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# INTERIM MEASURE WORK PLAN COAL STORAGE AREA SOLID WASTE MANAGEMENT UNIT 44 (SWMU 44) ZONE C CNC CHARLESTON SC

5/1/2001

NAVAL FACILITIES ENGINEERING COMMAND

# INTERIM MEASURE WORK PLAN

# Coal Storage Area, SWMU 44, Zone C

***Charleston Naval Complex***
***North Charleston, South Carolina***

SUBMITTED TO
***U.S. Navy Southern Division***
***Naval Facilities Engineering Command***

PREPARED BY
***CH2M-Jones***

*May 2001*

*Revision 0*
*Contract N62467-99-C-0960*
*158814.ZC.PR.02*

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CH2MHILL

May 30, 2001

John Litton, P.E., Director
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: Interim Measure Work Plan, Revision 0, SWMU 44, Zone C

Dear Mr. Litton:

Enclosed please find four copies of the Interim Measure Work Plan, Revision 0, SWMU 44, Zone C of the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Tony Hunt/Navy, w/att
Rob Harrell/Navy, w/att
David Scaturo/SCDHEC
Gary Foster/CH2M HILL, w/att

# Certification Page for the Interim Measure Work Plan, Revision 0, SWMU 44, Coal Storage Area, Zone C

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

Temporary Permit No. T2000342

Dean Williamson, P.E.

5/30/2001

Date

SOUTH CAROLINA
CH2M
HILL, INC.
No.: C00201
CERTIFICATE OF AUTHORIZATION

# Contents

# Acronyms and Abbreviations

| | |
|---|---|
| AOC | area of concern |
| BCT | BRAC Cleanup Team |
| BEQ | benzo(a)pyrene equivalent |
| BRAC | Base Realignment and Closure Act |
| BRC | background reference concentration |
| CA | corrective action |
| CNC | Charleston Naval Complex |
| COC | chemical of concern |
| COPC | chemical of potential concern |
| CRD | Commercial Redevelopment District |
| CSAP | Comprehensive Sampling and Analysis Plan |
| DET | Environmental Detachment Charleston |
| DRO | diesel range organics |
| EnSafe | EnSafe Inc. |
| EPA | U.S. Environmental Protection Agency |
| ft bgs | feet below ground surface |
| $ft^2$ | square feet |
| IM | interim measure |
| MCL | maximum contaminant level |
| MCS | media cleanup standard |
| mg/kg | milligrams per kilogram |
| NAVBASE | Naval Base |
| NFA | no further action |
| PAH | polynuclear aromatic hydrocarbon |
| PPE | personal protective equipment |
| RBC | risk-based concentration |
| RCRA | Resource Conservation and Recovery Act |

# Acronyms and Abbreviations, Continued

| | | |
|---|---|---|
| RFI | RCRA Facility Investigation |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SSL | soil screening level |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| TPH | total petroleum hydrocarbon |
| UCL | upper confidence level |
| UTL | upper threshold limit |
| $y^3$ | cubic yards |

SECTION 1.0

# Introduction

# 1.0 Introduction

In 1993, Naval Base (NAVBASE) Charleston was added to the list of bases scheduled for closure as part of the Defense Base Realignment and Closure Act (BRAC), which regulates closure and transition of property to the community. The Charleston Naval Complex (CNC) was formed as a result of the dis-establishment of the Charleston Naval Shipyard and NAVBASE on April 1, 1996.

CNC Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA); the South Carolina Department of Health and Environmental Control (SCDHEC) is the lead agency for CA activities at the site. All RCRA CA activities are performed in accordance with the Final Permit (Permit No. SC0 170 022 560).

In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to document the basis for an Interim Measure (IM) Work Plan at Solid Waste Management Unit (SWMU) 44 in Zone C of the CNC.

## 1.1 Background and Summary for Interim Measure Work Plan

As part of RCRA CA activities, a RCRA Facility Investigation (RFI) report was finalized for Zone C (EnSafe Inc. [EnSafe], 1997). Zone C is located on the western edge of the northern portion of CNC. It is bounded by McMillian Avenue to the south; Hobson Avenue to the east; Avenue "D" to the northeast; and the CNC property boundary to the west and north.

All data for SWMU 44 were evaluated during the preparation of this IM WP. Results of the evaluation show that concentrations of arsenic exceed levels that would allow the site to be used for unrestricted land use. Data for SWMU 44 (Coal Storage Area) in Zone C is adequate to support a recommendation for an IM. This IM WP supports a recommendation to remove soils with elevated concentrations of arsenic.

CH2M-Jones anticipates that this IM will be the only remedial action completed at the site. Upon IM completion, a CMS will be prepared. The CMS will evaluate the site chemical of concern (COC) concentrations, on a post-IM basis, and will determine appropriateness of no further action (NFA). If COC concentrations at the site necessitate further remedial action

(e.g., further excavation, land use controls), remedial alternatives will be evaluated in the CMS.

## 1.2 Document Organization

This IM WP consists of the following four sections, including this introductory section:

**1.0 Introduction** – Presents the purpose of the IM WP.

**2.0 Technical Basis and Rationale for Interim Measure** – Provides a brief overview of the site and previous investigations.

**3.0 Interim Measure Work Plan** – Presents the proposed cleanup objective and details associated with the proposed site cleanup plan.

**4.0 References** – Lists the references used in this document.

The appendix provides the IM Completion Report.

All tables and figures appear at the end of their respective sections.

SECTION 2.0

# Technical Basis and Rationale for Interim Measure

# 2.0 Technical Basis and Rationale for Interim Measure

## 2.1 Brief Overview of Site and Previous Investigations

SWMU 44 was formerly a coal storage yard used for unloading railcars and the intermediate storage of coal before use at the former steam-generation plant in Building 32. The entire area investigated during the RFI is approximately 8 acres, but coal was typically stored in an approximately 3-acre area along the elevated railroad trestle leading into the coal storage yard. SWMU 44 is bound on the west and north by Noisette Creek, on the south by a drainage ditch, and on the east by Avenue D. Figure 2-1 depicts an aerial view of SWMU 44. The Figure 2-1 inset shows the location of SWMU 44 with respect to the rest of CNC.

Coal storage operations began in the 1940s, but were scaled down in late 1955. Two coal piles were on site during the RFI, the largest of which was estimated to be 80 feet by 400 feet. The coal was removed during an IM conducted by the Supervisor of Shipbuilding, Conversion and Repair, Portsmouth, Virginia, Environmental Detachment Charleston (DET).

Initial studies at SWMU 44 focused on surface water runoff and surface water quality. Eight sampling events conducted between 1981 and 1985 indicated metals and total suspended solids in surface water runoff and surface water samples. The results of these data warranted an RFI, which was completed at SWMU 44 in late 1997 (EnSafe 1997). The RFI assessed impacts from metals and semivolatile organic compounds (SVOCs) on soil, sediment, groundwater, and/or surface water as a result of onsite coal storage. Samples were collected from each medium in areas with the highest potential for contamination, such as areas downgradient of the coal piles. In September 1996, the DET's extensive excavation of old coal and coal-dirt mixtures at SWMU 44 warranted supplemental sampling.Currently, the site remains as it was during its coal storage era minus any obvious quantities of stored coal. Two concrete pads, approximately 40 feet by 350 feet in size, are adjacent to the elevated railway trestle in the south-central portion of the site. Most of the remaining area of the site is undeveloped and covered by dirt, gravel, vegetation, or a mixture of the three components.

Native vegetation (low shrubs, wild grasses, and cattails) has recently taken root in several areas excavated by the DET. As a result of the extensive excavation operation, two ponds, each of which is approximately 100 - 200 feet in diameter and 3 feet deep, have formed at the former coal storage yard. The size and depth of these ponds fluctuate throughout the year and primarily depend on rainfall for recharge. The largest pond is located in the northern-most portion of the site; the smaller pond is located east of the elevated trestle, south of Building 1226 (see Figure 2-1).

SWMU 44 is not currently used by either federal or non-federal base tenants.

The zoning for SWMU 44 is Commercial Redevelopment District (CRD), as presented in the Charleston Naval Complex Base Development Study, Final Report (March 1998). Land uses allowed by this zoning includes light commercial businesses and limited residential use.

## 2.2 Interim Measures

In September 1996, the DET completed the removal of approximately 13,000 tons of coal and coal-dirt mixture at SWMU 44. The removal operation lowered the existing grade by a depth of 2 to 5 feet, resulting in at least two areas that have become ponds with native vegetation. The IM Completion Report is presented in the appendix of this report.

The DET did not remove coal from between the tracks, because any removal action would require hand-shoveling and pick axes, which would render these sections of track unusable.

## 2.3 RFI and Post-RFI Sampling Results

The status of the Zone C RCRA Facility Investigation Report is final (EnSafe 1997). Results of the RFI for SWMU 44 are discussed in Section 10.1 of the Zone C Final RFI Report.

### 2.3.1 RFI/Post-RFI Sampling Results in Soil

Two sampling events were conducted during the SWMU 44 RFI. During the first sampling event, 9 soil samples were collected from eight locations (one lower- and eight upper-interval samples). A shallow water table impeded the collection of lower-interval samples; saturated soil samples were not submitted for analysis. Soil samples were analyzed for metals and cyanide. The preliminary analysis indicated arsenic presence in soil at concentrations exceeding its risk-based concentration (RBC).

Two upper-interval sample locations were added for the second sampling event to delineate arsenic contamination. Samples obtained from the second sampling event were submitted

for metals analysis. Two additional soil sampling events were completed in January and August of 1997 to assess ecological risk at SWMU 44. The RFI concluded that aluminum, arsenic, beryllium, thallium, and benzo(a)pyrene equivalents (BEQs) were COCs in surface soils and sediments (EnSafe 1997).

As a result of the DET's IM (see Section 2.2) and the subsequent site alteration, some of the original RFI soil sample results were no longer applicable because some of the sampled soils were removed as part of the IM.

Supplemental post-RFI sampling was conducted at SWMU 44 to evaluate the excavated area for residual contamination concentrations. Sampling was conducted using a 60-foot grid at the request of SCDHEC. The supplemental post-RFI surface and subsurface soil sample locations are presented on Figure 2-2. Figure 2-2 also indicates the footprint of the excavation completed as part of the IM. Surface and subsurface soil arsenic concentrations are presented on Figures 2-3 and 2-4, respectively.

Other COCs evaluated in the post-RFI sampling effort, such as BEQs, aluminum, beryllium, and thallium, were infrequently detected and are not considered subject of this IM. These constituents are not present at levels that create an unacceptable risk and will be addressed in the CMS report for SWMU 44.

To gain perspective on the presented surface and subsurface data, a zone-specific reference concentration was developed for Zone C, as described in the following sections. The information provided below was previously submitted in a memorandum to SCDHEC for review on April 22, 2001. Verbal approval of the media cleanup standard (MCS) was received from SCDHEC on May 14, 2001.

### 2.3.2 Surface Soil

The statistically estimated Zone C background reference concentration for arsenic, as presented in the Final Zone C RFI, was 14.2 mg/kg. Table 2-1 presents the full data set for arsenic in surface soil samples in Zone C that are determined to be outside the influence of SWMU activities, sorted from highest to lowest value. Table 2-1 presents the original grid sample population for the RFI as well as new samples collected in March 2001. The Zone C reference concentration was a UTL95 value, after the three highest grid data points (39.4, 22.4, and 22.3 milligrams per kilogram [mg/kg]) were eliminated from the sample population.

The three highest concentration data points were eliminated from the reference sample population because they were considered outliers. However, since these samples are representative of anthropogenic background conditions at the base, they should be included in the background data evaluation. Therefore, the full range of arsenic results from grid locations was evaluated. The resulting UTL95 from the full data set was calculated as 28.7 mg/kg.

Additional soil samples were collected in March 2001 to characterize BEQ concentrations at railroad tracks; arsenic was also targeted for analysis in these samples. The railroad samples included samples from near and under railroad ties, and adjacent runoff areas. The results of this dataset are highlighted in Table 2-1. Eight of the railroad track samples were collected from areas adjacent to Zone C.

The arsenic concentrations in the eight samples collected in March 2001 ranged from 7.29 to 91.7 mg/kg. Since SWMU 44 has extensive railroad tracks traversing the site, and since some of the highest arsenic concentrations were observed near the railroad tracks, these railroad sample concentrations were included in a UTL 95% calculation for Zone C. When all "non-SWMU" samples (i.e., original grid samples as well as railroad samples collected in March 2001) are included in the UTL 95% calculation, the new UTL 5% was calculated as 66.1 mg/kg.

In addition to the above site-specific information, the position on arsenic that EPA Region IV has recently adopted is another factor to consider in developing a MCS. The EPA Region IV position was outlined in a letter from Dann Spariosu, EPA Region IV, to Mihir Mehta of SCDHEC. The letter recommends a remediation goal of 20 mg/kg for arsenic in soil, and cites a general range of arsenic background of 10 - 30 mg/kg within EPA Region IV.

Based on the above informationCH2M-Jones recommends establishing an arsenic MCS of 28.7 mg/kg. Other factors contributing to the recommendation of the arsenic MCS include:

- The proposed MCS represents the UTL 95% for the original background reference sample population.
- The value is less than the upper limit of the background range of arsenic within Region IV (30 mg/kg).

Though inclusion of the recent (March 2001) railroad samples is applicable to developing an MCS for SWMU 44, the data were not included so as to maintain a conservative measure.

It should be noted that developing a soil screening level (SSL)-based MCS was considered. Using EPA default assumptions, and a DAF of 10, the SSL is 14.5 mg/kg for arsenic in soil. As this value is lower than the reference concentration of 28.7 mg/kg, the reference concentration would be considered more relevant in deriving an MCS than would the SSL.

### 2.3.3 Subsurface Soils

The Zone C reference value for arsenic in subsurface soil, as presented in the Final Zone C RFI, was 14.1 mg/kg (EnSafe 1997). Table 2-2 presents the full data set for arsenic in subsurface soil grid samples in Zone C, sorted from highest to lowest value. The reference value was an estimated UTL 95% value, after the highest data point (31.6 mg/kg) was eliminated from the sample population.

The basis for removing the highest data point was that it was considered an outlier. However, the outlier is representative of anthropogenic background conditions at the base and should be included in evaluation of background data. Therefore, the full range of arsenic results from grid locations was included in the reference concentration estimations. The resulting UTL 95% was calculated as 32.0 mg/kg.

Future construction activity could mix subsurface and surface soils. Considering this scenario, and the closeness of the calculated UTL 95% values for surface (28.7 mg/kg) and subsurface (32.0 mg/kg) soils, CH2M-Jones recommends identical MCS for both subsurface and surface soils.

It should be noted that developing an SSL-based MCS was considered. Using EPA default assumptions, and a DAF of 10, the SSL for arsenic in soil is 14.5 mg/kg. As this value is lower than the reference concentration of 28.7 mg/kg, the reference concentration would be more relevant in deriving an MCS than would the SSL.

## 2.4 Determination of Soil Excavation Limits

Surface and subsurface soils are discussed separately in the text that follows.

### 2.4.1 Surface Soil Excavation

As presented in Section 2.3.3, the recommended MCS for arsenic is 28.7 mg/kg in both surface and subsurface soils. The objective of the IM is to ensure that, upon IM completion, the site exposure concentration and the half-acre parcel exposure concentration is equal to or less than the MCS. Note that it is possible for individual soil samples within SWMU 44 to exceed the statistically based MCS, provided that the UCL95 concentration is lower than the

MCS. A half-acre box will be used as an exposure area for future assumed residential land use, where statistical upper-bound averages (i.e., UCL 95%) are at or below reference levels for arsenic.

The following presents the phased process that was used to determine excavation extents:

1. Initially, the full range of SWMU data was evaluated, and a UCL95 calculation was performed to produce a site upper-bound estimate on the average concentration. This phase determined if the site data, as a whole, exceeds the MCS. No excavation contours were developed as part of completing this phase. Rather, results from this evaluation determined the overall exposure concentration at the SWMU.

2. A half-acre box was then moved over the site with the purpose to "box in" as many of the highest arsenic levels on the site. Several half-acre box calculations were performed, as required, to address all the highest levels of arsenic in soil. Once a box was drawn around the samples, a UCL95 was calculated for data within that box. If the UCL95 concentration is below the MCS, no excavation is required within that box. If the UCL95 is greater than the MCS, then some soil requires removal.

3. Two-dimensional kriging was used to estimate the extent of excavation within boxes that are determined to require soil removal, based on results of Phase 2 above. (Kriging is a mathematical process recognized by the EPA as the best and standard means for the interpolation and extrapolation of measured data.) Where excavation is required in a half-acre box, it was assumed that the sample locations where soil is being removed were replaced with "clean" soil. For the purpose of this IM Work Plan, it was assumed that the clean soil has an arsenic concentration of 7 mg/kg.

### 2.4.2 Subsurface Soil Excavation

As presented above, the recommended MCS for arsenic in subsurface soil is 28.7 mg/kg. Although there is no direct exposure of subsurface soils to human receptors, the MCS will be used assuming that subsurface soil is mixed uniformly with surface soil in a construction activity scenario.

The same phased process used to delineate the extent of surface soil requiring removal was also used for subsurface soil removal.

**TABLE 2-1**
Surface Grid and Railroad Samples ("non-SWMU") Collected in Zone C - Arsenic [a,b]
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth | Data Set |
|---|---|---|---|---|---|---|---|---|
| GDC | GDLSB01301 | GDLSB01301 | AS | 91.7 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | GDLSB01201 | GDLSB01201 | AS | 74.1 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | CGDCSB002 | GDCSB00201 | AS | 39.4 | = | 03/13/1995 | 0 | RFI Background Data Set |
| GDC | GDLSB01701 | GDLSB01701 | AS | 30.1 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | GDLSB01801 | GDLSB01801 | AS | 27.9 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | GDLSB01401 | GDLSB01401 | AS | 26.2 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | CGDCSB028 | GDCSB02801 | AS | 22.4 | = | 04/20/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB031 | GDCSB03101 | AS | 22.3 | = | 04/17/1995 | 0 | RFI Background Data Set |
| GDC | GDLSB01601 | GDLSB01601 | AS | 17.4 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | GDLSB01901 | GDLSB01901 | AS | 14.5 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | CGDCSB021 | GDCSB02101 | AS | 12.5 | = | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB035 | GDCSB03501 | AS | 10.2 | = | 04/12/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB017 | GDCSB01701 | AS | 9.6 | J | 04/10/1995 | 0 | RFI Background Data Set |
| GDC | GDLSB01501 | GDLSB01501 | AS | 7.29 | = | 03/22/2001 | 0 | March 2001 Data |
| GDC | CGDCSB005 | GDCSB00501a | AS | 7.2 | = | 03/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB036 | GDCSB03601 | AS | 6.6 | = | 04/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB041 | GDCSB04101 | AS | 5.3 | = | 06/28/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB019 | GDCSB01901 | AS | 3.8 | J | 04/14/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB006 | GDCSB00601b | AS | 3.4 | = | 03/17/1995 | 0 | RFI Background Data Set |

**TABLE 2-1**
Surface Grid and Railroad Samples ("non-SWMU") Collected in Zone C - Arsenic [a,b]
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth | Data Set |
|---|---|---|---|---|---|---|---|---|
| GDC | CGDCSB025 | GDCSB02501 | AS | 3.3 | J | 04/12/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB001 | GDCSB00101a | AS | 3 | = | 03/15/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB043 | GDCSB04301 | AS | 3 | U | 06/28/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB009 | GDCSB00901 | AS | 2.7 | UJ | 03/31/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB037 | GDCSB03701 | AS | 2.7 | = | 04/12/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB039 | GDCSB03901b | AS | 2.6 | = | 06/29/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB040 | GDCSB04001b | AS | 2.6 | = | 06/29/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB029 | GDCSB02901 | AS | 2.5 | U | 04/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB003 | GDCSB00301b | AS | 2.4 | = | 03/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB015 | GDCSB01501 | AS | 2.4 | J | 04/10/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB038 | GDCSB03801a | AS | 2.3 | U | 06/29/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB030 | GDCSB03001 | AS | 2.1 | U | 04/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB044 | GDCSB04401 | AS | 2 | U | 06/28/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB024 | GDCSB02401 | AS | 1.8 | = | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB018 | GDCSB01801 | AS | 1.7 | J | 04/14/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB042 | GDCSB04201 | AS | 1.6 | U | 06/28/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB012 | GDCSB01201 | AS | 1.5 | = | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB020 | GDCSB02001 | AS | 1.4 | J | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB007 | GDCSB00701 | AS | 1 | J | 04/14/1995 | 0 | RFI Background Data Set |

**TABLE 2-1**
Surface Grid and Railroad Samples ("non-SWMU") Collected in Zone C - Arsenic [a,b]
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth | Data Set |
|---|---|---|---|---|---|---|---|---|
| GDC | CGDCSB023 | GDCSB02301 | AS | 0.79 | J | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB013 | GDCSB01301 | AS | 0.77 | J | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB026 | GDCSB02601 | AS | 0.74 | J | 04/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB004 | GDCSB00401a | AS | 0.73 | J | 04/14/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB027 | GDCSB02701 | AS | 0.7 | U | 04/20/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB016 | GDCSB01601 | AS | 0.62 | J | 04/10/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB033 | GDCSB03301 | AS | 0.6 | J | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB008 | GDCSB00801a | AS | 0.58 | J | 03/17/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB010 | GDCSB01001 | AS | 0.41 | UJ | 04/10/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB022 | GDCSB02201 | AS | 0.4 | J | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB011 | GDCSB01101 | AS | 0.38 | UJ | 04/10/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB014 | GDCSB01401 | AS | 0.35 | UJ | 04/14/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB034 | GDCSB03401 | AS | 0.33 | U | 04/11/1995 | 0 | RFI Background Data Set |
| GDC | CGDCSB032 | GDCSB03201 | AS | 0.33 | UJ | 04/12/1995 | 0 | RFI Background Data Set |

a. Data collected to support railroad sampling effort is highlighted in gray.
b. Sorted from highest to lowest concentration.

**TABLE 2-2**
Subsurface Grid Samples Collected in Zone C - Arsenic (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value mg/kg | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| GDC | CGDCSB030 | GDCSB03002 | AS | 31.6 | = | 04/17/1995 | 3 |
| GDC | CGDCSB010 | GDCSB01002 | AS | 14.1 | J | 04/10/1995 | 3 |
| GDC | CGDCSB004 | GDCSB00402a | AS | 12.1 | J | 04/14/1995 | 3 |
| GDC | CGDCSB036 | GDCSB03602 | AS | 11.2 | = | 04/17/1995 | 3 |
| GDC | CGDCSB028 | GDCSB02802 | AS | 6.4 | = | 04/20/1995 | 3 |
| GDC | CGDCSB008 | GDCSB00802a | AS | 5.4 | = | 03/17/1995 | 3 |
| GDC | CGDCSB027 | GDCSB02702 | AS | 4.9 | U | 04/20/1995 | 3 |
| GDC | CGDCSB009 | GDCSB00902 | AS | 3.1 | J | 03/31/1995 | 3 |
| GDC | CGDCSB039 | GDCSB03902 | AS | 2.7 | = | 06/29/1995 | 3 |
| GDC | CGDCSB025 | GDCSB02502 | AS | 1.9 | J | 04/12/1995 | 3 |
| GDC | CGDCSB035 | GDCSB03502 | AS | 1.9 | = | 04/12/1995 | 3 |
| GDC | CGDCSB029 | GDCSB02902 | AS | 1.6 | U | 04/17/1995 | 3 |
| GDC | CGDCSB031 | GDCSB03102 | AS | 0.83 | U | 04/17/1995 | 3 |
| GDC | CGDCSB015 | GDCSB01502 | AS | 0.62 | J | 04/10/1995 | 3 |
| GDC | CGDCSB012 | GDCSB01202 | AS | 0.44 | J | 04/11/1995 | 3 |
| GDC | CGDCSB024 | GDCSB02402 | AS | 0.4 | U | 04/11/1995 | 3 |
| GDC | CGDCSB001 | GDCSB00102b | AS | 0.37 | U | 03/15/1995 | 3 |
| GDC | CGDCSB019 | GDCSB01902 | AS | 0.36 | UJ | 04/14/1995 | 3 |
| GDC | CGDCSB026 | GDCSB02602 | AS | 0.36 | UJ | 04/17/1995 | 3 |
| GDC | CGDCSB032 | GDCSB03202 | AS | 0.36 | J | 04/12/1995 | 3 |
| GDC | CGDCSB013 | GDCSB01302 | AS | 0.34 | U | 04/12/1995 | 3 |
| GDC | CGDCSB020 | GDCSB02002 | AS | 0.34 | UJ | 04/11/1995 | 3 |
| GDC | CGDCSB033 | GDCSB03302 | AS | 0.34 | U | 04/11/1995 | 3 |
| GDC | CGDCSB037 | GDCSB03702 | AS | 0.34 | U | 04/12/1995 | 3 |
| GDC | CGDCSB038 | GDCSB03802b | AS | 0.34 | U | 06/29/1995 | 3 |
| GDC | CGDCSB014 | GDCSB01402 | AS | 0.33 | UJ | 04/14/1995 | 3 |
| GDC | CGDCSB021 | GDCSB02102 | AS | 0.33 | U | 04/11/1995 | 3 |
| GDC | CGDCSB022 | GDCSB02202 | AS | 0.33 | U | 04/11/1995 | 3 |
| GDC | CGDCSB023 | GDCSB02302 | AS | 0.33 | U | 04/11/1995 | 3 |
| GDC | CGDCSB034 | GDCSB03402 | AS | 0.33 | U | 04/11/1995 | 3 |

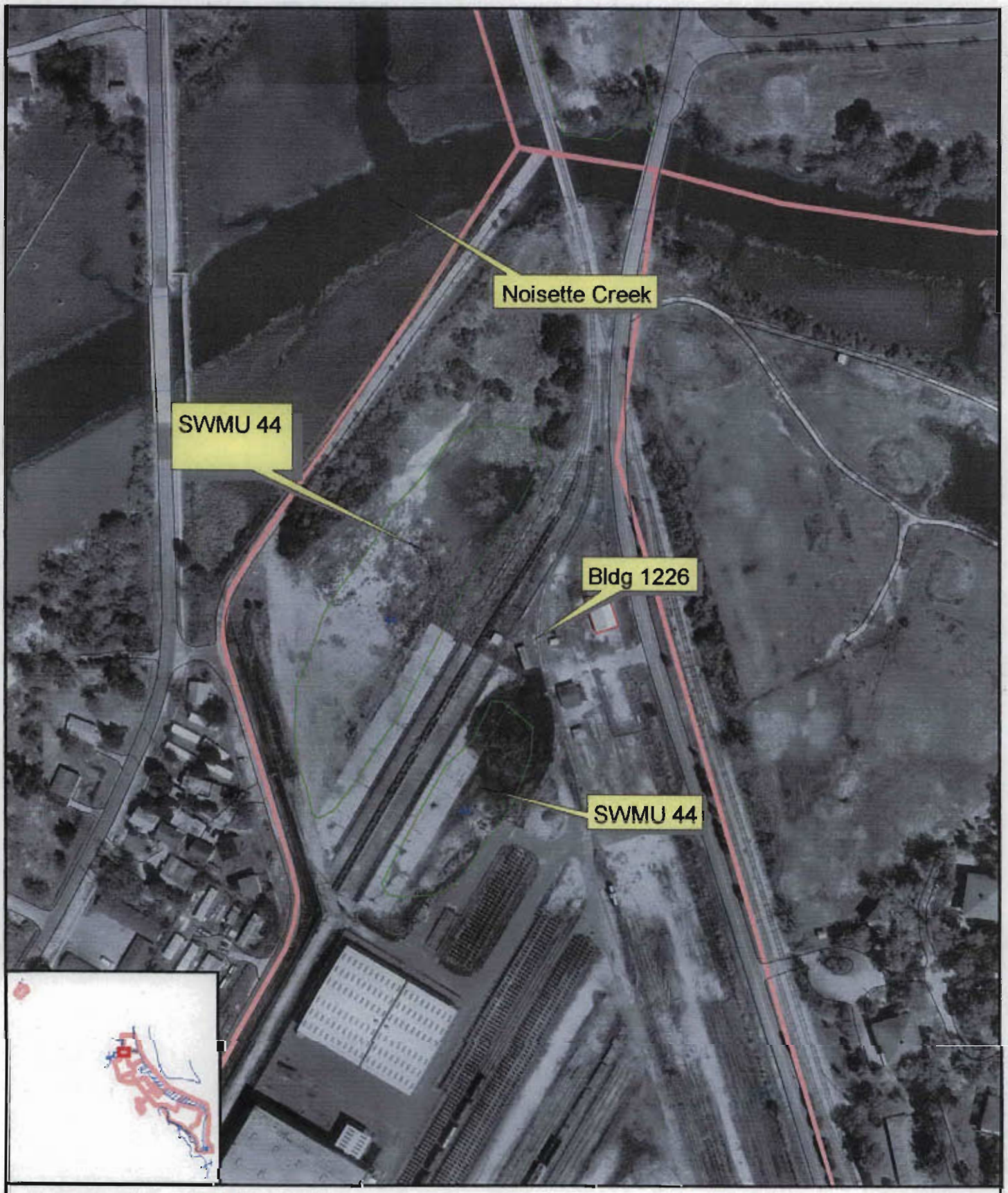



**Figure 2-1**
SWMU 44
Aerial View
Charleston Naval Complex

CH2MHILL

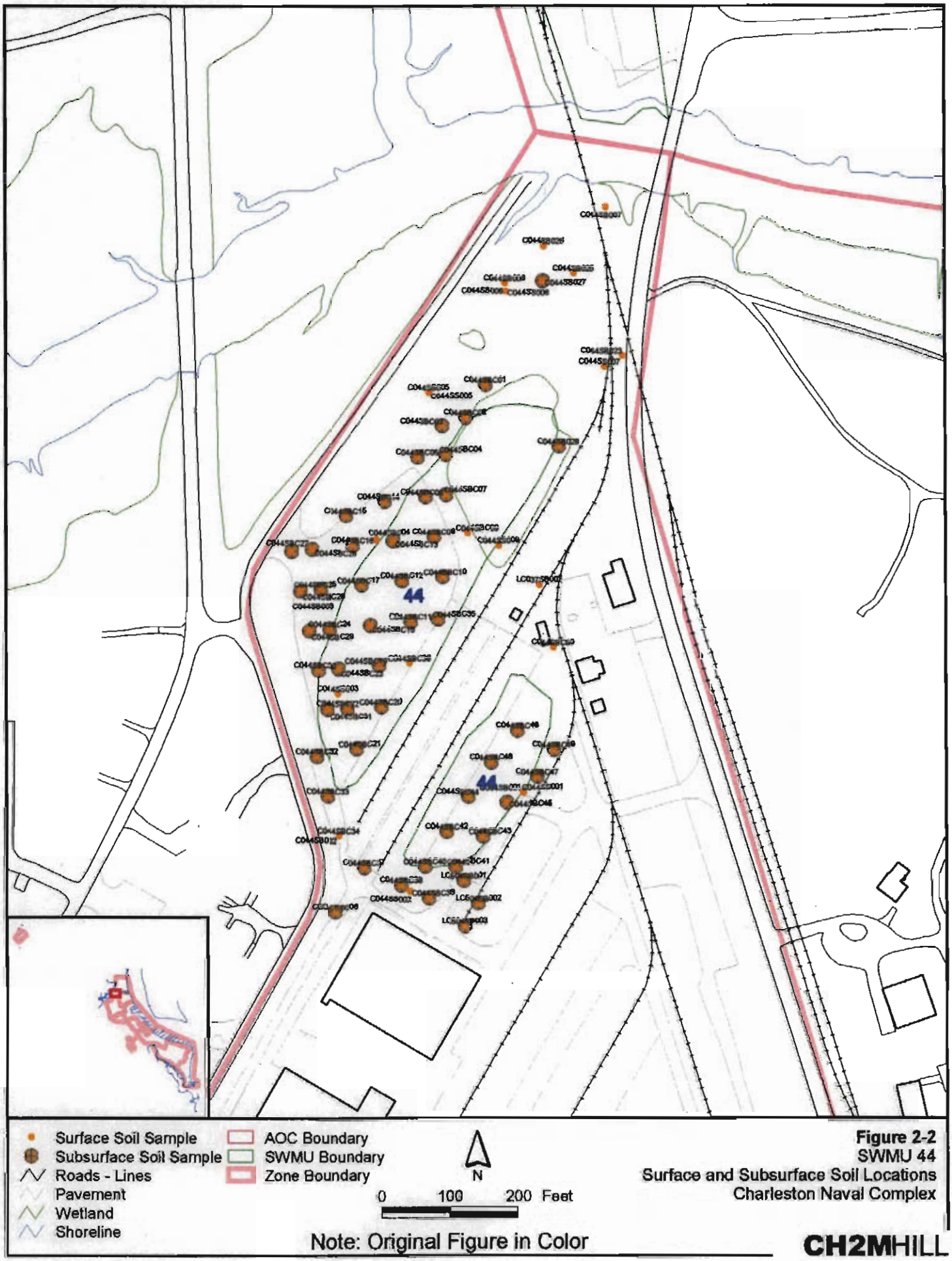
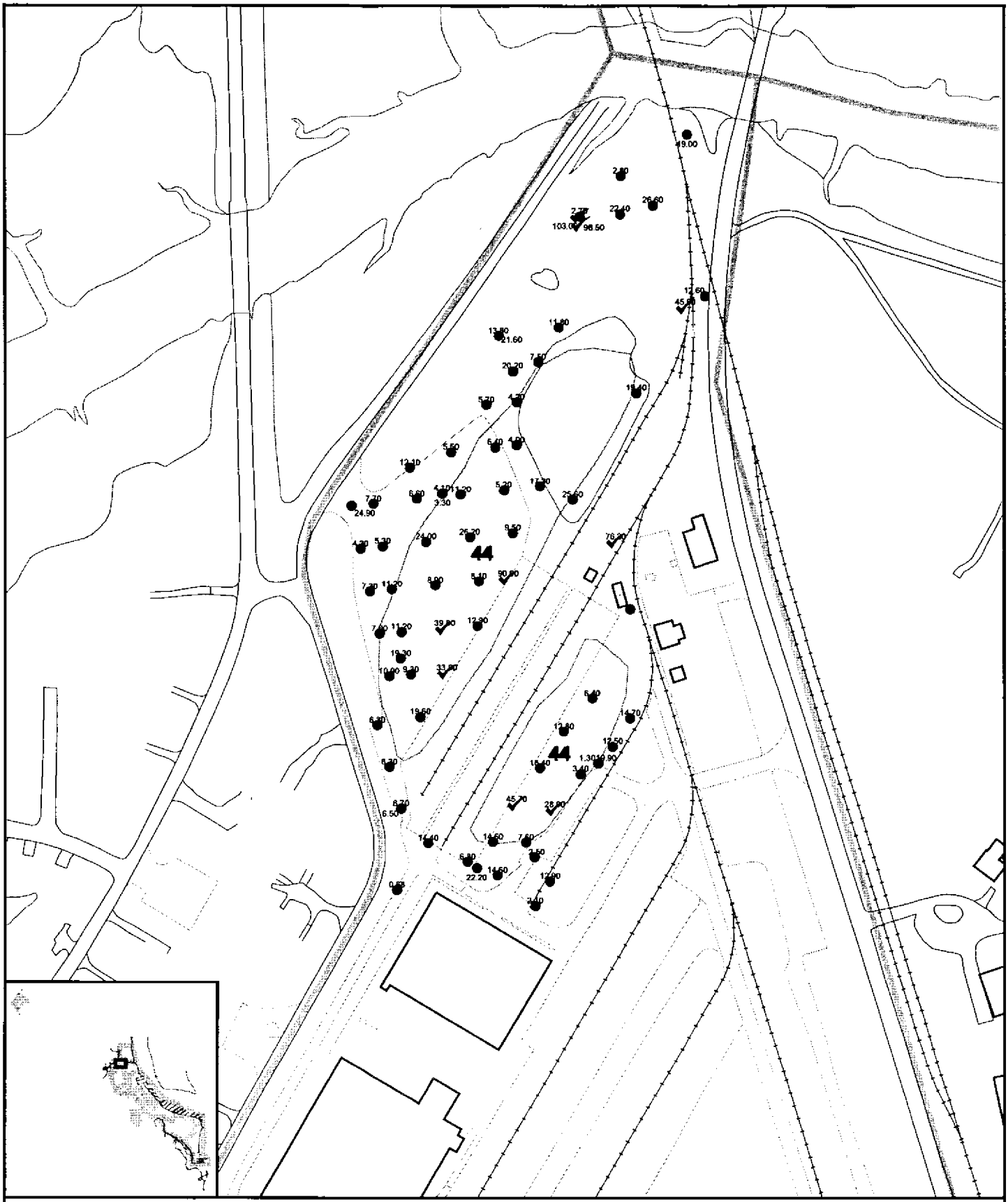



**Figure 2-2**
SWMU 44
Surface and Subsurface Soil Locations
Charleston Naval Complex

Note: Original Figure in Color

CH2MHILL




● <28.7
✔ > 28.7
Roads - Lines
Pavement
Wetland
Shoreline
AOC Boundary
SWMU Boundary
Zone Boundary

**Figure 2-3**
SWMU 44
Arsenic in Surface Soils
Charleston Naval Complex

**CH2MHILL**

File Path: c:\paulsarcview\swmu44.apr, Date: 27 Mar 2001 13:04, User: PFAVARA

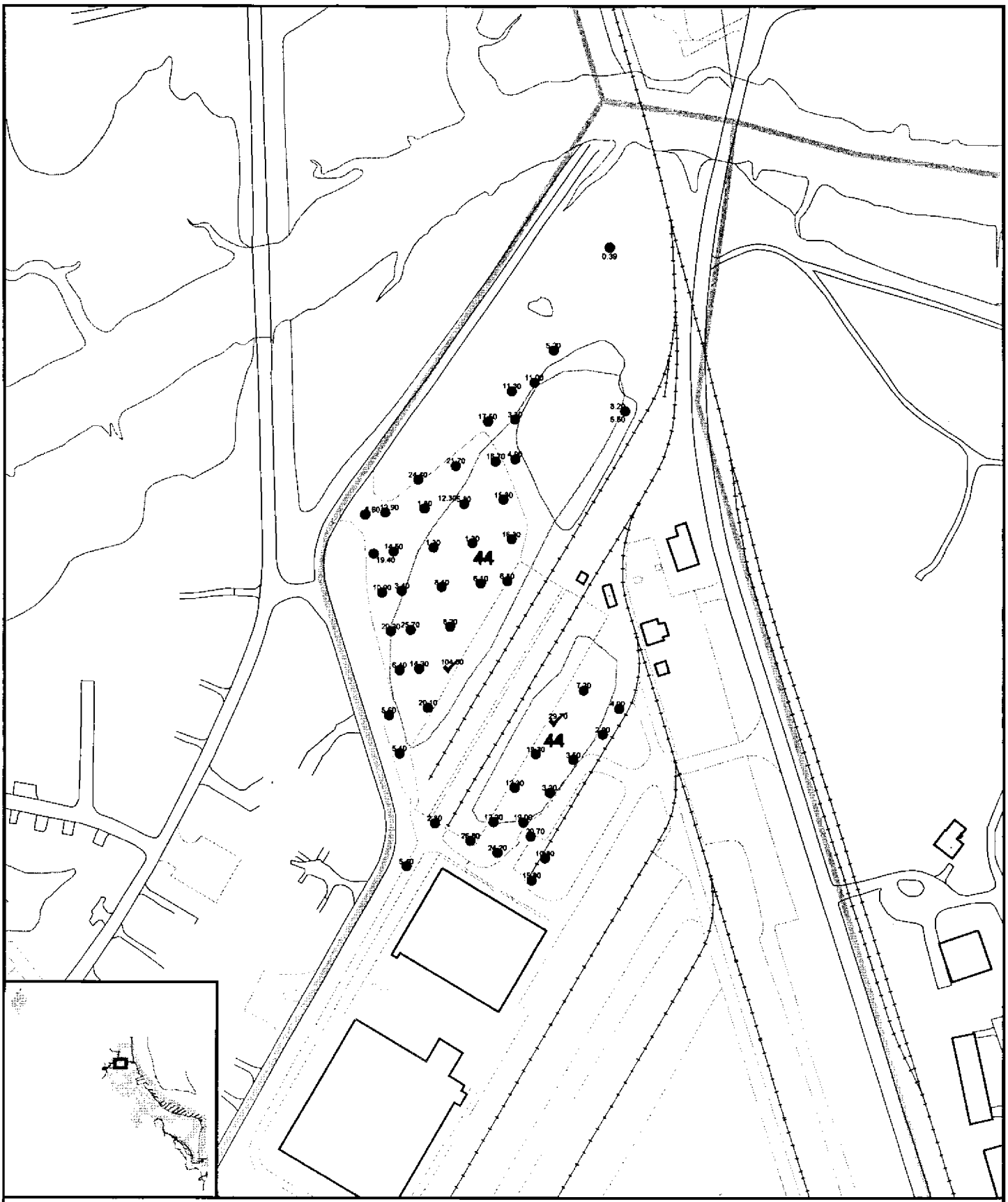



**Figure 2-4**
SWMU 44
Arsenic in Subsurface Soils
Charleston Naval Complex

**CH2MHILL**

File Path: c:\paulsarcview\swmu44.apr, Data: 27 Mar 2001 13:15, User: PFAVARA

SECTION 3.0

# Interim Measure Work Plan

# 3.0 Interim Measure Work Plan

This section presents the details associated with the proposed site cleanup plan. The objective of the IM is to remove arsenic in surface and subsurface soils to a level that reduces the overall site exposure concentration to below the MCS of 28.7 mg/kg. Following removal of the contaminated soils, the site will be backfilled with clean fill.

To achieve the above cleanup objective, an iterative process was employed to evaluate those areas in SWMU 44 requiring soil excavation. First, the overall site data were evaluated to determine if the exposure concentration for the SWMU data set was below the MCS. Second, the results of this evaluation were further evaluated to see if the UCL95 for the default exposure area (half-acre) was below the MCS. The process is further detailed in the following sections.

## 3.1 Surface Soil

Table 3-1 presents the arsenic data in surface soil at SWMU 44, sorted from the highest to lowest concentration. The UCL 95% concentration was calculated several different times; each time the highest sample concentration was eliminated from calculation. For example, the first UCL 95% calculation used all arsenic data. The second calculation was calculated using all data except the highest concentration. The third calculation was performed with all data except the two highest concentrations, and so on.

Review of the summary information presented at the bottom of Table 3-1 revealed that, when the whole sample population is considered, the exposure concentration (21.3 mg/kg) in the entire SWMU is below the MCS.

The data were further evaluated to determine if the exposure concentration for the default exposure area (half-acre) was below the reference concentration. The data evaluation showed that soil removal was required to achieve an exposure concentration below the MCS for a half-acre exposure area.

Two-dimensional kriging was performed to initially estimate the area of soil requiring cleanup.

The EVS-PRO software package was used to complete the two-dimensional kriging. EVS-PRO utilizes expert systems to analyze the input data, construct a multidimensional

variogram that best fits the data set being analyzed, and then perform kriging in the domain to be considered in the visualization. One of the fundamental criteria used in EVS-PRO's variogram and kriging algorithms was to produce kriged distributions that honor the measured distributions as closely as possible. Engineering judgement was also used to estimate appropriate excavation limits.

Figure 3-1 shows the surface soil exposure concentration and proposed excavation areas. To evaluate the UCL 95% on a half-acre area basis, half-acre boxes were drawn around sample points with concentrations greater than the MCS. A total of five boxes were drawn, as illustrated on Figure 3-1. Four of the five boxes were calculated to have a UCL 95% greater than the MCS.

To allow for a UCL 95% concentration reduction to a level below the background in the remaining four boxes, soil removal is required. Proposed excavation shapes are represented on Figure 3-1. To evaluate a UCL 95% concentration for an exposure box where excavation was performed, it was assumed that the backfilled soil would have an arsenic concentration of 7 mg/kg. With this approach, the soil sample points in an excavation shape were assumed to be 7 mg/kg arsenic.

Three areas, as illustrated on Figure 3-1, are proposed for excavation. The volume of soil for removal from each excavation area is presented on Figure 3-2. A total excavation area of approximately 9,000 square feet ($ft^2$) is required to a depth of one foot. This area corresponds to approximately 335 cubic yards ($y^3$) of soil, not accounting for a swell factor. The weight of soil removed from the site is estimated as 550 tons (assuming 1.65 tons of soil per $y^3$ of soil in place).

A review of Figure 3-1 revealed several areas where soil samples were above the MCS but are not recommended for remediation. Two of these values (75.6 and 45.6 mg/kg) are adjacent to railroad tracks. Data in Table 2-1 indicate high arsenic levels exist near railroad tracks. As these two locations are more influenced by the railroad activity than the SWMU activity, removal of soil from these areas is not warranted.

Two high arsenic values were also reported in RFI samples collected north of SWMU 44, with concentrations of 98.5 and 103 mg/kg. Inadequate data exist around these samples to determine if soil removal is required, and, if soil removal is required, the amount of soil to be removed to comply with the MCS. Surface soil samples will be collected in the vicinity of the elevated arsenic samples to delineate the extent of elevated arsenic in soil. Subsurface

soil data will not be necessary, as groundwater is within 1.5 - 2 feet of the ground surface in this area.

Once the delineation sampling data is available and evaluated, an addendum to this IM Work Plan will be provided to SCDHEC. The addendum will describe the extent of elevated arsenic in the area and make a recommendation for NFA or soil removal. If soil removal is recommended, the extent of the excavation will be defined.

## 3.2 Subsurface Soil

Table 3-2 provides the arsenic data of subsurface soil at SWMU 44, sorted from highest to lowest concentration. The UCL 95% concentration was calculated several different times; each time the highest sample concentration was removed from calculation. For example, the first UCL 95% calculation used all arsenic data. The second calculation was calculated using all data, less the highest concentration. The third calculation was performed with all data, less the two highest concentrations, and so on. Review of the summary information presented at the bottom of Table 3-2 shows that the exposure concentration for the entire SWMU is below the MCS.

These data were further evaluated to determine if the exposure concentration for the default exposure area (half-acre) was below the reference concentration. This assessment showed that soil removal was required to achieve an exposure concentration of lower than the MCS for a half-acre exposure area.

As was the case for surface soil, kriging and engineering judgement were used to estimate excavation contours.

Figure 3-3 shows the exposure concentration and proposed excavation areas for surface soil. To evaluate the UCL 95% on a half-acre area basis, half-acre boxes were drawn around sample points with concentrations greater than the MCS. A total of four boxes were drawn, as illustrated on Figure 3-3. All four boxes have a UCL 95% greater than the MCS.

To allow for a UCL 95% concentration reduction to a level lower than the MCS, soil removal is required. Proposed excavation shapes are represented on Figure 3-3. To evaluate a UCL 95% concentration for an exposure box where excavation was performed, it was assumed that the backfilled soil would have an arsenic concentration of 7 mg/kg. With this approach, the soil sample points in an excavation shape were assumed to be 7 mg/kg of arsenic.

Two areas, as defined on Figure 3-3, are proposed for excavation. The volume of soil for removal from each excavation area is presented on Figure 3-4. A total excavation area of approximately 3,200 $ft^3$ is recommended. For areas of excavation where no surface soil removal is required, excavation will start at a one-foot depth and proceed to 5 feet, or until groundwater is reached. The first foot of soil will be removed and later used as fill. If both surface and subsurface soils require removal in the same area, the excavation will start at the land surface, and all excavated materials will be managed as a disposable waste.

## 3.3 Excavation Summary

Table 3-3 provides a summary of the five excavation areas within SWMU .

## 3.4 Health and Safety

All work completed as part of this IM will be performed in accordance with the CH2M-Jones Site-Specific Health and Safety Plan.

## 3.5 Sampling and Analysis Plan

All investigative work will be performed in accordance with the Comprehensive Sampling and Analysis Plan (CSAP) portion of the RFI Work Plan (EnSafe 1997).

## 3.6 Pre-Excavation Activities

The excavation limits for surface and subsurface soils are presented on Figures 3-2 and 3-4, respectively. The limits of the excavation limits will be staked to provide a boundary for the actual limits of soil to be removed. To prepare for the start of onsite operations, CH2M-Jones will notify the necessary agencies, departments, and utilities regarding planned activities at the project site. No permits are necessary for completing the removal of soils at SWMU 44.

CH2M-Jones will examine the site for existing water, electricity, natural gas, telephone, or other utility lines that may pose a potential hazard at the site. Utilities will be clearly marked and identified.

CH2M-Jones requires and places significant emphasis on project health and safety for our own personnel, our subcontractors, and the local community. Once all mobilized site personnel have arrived on site, a project briefing and health and safety orientation meeting will be conducted for all site personnel. Work areas will be designated. Site control procedures, including work area barricades, daily site security, and site cleanliness and

maintenance procedures, will be reviewed and implemented. Vehicle access areas will be identified and site traffic monitored.

### 3.6.1 Site Security Zones

The contaminant levels reported at SWMU 44 are within a range considered protective of industrial workers. Therefore, personnel working at the site will be required to comply with wearing Level D personal protective equipment (PPE). The excavation area will be clearly marked with warning tape to warn of possible tripping or falling hazards.

### 3.6.2 Site Clearing

Site preparation, clearing, and grubbing of onsite vegetation will begin in areas where excavation and site preparation activities will take place. In areas not disturbed by site activities, reasonable attempts will be made to limit the disturbance of ground cover. No activities in or under existing site structures are planned as part of this IM.

## 3.7 Support Activities

### 3.7.1 Waste Management

The following three waste streams will be generated as part of this IM: 1) excavated soils, 2) decontamination wastes, and 3) PPE. No hazardous wastes are expected to be generated as a result of this IM. Excavated soils will be characterized in accordance with South Carolina Hazardous Waste Management Regulations (Section SCDHEC R.61-79.261) and disposed of in accordance with all applicable regulations and permits. Assuming soils will be characterized as non-hazardous, they will be sent to a subtitle D landfill. Decontamination wastes and PPE also will be disposed of in accordance with applicable regulations.

Offsite transportation and disposal will be performed by properly permitted and licensed subcontractors. Materials designated for offsite disposal will be documented, tracked, and their disposition verified. This information will be reported in the IM Completion Report.

### 3.7.2 Equipment Decontamination

Decontamination of personnel, sampling and removal equipment, and materials will be in accordance of the CH2M-Jones Site Specific Project Health and Safety Plan.

# 3.8 Excavation of Soils

## 3.8.1 Excavation

Figures 3-2 and 3-4 present the estimated limits of the excavation of surface and subsurface soils, respectively. Surface soil will be excavated to a depth of one foot. Confirmation sampling will be performed at the limits of the excavation. One confirmation sample will be collected for approximately every 50 - 75 perimeter feet of the excavation. In the case of a small excavation footprint with a perimeter of less than 200 feet, one sample will be collected on each side of an excavation area.

Subsurface soils will be excavated in one-foot lifts. At the bottom of each excavated lift, soil samples will be collected to determine if the one half-acre exposure box, including the bottom of the excavation, complies with the exposure concentration limit (28.7 mg/kg) for the half-acre parcel. If the first excavated lift (1 - 2 feet) complies with the cleanup objective, no further excavation will be warranted. If the exposure concentration is greater than the MCS, deeper soils will be excavated.

Confirmation samples for subsurface soil excavation will be collected as follows:

- Approximately four samples will be collected from each excavation bottom to determine if an adequate depth of soil has been removed.
- Approximately one sample for every 50 - 75 linear feet of excavation perimeter will be collected to determine if an adequate area of soil has been removed.

Excavated soils will be transferred immediately to a disposal container (e.g., a roll-off box or similar container) and subsequently transported to an appropriately permitted offsite disposal facility for landfilling. The transported waste will be covered with a tarp to minimize airborne transfer of soil particulates.

## 3.8.2 Site Restoration

The excavation will be backfilled with appropriate fill material to an elevation that approximates pre-excavation topography. The site will then be seeded to promote growth of grass.

## 3.9 Interim Measure Completion Report

Upon IM WP approval, the IM will be implemented. A final report will be submitted within 60 days of completion of the IM. The final report will summarize actions performed and will provide the following information:

- Excavated volumes
- Nature and volume of waste generated
- Waste disposal
- Sampling results
- Site photographs
- Problems encountered
- Other information that could be helpful in evaluating the IM

**TABLE 3-1**
Arsenic in Surface Soil (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| 044 | C044SB006 | 044SB00601a | AS | 103 | J | 03/14/1995 | 0 |
| 044 | C044SS006 | 044SS00601 | AS | 98.5 | J | 07/23/1997 | 0 |
| 044 | C044SBC35 | 044SBC3501 | AS | 90.8 | = | 03/03/1999 | 0 |
| 037 | LC037SB002 | 037SB002C1 | AS | 76.3 | = | 05/20/1997 | 0 |
| 044 | C044SB008 | 044SB00801 | AS | 53.6 | J | 03/14/1995 | 0 |
| 044 | C044SBC42 | 044SBC4201 | AS | 45.7 | = | 03/05/1999 | 0 |
| 044 | C044SS007 | 044SS00701 | AS | 45.6 | J | 07/24/1997 | 0 |
| 044 | C044SBC19 | 044SBC1901 | AS | 39.8 | = | 03/04/1999 | 0 |
| 044 | C044SBC20 | 044SBC2001 | AS | 33.6 | = | 03/04/1999 | 0 |
| 044 | C044SBC43 | 044SBC4301 | AS | 28.9 | = | 03/05/1999 | 0 |
| 044 | C044SB025 | 044SB02501 | AS | 26.6 | = | 01/17/1997 | 0 |
| 044 | C044SBC12 | 044SBC1201 | AS | 26.2 | = | 03/04/1999 | 0 |
| 044 | C044SS009 | 044SS00901 | AS | 25.6 | J | 07/28/1997 | 0 |
| 044 | C044SBC27 | 044SBC2701 | AS | 24.9 | = | 03/04/1999 | 0 |
| 044 | C044SBC17 | 044SBC1701 | AS | 24 | = | 03/04/1999 | 0 |
| 044 | C044SB027 | 044SB02701 | AS | 22.4 | = | 08/11/1997 | 0 |
| 044 | C044SS002 | 044SS00201 | AS | 22.2 | J | 07/23/1997 | 0 |
| 044 | C044SS005 | 044SS00501 | AS | 21.6 | J | 07/23/1997 | 0 |
| 044 | C044SBC03 | 044SBC0301 | AS | 20.2 | = | 03/03/1999 | 0 |
| 044 | C044SS001 | 044SS00101 | AS | 19.9 | J | 07/23/1997 | 0 |
| 044 | C044SBC21 | 044SBC2101 | AS | 19.6 | = | 03/04/1999 | 0 |
| 044 | C044SB028 | 044SB02801 | AS | 19.4 | = | 08/11/1997 | 0 |
| 044 | C044SS003 | 044SS00301 | AS | 19.3 | J | 07/23/1997 | 0 |
| 044 | C044SB007 | 044SB00701 | AS | 19 | J | 03/14/1995 | 0 |
| 044 | C044SBC44 | 044SBC4401 | AS | 18.4 | = | 03/05/1999 | 0 |
| 044 | C044SBC09 | 044SBC0901 | AS | 17.3 | J | 03/03/1999 | 0 |
| 044 | C044SS008 | 044SS00801 | AS | 15.7 | J | 07/24/1997 | 0 |
| 044 | C044SBC49 | 044SBC4901 | AS | 14.7 | J | 03/05/1999 | 0 |
| 044 | C044SBC39 | 044SBC3901 | AS | 14.6 | J | 03/05/1999 | 0 |

**TABLE 3-1**
Arsenic in Surface Soil (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| 044 | C044SBC40 | 044SBC4001 | AS | 14.6 | J | 03/05/1999 | 0 |
| 044 | C044SBC37 | 044SBC3701 | AS | 14.4 | J | 03/05/1999 | 0 |
| 044 | C044SB005 | 044SB00501 | AS | 13.8 | J | 03/14/1995 | 0 |
| 044 | C044SBC36 | 044SBC3601 | AS | 12.9 | J | 03/04/1999 | 0 |
| 504 | LC504SB002 | 504SB002C1 | AS | 12.9 | = | 07/10/1997 | 0 |
| 044 | C044SBC46 | 044SBC4601 | AS | 12.8 | J | 03/05/1999 | 0 |
| 044 | C044SB023 | 044SB02301 | AS | 12.6 | = | 06/27/1995 | 0 |
| 044 | C044SBC47 | 044SBC4701 | AS | 12.5 | J | 03/05/1999 | 0 |
| 044 | C044SBC15 | 044SBC1501 | AS | 12.1 | J | 03/04/1999 | 0 |
| 044 | C044SBC01 | 044SBC0101 | AS | 11.8 | J | 03/03/1999 | 0 |
| 044 | C044SBC13 | 044SBC1301 | AS | 11.2 | J | 03/04/1999 | 0 |
| 044 | C044SBC23 | 044SBC2301 | AS | 11.2 | J | 03/04/1999 | 0 |
| 044 | C044SBC24 | 044SBC2401 | AS | 11.2 | J | 03/04/1999 | 0 |
| 044 | C044SBC31 | 044SBC3101 | AS | 10.9 | J | 03/05/1999 | 0 |
| 044 | C044SBC10 | 044SBC1001 | AS | 9.5 | J | 03/03/1999 | 0 |
| 044 | C044SBC22 | 044SBC2201 | AS | 9.3 | J | 03/04/1999 | 0 |
| 044 | C044SBC18 | 044SBC1801 | AS | 8.9 | J | 03/04/1999 | 0 |
| 044 | C044SBC33 | 044SBC3301 | AS | 8.3 | J | 03/05/1999 | 0 |
| 044 | C044SBC11 | 044SBC1101 | AS | 8.1 | J | 03/04/1999 | 0 |
| 044 | C044SBC26 | 044SBC2601 | AS | 7.7 | J | 03/04/1999 | 0 |
| 044 | C044SB024 | 044SB02401 | AS | 7.6 | = | 06/27/1995 | 0 |
| 044 | C044SBC41 | 044SBC4101 | AS | 7.6 | J | 03/05/1999 | 0 |
| 044 | C044SBC02 | 044SBC0201 | AS | 7.5 | J | 03/03/1999 | 0 |
| 044 | C044SBC29 | 044SBC2901 | AS | 7.3 | J | 03/04/1999 | 0 |
| 044 | C044SBC30 | 044SBC3001 | AS | 7 | J | 03/04/1999 | 0 |
| 044 | C044SBC38 | 044SBC3801 | AS | 6.8 | J | 03/05/1999 | 0 |
| 044 | C044SBC34 | 044SBC3401 | AS | 6.7 | J | 03/05/1999 | 0 |
| 044 | C044SBC16 | 044SBC1601 | AS | 6.6 | J | 03/04/1999 | 0 |
| 044 | C044SB002 | 044SB00201 | AS | 6.5 | J | 03/13/1995 | 0 |
| 044 | C044SBC06 | 044SBC0601 | AS | 6.4 | J | 03/03/1999 | 0 |

**TABLE 3-1**
Arsenic in Surface Soil (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| 044 | C044SBC48 | 044SBC4801 | AS | 6.4 | J | 03/05/1999 | 0 |
| 044 | C044SBC32 | 044SBC3201 | AS | 6.3 | J | 03/05/1999 | 0 |
| 044 | C044SBC05 | 044SBC0501 | AS | 5.7 | J | 03/03/1999 | 0 |
| 044 | C044SBC14 | 044SBC1401 | AS | 5.5 | J | 03/04/1999 | 0 |
| 044 | C044SBC25 | 044SBC2501 | AS | 5.3 | J | 03/04/1999 | 0 |
| 044 | C044SBC08 | 044SBC0801 | AS | 5.2 | J | 03/03/1999 | 0 |
| 044 | C044SB003 | 044SB00301 | AS | 5 | J | 03/14/1995 | 0 |
| 044 | C044SBC28 | 044SBC2801 | AS | 4.3 | J | 03/04/1999 | 0 |
| 044 | C044SBC04 | 044SBC0401 | AS | 4.2 | J | 03/03/1999 | 0 |
| 044 | C044SB004 | 044SB00401 | AS | 4.1 | J | 03/14/1995 | 0 |
| 044 | C044SBC07 | 044SBC0701 | AS | 4 | J | 03/03/1999 | 0 |
| 044 | C044SBC50 | 044SBC5001 | AS | 3.7 | J | 03/05/1999 | 0 |
| 044 | C044SBC45 | 044SBC4501 | AS | 3.4 | J | 03/05/1999 | 0 |
| 044 | C044SS004 | 044SS00401 | AS | 3.3 | J | 07/23/1997 | 0 |
| 044 | C044SB026 | 044SB02601 | AS | 2.8 | J | 01/17/1997 | 0 |
| 044 | C044SB006 | 044SB00601b | AS | 2.7 | U | 09/13/1995 | 0 |
| 504 | LC504SB001 | 504SB001C1 | AS | 2.5 | = | 07/10/1997 | 0 |
| 504 | LC504SB003 | 504SB003C1 | AS | 2.1 | = | 07/10/1997 | 0 |
| 044 | C044SB001 | 044SB00101 | AS | 1.3 | J | 03/13/1995 | 0 |
| GDC | CGDCSB008 | GDCSB00801a | AS | 0.58 | J | 03/17/1995 | 0 |

**TABLE 3-2**
Arsenic in Subsurface Soil (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| 044 | C044SBC20 | 044SBC2002 | AS | 104 | = | 03/04/1999 | 3 |
| 044 | C044SBC46 | 044SBC4602 | AS | 29.7 | J | 03/05/1999 | 3 |
| 044 | C044SBC38 | 044SBC3802 | AS | 26.8 | J | 03/05/1999 | 3 |
| 044 | C044SBC23 | 044SBC2302 | AS | 25.7 | = | 03/04/1999 | 3 |
| 044 | C044SBC15 | 044SBC1502 | AS | 24.4 | = | 03/04/1999 | 3 |
| 044 | C044SBC39 | 044SBC3902 | AS | 24.2 | J | 03/05/1999 | 3 |
| 044 | C044SBC14 | 044SBC1402 | AS | 21.7 | J | 03/04/1999 | 3 |
| 504 | LC504SB001 | 504SB001C2 | AS | 20.7 | = | 07/10/1997 | 3 |
| 044 | C044SBC30 | 044SBC3002 | AS | 20.3 | J | 03/04/1999 | 3 |
| 044 | C044SBC21 | 044SBC2102 | AS | 20.1 | J | 03/04/1999 | 3 |
| 044 | C044SBC28 | 044SBC2802 | AS | 19.4 | J | 03/04/1999 | 3 |
| 044 | C044SBC44 | 044SBC4402 | AS | 19.3 | J | 03/05/1999 | 3 |
| 044 | C044SBC41 | 044SBC4102 | AS | 19 | J | 03/05/1999 | 3 |
| 044 | C044SBC05 | 044SBC0502 | AS | 17.5 | J | 03/03/1999 | 3 |
| 044 | C044SBC06 | 044SBC0602 | AS | 16.7 | J | 03/03/1999 | 3 |
| 044 | C044SBC10 | 044SBC1002 | AS | 16.3 | J | 03/03/1999 | 3 |
| 044 | C044SB028 | 044SB02802 | AS | 15.9 | = | 08/11/1997 | 3 |
| 504 | LC504SB003 | 504SB003C2 | AS | 15.8 | = | 07/10/1997 | 3 |
| 044 | C044SBC08 | 044SBC0802 | AS | 15.3 | J | 03/03/1999 | 3 |
| 044 | C044SBC25 | 044SBC2502 | AS | 14.5 | J | 03/04/1999 | 3 |
| 044 | C044SBC22 | 044SBC2202 | AS | 14.3 | J | 03/04/1999 | 3 |
| 044 | C044SBC26 | 044SBC2602 | AS | 12.9 | J | 03/04/1999 | 3 |
| 044 | C044SB004 | 044SB00402 | AS | 12.3 | J | 03/14/1995 | 3 |
| 044 | C044SBC40 | 044SBC4002 | AS | 12.3 | J | 03/05/1999 | 3 |
| 044 | C044SBC42 | 044SBC4202 | AS | 12.3 | J | 03/05/1999 | 3 |
| 044 | C044SBC03 | 044SBC0302 | AS | 11.3 | J | 03/03/1999 | 3 |
| 044 | C044SBC02 | 044SBC0202 | AS | 11 | J | 03/03/1999 | 3 |
| 044 | C044SBC29 | 044SBC2902 | AS | 10.9 | J | 03/04/1999 | 3 |
| 504 | LC504SB002 | 504SB002C2 | AS | 10.8 | = | 07/10/1997 | 3 |
| 044 | C044SB028 | 044SB02803 | AS | 8.2 | = | 08/11/1997 | 3 |

**TABLE 3-2**
Arsenic in Subsurface Soil (Sorted from Highest to Lowest Concentration)
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Site ID | Station ID | Sample ID | Parameter ID | Analytical Value (mg/kg) | Projected Qualifier | Date Collected | Upper Depth |
|---|---|---|---|---|---|---|---|
| 044 | C044SBC19 | 044SBC1902 | AS | 8.2 | J | 03/04/1999 | 3 |
| 044 | C044SBC18 | 044SBC1802 | AS | 8.1 | J | 03/04/1999 | 3 |
| 044 | C044SB027 | 044SB02703 | AS | 7.8 | = | 08/11/1997 | 3 |
| 044 | C044SBC48 | 044SBC4802 | AS | 7.3 | J | 03/05/1999 | 3 |
| 044 | C044SBC35 | 044SBC3502 | AS | 6.8 | J | 03/03/1999 | 3 |
| 044 | C044SBC27 | 044SBC2702 | AS | 6.6 | J | 03/04/1999 | 3 |
| 044 | C044SBC31 | 044SBC3102 | AS | 6.4 | J | 03/05/1999 | 3 |
| 044 | C044SBC11 | 044SBC1102 | AS | 6.1 | J | 03/04/1999 | 3 |
| 044 | C044SBC13 | 044SBC1302 | AS | 5.8 | J | 03/04/1999 | 3 |
| 044 | C044SBC32 | 044SBC3202 | AS | 5.6 | J | 03/05/1999 | 3 |
| 044 | C044SB028 | 044SB02804 | AS | 5.5 | = | 08/11/1997 | 3 |
| 044 | C044SBC33 | 044SBC3302 | AS | 5.4 | J | 03/05/1999 | 3 |
| GDC | CGDCSB008 | GDCSB00802a | AS | 5.4 | = | 03/17/1995 | 3 |
| 044 | C044SBC01 | 044SBC0102 | AS | 5.2 | J | 03/03/1999 | 3 |
| 044 | C044SBC07 | 044SBC0702 | AS | 4.9 | J | 03/03/1999 | 3 |
| 044 | C044SBC49 | 044SBC4902 | AS | 4 | J | 03/05/1999 | 3 |
| 044 | C044SBC45 | 044SBC4502 | AS | 3.5 | J | 03/05/1999 | 3 |
| 044 | C044SBC24 | 044SBC2402 | AS | 3.4 | J | 03/04/1999 | 3 |
| 044 | C044SBC04 | 044SBC0402 | AS | 3.3 | J | 03/03/1999 | 3 |
| 044 | C044SBC43 | 044SBC4302 | AS | 3.3 | J | 03/05/1999 | 3 |
| 044 | C044SBC37 | 044SBC3702 | AS | 2.8 | J | 03/05/1999 | 3 |
| 044 | C044SBC47 | 044SBC4702 | AS | 2 | J | 03/05/1999 | 3 |
| 044 | C044SBC16 | 044SBC1602 | AS | 1.8 | J | 03/04/1999 | 3 |
| 044 | C044SBC12 | 044SBC1202 | AS | 1.3 | J | 03/04/1999 | 3 |
| 044 | C044SBC17 | 044SBC1702 | AS | 1.3 | J | 03/04/1999 | 3 |
| 044 | C044SB027 | 044SB02702 | AS | 0.39 | U | 08/11/1997 | 3 |

**TABLE 3-3**
Excavation Summary
*IM Work Plan, SWMU 44 in Zone C, Charleston Naval Complex*

| Excavation Area | Depth (feet) | Tons of Removal per Interval (0 -1 foot) | Tons of Removal per Interval (1 - 2 feet) | Tons of Removal per Interval (2 - 3 feet) | Tons of Removal per Interval (3 - 4 feet) | Tons of Removal per Interval (4 - 5 feet) | Total Possible Tons of Removal per Interval |
|---|---|---|---|---|---|---|---|
| 1 Surface | 0 -1 | 75 | 0 | 0 | 0 | 0 | 75 |
| 2 Surface | 0-1 | 290 | 0 | 0 | 0 | 0 | 290 |
| 3 Surface | 0-1 | 190 | 0 | 0 | 0 | 0 | 190 |
| 4 Subsurface | Potentially 1 – 5 | 0 | 160 | 160 | 160 | 160 | 640 |
| 5 Subsurface | Potentially 1 – 5 | 0 | 37 | 37 | 37 | 37 | 168 |
| Total | --- | --- | --- | --- | --- | --- | 1,363 |

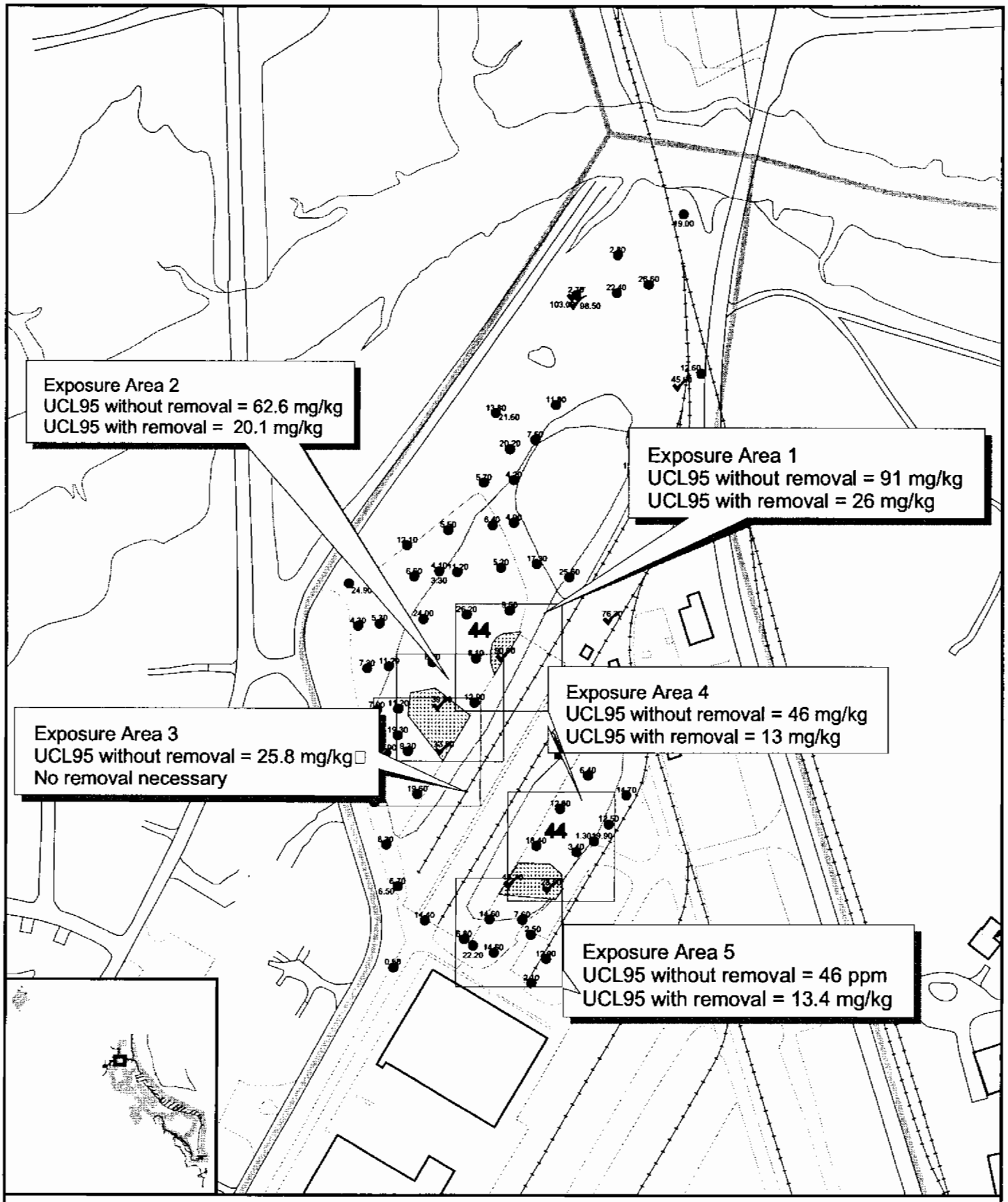



**Figure 3-1**
Surface Exposure and Excavation Areas
SWMU 44
Charleston Naval Complex

CH2MHILL

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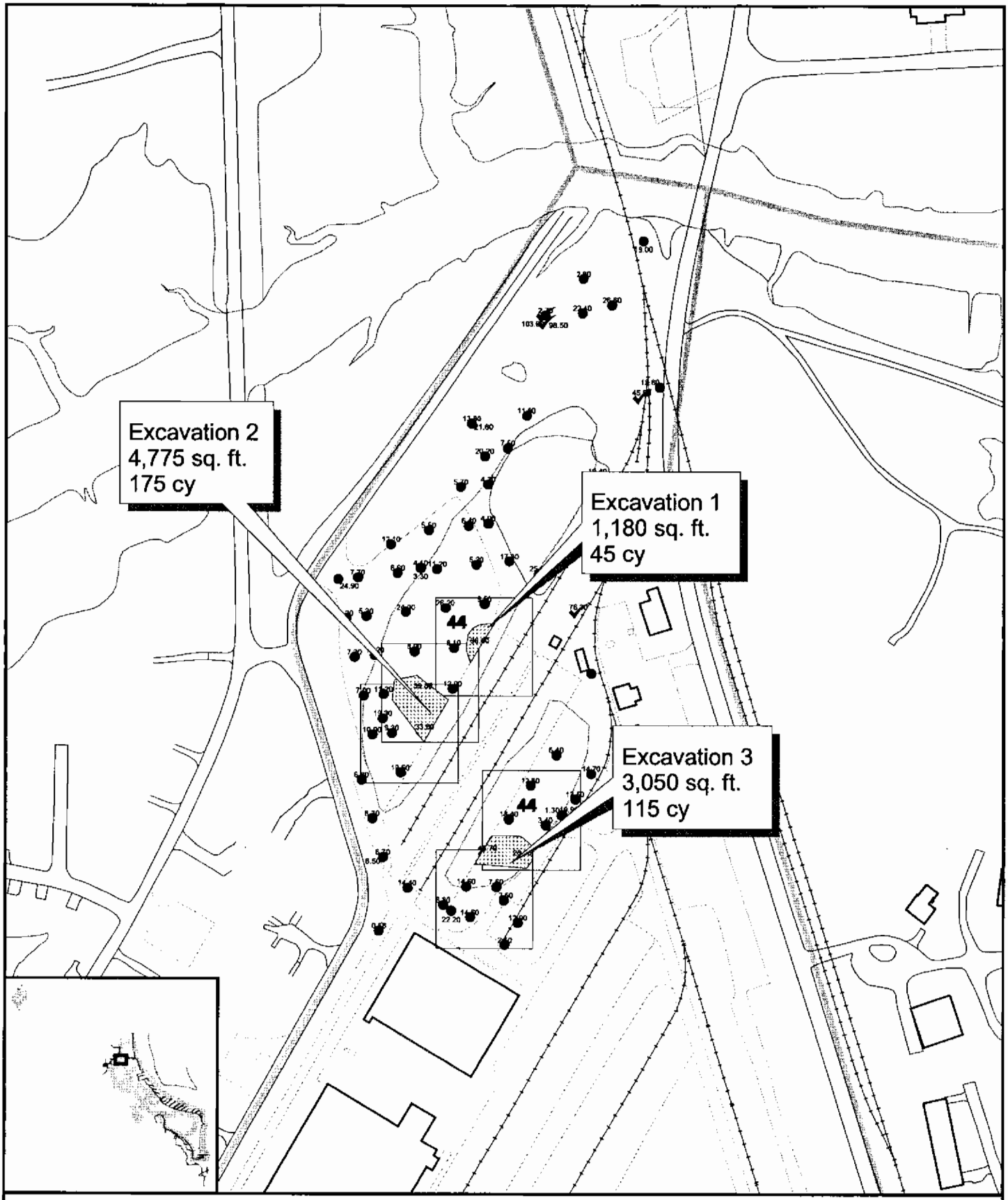


**Figure 3-2**
Surface Excavation Areas
SWMU 44
Charleston Naval Complex

CH2MHILL

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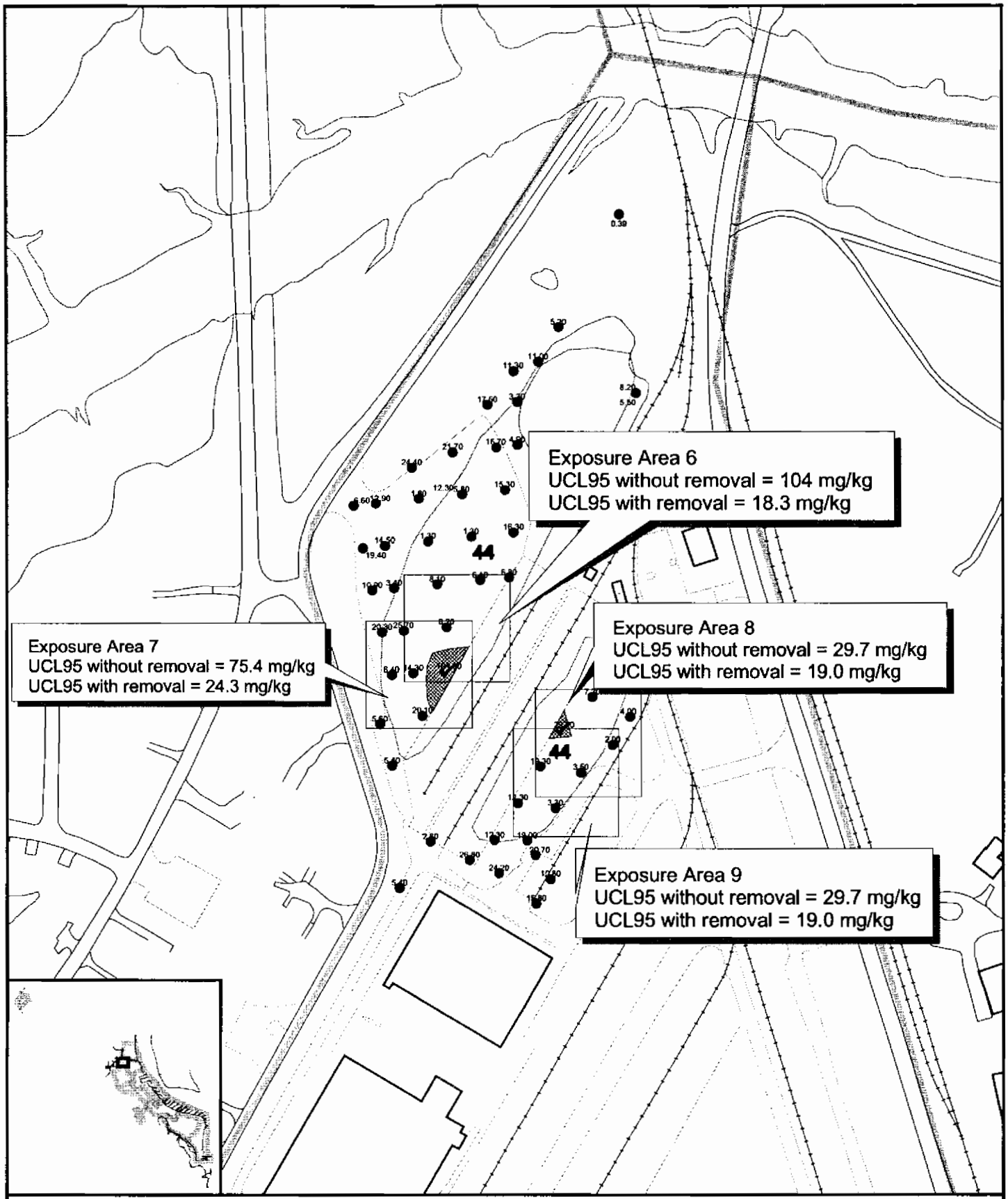


**Figure 3-3**
Subsurface Exposure and Excavation Areas
SWMU 44
Charleston Naval Complex

**CH2MHILL**

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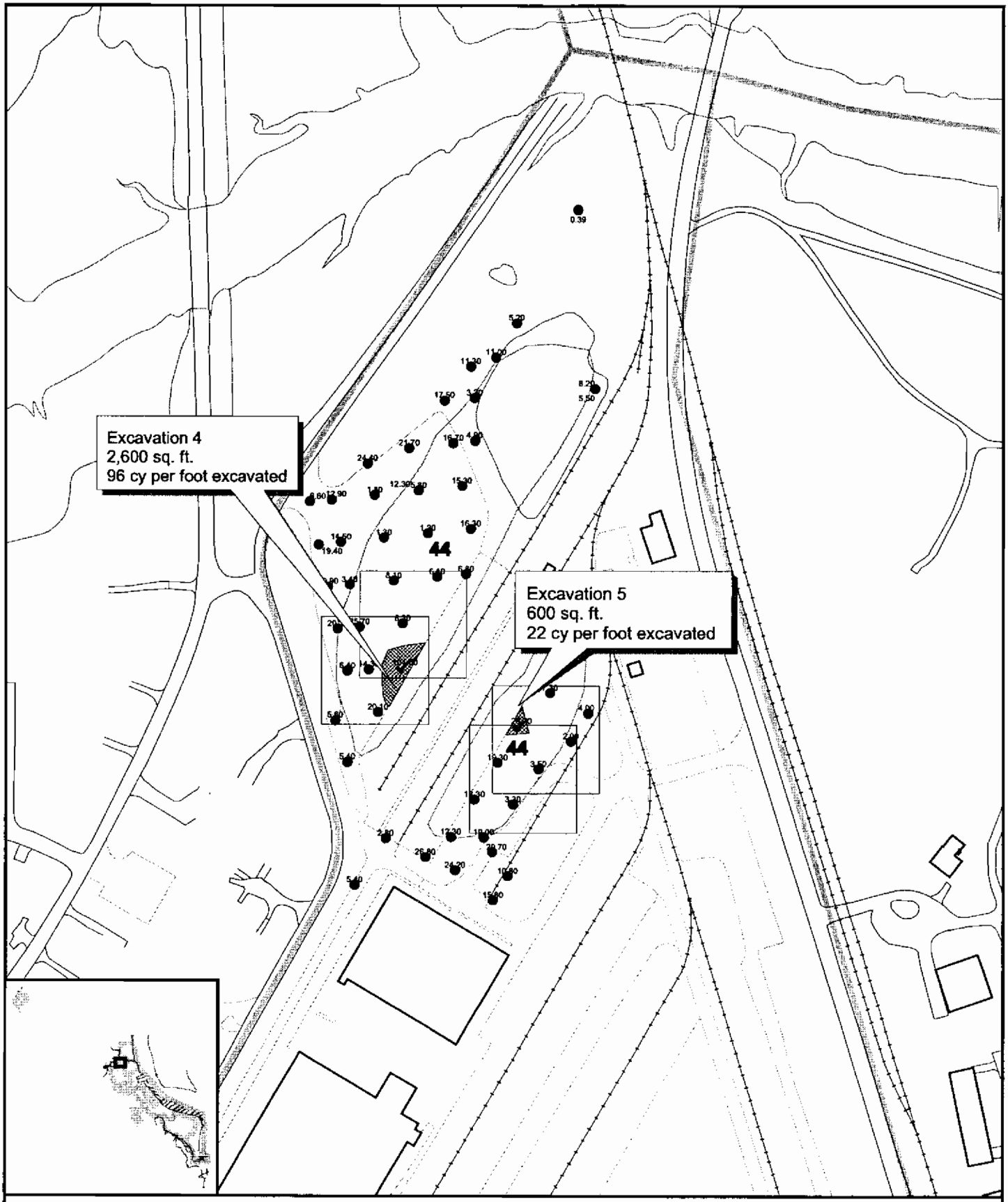


**Figure 3-4**
Subsurface Excavation Areas
SWMU 44
Charleston Naval Complex

CH2MHILL

File Path: c:\paulsarcview\aprs\swmu44.apr, Date: 23 May 2001 12:48, User: PFAVARA

SECTION 4.0

# References

# 4.0 References

EnSafe Inc. *Zone C RCRA Facility Investigation Report, NAVBASE Charleston*. Revision 0. November 14, 1997.

Environmental Detachment Charleston (DET). Completion Report -- Interim/Stabilization Measure for SWMU 44. February 10, 1997.

# Appendix

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010

5090
Code 1876
7 Feb 1997

Mr. G. Randall Thompson, Director
Division of Hazardous and Infectious Waste Management
Bureau of Solid And Hazardous Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia SC 29201

Re: INTERIM MEASURE REPORT FOR SOLID WASTE MANAGEMENT UNIT 44

Dear Mr. Thompson:

The enclosed interim measure report is submitted to fulfill the requirement of Permit Condition IV.D.6 for Permit Number SCO 170 022 560.

If the Department should have any questions, please contact me at (803) 820-7481.

Sincerely,

BRIAN K. STOCKMASTER
Remedial Project Manager
Environmental Division

Encl:
(1) SWMU 44 Report
Copy to:
SCDHEC (2) (Mr. Tapia, Mr. Bergstrand)
USEPA (1) (Mr. Bassett)
CSO Naval Base Charleston (LCDR Rose)

# COMPLETION REPORT

**INTERIM/STABLIZATION MEASURE FOR**
**SWMU 44 (COAL STORAGE YARD)**
**NAVAL BASE CHARLESTON**
**CHARLESTON, SC**

SITE: SWMU 44 (Coal Storage Yard)

Prepared for:

**DEPARTMENT OF THE NAVY**
**SOUTHERN DIVISION**
**NAVAL FACILITIES ENGINEERING COMMAND**
**NORTH CHARLESTON S.C.**

Prepared by:

**Supervisor of Shipbuilding, Conversion and Repair,**
**USN, (SUPSHIP) Portsmouth Va.,**
**Environmental Detachment Charleston S.C.**
**1899 North Hobson Ave.**
**North Charleston, SC 29405-2106**

February 10, 1997

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## TABLE OF CONTENTS (CONT.)



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## ACRONYM LIST

| | |
|---|---|
| AOC | Area of Concern |
| BEQ | Benzo(a)pyrene Equivalents |
| BTU | British Thermal Unit |
| CMS | Corrective Measure Study |
| CNCRA | Charleston Naval Complex Redevelopment Authority |
| COPC | Constituents of Potential Concern |
| DERP | Defense Environmental Restoration Program |
| DON | Department of the Navy |
| DQO | Data Quality Objective |
| EOX | Extractable Organic Halides |
| EPA | U.S. Environmental Protection Agency |
| IM | Interim Measure |
| IR | Installation Restoration |
| RBC | Risk Based Concentration |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RFI | RCRA Facility Investigation |
| SARA | Superfund Amendments and Restoration Act |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SOUTHDIV | Southern Division Naval Facilities Engineering Command |
| SPORTENVDETCHASN | Supervisor of Shipbuilding, Conversion and Repair, Portsmouth Va., Environmental Detachment Charleston |
| SWMU | Solid Waste Management Unit |
| TPH | Total Petroleum Hydrocarbons |

# 1. INTRODUCTION

**1.1 INSTALLATION RESTORATION PROGRAM.** The purpose of the Department of the Navy (DON) Installation Restoration (IR) Program is to identify, assess, characterize, and cleanup or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps activities. The Defense Environmental Restoration Program (DERP) is codified in the Superfund Amendments and Reauthorization Act (SARA) Section 211 (10 USC 2701). The IR Program is a component of DERP.

**1.1.1 Naval Base Charleston IR Program.** At Naval Base Charleston, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was prepared which divided the Naval Base into zones and identified Solid Waste Management Units (SWMU) and Areas of Concern (AOC) within each zone. The RFA evaluated each SWMU and AOC and determined which sites required further investigation. Based on the RFA, a RCRA Facility Investigation (RFI) work plan has been or is being prepared for each zone containing SWMUs and AOCs requiring further investigation. On completion of the RFI for each zone, a RFI report will be prepared for that zone. The RFI reports will identify SWMUs and AOCs containing hazardous wastes requiring remediation. Eventually, Corrective Measures Studies (CMS) will be prepared to determine the best means of remediating each site.

**1.2 INTERIM MEASURES.** Interim Measures (IM) performed as part of the IR Program are intended to eliminated sources of environmental contamination or limit the spread of environmental contamination prior to the completion of RFI CMSs.

**1.3 SOLID WASTE MANAGEMENT UNIT 44.** SWMU 44 is the site of the former Naval Base Charleston coal storage yard which consists of approximately 4.14 acres located in Zone C of the RFI. The site is bordered on two sides by drainage ditches which run into Noisette Creek, a tidal creek that flows back into wetland areas and into the Cooper River (see Figure A-1). Coal was received from railroad cars and stored on site prior to transfer to the Power House

(Building 32). The rail cars were pushed up an inclined trestle and the coal dumped on two concrete pads at the center of the site. The coal was eventually moved off the concrete pads onto the soil for storage until ready for use at the Power House. Over the years coal became embedded in the soil at varying depths.

**1.4 SOLID WASTE MANAGEMENT UNIT 44 INTERIM MEASURE.** During the interval between the RFI and the completion of the CMS, it was decided by Southern Division Naval Facilities Engineering Command (SOUTHDIV) that an IM would be performed by Supervisor of Shipbuilding, Conversion and Repair, Portsmouth Va., Environmental Detachment Charleston (SPORTENVDETCHASN). The objective of this IM was to remove the bulk coal which acted as a source of comtamination to soil and surface water runoff. Groundwater remediation was not an objective of this IM. This IM was consistent with the ultimate cleanup of SWMU 44 and was not intended to circumvent the public participation process inherent within environmental cleanup under RCRA authority.

## 2. INTERIM MEASURE EXECUTION

**2.1 ACTIONS REQUIRED BY INTERIM MEASURE WORK PLAN.** Coal and coal waste was removed to eliminate the source of soil contamination and acidic surface water runoff. Coal and coal waste was removed from an approximate 4.14 acre area except as noted below.

**2.1.1 Railroad Track.** SPORTENVDETCHASN requested, per memorandum Serial:CEERD/039 dated 5/9/96, permission from Charleston Naval Complex Redevelopment Authority (CNCRA) to remove a section of railroad tracks parallel to the inclined trestle to the east at SWMU 44 (see Figure A-1). Per Charleston Naval Weapons Station Public Works Department Trackage Inspection Report, this section of track was not certified and would require extensive repair prior to recertification. Removal of coal from this section of tracks would require hand shoveling and pick axes. This removal method would render this section of track unusable.

Technical guidance was provided on the track removal from SOUTHDIV (memo #5090, Code 1876, dated 31 May 1996). SPORTENVDETCHASN was directed to remove only the easily accessible coal in and around the track in question. Complete removal of the coal would be addressed as part of any future corrective measure action if necessary. Based on this, the coal between the tracks was not removed (see photograph page C-6).

**2.2 PROBLEMS ENCOUNTERED.** No problems were encountered during execution of Interim/Stabilization Measure for SWMU 44 (Coal Storage Yard).

**2.3 PLAN MODIFICATIONS AND JUSTIFICATION.** There were no modifications to the IM work plan.

## 3. INTERIM MEASURE OUTCOME

**3.1 SITE CONDITIONS FOLLOWING COMPLETION OF WORK.** On 9 September 1996, after work completed, SPORTENVDETCHASN had removed 13,246.39 tons of coal and coal/dirt mixture from SWMU 44. The coal had a variable range of thickness from several inches to 5 feet throughout the approximate 4.14 acre site. This variance created one low area on the north side of the site and one low area on the south side of the site (see Figure A-1 and photographs pages C-3 and C-6). These low areas allow for a ponding effect during times of heavy precipitation. Coal and coal/dirt mixture were removed in and around all railroad tracks except as noted in section 2.1.1 of this report. Drainage ditches were scraped for residual coal runoff and reshaped for water collection and drainage. All open areas of SWMU 44 were raked and groomed to help prevent erosion. Photographs of SWMU 44 are included as Appendix C.

**3.2 AREAS REQUIRING FURTHER ACTION.** No further action per this IM remains at SWMU 44.

# 4. SAMPLING

**4.1 SAMPLING EVOLUTIONS AND RESULTS.** Disposal of 6,443 tons of usable coal was based on Omni Environmental (vendor for the usable coal) conducting an analysis to determine the British Thermal Unit (BTU) value of the coal. The BTU content was determined to be 12,628. This value made the coal a recoverable product. Sample results were screening data only for vendors information and are included in Appendix B.

Disposal of 3,300 tons of unusable coal (which was approximately 50% coal/50% dirt) was based on a sample taken 22 March 1996 (reported 27 March 1996) that was a composite sample taken from different locations around SWMU 44. This sample was analyzed for extractable organic halides (EOX), total petroleum hydrocarbons (TPH), and 8 RCRA metals plus nickel, antimony, and beryllium. Results are included in Appendix B.

Disposal of 3,503.39 tons of unusable coal (which was approximately 5% coal/95% dirt) was based on samples taken 14 June 1996 (reported 21 June 1996). Grab samples were taken at four different locations around SWMU 44. These samples were analyzed for EOX and the following metals based on the COPCs identified in the RFI Report: aluminum, arsenic, beryllium, chromium, manganese, and thallium. Results are included in Appendix B.

# 5. WASTE GENERATION

**5.1 HAZARDOUS/POTENTIALLY HAZARDOUS WASTE.** No hazardous/potentially hazardous waste was generated during performance of Interim/Stabilization Measure for SWMU 44 (Coal Storage Yard).

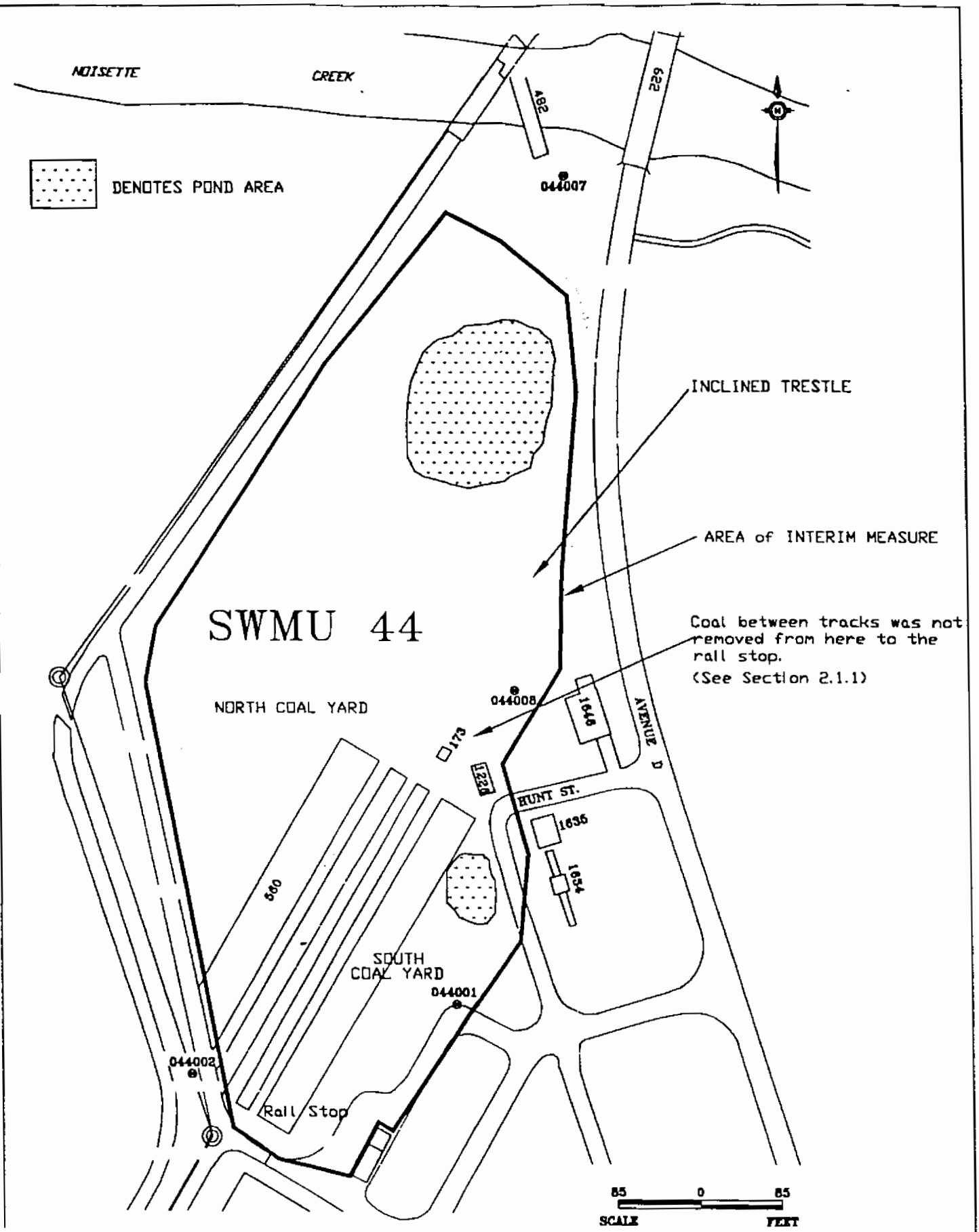
**5.2 NON-HAZARDOUS WASTE.** Disposed of 3,300 tons of coal/dirt mixture (which was approximately 50% coal/50% dirt) to Southeastern Soil Recovery Incorporated, Summerville, SC. This coal/dirt mixture was used as a product for the manufacture of asphalt. South Carolina Department of Health and Environmental Control (SCDHEC) approval for this use and DD Form 1155 (Order For Supplies Or Services) are included in Appendix D for documentation of disposal.

Disposed of 3,503.39 tons of coal/dirt mixture (which was approximately 5% coal/95% dirt) to Charleston County Landfill at Bee's Ferry Road in Charleston, SC to be used as a daily cover. SCDHEC approval for this use and DD Form 1155 (Order For Supplies Or Services) are included in Appendix D for documentation of disposal.

**5.3 REUSABLE PRODUCT.** Disposed of 6,443 tons of coal, through Omni Environmental, to Giant Cement Company, Harleyville, SC. This coal was taken based on the BTU value sample results outlined in Section 4.1.

# APPENDIX A

# SITE MAP




SWMU 44 SITE MAP
FIGURE A-1