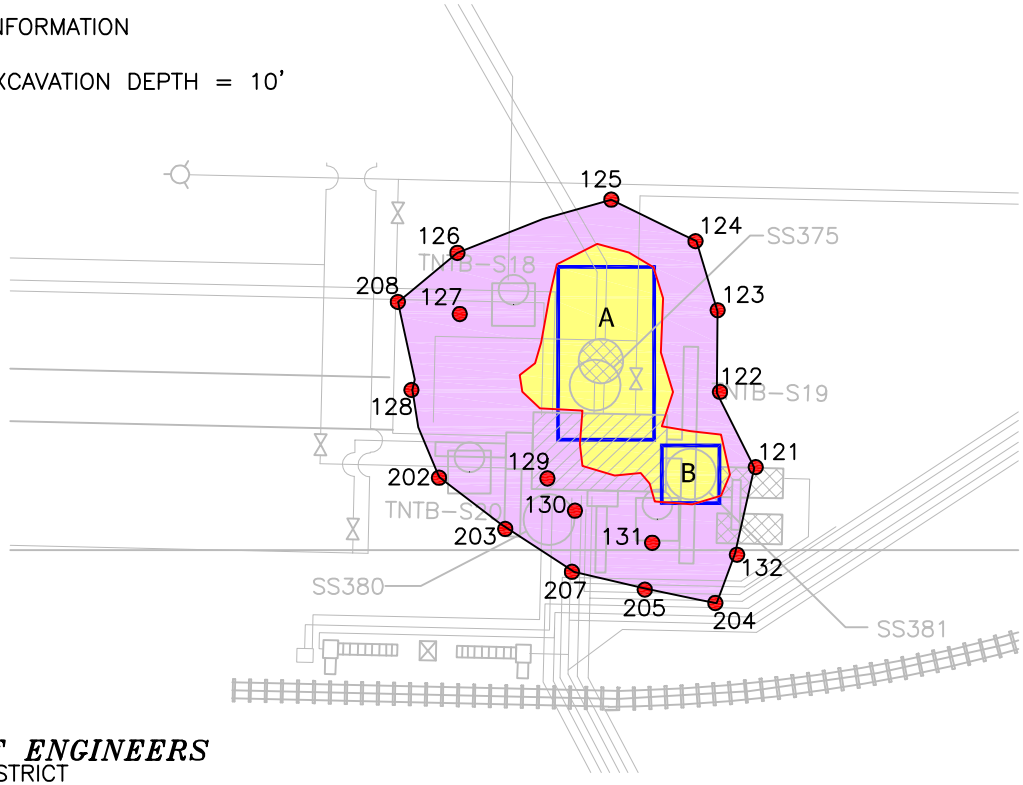
PROPOSED EXCAVATION DEPTH = 10'

DETAIL OF PROPOSED EXCAVATION

| AREA | AREA (FT. L,W&D) | VOLUME (C.Y) |
|---|---|---|
| A | 25' X 45' X 10' | 417.00 |
| B | 15' X 15' X 10' | 83.00 |

N

AREA A: CONCRETE ENCOUNTERED IN SOUTHWEST CORNER.




*US ARMY CORPS OF ENGINEERS*
HUNTINGTON DISTRICT
*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*BI-TRI HOUSE BUILDING 452*
*FUTURE EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 35A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.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DATE PREPARED: OCTOBER 2005

BI–TRI HOUSE
BUILDING 452

F:\AUGUST-REVISIONS\SANDUSKY-PROPOSED_BUILDING_452-CUT.DWG, 2/13/2006 9:41:49 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 85.00 |
| | ACTUAL EXCAVATION | 85.00 |
| | FUTURE EXCAVATION | 1,108.46 |

SAMPLE NUMBER = 5393 – XXX

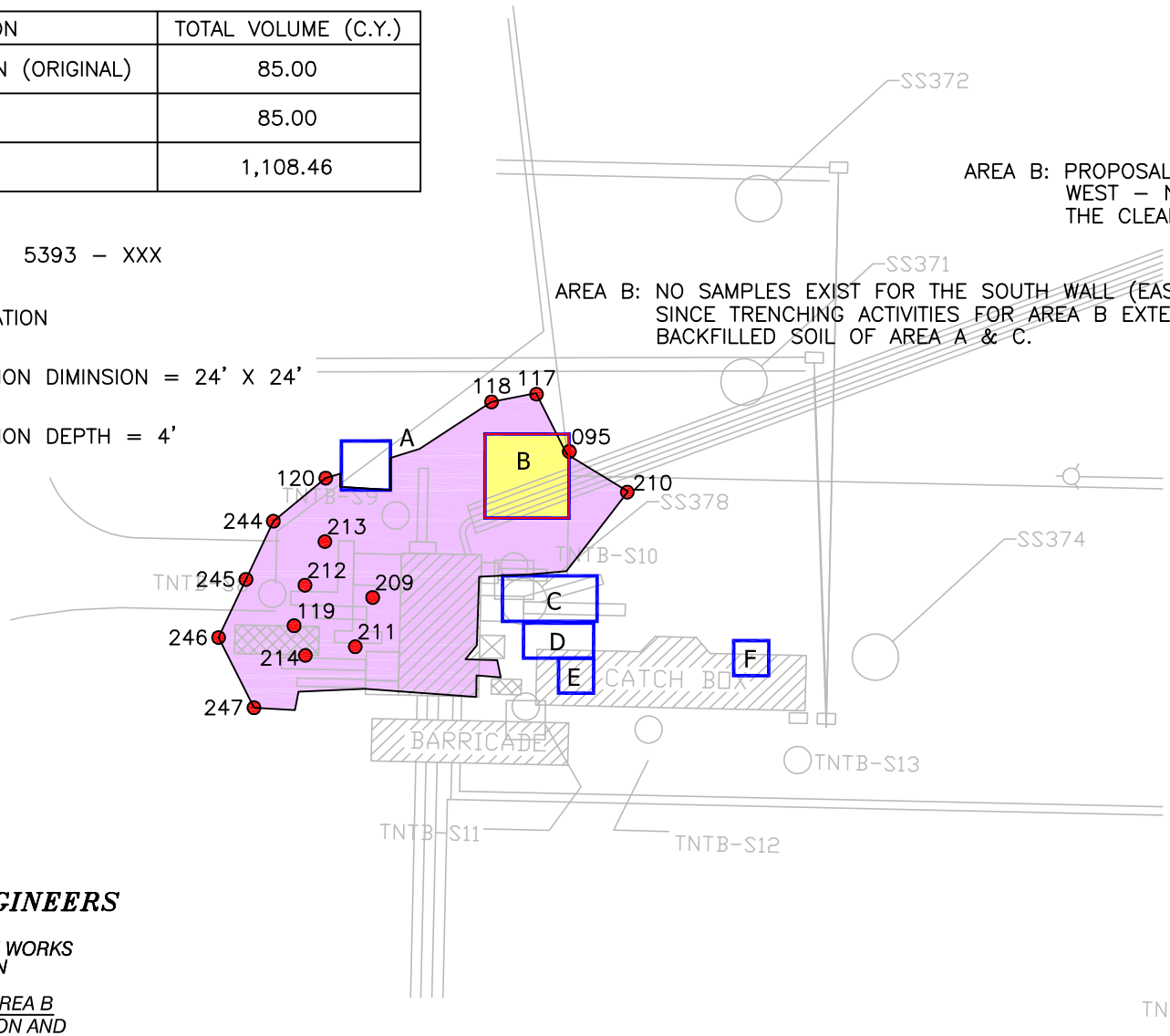
HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 24' X 24'

PROPOSED EXCAVATION DEPTH = 4'

AREA B: PROPOSAL TO OVER EXCAVATE WEST – NORTHWEST WALL TO THE CLEAN SOIL OF AREA A

AREA B: NO SAMPLES EXIST FOR THE SOUTH WALL (EAST AND WEST ENDS) SINCE TRENCHING ACTIVITIES FOR AREA B EXTENDED INTO THE CLEAN BACKFILLED SOIL OF AREA A & C.




**US ARMY CORPS OF ENGINEERS**
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*WASH HOUSE - 5 BUILDING 456 AREA B*
*FUTURE EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 49A & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.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DATE PREPARED: OCTOBER 2005

WASH HOUSE AREA B
BUILDING 456

E:\AUGUST-REVISIONS\SANDUSKY-PROPOSED_BUILDING_456-CUT.DWG, 2/13/2006 9:43:26 AM, 1:50

LEGEND:

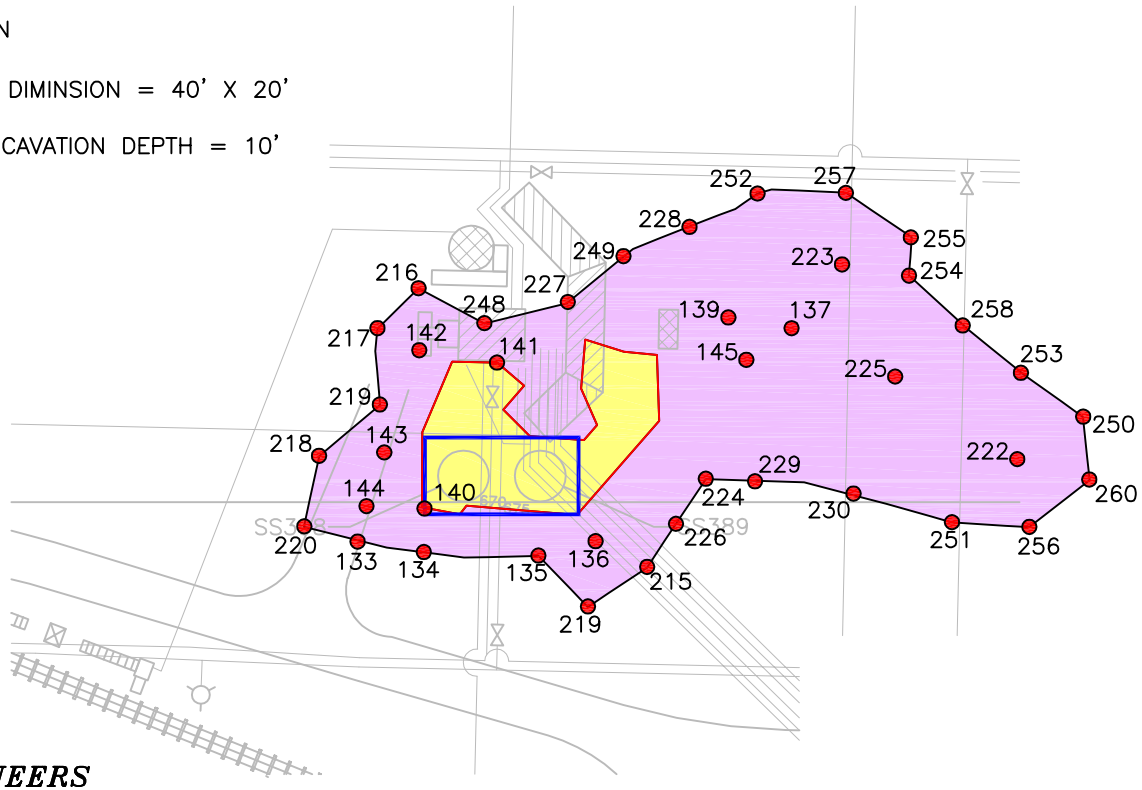
| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 296.00 |
| | ACTUAL EXCAVATION | 379.18 |
| | FUTURE EXCAVATION | 2,657.98 |

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 40' X 20'

PROPOSED AVERAGE EXCAVATION DEPTH = 10'




**US ARMY CORPS OF ENGINEERS**
HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*TNT AREA B*
*FORTIFIER HOUSE BUILDING 463*
*FUTURE EXCAVATION , STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50
1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 42A HAZARD INDEX CALCULATIONS ON FOLLOWING PAGES.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DATE PREPARED: OCTOBER 2005

FORTIFIER HOUSE
BUILDING 463

F:\AUGUST-REVISIONS\SANDUSKY-PROPOSED_BUILDING_463-CUT.DWG, 2/13/2006 9:44:16 AM, 1:50

LEGEND:

| COLOR | DESCRIPTION | * TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 33.00 |
| | ACTUAL EXCAVATION | 31.46 |
| | FUTURE EXCAVATION | 250.00 |

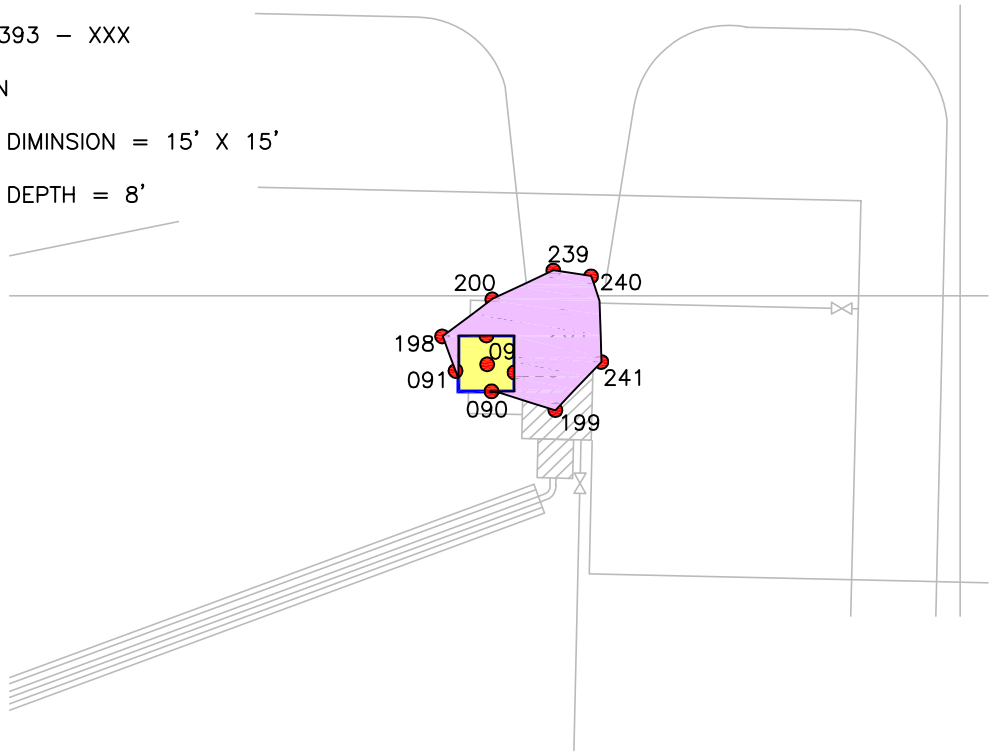
* INCLUDES AREAS A & B

SAMPLE NUMBER = 5393 – XXX

HISTORICAL INFORMATION

PROPOSED EXCAVATION DIMINSION = 15' X 15'

PROPOSED EXCAVATION DEPTH = 8'




*US ARMY CORPS OF ENGINEERS*

HUNTINGTON DISTRICT

*FORMER PLUM BROOK ORDNANCE WORKS*
*NASA PLUM BROOK STATION*
*NORTHEAST NAILHOUSE*
*FUTURE EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL*

0 50

1"=50'

NOTE: FOR CONFIRMATION SAMPLE RESULTS AND HAZARD INDEX CALCULATION SUMMARIES, SEE TABLES 51A, & HAZARD INDEX CALCULATION ON FOLLOWING PAGES.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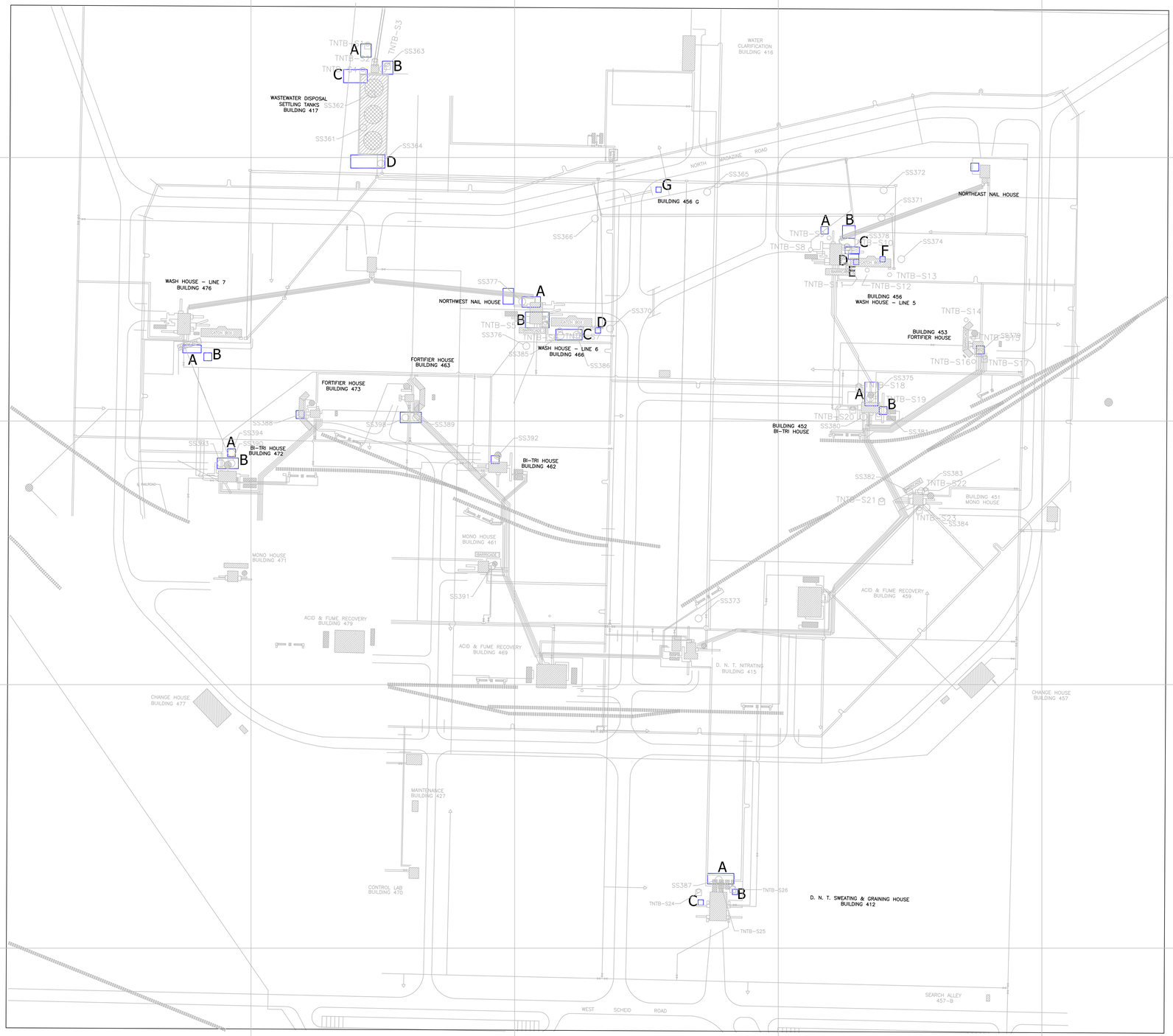
DATE PREPARED: OCTOBER 2005

NORTHEAST NAIL HOUSE




LEGEND:

PROPOSED EXCAVATION (ORIGINAL)
TOTAL VOLUME (C.Y.) = 2961.00

100 0 100
SCALE: 1"=100'

US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
TNT AREA B GENERAL SITE FEATURES MAP

ORIGINAL PROPOSED EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL

PREPARED BY:
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SANDUSKY-PROPOSED_EXCAVATION

DATE PREPARED: OCTOBER 2005
DATE REVISED:

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LEGEND:

FUTURE EXCAVATION TOTAL VOLUME (C.Y.) = 6716.42

PROPOSED EXCAVATION (ORIGINAL) TOTAL VOLUME (C.Y.) = 2961.00

100 0 100
SCALE: 1"=100'

US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
TNT AREA B GENERAL SITE FEATURES MAP

FUTURE
FUTURE EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL

PREPARED BY:
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DATE PREPARED: OCTOBER 2005
DATE REVISED:

SANDUSKY-FINAL-CONTINUED_EXCAVATION

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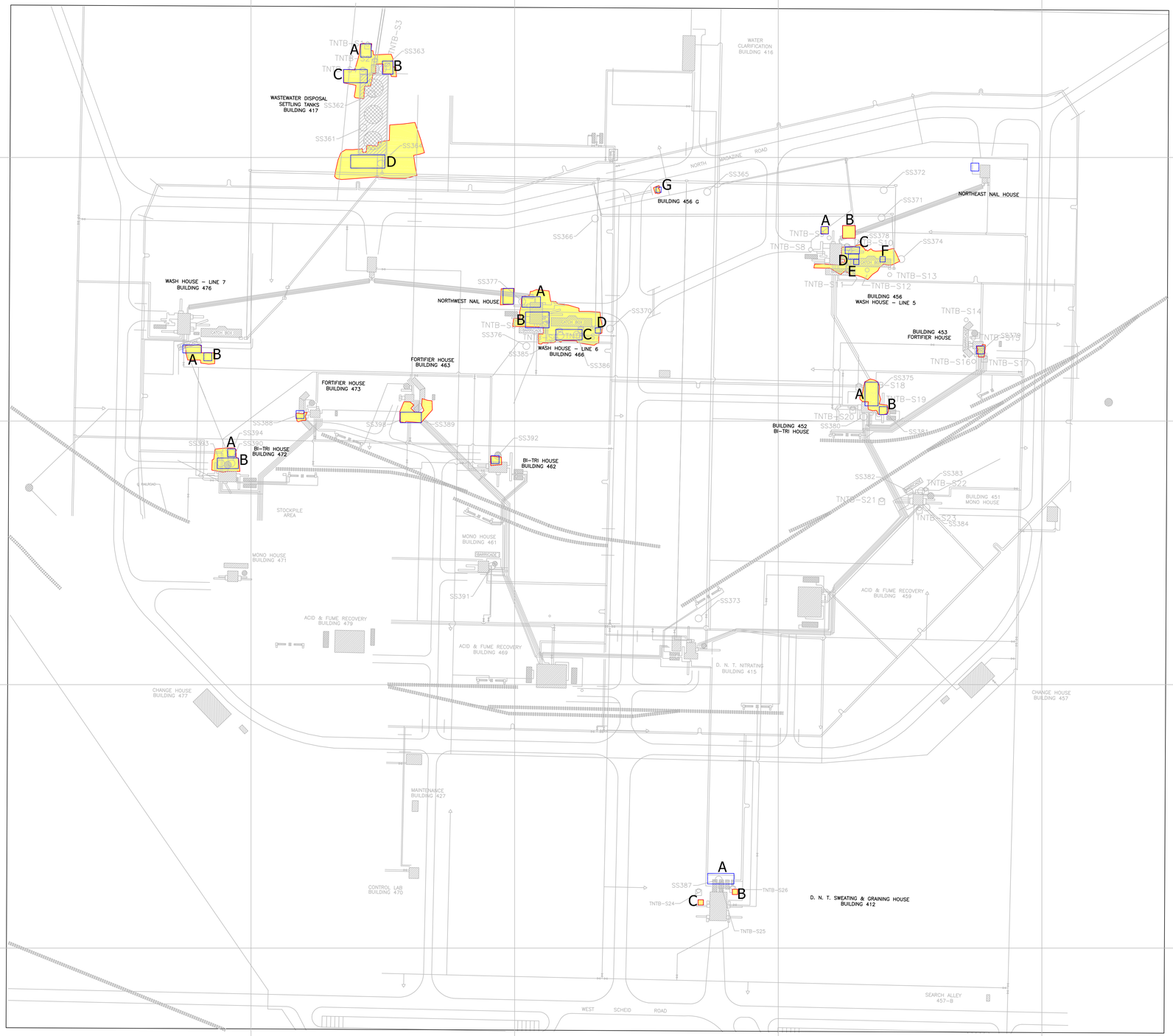


LEGEND:

ACTUAL EXCAVATION TOTAL VOLUME (C.Y.) = 5216.84

PROPOSED EXCAVATION (ORIGINAL) TOTAL VOLUME (C.Y.) = 2961.00

100 0 100

SCALE: 1"=100'

US ARMY CORPS OF ENGINEERS

HUNTINGTON DISTRICT

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
TNT AREA B GENERAL SITE FEATURES MAP

ACTUAL EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL

PREPARED BY:
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SANDUSKY-FINAL_EXCAVATION

DATE PREPARED: OCTOBER 2005
DATE REVISED:

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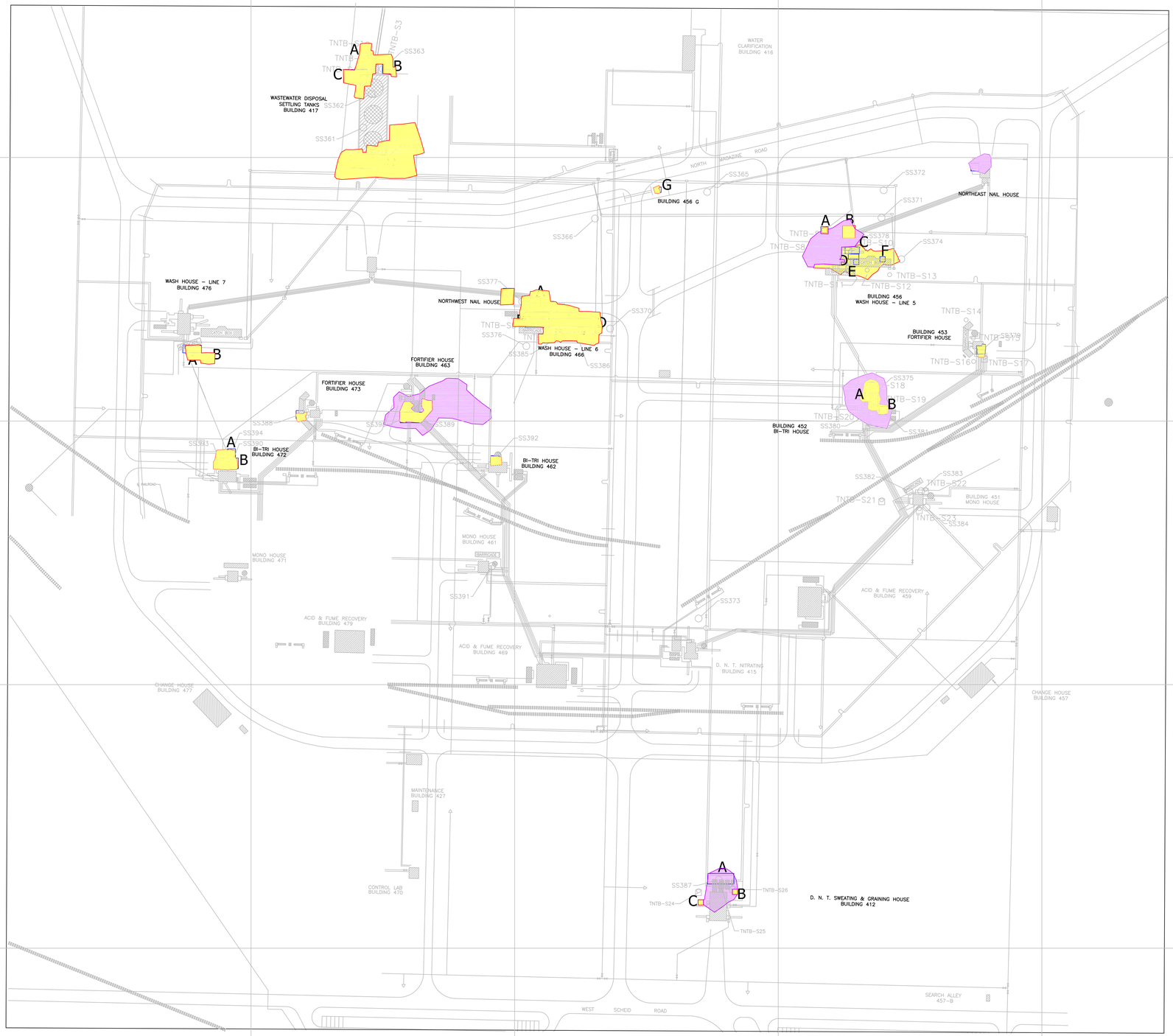


LEGEND:

| COLOR | DESCRIPTION | TOTAL VOLUME (C.Y.) |
|---|---|---|
| | PROPOSED EXCAVATION (ORIGINAL) | 2961.00 |
| | ACTUAL EXCAVATION | 5216.84 |
| | FUTURE EXCAVATION | 6716.42 |

100 0 100
SCALE: 1"=100'

US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT

FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
TNT AREA B GENERAL SITE FEATURES MAP

ORIGINAL PROPOSED, ACTUAL & FUTURE EXCAVATION, STABILIZATION AND DISPOSAL OF CONTAMINATED SOIL

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SANDUSKY-TOTAL_EXCAVATION

DATE PREPARED: OCTOBER 2005
DATE REVISED:

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