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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM AREA OF CONCERN 602 AND 604 AND SOLID WASTE MANAGEMENT UNIT
106/AREA OF CONCERN 603 ZONE E CNC CHARLESTON SC
8/24/2001
CH2M HILL

RFI REPORT ADDENDUM

AOC 602, AOC 604, and SWMU 106/AOC 603 Zone E



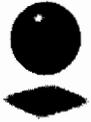
***Charleston Naval Complex
North Charleston, South Carolina***

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

CH2M-Jones

August 2001

Contract N62467-99-C-0960



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August 24, 2001

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Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RFI Report Addendum (Revision 0) - AOC 602, AOC 604, and SWMU 106/AOC 603,
Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 0) for AOC 602, AOC 604, and SWMU 106/AOC 603 in Zone E 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.

The principal author of this document is Kris Garcia. Please contact her at 770/604-9182, extension 476, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

RFI REPORT ADDENDUM

AOC 602, AOC 604, and SWMU 106/AOC 603 Zone E



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

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

PREPARED BY
CH2M-Jones

August 2001

*Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.00*

Certification Page for RFI Report Addendum (Revision 0) – AOC 602, AOC 604, and SWMU 106/AOC 603, Zone E

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.



Date



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16	A Responses to SCDHEC Comments on AOC 602 in the <i>Zone E RFI Report, Revision 0</i>	
17	(EnSafe, 1997)	

1 Acronyms and Abbreviations

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BRAC	Base Realignment and Closure Act
6	BRC	background reference concentration
7	CA	corrective action
8	CMS	corrective measures study
9	CNC	Charleston Naval Complex
10	COC	chemical of concern
11	COPC	chemical of potential concern
12	CSI	confirmatory sampling investigation
13	DAF	dilution attenuation factor
14	EnSafe	EnSafe Inc.
15	EPA	U.S. Environmental Protection Agency
16	HI	hazard index
17	IM	interim measure
18	MCL	maximum contaminant level
19	mg/kg	milligram per kilogram
20	NAVBASE	Naval Base
21	NFA	no further action
22	NFI	no further investigation
23	ng/kg	nanogram per kilogram
24	OP	organo-phosphorous
25	OVA	organic vapor analysis
26	OWS	oil/water separator
27	PCB	polychlorinated biphenyl
28	ppb	part per billion
29	QA	quality assurance
30	QC	quality control

1	RBC	risk-based concentration
2	RCRA	Resource Conservation and Recovery Act
3	RFA	RCRA Facility Assessment
4	RFI	RCRA Facility Investigation
5	SCDHEC	South Carolina Department of Health and Environmental Control
6	SSL	soil screening level
7	SVOC	semivolatile organic compound
8	SWMU	solid waste management unit
9	TCDD	tetrachlorodibenzo-p-dioxin
10	TEQ	2,3,7,8-TCDD equivalent
11	UST	underground storage tank
12	VOC	volatile organic compound

1.0 Introduction

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

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

11 In April 2000, CH2M-Jones was awarded a contract to provide environmental investigation
12 and remediation services at the CNC. This submittal has been prepared by CH2M-Jones to
13 complete the RCRA Facility Investigation (RFI) for Area of Concern (AOC) 602 in Zone E of
14 the CNC. The site is recommended for No Further Action (NFA). Figure 1-1 illustrates the
15 location of Zone E in the CNC. Figure 1-2 provides an aerial view of AOC 602 within
16 Zone E.

1.1 Background

18 AOC 602 is a former electrical substation at Building 95 in Zone E (see Figure 1-1).
19 Constructed in 1943, Building 95 was originally used as an electrical substation for Dry
20 Dock 3 and housed polychlorinated biphenyl (PCB)-containing transformers until
21 renovation of the building in 1989 (see Figure 1-2). The renovation was interrupted by
22 Hurricane Hugo and the building was subsequently taken out of service. Currently this area
23 is paved with concrete/asphalt and zoned for industrial use (M-2).

24 Dielectric fluid is the material of concern for AOC 602 identified in the *Final Zone E RFI*
25 *Work Plan* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995). Potential receptors that may be
26 exposed to site contaminants include current and future building users and any site
27 workers this area may support following base closure.

28 During the RCRA Facility Assessment (RFA), this unit was identified for a Confirmatory
29 Sampling Investigation (CSI) to assess whether releases of contamination at the site had
30 occurred. All field activities were conducted as part of the RFI phase.

1.2 Purpose of the RFI Report Addendum

This RFI Report Addendum provides information about AOC 602 that documents the conclusions from the *Zone E RFI Report, Revision 0* (EnSafe, 1997), evaluates the data, and provides conclusions regarding site closure. Based on a review of the data, CH2M-Jones has determined that investigation activities are complete and recommends the site for NFA.

Prior to changing the status of any site to NFA in the CNC RCRA CA permit, the BRAC Cleanup Team (BCT) agreed that the following issues should be considered:

- Status of the RFI
- Presence of metals (inorganics) in groundwater
- Potential linkage to Solid Waste Management Unit (SWMU) 37, Investigated Sanitary Sewers at the CNC
- Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- Potential linkage to AOC 504, Investigated Railroad Lines at the CNC
- Potential linkage to surface water bodies (Zone J)
- Potential contamination associated with oil/water separators (OWSs)
- Relevance or need for land use controls at the site

A discussion of these issues is provided in this RFI Report Addendum to expedite evaluation of the site.

Provided that the information presented in this report is adequate to address these site closeout items, it is expected that the BCT will concur that NFA is appropriate for the site. At that time, a Statement of Basis will be prepared that will be made available for public comment in accordance with SCDHEC policy. This will allow for public participation in the final remedy selection.

1.3 Report Organization

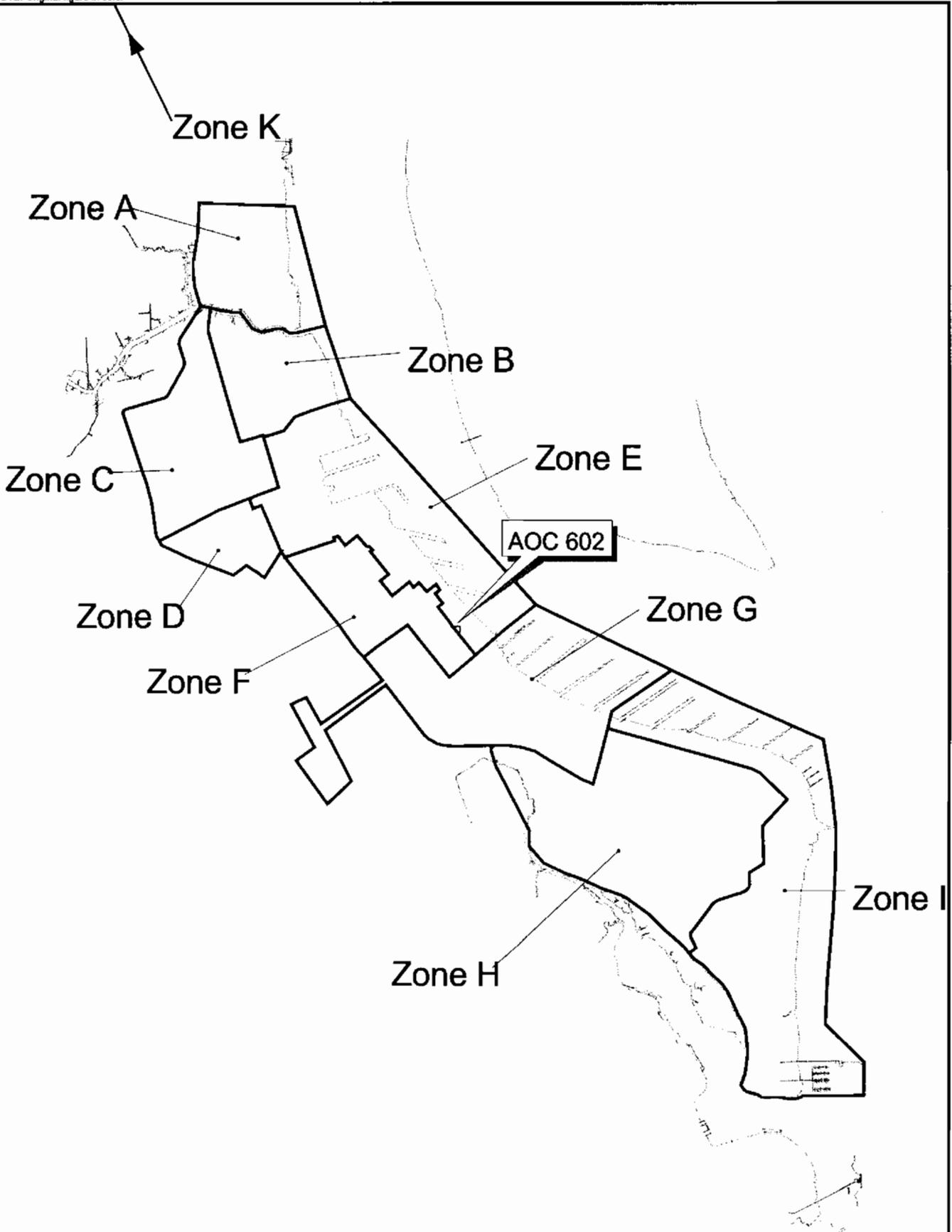
This RFI Report Addendum consists of the following sections, including this introductory section:

1.0 Introduction — Presents the purpose of the report and background information relating to the RFI Report Addendum.

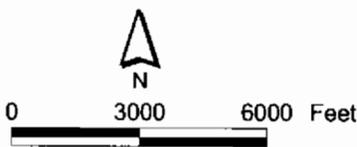
2.0 Summary of RFI Conclusions for AOC 602 — Summarizes the conclusions from the RFI investigations and risk evaluations for AOC 602.

- 1 **3.0 Interim Measures and UST/AST Removals** —Provides information regarding any
2 interim measures (IMs) or tank removal activities performed at the site.
- 3 **4.0 Summary of Additional Investigations** — Summarizes information collected after
4 completion of the RFI report.
- 5 **5.0 COPC/COC Refinement**—Provides further evaluation of chemicals of potential concern
6 (COPCs) based on RFI and additional data to assess them as chemicals of concern (COCs).
- 7 **6.0 Summary of Information Related to Site Closeout Issues**—Discusses the various site
8 closeout issues that the BCT agreed to evaluate prior to site closeout.
- 9 **7.0 Recommendations**—Provides recommendations for proceeding with site closure.
- 10 **8.0 References** — Lists the references used in this document.
- 11 **Appendix A** contains responses to SCDHEC comments for this site from the *Zone E RFI*
12 *Report, Revision 0* (EnSafe, 1997).
- 13 All figures appear at the end of their respective sections.

NOTE: Original figure in color



∇ Shoreline
□ Zone Boundary



1 inch = 2666.67 feet

Figure 1-1
AOC 602 Zone E
Site Location Map
Charleston Naval Complex

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NOTE: Aerial Photo Date is 1997
NOTE: Original figure created in color



-  Fence
-  Roads
-  AOC Boundary
-  SWMU Boundary
-  Buildings
-  Zone Boundary

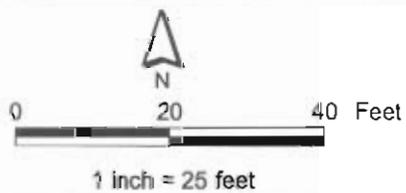


Figure 1-2
AOC 602
Site Map
Charleston Naval Complex

2.0 Summary of RFI Conclusions for AOC 602

This section summarizes the results and conclusions from the soil and wipe sample investigations conducted in the area of AOC 602, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Figure 2-1 presents the site features and RFI surface and subsurface soil sample locations. Figure 2-2 shows locations where wipe samples were collected.

As part of the Zone E RFI, surface soil, subsurface soil, and wipe sample investigations were conducted at AOC 602 in January and February 1995. The RFI report presented the results of this investigation and conclusions concerning contamination and risk, as summarized in Sections 2.1 and 2.2 of this report addendum. A further evaluation of COCs is provided in Section 5.0.

2.1 Soil

2.1.1 Surface Soil

A total of four surface soil samples were collected for PCB analyses by EnSafe (see Figure 2-1). In addition, three of the surface soil samples were collected as duplicate samples and were analyzed for volatile organic compound (VOCs), semivolatile organic compounds (SVOCs), pesticides, PCBs, and metals, in addition to organo-phosphorous (OP) pesticides, herbicides, hexavalent chromium, and dioxins. In order to collect these samples, it was necessary to core through the overlying concrete to reach the soils.

The comparison criteria used for the *Zone E RFI Report, Revision 0*, included the "Tier 1" criteria, which are the U.S. Environmental Protection Agency (EPA) Region III residential risk-based concentrations (RBCs), soil screening levels (SSLs) (based on a dilution attenuation factor [DAF] of 10) and background reference concentrations (BRCs) (see Tables 6.2 and 5.5 respectively, of the *Zone E RFI Report, Revision 0*). The analytical results from these samples showed two detections for PCBs present in only one sample (602SB004): Aroclor 1254 at 0.19 milligrams per kilogram (mg/kg), and Aroclor 1260 at 0.21 mg/kg (see Table 10.48.6.2 in the RFI report).

In addition, five dioxins were reported to be present in the duplicate samples:

- 1234678-HpCDD in all three samples
- 123478-HxCDF in one sample

- 1 • 123678-HxCDF in one sample
 - 2 • 1234678-HxCDF in one sample
 - 3 • OCDD in all three samples
- 4 Dioxin equivalents (tetrachlorodibenzo-p-dioxin [TCDD] 2,3,7,8-TCDD equivalent [TEQs])
5 were calculated for each sample, with results ranging from 0.133 to 0.590 nanograms per
6 kilogram (ng/kg). The RFI report found that the TCDD TEQ was significantly below the
7 industrial RBC (at the time the RFI report was prepared) of 1,000 ng/kg, and concluded that
8 TCDD TEQ was not a COPC because there were no exceedances of the SSL.

9 **2.1.2 Subsurface Soil**

10 Subsurface samples were collected from the same locations as the surface soil samples (see
11 Figure 2-1). Constituents detected in subsurface soil samples were evaluated relative to their
12 respective SSLs (DAF = 10 for all analytes).

13 All four subsurface soil samples were analyzed for PCBs. In addition, one sample
14 (602SB004) was analyzed for VOCs due to elevated organic vapor analysis (OVA) readings
15 recorded in the field.

16 None of the subsurface soil samples had detectable levels of PCBs.

17 Analytical results from the subsurface soil sample collected from 602SB004 and analyzed for
18 VOCs indicated the presence of two VOCs, acetone and methylene chloride. Evaluations
19 indicated that neither acetone nor methylene chloride exceeded its respective SSL (which
20 was based on DAF = 10).

21 **2.2 Wipe Samples**

22 Wipe samples were collected at four locations at AOC 602 (see Figure 2-2), all of which were
23 analyzed only for PCBs. The sample locations were field-selected in an attempt to identify
24 potential worst case situations. Analytical results from the wipe samples indicated no PCBs
25 were present at detectable levels.

26 **2.3 Human Health Risk Assessment**

27 The *Zone E RFI Report, Revision 0* noted that the area is currently industrialized and there
28 were no current residential properties for consideration in the risk assessment. As a result,
29 all risk evaluation activities were based on potential future unrestricted land use and
30 current industrial scenarios. The detailed presentation of the human health risk assessment

1 (HHRA) for AOC 602 is presented in Section 10.46.6 of the *Zone E RFI Report, Revision 0*, and
2 summarized in the sections below.

3 **2.3.1 Soil**

4 Two COCs were identified for surface soils at AOC 602, based on unrestricted land use
5 scenario RBCs, Aroclor 1256 and Aroclor 1260, in the surface soil sample from 602SB004
6 with a combined single-point risk level of 2×10^{-6} . No PCBs were detected in the subsurface
7 soils and only surface soils were affected. No COPCs or COCs were identified for
8 subsurface soils.

9 An exposure point concentration for PCBs, using all four data points, was calculated to be 5
10 $\times 10^{-7}$, using an assumed de minimus risk level of 1×10^{-7} for the three samples where no
11 PCBs were detected. The hazard index (HI) for soil at boring 602SB004 was calculated as 0.2.
12 Aroclor 1256 and Aroclor 1260 in the surface soils were retained as COCs based on the
13 single exceedance of the residential RBC.

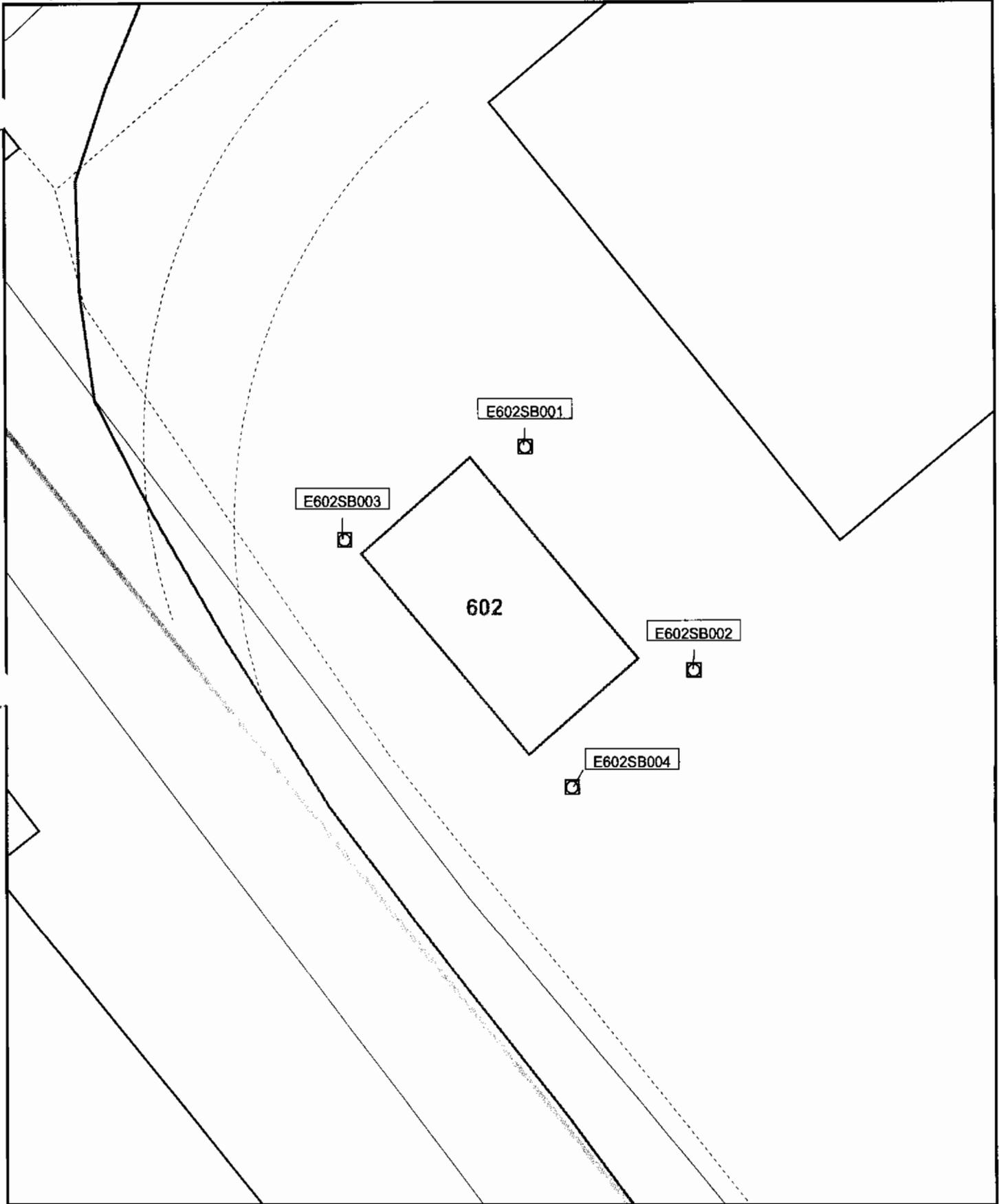
14 **2.3.2 Wipe Samples**

15 PCBs were not detected in any of the four wipe samples. Therefore, no COPCs or COCs
16 were identified.

17 **2.4 Conclusions and Recommendations**

18 The RFI concluded that Aroclors 1254 and 1260 were the only COCs for soils at AOC 602.

NOTE: Original figure created in color



- Surface Soil Sample
- Subsurface Soil Sample
- - - Fence
- ≡ Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Zone Boundary
- ▭ Buildings

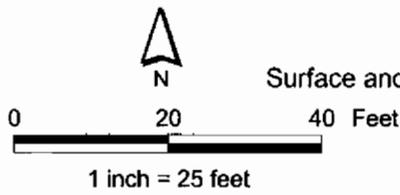
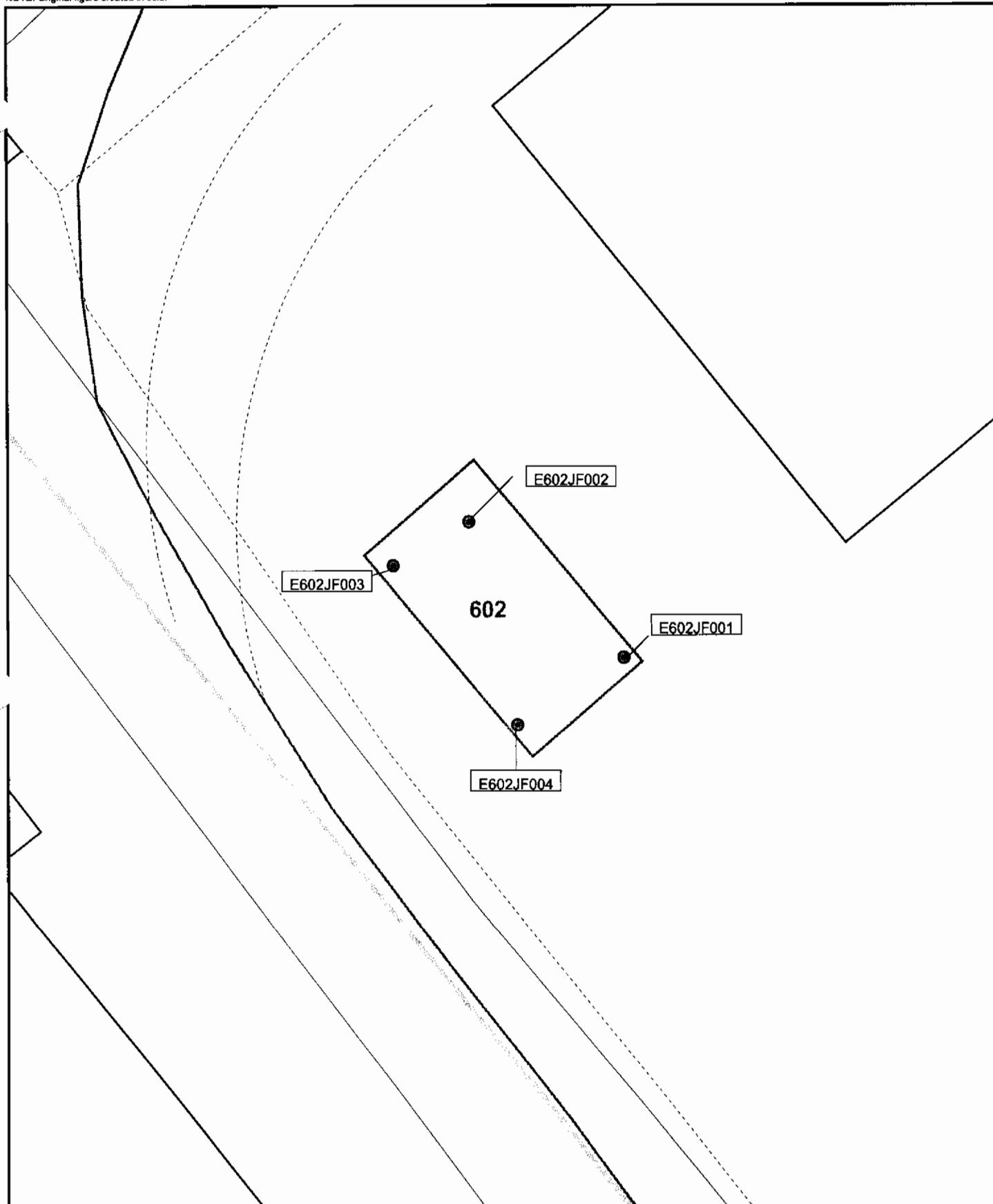


Figure 2-1
AOC 602

Surface and Subsurface Soil Sample Location Map
Charleston Naval Complex

NOTE: Original figure created in color



- Wipe Sample
- Fence
- Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings
- Zone Boundary

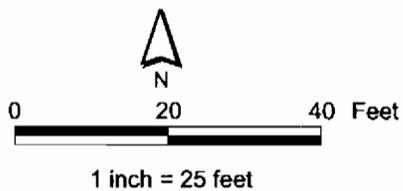


Figure 2-2
AOC 602
Wipe Sample Location Map
Charleston Naval Complex

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1 **3.0 Interim Measures and UST/AST Removals**

- 2 No interim measures (IMs) have been performed at AOC 602. In addition, no underground
3 storage tanks (USTs) or aboveground storage tanks (ASTs) are known to have been located
4 at or removed from AOC 602.

1 **4.0 Summary of Additional Investigations**

- 2 No additional investigations have been conducted at AOC 602 since the RFI field
- 3 investigations conducted by EnSafe in November 1995 and January 1996.

1 **5.0 COPC/COC Refinement**

2 The site was defined as an AOC only because PCB-containing transformers were known to
3 have formerly existed at this unit. The transformers were removed during the 1989
4 renovation of Building 95. No RCRA-regulated activities were conducted at this site. There
5 have been no reported releases of hazardous wastes or materials, disposal of wastes, or
6 adverse employee interview information at this site.

7 Based on the RFI results (see Section 2.0 of this report addendum), as presented in the *Zone*
8 *E RFI Report, Revision 0* (EnSafe, 1997), two PCB isomers (Aroclor 1256 and Aroclor 1260)
9 were identified as exceeding unrestricted land use scenario RBCs at one surface soil location
10 and therefore are considered preliminary COPCs. These COPCs are further evaluated in the
11 following subsections to assess whether they are COCs.

12 In addition, the two detected VOCs in soil sample 602SB004 were rescreened using the SSL
13 for VOCs (DAF = 1) that the BCT is currently using.

14 **5.1 Surface Soil**

15 Only two parameters in a single surface soil sample (602SB004) were above criteria:

- 16 • Aroclor 1254 at 0.19 mg/kg
- 17 • Aroclor 1260 at 0.21 mg/kg

18 No other COPCs were identified. However, upon further evaluation, none of the surface
19 soil COPCs qualified as COCs. The rationale is provided below.

20 **5.1.1 PCBs: Aroclor 1257 and Aroclor 1260**

21 PCBs exceeded the unrestricted land use scenario RBC of 0.083 mg/kg (for Aroclor 1256
22 and Aroclor 1260) in the surface soils that was in effect at the time of the *Zone E RFI Report,*
23 *Revision 0*. However, the concentrations of both Aroclors detected are well below the
24 current unrestricted land use scenario RBC of 0.32 mg/kg. Therefore, these constituents are
25 no longer classified as COPCs or COCs and do not warrant further consideration.

26 In addition, although EnSafe also identified Aroclors 1254 and 1260 as COCs based on their
27 reported SSL values, the comparison criteria used by EnSafe could not be duplicated using
28 the methodologies in current EPA guidance. When compared against published SSLs
29 (based on a DAF of 1 for volatile constituents and a DAF of 10 for non-volatile organics and

1 inorganics) no constituents were detected at concentrations exceeding the SSLs. As a result,
2 no COCs were retained at SWMU 602.

3 **5.1.2 Dioxin as TCDD Equivalents**

4 The *Zone E RFI Report, Revision 0* initially excluded dioxin as a COC because the detected
5 concentrations did not exceed the former EPA Region III industrial RBC of 1,000 ng/kg.
6 However, as part of this RFI Report Addendum, the issue of dioxin concentrations was
7 revisited for comparison to unrestricted land use scenario RBCs.

8 Dioxins were detected in all three surface soils analyzed for dioxin. Concentrations ranged
9 from 0.133 to 0.59 ng/kg. An EPA memorandum entitled *Approach for Addressing Dioxin in*
10 *Soil at CERCLA and RCRA Sites*, dated April 13, 1998, establishes "1 part per billion (ppb) as
11 a cleanup level for dioxin in residential soils at Superfund and RCRA cleanup sites where
12 dioxin is a principal contaminant of concern at a facility." EPA's recommended action level
13 of 1 ppb is based on the ubiquitous presence of TEQs in the urban environment. All results
14 for this site are below the 1 ppb (1,000 ng/kg) concentration. As a result, TEQ is not
15 considered a COC for this site and does not warrant further evaluation.

16 **5.1.3 Summary**

17 There are no COCs in surface soil at AOC 602 that require further action.

18 **5.2 Subsurface Soil**

19 No COPCs were identified in the *Zone E RFI Report, Revision 0* for subsurface soils collected
20 and analyzed from AOC 602.

21 Analytical results from the subsurface soil sample collected from 602SB004 and analyzed for
22 VOCs indicated the presence of two VOCs, acetone and methylene chloride. Evaluations
23 indicated that neither acetone nor methylene chloride exceeded their respective SSLs.
24 However, this assessment was based on DAF = 10.

25 CH2M-Jones rescreened these with respect to SSLs based on a DAF = 1 for VOCs. The
26 results are presented below.

27 **5.2.1 Methylene Chloride**

28 Methylene chloride was detected in the subsurface soil sample obtained at location
29 602SB004 at a concentration of 0.002 mg/kg. This concentration is above the SSL of 0.001
30 mg/kg for a DAF = 1. However, methylene chloride was not detected in other surface or
31 subsurface soil samples, indicating it is not present at significant concentrations at this site

1 and was present in the associated laboratory quality assurance/quality control (QA/QC)
2 samples (SDG 24456) at a similar concentration. Therefore, methylene chloride is not
3 considered a COC at AOC 602.

4 **5.2.2 Acetone**

5 Acetone was detected in the subsurface soil sample obtained at location 602SB004 at a
6 concentration of 0.085 mg/kg. This concentration is well below the SSL of 0.8 mg/kg for a
7 DAF = 1. Acetone was not detected in other soil samples and was present in the associated
8 laboratory QA/QC samples (SDG 24456) at a similar concentration. Therefore, acetone is
9 not considered a COC at AOC 602.

10 **5.2.3 Summary**

11 There are no COCs in subsurface soil at AOC 602 that require further action.

12 **5.3 Wipe Samples**

13 No COPCs were identified in the *Zone E RFI Report, Revision 0* for the wipe samples
14 collected and analyzed from AOC 602.

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within the CNC, including AOC 602.

In accordance with the RFI completion process, if a determination of no further investigation (NFI) is made upon completion of the RFI, then a site may proceed to either NFA status or to a corrective measures study (CMS). The results of the CH2M-Jones evaluation have concluded that no COCs related to AOC 602 are present; therefore, CH2M-Jones recommends this site for NFA.

The remaining subsections address the issues that BCT agreed to evaluate prior to site closeout.

6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and antimony) in groundwater at concentrations above the applicable maximum contaminant level (MCL), preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit.

Groundwater was not a media of concern at AOC 602.

6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC

Data indicate that this AOC was never connected to the sanitary sewer system; thus, there are no concerns regarding connections to the sanitary sewer. Therefore, further evaluation of this issue is not warranted.

6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC

The sections of the stormwater sewer system in the vicinity of the site were not investigated as part of the AOC 699 investigations. There is no evidence of past site uses or the presence of contamination near the stormwater sewer system near the site that could have potentially impacted the stormwater sewer system. Based on these findings, further evaluation of this linkage is not warranted.

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC

The area associated with AOC 602 is bounded on the west, north, and south sides by railroad spurs. However, the area is fully covered in concrete and there are no apparent interactions between AOC 602 and the nearby railroad lines. In addition, there is no known linkage between AOC 602 and the investigated railroad lines of AOC 504; therefore, further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to AOC 602 is the Cooper River, which lies approximately 400 feet to the northeast. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. Since no COCs were identified for this AOC, potential migration of contaminants to surface water is not likely from this unit. In addition, the entire site is covered with buildings and pavement, which eliminates contact of surface soils beneath the paving with stormwater. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the surface soil. Further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

The groundwater is not a media of concern at this unit; consequently, the potential for groundwater contamination to enter the Cooper River is not likely. Therefore, further evaluation of potential migration of contaminated groundwater to a surface water body is not warranted.

1 **6.7 Potential Contamination in Oil/Water Separators (OWSs)**

2 There are no OWSs associated with AOC 602. In addition, there is no reference to an OWS
3 at this facility made in the *Oil Water Separator Data*, Department of the Navy, September
4 2000 report. Therefore, further evaluation of this issue is not warranted.

5 **6.8 Land Use Control Management Plan**

6 No COCs have been identified at AOC 602. This evaluation was based on unrestricted risk-
7 based criteria land use classification. Therefore, land use controls are not necessary.

1 **7.0 Recommendations**

2 AOC 602 is a former electrical substation at Building 95 (refer to Figure 1-2). Constructed in
3 1943, Building 95 was originally used as an electrical substation for Dry Dock 3 and housed
4 PCB-containing transformers until renovations were conducted in 1989. The area is paved
5 with concrete/asphalt and covered with inert construction debris.

6
7 Evaluation of the media of concern (surface soils, subsurface soils, and dust) indicated that
8 there were no issues associated with the historical operation of or releases from this unit.

9 According to the *Zone E RFI Report, Revision 0* (EnSafe, 1997), the only COPCs identified at
10 AOC 602 were PCB Aroclors 1254 and 1260. However, further review of these parameters as
11 described in this report addendum indicate that PCBs are not COCs. Following current
12 protocols and published standards, no constituents were retained as COCs.

13 In addition, there were no visible signs of spills and no known releases from this unit.

14 Although the RFI report concludes that further action may be appropriate for AOC 602,
15 evaluation of COPCs by CH2M-Jones did not confirm this assessment. Therefore, this site is
16 recommended for NFA.

17 Once the BCT concurs that NFA is appropriate for the site, a Statement of Basis will be
18 prepared that will be made available for public comment in accordance with SCDHEC
19 policy. This will allow for public participation in the final remedy selection.

1 **8.0 References**

- 2 EnSafe Inc./ Allen & Hoshall. *Zone E RFI Report Workplan*. 1995.
- 3 EnSafe Inc. *Zone E RFI Report, NAVBASE Charleston, Revision 0*. November 1997.
- 4 U.S. Environmental Protection Agency. *Soil Screening Guidance. Technical Background*
5 *Document*. May 1996.
- 6 U.S. Environmental Protection Agency. *Approach for Addressing Dioxin in Soil at CERCLA*
7 *and RCRA Sites. Technical Memorandum*. April 13, 1998.
- 8 U.S. Navy. *Oil Water Separator Data*. September 2000.

Only one comment was received with respect to AOC 602. The comments from SCDHEC on the *Zone E RFI Report, Revision 0* are undated.

Comment 27

Soil boring 602SB004 exhibited detections of Arochlor 1254 and Arochlor 1260 above residential RBC values. The surface soil around 602SB004 should therefore be investigated for PCB.

EnSafe/Navy Response

Additional samples will be collected in the area around 602SB004 to assure that the site has been delineated.

CH2M-Jones Response

The detected concentrations were below industrial RBCs and current residential RBCs, which is the delineation standard agreed upon for Zone E between SCDHEC, the Navy, and CH2M-Jones. As a result, no additional field investigations are necessary at this unit.

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1 Acronyms and Abbreviations

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BEQ	benzo(a)pyrene equivalent
6	BRAC	Base Realignment and Closure Act
7	CA	corrective action
8	CMS	corrective measures study
9	CNC	Charleston Naval Complex
10	COC	chemical of concern
11	COPC	chemical of potential concern
12	CSI	Confirmation Sampling Investigation
13	DAF	dilution attenuation factor
14	DRO	diesel range organics
15	EnSafe	EnSafe Inc.
16	EPA	U.S. Environmental Protection Agency
17	GRO	gasoline range organics
18	IM	interim measure
19	MCL	maximum contaminant level
20	µg	microgram
21	mg/kg	milligram per kilogram
22	MTBE	methyl tert-butyl ether
23	NAVBASE	Naval Base
24	NFA	no further action
25	NFI	no further investigation
26	OWS	oil/water separator
27	PAH	polycyclic aromatic hydrocarbon
28	PCB	polychlorinated biphenyl
29	RBC	risk-based concentration
30	RCRA	Resource Conservation and Recovery Act

1	RFA	RCRA Facility Assessment
2	RFI	RCRA Facility Investigation
3	SCDHEC	South Carolina Department of Health and Environmental Control
4	SSL	soil screening level
5	SVOC	semivolatile organic compound
6	SWMU	solid waste management unit
7	TPH	total petroleum hydrocarbon
8	UST	underground storage tank
9	VOC	volatile organic compound

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.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA) with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. 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 complete the RCRA Facility Investigation (RFI) report for Area of Concern (AOC) 604 in Zone E of the CNC. The site is recommended for no further action (NFA). Figure 1-1 illustrates the location of Zone E within the CNC. Figure 1-2 provides an aerial view of AOC 604 within Zone E.

1.1 Background

AOC 604 is a former electrical substation at Building 96 (see Figure 1-2). Constructed in 1946, Building 95 was originally used as an electrical substation for Dry Dock 4 in Zone E, which housed polychlorinated biphenyl (PCB)-containing transformers. Two permanent transformers and one temporary transformer are currently located adjacent to Building 96, however they do not contain PCBs. During the RCRA Facility Assessment (RFA), stained soil from a small leak in one of the transformers was observed. As of a July 2001 site visit to the facility, the structure is currently empty. This site had not been investigated prior to the RFI field investigation.

PCB-contaminated dielectric fluid is the material of concern for AOC 604 identified in the *Zone E RFI Work Plan* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995). Potential receptors that may be exposed to site contaminants include current and future building users, and any site workers that this area may support following base closure.

1 In the RFA, this unit was identified for a Confirmatory Sampling Investigation (CSI) to
2 assess whether releases of contamination at the site had occurred. All field activities were
3 conducted as part of the RFI phase.

4 As part of the AOC 604 field investigation, surface soil, subsurface soil, and wipe samples
5 were collected and analyzed.

6 This area is zoned for industrial use (M-2).

7 **1.2 Purpose of the RFI Report Addendum**

8 This RFI Report Addendum provides information about AOC 604 that documents the
9 conclusions from the RFI report, evaluates the data, and provides conclusions regarding site
10 closure.

11 Based on a review of the data, CH2M-Jones has determined that investigation activities are
12 complete and recommends the site for NFA.

13 Prior to changing the status of any site to NFA in the CNC RCRA CA permit, the BRAC
14 Cleanup Team (BCT) agreed that the following issues should be considered:

- 15 • Status of the RFI
- 16 • Presence of metals (inorganics) in groundwater
- 17 • Potential linkage to Solid Waste Management Unit (SWMU) 37, Investigated Sanitary
18 Sewers at the CNC
- 19 • Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- 20 • Potential linkage to AOC 504, Investigated Railroad Lines at the CNC
- 21 • Potential linkage to surface water bodies (Zone J)
- 22 • Potential contamination associated with oil/water separators (OWSs)
- 23 • Relevance or need for land use controls at the site

24 A discussion of these issues is provided in this RFI Report Addendum to expedite
25 evaluation of the site.

26 Provided that the information presented in this report is adequate to address these site
27 closeout items, it is expected that the BCT will concur that NFA is appropriate for the site.
28 At that time, a Statement of Basis will be prepared that will be made available for public
29 comment in accordance with SCDHEC policy. This will allow for public participation in the
30 final remedy selection.

1 **1.3 Report Organization**

2 This RFI Report Addendum consists of the following sections, including this introductory
3 section:

4 **1.0 Introduction** — Presents the purpose of the report and background information relating
5 to the RFI Report Addendum.

6 **2.0 Summary of RFI Conclusions for AOC 604** — Summarizes the conclusions from the
7 RFI investigations and risk evaluations for AOC 604.

8 **3.0 Interim Measures and UST/AST Removals** – Provides information regarding any
9 interim measures (IMs) or tank removal activities performed at the site.

10 **4.0 Summary of Additional Investigations** —No additional investigations have been
11 conducted at this site.

12 **5.0 COPC/COC Refinement** — Provides further evaluation of chemicals of potential
13 concern (COPCs) based on RFI and additional data to assess them as chemicals of concern
14 (COCs).

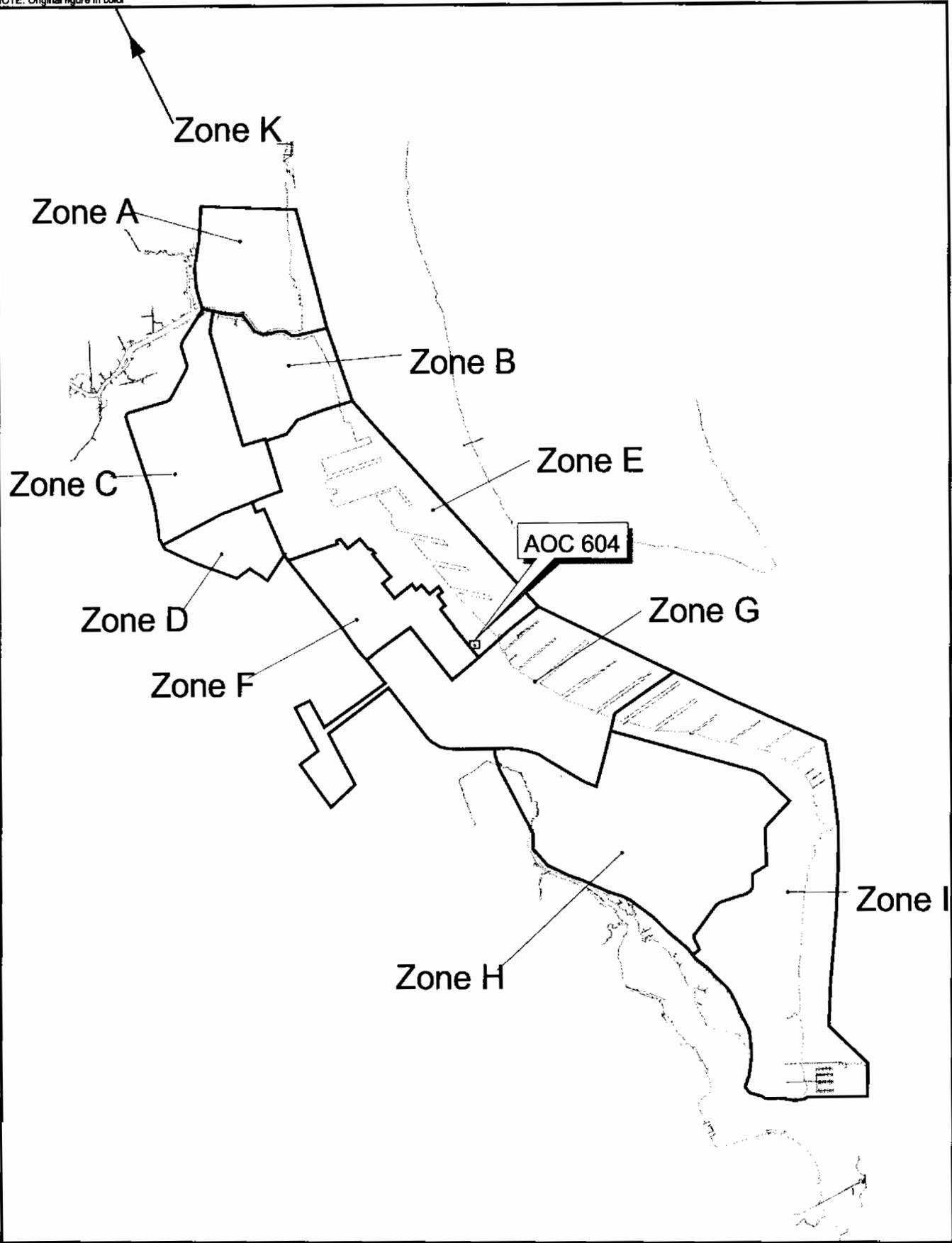
15 **6.0 Summary of Information Related to Site Closeout Issues**—Discusses the various site
16 closeout issues that the BCT agreed to evaluate prior to site closeout.

17 **7.0 Recommendations**—Provides recommendations for proceeding with site closure.

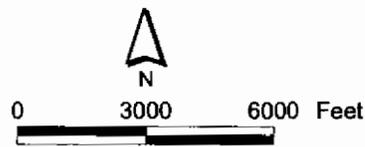
18 **8.0 References** — Lists the references used in this document.

19 All figures appear at the end of their respective sections.

NOTE: Original figure in color



△ Shoreline
□ Zone Boundary



1 inch = 2666.67 feet

Figure 1-1
AOC 604 Zone E
Site Location Map
Charleston Naval Complex

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NOTE: Aerial Photo Data is 1997
NOTE: Original figure created in color



- Railroads
- Roads
- AOC Boundary
- SWMU Boundary
- Buildings
- Zone Boundary

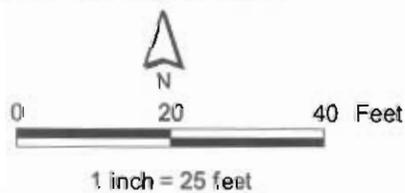


Figure 1-2
Site Map
AOC 604
Zone E
Charleston Naval Complex

2.0 Summary of RFI Conclusions for AOC 604

This section summarizes the results and conclusions from the soil and wipe sample investigations conducted in the area of AOC 604, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997), Section 10.49. Figure 2-1 presents the site features and RFI surface and subsurface soil sample locations. Figure 2-2 shows locations where the wipe samples were collected.

As part of the Zone E RFI, surface soil, subsurface soil, and wipe sample investigations were conducted at AOC 604 in January and February 1996. The RFI report presented the results of this investigation as well as conclusions concerning contamination and risk, as summarized in Sections 2.1 and 2.2 of this report addendum. A further evaluation of COCs is provided in Section 5.0.

2.1 Soil

2.1.1 Surface Soil

A total of four surface soil samples were collected for PCB analyses (see Figure 2-1). In addition, one surface soil sample (604SB003) was submitted for volatile organic compound (VOC) analysis, and one surface soil sample (604SB004) was analyzed for total petroleum hydrocarbon (TPH). No duplicate surface soil samples were collected at AOC 604.

Comparison criteria for these samples were U.S. Environmental Protection Agency (EPA) Region III residential and industrial risk-based concentrations (RBCs), and soil screening levels (SSLs) (dilution attenuation factor [DAF] = 10).

Analytical results from the surface soil samples showed the following detections:

- Acetone at 0.09 milligrams per kilogram (mg/kg) in 604SB003
- Xylenes at 0.002 mg/kg in 604SB003
- PCB-Aroclor 1260 at concentrations of 0.0089 mg/kg and 0.017 mg/kg in 604SB001 and 604SB002, respectively
- TPH-gasoline range organics (GRO)¹ at 3.8 mg/kg in 604SB004
- TPH-diesel range organics (DRO) at 1,610 mg/kg in 604SB004

¹ The RFI report refers to occurrences of gasoline and kerosene. However, the data provided do not include any discussion on how these constituents were identified from the TPH analysis. The terms TPH-GRO and TPH-DRO are used in this RFI Report Addendum.

1 None of the VOCs or PCBs exceeded their respective unrestricted land use or industrial
2 RBCs.

3 TPH-GRO and TPH-DRO were detected in one of the surface soil samples (604SB004). The
4 RFI report noted that no RBCs or SSLs had been established for TPHs in soil.

5 **2.1.2 Subsurface Soil**

6 A total of four subsurface soil samples, co-located with the surface soil sample locations (see
7 Figure 2-1) were collected for PCB analyses. In addition, one subsurface soil sample
8 (604SB003) was submitted for VOC analysis and one subsurface soil sample (604SB004) was
9 analyzed for TPH. No duplicate subsurface soil samples were collected at AOC 604.

10 Analytical results from the subsurface soil samples showed detections for one VOC and one
11 TPH:

- 12 • Acetone at 0.11 mg/kg in 604SB003
- 13 • TPH-DRO at 17.3 mg/kg in 604SB004

14 Acetone did not exceed its SSL (DAF = 10).

15 TPH-DRO were detected in one of the subsurface soil samples (604SB004). The RFI report
16 noted that no RBC or SSL had been established for TPH in soil.

17 **2.2 Wipe Samples**

18 PCB-Aroclor 1260² was detected in three of the four wipe samples (see Figure 2-2) at the
19 following concentrations:

- 20 • 0.59 J µg (micrograms)/wipe in 604JF002
- 21 • 3.2 J µg/wipe in 604JF003
- 22 • 2.1 J µg/wipe in 604JF004

23 The RFI report noted that no RBC or SSL had been established for PCBs in dust.

² The RFI report did not specify the PCB isomer detected in three of the four wipe samples. However, data sheets presented in Appendix H of the RFI report list the PCB occurrences in wipe samples as being Aroclor-1260. For consistency with the data sets, CH2M-Jones has adopted references to Aroclor-1260 throughout this RFI Report Addendum when discussing PCB detections in wipe samples.

1 **2.3 Human Health Risk Assessment**

2 The *Zone E RFI Report, Revision 0* noted that the area is currently industrialized and there
3 were no current residential properties for consideration in the human health risk
4 assessment (HHRA). As a result, all risk evaluation activities were based on potential future
5 unrestricted land use and current industrial scenarios. The risk assessment for AOC 604 is
6 presented in Section 10.49.6 of the *Zone E RFI Report, Revision 0*, and summarized in the
7 subsections below.

8 **2.3.1 Surface and Subsurface Soil**

9 At AOC 604, four surface soil samples and four subsurface soil samples were obtained and
10 evaluated to characterize the site. No constituents were detected at concentrations
11 exceeding the unrestricted land use or industrial RBCs (surface soils) or SSLs (subsurface
12 soils, DAF = 10). No COPCs or COCs were identified for soil at AOC 604.

13 **2.3.2 Wipe Samples**

14 PCBs were detected at very low concentrations ranging from 0.59 to 3.2 µg/wipe in three of
15 the four wipe samples collected from areas located near PCB-containing equipment and
16 areas with visual evidence of spills and leaks. These data were not evaluated in the RFI risk
17 assessment for AOC 604 because there are no risk-based standards for PCBs in dust.

18 **2.3.3 Risk Summary**

19 No COPCs nor COCs were identified for AOC 604 in soil.

20 **2.4 Conclusions and Recommendations**

21 The RFI concluded that NFA was appropriate for AOC 604 on the basis of the
22 concentrations detected in the samples collected at the site. Following agency review,
23 SCDHEC had no comments or needs for additional information for this unit.

NOTE: Original figure created in color

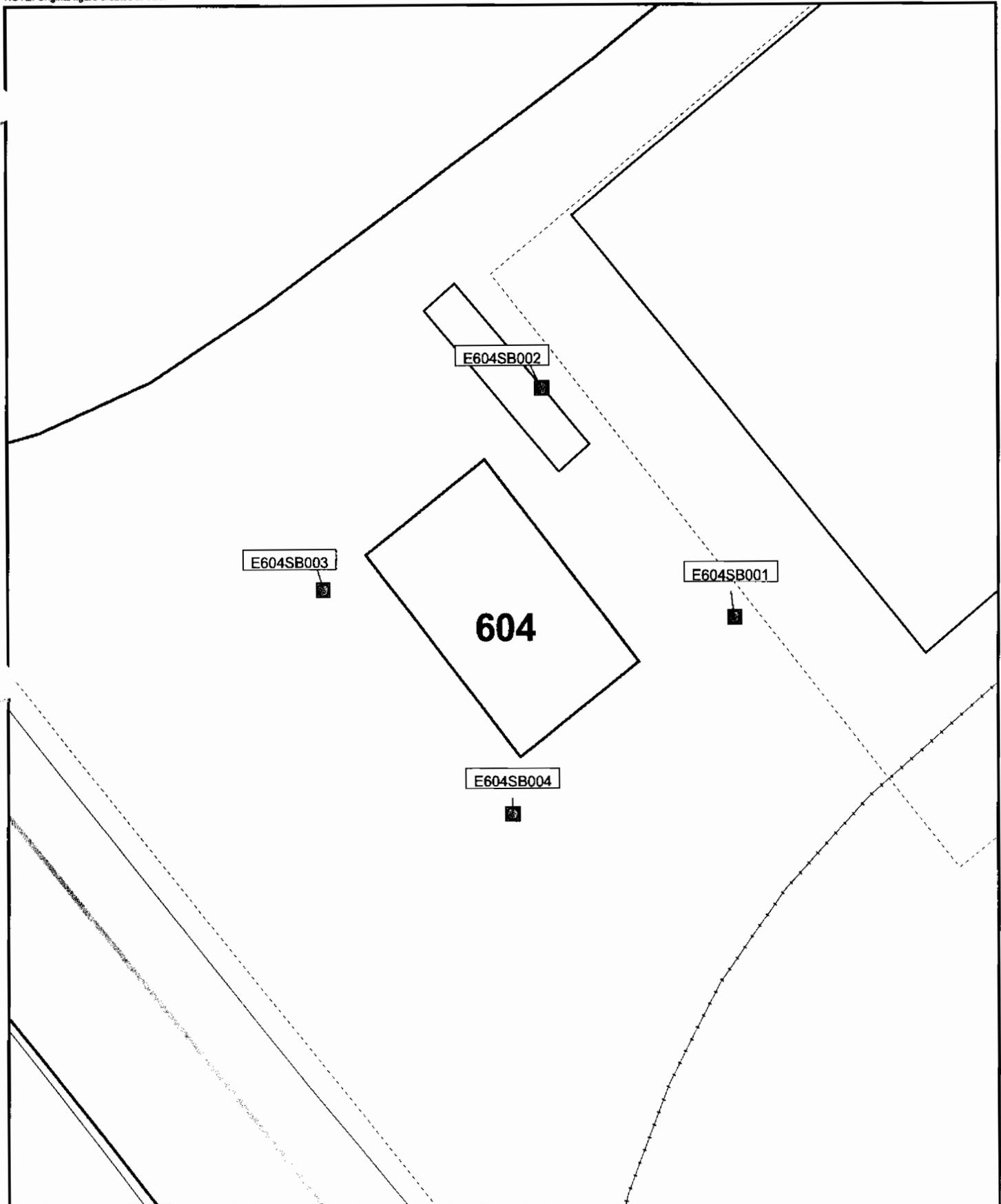


Figure 2-1
Surface and Subsurface Soil Sample Location Map

AOC 604

Zone E

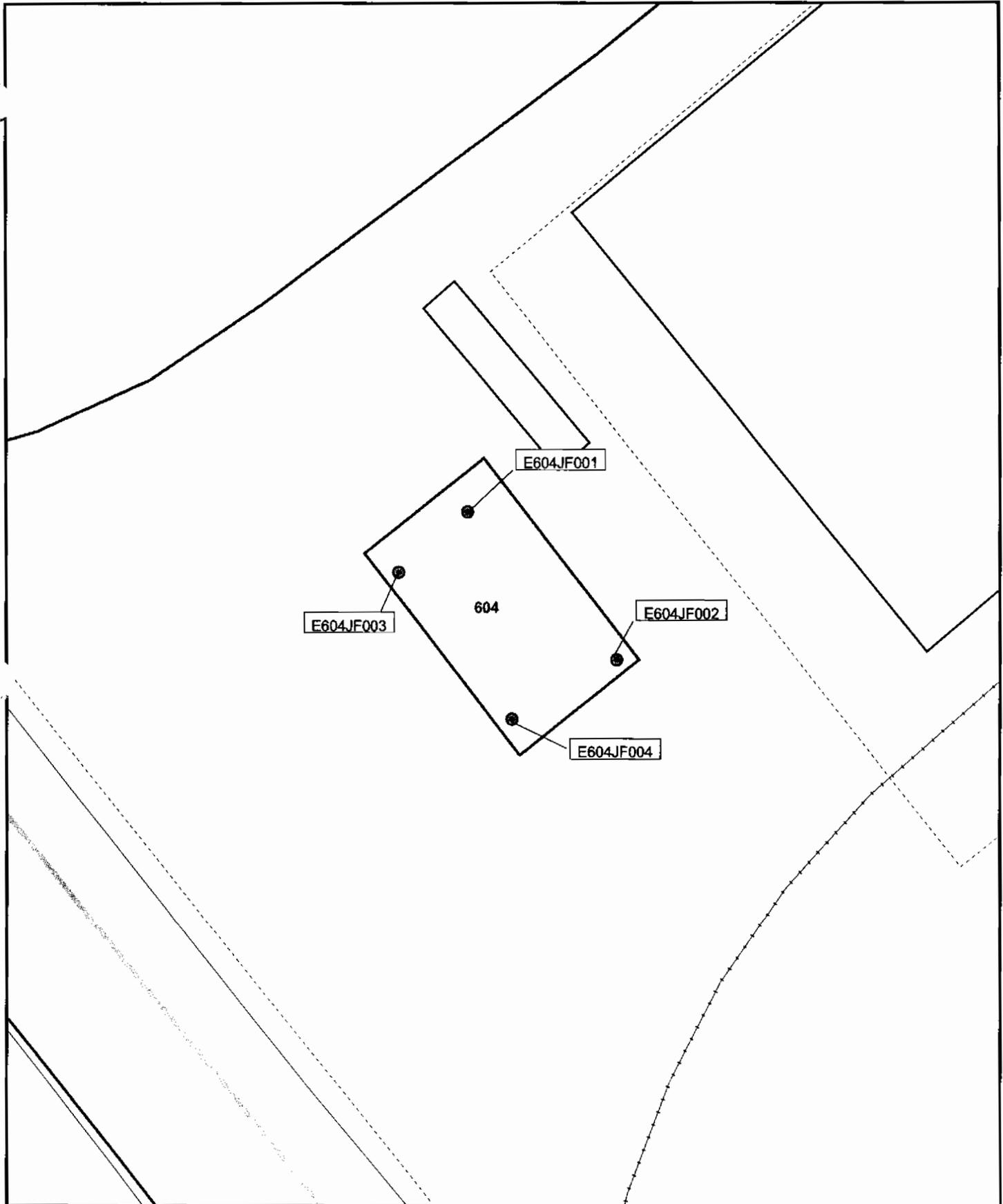
Charleston Naval Complex

- Surface Soil Sample
- Subsurface Soil Sample
- ≡ Railroads
- ≡ Roads
- ▭ Buildings
- ▭ AOC Boundary
- ▭ SWMU Boundary
- - - Zone Boundary
- - - Fence

0 30 60 Feet
1 inch = 25 feet

CH2MHILL

NOTE: Original figure created in color



- Wipe Sample
- ▭ Buildings
- - - Fence
- - - Zone Boundary
- - - Railroads
- - - Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary

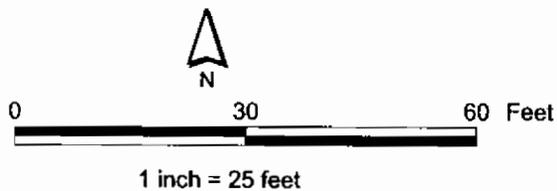


Figure 2-2
Wipe Sample Location Map
AOC 604
Zone E
Charleston Naval Complex

CH2MHILL

1 **3.0 Interim Measures and UST/AST Removals**

- 2 No interim measures have been performed at AOC 604. In addition, no underground
3 storage tanks (USTs) or aboveground storage tanks (ASTs) are known to have been located
4 at or removed from AOC 604.

1 **4.0 Summary of Additional Investigations**

- 2 No additional investigations have been conducted at AOC 604 since the RFI field
- 3 investigation conducted in January and February 1996.

1 **5.0 COPC/COC Refinement**

2 The risk analyses performed for the *Zone E RFI Report, Revision 0* considered both
3 unrestricted land use and industrial RBCs as well as SSLs. However, the SSLs used for
4 VOCs during the RFI analysis were based on a DAF = 10. The detected VOCs have been re-
5 evaluated with respect to SSLs based on a DAF = 1. In addition, the RFI report does not
6 include discussion of TPH detections, which are evaluated as a COPC in this section.

7 **5.1 Surface Soil**

8 The following VOCs and TPH constituents were detected in surface soils at AOC 604:

- 9 • Acetone
- 10 • Xylenes
- 11 • TPH-GRO
- 12 • TPH-DRO

13 Each of these constituents is discussed in detail below.

14 **5.1.1 Acetone**

15 Acetone was detected in the surface soil sample obtained at location 604SB003 at a
16 concentration of 0.09 mg/kg. This concentration is well below the EPA Region III
17 residential RBC of 7,800 mg/kg and the SSL of 0.8 mg/kg (DAF = 1). Therefore, acetone is
18 not considered a COC at AOC 604.

19 **5.1.2 Xylene**

20 Xylene was detected in the surface soil sample obtained at location 604SB003 at a
21 concentration of 0.002 mg/kg. This concentration is well below the EPA Region III
22 residential RBC of 160,000 mg/kg and the SSL of 9 mg/kg (DAF = 1). Therefore, xylene is
23 not considered a COC at AOC 604.

1 5.1.3 Total Petroleum Hydrocarbons

2 TPH-GRO and TPH-DRO were not addressed in the RFI report because there were no
3 criteria established. In addition, Table 1 in the SCDHEC guidance document *South Carolina*
4 *Risk-Based Corrective Action for Petroleum Releases* (SCDHEC, 1998) does not include TPH as a
5 required analysis for petroleum sites, but rather demonstrates a preference for basing
6 decisions on specific chemical concentrations. However, a preliminary screening level of
7 100 mg/kg has been previously used in the RFI report, and in the absence of any other
8 criteria established by the BCT, it is being used here for preliminary screening.

9 TPH-GRO and TPH-DRO were detected in surface soil sample 604SB004 at 3.8 mg/kg and
10 1,610 mg/kg, respectively.

11 TPH-DRO was detected above the screening level of 100 mg/kg. TPH analysis is generally
12 used as a screening value to determine where, and if, additional samples should be
13 collected. TPH results represent the cumulative concentrations of a variety of long-chain
14 hydrocarbons. GRO analysis includes carbon chains of up to 10 carbon atoms long; DRO
15 analysis is specific to carbon chains of 10 to approximately 28 carbon atoms. The TPH
16 analysis can be influenced by many compounds with the appropriate number of carbon
17 atoms that are not necessarily related to petroleum products.

18 Whenever TPH analysis exceeds the screening criteria, VOC and semivolatile organic
19 compound (SVOC) analyses should be considered to determine which constituent(s)
20 contributed to the TPH results. The *South Carolina Risk-Based Corrective Action for Petroleum*
21 *Releases* document (Bureau of Underground Storage Tank Management, 1998) has identified
22 BTEX, methyl tert-butyl ether (MTBE), and several polycyclic aromatic hydrocarbons
23 (PAHs) (total naphthalene, benzo[a]anthracene, benzo[b]fluoranthene,
24 benzo[k]fluoranthene, chrysene, and dibenz[a-h]anthracene) as hydrocarbon COCs for
25 releases of used petroleum products based on their toxicity, mobility, persistence, and
26 presence in material released.

27 At AOC 604, sample 604SB004 was analyzed for both VOC and SVOCs. However, none of
28 the other organic constituents identified in the *South Carolina Risk-Based Corrective Action for*
29 *Petroleum Releases* document were detected, except for xylene, which occurred at a very low
30 concentration (0.002 mg/kg).

31 Soil boring 604SB004 is located inside Building 604 at the southernmost corner. There is no
32 OWS associated with this building.

1 TPHs are not known to be related to the operational history of AOC 604. Therefore, TPHs
2 are not considered further in this RFI Report Addendum.

3 **5.1.4 Summary**

4 There are no COCs requiring further action in surface soil at AOC 604.

5 **5.2 Subsurface Soil**

6 Analytical results presented in the *Zone E RFI Report, Revision 0* for subsurface soil samples
7 (see Figure 2-1) showed detections for one VOC (acetone) and one TPH (DRO).

8 **5.2.1 Acetone**

9 Acetone was detected in the subsurface soil sample obtained at location 604SB003 at a
10 concentration of 0.11 mg/kg. This concentration is well below the EPA Region III
11 residential RBC of 7,800 mg/kg, and below the Region III SSL of 0.120 mg/kg (DAF = 1).
12 Acetone was not detected in other soil samples. Therefore, acetone is not considered a COC
13 at AOC 604.

14 **5.2.2 Total Petroleum Hydrocarbons**

15 TPH-DRO was detected in the one subsurface soil sample (604SB004) analyzed for TPH, at a
16 concentration of 17.3 mg/kg. This is below the historical CNC screening level of 100
17 mg/kg, as described above in Subsection 5.1.3. Therefore, this constituent is not considered
18 at COC at AOC 604.

19 **5.2.3 Summary**

20 There are no COCs requiring further action in subsurface soil at AOC 604.

Section 6.0

1 **6.0 Summary of Information Related to Site** 2 **Closeout Issues**

3 **6.1 RFI Status**

4 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within Zone E of
5 the CNC, including AOC 604.

6 In accordance with the RFI completion process, if a determination of no further
7 investigation (NFI) is made upon completion of the RFI, then a site may proceed to either
8 NFA status or to a corrective measures study (CMS). The RFI investigation has
9 demonstrated that no COPCs or COCs related to AOC 604 are present; therefore, CH2M-
10 Jones recommends this site for NFA.

11 The remaining subsections address the issues that BCT agreed to evaluate prior to site
12 closeout.

13 **6.2 Presence of Inorganics in Groundwater**

14 For the purpose of site closeout documentation, the inorganics in groundwater issue refers
15 to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and
16 antimony) in groundwater at concentrations above the applicable maximum contaminant
17 level (MCL), preceded or followed by detections of these same metals below the MCL or
18 below the practicable quantitation limit. Groundwater was not a media of concern at AOC
19 604.

20 **6.3 Potential Linkage to SWMU 37, Investigated Sanitary** 21 **Sewers at the CNC**

22 No data indicate that AOC 604 was ever connected to the sanitary sewer system. Therefore,
23 further evaluation of this issue is not warranted.

6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC

The sections of the stormwater sewer system in the vicinity of the site were not investigated as part of the AOC 699 investigations. There is no evidence of past site uses or the presence of contamination near the stormwater sewer system near the site that could have potentially impacted the stormwater sewer system. Based on these findings, further evaluation of this issue is not warranted.

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC

The area associated with AOC 604 is bounded to the west, north, and south sides by railroad spurs. There is no known linkage between AOC 604 and the investigated railroad lines of AOC 504; therefore, further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to AOC 604 is the Cooper River, which lies approximately 400 feet to the northeast. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. Since the entire site is covered with buildings and pavement, which eliminates contact of surface soil with stormwater, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the surface soil.

No soil COCs were identified for this site, and groundwater is not a media of concern. Further evaluation of this issue is not warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There are no OWSs associated with AOC 604. In addition, there is no reference made in the *Oil Water Separator Data* report by the Department of the Navy (September, 2000) to an OWS at this facility. Therefore, further evaluation of this issue is not warranted.

1 **6.8 Land Use Control Management Plan**

- 2 The RFI screening did not identify any COCs at AOC 604. This evaluation was based on a
- 3 unrestricted land use classification. Therefore, land use controls are not necessary.

1 **7.0 Recommendations**

2 AOC 604 is a former electrical substation at Building 96. Constructed in 1946, Building 95
3 was originally used as an electrical substation for Dry Dock 4. It originally housed PCB-
4 containing transformers. Two permanent transformers and one temporary transformer
5 were located adjacent to Building 96, however there is now no PCB- containing equipment
6 located at this unit.

7 Evaluation of the media of concern (surface soils, subsurface soils, and dust) indicated that
8 there were no issues associated with the historical operation of or releases from this unit.
9 According to the *Zone E RFI Report, Revision 0*, no COCs were identified in at AOC 604. In
10 addition, there were no visible signs of spills and no known releases from this unit.

11 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) concluded that NFI and NFA are
12 appropriate for AOC 604; evaluation of COPCs by CH2M-Jones confirmed this assessment.
13 Therefore, this site is recommended for NFA.

14 Once the BCT concurs that NFA is appropriate for the site, a Statement of Basis will be
15 prepared that will be made available for public comment in accordance with SCDHEC
16 policy. This will allow for public participation in the final remedy selection.

1 8.0 References

- 2 Bureau of Underground Storage Tank Management. *South Carolina Risk-Based Corrective*
- 3 *Action for Petroleum Releases*. 1998.
- 4 EnSafe Inc./Allen & Hoshall. *Zone E RFI Report Workplan*. 1995.
- 5 EnSafe Inc. *Zone E RFI Report, NAVBASE Charleston, Revision 0*. November 1997.
- 6 South Carolina Department of Health and Environmental Control. *South Carolina Risk-Based*
- 7 *Corrective Action for Petroleum Releases*. 1998.
- 8 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*
- 9 *Document*. May 1996.
- 10 U.S. Navy. *Oil Water Separator Data*. September 2000.

SWMU 106/AOC 603

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1 Acronyms and Abbreviations

2	AOC	area of concern
3	AST	aboveground storage tank
4	BCT	BRAC Cleanup Team
5	BEQ	benzo(a)pyrene equivalent
6	BRAC	Base Realignment and Closure Act
7	BRC	background reference concentration
8	CA	corrective action
9	CMS	corrective measures study
10	CNC	Charleston Naval Complex
11	COC	chemical of concern
12	COPC	chemical of potential concern
13	CSI	confirmation sampling investigation
14	DAF	dilution attenuation factor
15	EnSafe	EnSafe Inc.
16	EPA	U.S. Environmental Protection Agency
17	FRE	fixed-point risk evaluation
18	HI	hazard index
19	ILCR	incremental lifetime cancer risk
20	IM	interim measure
21	MCL	maximum contaminant level
22	µg/L	microgram per liter
23	mg/kg	milligram per kilogram
24	NAVBASE	Naval Base
25	NFA	no further action
26	NFI	no further investigation
27	OWS	oil/water separator
28	PCB	polychlorinated biphenyl
29	RBC	risk-based concentration
30	RCRA	Resource Conservation and Recovery Act

1	RFA	RCRA Facility Assessment
2	RFI	RCRA Facility Investigation
3	SCDHEC	South Carolina Department of Health and Environmental Control
4	SSL	soil screening level
5	SVOC	semivolatile organic compound
6	SWMU	solid waste management unit
7	TDS	total dissolved solids
8	UST	underground storage tank
9	VOC	volatile organic compound

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.

Corrective Action (CA) activities are being conducted under the Resource Conservation and Recovery Act (RCRA) with the South Carolina Department of Health and Environmental Control (SCDHEC) as the lead agency for CA activities at the CNC. 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 complete the RCRA Facility Investigation (RFI) report for Solid Waste Management Unit (SWMU) 106 and Area of Concern (AOC) 603 in Zone E of the CNC. The site is recommended for No Further Action (NFA). Figure 1-1 illustrates the location of Zone E within the CNC. Figure 1-2 provides an aerial view of SWMU 106 and AOC 603 within Zone E.

1.1 Background

SWMU 106 consists of an abrasive blasting area near Dry Docks 3 and 4 (see Figure 1-2). When blasting operations occurred, temporary structures were erected using scaffolding and herculite to contain blast material. Steel grit and sodium bicarbonate were the reported materials used for blasting. However, blasting operations were reported in the 1995 RCRA Facility Assessment (RFA) report as being rarely conducted.

Waste materials associated with this unit consisted of abrasive blasting wastes containing paint residues, organic solvents, and metallic residues. As reported in the RFA report (EnSafe Inc. [EnSafe], 1995), an estimated 24 pounds per hour of blasting wastes were generated during blasting operations; however, only approximately three waste containers (of unspecified size) per year were actually generated.

AOC 603 is a former burning dump which was used during the 1920s and 1930s, and was located where Dry Dock 3 currently exists. Little information exists regarding AOC 603. The

1 area associated with AOC 603 generally surrounds SMWU 106, includes the area between
2 Dry Docks 3 and 4, and extends around the perimeter of Dry Dock 3 (see Figure 1-2). The
3 area is currently paved with asphalt/concrete, although this area was unpaved and covered
4 with rock at one time.

5 A previous investigation was conducted in 1989 and is described in this RFI Report
6 Addendum. As part of the SWMU 106 and AOC 603 field investigation, EnSafe collected
7 surface soil, subsurface soil, and groundwater samples. During the RFA, SWMU 106 was
8 identified for an RFI and AOC 603 was identified for a Confirmation Sampling
9 Investigation (CSI). All field activities were conducted as part of the RFI phase.

10 This area is zoned for industrial use (M-2).

11 **1.2 Purpose of the RFI Report Addendum**

12 This report addendum provides information about SWMU 106 and AOC 603 that
13 documents the conclusions from the *Zone E RFI Report, Revision 0* (EnSafe, 1997), evaluates
14 the data, and provides conclusions regarding site closure.

15 SCDHEC comments on the RFI report for SWMU 106 and AOC 603 are presented in
16 Appendix A of this report addendum. As a result of the RFI findings, there are no
17 additional investigations necessary at this unit subsequent to Revision 0 of the *Zone E RFI*
18 *Report*.

19 Prior to changing the status of any site to NFA¹ in the CNC RCRA CA permit, the BRAC
20 Cleanup Team (BCT) agreed that the following issues should be considered:

- 21 • Status of the RFI
- 22 • Presence of metals (inorganics) in groundwater
- 23 • Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- 24 • Potential linkage to AOC 699, Investigated Storm Sewers at the CNC
- 25 • Potential linkage to AOC 504, Investigated Railroad Lines at the CNC
- 26 • Potential linkage to surface water bodies (Zone J)
- 27 • Potential contamination associated with oil/water separators (OWSs)
- 28 • Relevance or need for land use controls at the site

¹ The RFI report recommended an Interim Measure (IM)/ Corrective Measures Study (CMS) for groundwater. However, groundwater in Zone E is being addressed as a single, separate entity. This RFI Report Addendum for SWMU 106 and AOC 603 provides final recommendations for soils only.

1 A discussion of these issues is provided in this RFI Report Addendum to expedite
2 evaluation of the site.

3 Provided that the information presented in this report addendum is adequate to address
4 these site closeout items, it is expected that the BCT will concur that NFA is appropriate for
5 the site. At that time, a Statement of Basis will be prepared that will be made available for
6 public comment in accordance with SCDHEC policy. This will allow for public
7 participation in the final remedy selection.

8 **1.3 Report Organization**

9 This RFI Report Addendum consists of the following sections, including this introductory
10 section:

11 **1.0 Introduction** — Presents the purpose of the report and background information relating
12 to the RFI Report Addendum.

13 **2.0 Summary of RFI Conclusions for SWMU 106 and AOC 603** — Summarizes the
14 conclusions from the RFI investigations and risk evaluations for SWMU 106 and AOC 603.

15 **3.0 Summary of Interim Measures and UST/ AST Removal Activities** — Summarizes any
16 interim measures conducted at this site and activities and conclusions related to tank
17 removal activities.

18 **4.0 Summary of Additional Investigations** — Summarizes information collected after
19 completion of the RFI report.

20 **5.0 COPC/COC Refinement** — Evaluates chemicals of potential concern (COPCs) and
21 identifies chemicals of concern (COCs) based on current screening criteria using all RFI
22 data.

23 **6.0 Summary of Information Related to Site Closeout Issues**—Discusses the various site
24 closeout issues that the BCT agreed to evaluate prior to site closeout.

25 **7.0 Recommendations**—Provides recommendations for proceeding with site closure.

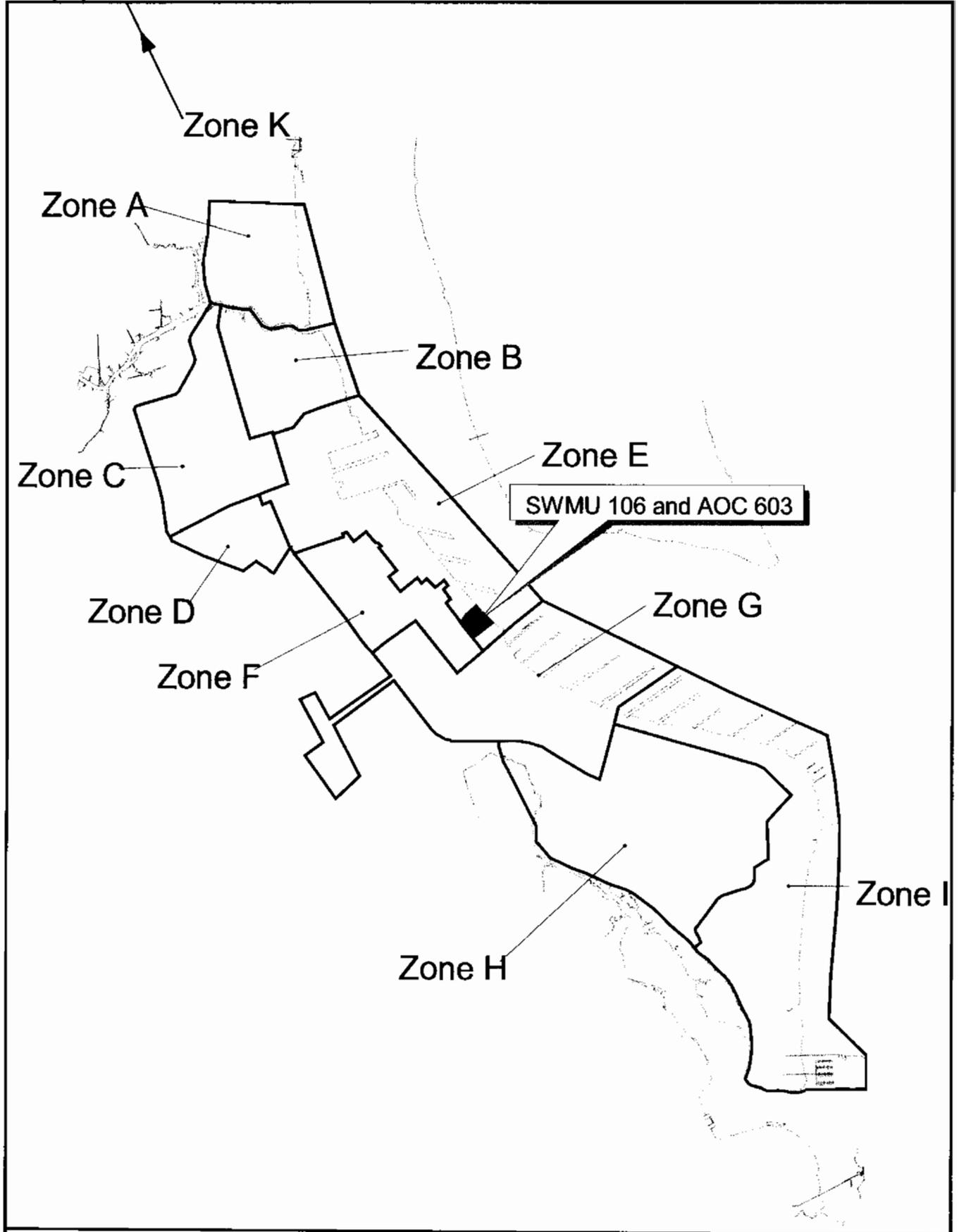
26 **8.0 References** — Lists the references used in this document.

27 **Appendix A** contains responses to SCDHEC comments regarding SWMU 106 and AOC 603
28 in the *Zone E RFI Report, Revision 0*.

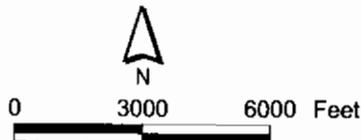
29 **Appendix B** contains analytical data from samples collected during the RFI.

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

NOTE: Original figure in color



Shoreline
Zone Boundary



1 inch = 2666.67 feet

Figure 1-1
SWMU 106 and AOC 603 Zone E
Site Location Map
Charleston Naval Complex

CH2MHILL

NOTE: Aerial Photo Date is 1997
NOTE: Original figure created in color

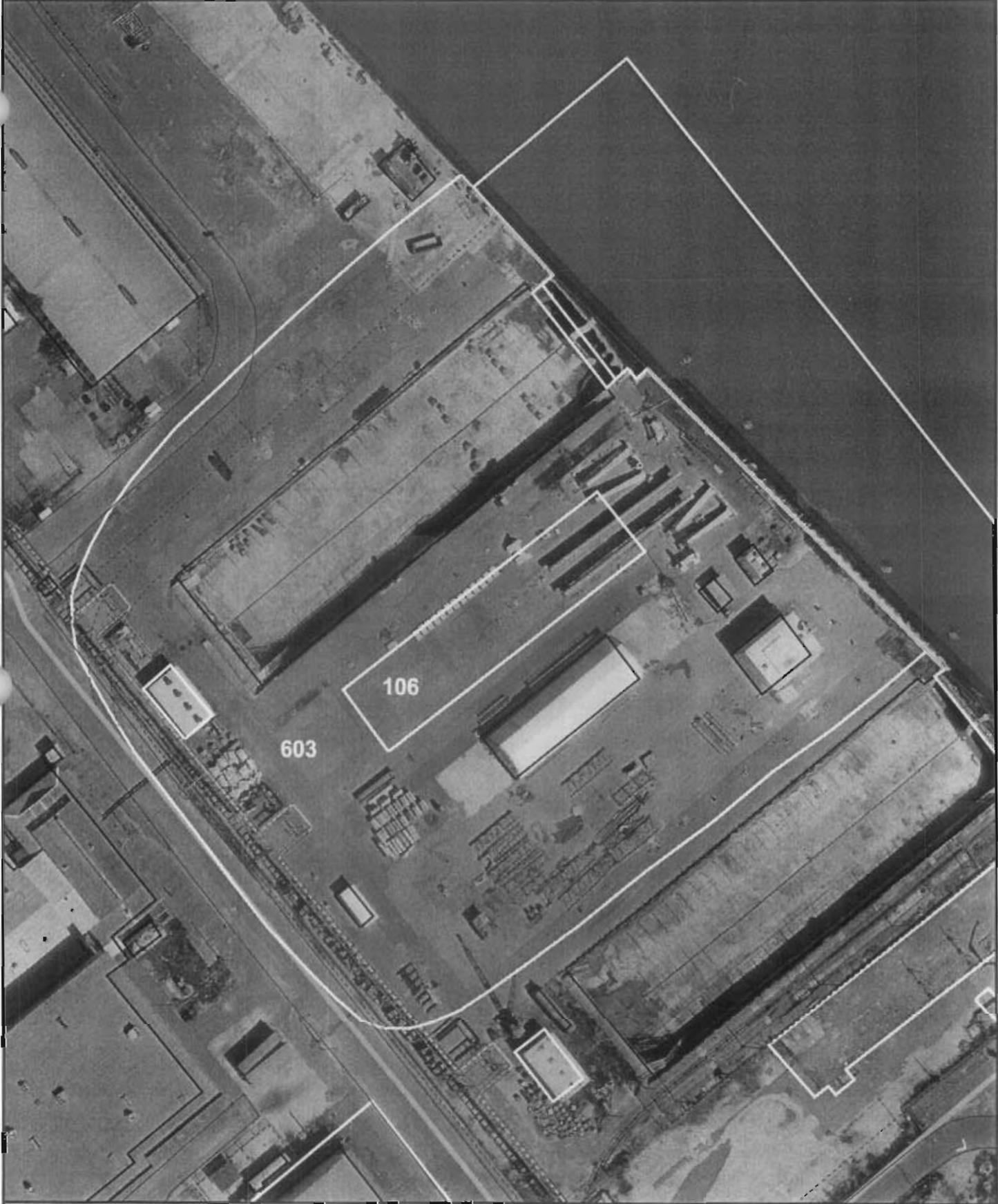
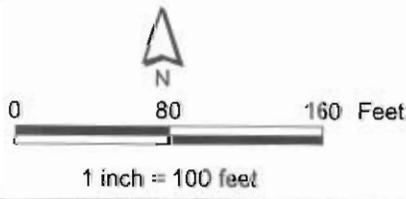


Figure 1-2
SWMU 106 and AOC 603
Site Map
Charleston Naval Complex

-  Fence
-  Roads
-  AOC Boundary
-  SWMU Boundary
-  Buildings
-  Zone Boundary



2.0 Summary of RFI Conclusions for SWMU 106 and AOC 603

This section summarizes the results and conclusions from the soil and groundwater investigations conducted in the area of SWMU 106 and AOC 603, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997), Section 10.15. Figure 2-1 presents the site features and RFI surface and subsurface soil sample locations. Figure 2-2 shows the location of the shallow/deep monitoring well pair installed and investigated as part of the RFI.

As part of the Zone E RFI, surface soil, subsurface soil, and groundwater investigations were conducted at SWMU 106 and AOC 603 in September 1995. The RFI report presented the results of this investigation and the conclusions concerning contamination and risk, as summarized in Sections 2.1 and 2.2 of this report addendum. A further evaluation of COCs is provided in Section 5.0.

In 1989, prior to the RFI field investigation, a blast media sampling event was conducted in association with the blast area (SWMU 106). The results are presented in Table 2-1. None of the analytes were reported as being present at detectable levels. AOC 603 had not been investigated prior to the RFI. No further investigations were performed during the interval between the 1989 event and the RFI.

2.1 Soil

2.1.1 Surface Soil

A total of seven surface soil samples (see Figure 2-1) were collected for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide analyses. Detected organic analytes in the surface soil samples (see Appendix B of this report addendum) included the following parameters:

- **VOCs:** acetone
- **SVOCs:** acenaphthelene, benzo(g,h,i)perylene, benzoic acid, 4-chloro-3-methylphenol, fluoranthene, phenanthrene, and pyrene
- **SVOCs as Benzo(a)pyrene Equivalents (BEQs):** benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a)anthracene, and indeno(1,2,3-cd)pyrene
- **Pesticides:** alpha-chlordane, 4-4'-dichlorodiphenyltrichloro-ethane (4-4'-DDT), and endrin aldehyde

1 Surface soil samples were evaluated relative to the U.S. Environmental Protection Agency
2 (EPA) Region III residential and industrial risk-based concentrations (RBCs) and soil
3 screening levels (SSLs) with a dilution attenuation factor (DAF) = 10.

4 Based on the analysis presented in the *Zone E RFI Report, Revision 0*, only one parameter
5 (arsenic) exceeded the Region III industrial RBC of 3.8 milligrams per kilogram (mg/kg),
6 which was in effect at the time. This exceedance occurred in five of the seven surface soil
7 samples (see Appendix H of the *Zone E RFI Report, Revision 0*). As a result, arsenic was
8 retained as a surface soil COPC in the RFI report.

9 **2.1.2 Subsurface Soil**

10 Seven subsurface soil samples, co-located with the surface soil sample locations (see Figure
11 2-1) were collected for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide analyses.
12 Detected analytes (see Appendix B of this report addendum) in the subsurface soil samples
13 included the following organic parameters:

- 14 • **VOCs:** acetone
- 15 • **SVOCs:** acenaphthelene, anthracene, benzo(g,h,i)perylene, benzoic acid, bis(2-
16 ethylhexyl)phthalate, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene,
17 phenanthrene, and pyrene
- 18 • **SVOCs as BEQs:** benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene,
19 benzo(a)pyrene, chrysene, dibenzo(a)anthracene, and indeno(1,2,3-cd)pyrene
- 20 • **Pesticides:** alpha-BHC, delta-BHC, gamma-BHC, gamma-chlordane, and heptachlor
21 epoxide
- 22 • **Other:** cyanide

23 Subsurface soil sample were evaluated relative to Zone E-specific (Tier 1) SSLs and site-
24 specific (Tier 2) SSLs (see Tables 6.2 and 10.5.5.2, respectively, in the *Zone E RFI Report,*
25 *Revision 0*). Based on the analysis presented in the *Zone E RFI Report, Revision 0*, no
26 parameters exceeded their respective site-specific (Tier 2) SSLs.

2.2 Groundwater

One deep and one shallow monitoring well pair (NBCE106001 and NBCE106001D, respectively) was installed as part of the RFI investigation. The groundwater samples obtained from both the shallow and deep wells were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide, chlorides, sulfates, and total dissolved solids (TDS). Samples from wells NBCE106001 and NBCE106001D were also analyzed for organotins. No duplicate groundwater samples were collected at SWMU 106 and AOC 603.

Constituents detected in the groundwater samples were evaluated relative to maximum contaminant levels (MCLs), tap water RBCs, and Zone E groundwater background reference concentrations (BRCs).

Although four sampling events were completed on these two wells, only one set of sample results was presented for the nature and extent evaluation portion of RFI report. However, all four sets of data were used in the risk analysis performed for SWMU 106 and AOC 603. The following subsections present the findings as they were presented in the *Zone E RFI Report, Revision 0*.

2.2.1 Shallow Groundwater

Only one organic constituent, 4-methylphenol, was detected in the shallow groundwater sample at a concentration of 1.0 microgram per liter ($\mu\text{g}/\text{L}$). There was (and is) no MCL for 4-methylphenol; the Region III tap water RBC for 4-methylphenol is 18 $\mu\text{g}/\text{L}$. The detected concentration of 4-methylphenol is well below the RBC.

A total of nine metals were detected in shallow groundwater at SWMU 106 and AOC 603. Of these nine metals, only arsenic and iron exceeded their respective evaluation criteria:

- Arsenic was detected at a concentration of 36.3 $\mu\text{g}/\text{L}$, which exceeded both the tap water RBC of 0.045 $\mu\text{g}/\text{L}$ and the Zone E BRC of 18.7 $\mu\text{g}/\text{L}$, but did not exceed the MCL of 50 $\mu\text{g}/\text{L}$.
- Iron was detected at a concentration of 20,400 $\mu\text{g}/\text{L}$, which exceeded the tap water RBC of 1,100 $\mu\text{g}/\text{L}$. No shallow groundwater iron BRC was developed for Zone E. The secondary MCL for iron is 300 $\mu\text{g}/\text{L}$.

2.2.2 Deep Groundwater

Only one organic constituent, acetone, was detected in the deep groundwater sample at a concentration of 13.0 $\mu\text{g}/\text{L}$. There was (and is) no MCL for acetone. The tap water RBC acetone is 160 $\mu\text{g}/\text{L}$. The detected concentration of acetone is well below the RBC.

- 1 A total of 10 metals were detected in deep groundwater at SWMU 106 and AOC 603. Of
2 these 10 metals, beryllium, iron, and manganese exceeded their respective evaluation
3 criteria:
- 4 • Beryllium was detected at a concentration of 1.3 µg/L, which exceeded both the tap
5 water RBC of 0.016 µg/L and the deep groundwater BRC of 1.2 µg/L, but did not
6 exceed the MCL of 4 µg/L.
 - 7 • Iron was detected at a concentration of 1,430 µg/L, which exceeded the tap water RBC
8 of 1,100 µg/L. No deep groundwater BRC was developed for iron in Zone E. The
9 secondary MCL for iron is 300 µg/L.
 - 10 • Manganese was detected at a concentration of 949 µg/L, which exceeded both the tap
11 water RBC of 84 µg/L and the deep groundwater BRC of 869 µg/L. There is no MCL for
12 manganese. The secondary MCL for manganese is 500 µg/L.

13 **2.3 Human Health Risk Assessment**

14 The *Zone E RFI Report, Revision 0* noted that Zone E is currently industrialized and there are
15 no current residential properties for consideration in the human health risk assessment
16 (HHRA). As a result, all risk evaluation activities were based on potential future
17 unrestricted land use and current industrial land use scenarios. The detailed presentation of
18 the risk assessment for SWMU 106 and AOC 603 is presented in Section 10.15.6 of the *Zone*
19 *E RFI Report, Revision 0*, and summarized in the subsections below. The risk assessment
20 presented in the RFI report was based on future unrestricted land use and current industrial
21 land use scenarios and used a fixed-point risk evaluation (FRE) methodology.

22 **2.3.1 Surface and Subsurface Soil**

23 At SWMU 106 and AOC 603, the COPCs identified for future residents for site soils
24 included BEQs, antimony, and arsenic in surface soil. For future industrial workers, arsenic
25 was identified as a COPC in surface soil. The risk assessment concluded that surface soils
26 present excessive risks under the unrestricted land use and industrial exposure scenarios, as
27 a result of potential exposure to arsenic and BEQs (residents only). In addition, an increased
28 non-cancer hazard was derived for arsenic in the future unrestricted land use scenario.

29 Only BEQs and arsenic were retained as COCs in surface soil for unrestricted land use
30 scenarios.

2.3.2 Groundwater

The *Zone E RFI Report, Revision 0* did not address all four quarters of groundwater sampling in the nature and extent evaluation presented in Section 10.15.4 or in the quantitative risk assessment presented in Section 10.15.6. However, all four quarters of data (see Appendix B) were qualitatively evaluated in the risk assessment discussion and the full data set was presented in Appendix H of the RFI report.

Arsenic was identified as a COPC in shallow groundwater, and beryllium and manganese were identified as COPCs for deep groundwater. Following the FRE analysis, arsenic was retained as a COC for shallow groundwater given a derived incremental lifetime cancer risk (ILCR) of 8×10^{-4} and a hazard index (HI) of 7.

In deep groundwater, beryllium² and manganese were retained as COCs given a derived cancer risk of 8×10^{-5} for beryllium and an HI greater than 2 for manganese.

2.3.3 Risk Summary

Based on an unrestricted land use scenario, the following COCs were identified:

- **Arsenic:** surface soil, shallow groundwater
- **BEQs:** surface soil
- **Beryllium:** deep groundwater
- **Manganese:** deep groundwater

2.4 Conclusions and Recommendations

2.4.1 Surface Soil

The calculated soil pathway unrestricted land use exposure risk ranges from $4E-05$ to $8E-05$ with an arithmetic mean risk of $2E-05$, and the equated HI ranges from 0.03 to 1 with an arithmetic mean of 0.4. Both values are between the EPA's acceptable ranges of $1E-06$ and $1E-04$ for risk and 3 and 0.1 for HI. Since this site is covered with asphalt, NFA was recommended for surface soil in the RFI.

2.4.2 Subsurface Soil

No subsurface soil COCs were identified; therefore NFA for subsurface soils is appropriate.

² The RFI report text indicates that beryllium and manganese are the deep groundwater COCs, and is supported by the identification of these two metals as COPCs in Table 10.15.6.4. However, Table 10.15.7.1 identifies arsenic and manganese as the COCs for deep groundwater. Arsenic was not detected in the deep groundwater samples. Therefore, it is assumed that

1 **2.4.3 Shallow Groundwater**

2 Shallow groundwater-associated risk at monitoring well NBCE106001 was calculated to be
3 8E-04 for arsenic with an equated HI of 7 for assumed exposure via drinking of the shallow
4 groundwater. These calculated risk values exceed EPA's acceptable ranges for risk and HI,
5 and groundwater containment and treatment was recommended in the text of the *Zone E*
6 *RFI Report, Revision 0*, although other options were also identified as being potentially
7 applicable.

8 **2.4.4 Deep Groundwater**

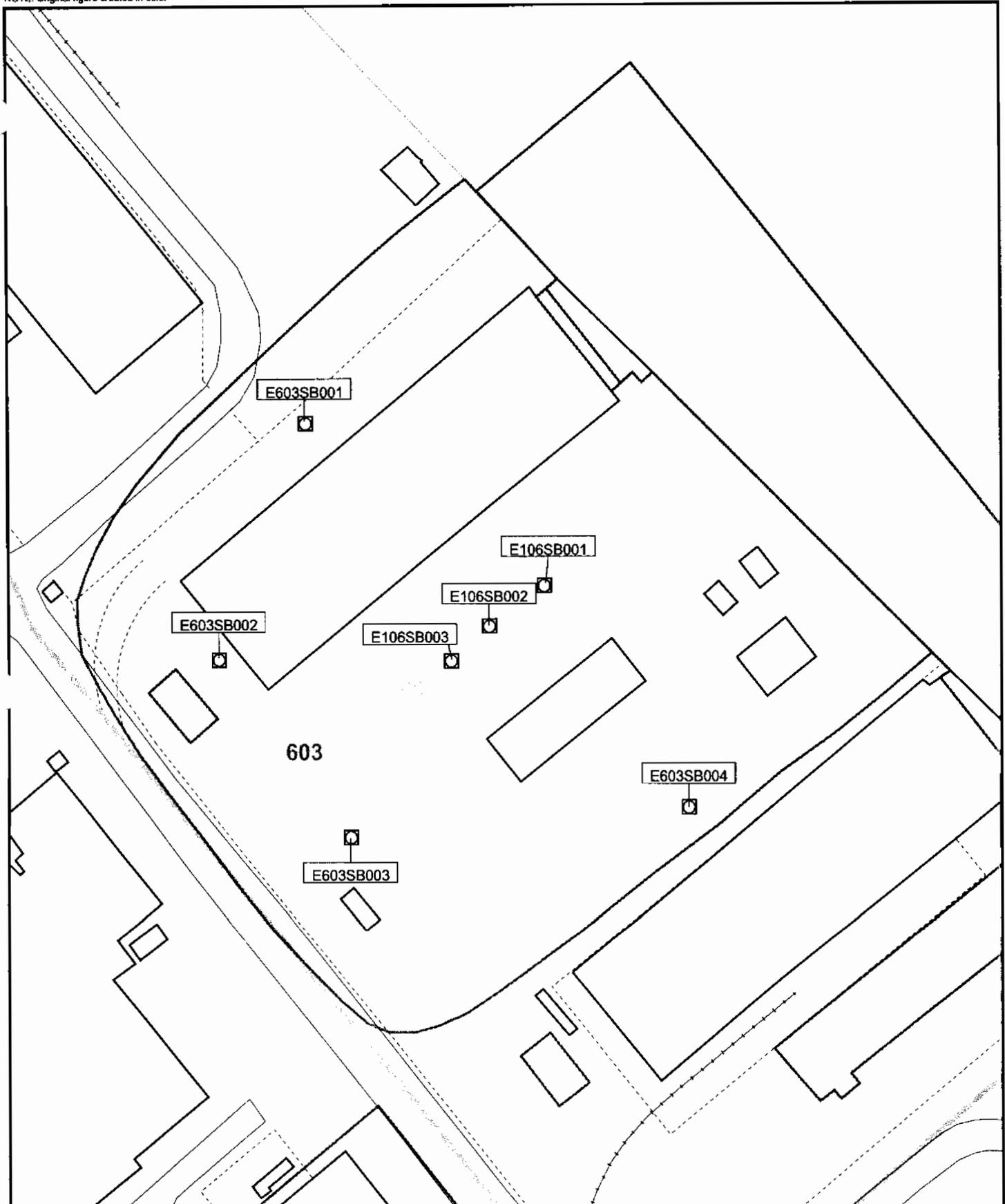
9 Beryllium was identified in deep groundwater at a concentration that represents risk above
10 8E-05. Manganese was identified at a concentration that represents an HI above 2. Both are
11 between EPA's acceptable ranges of 1E-06 and 1E-04 for risk and 3 and 0.1 for HI. Since they
12 were within acceptable ranges, continued monitoring was recommended in the RFI report.

the reference to arsenic as a COC for deep groundwater is a typographical error and the correct metals are beryllium and manganese.

TABLE 2-1
 Results From the Blast Media Sampling Event at SWMU 106
RFI Report Addendum, SWMU 106 and AOC 603, Zone E, Charleston Naval Complex

Previous Investigation	Analytical Results	
Date: June 2, 1989	Flash Point	>140°F
Type: Blast Media	Total Halogens	0.12 wt%
Location: Adjacent to quaywall between Dry Docks 3 and 4	pH	7.0 @ 25°C
	Arsenic	<1.0ppm
	Cadmium	<0.5 ppm
	Chromium	<1.0 ppm
	Lead	<1.0 ppm

NOTE: Original figure created in color



- Subsurface Soil Sample
- Surface Soil Sample
- - - Fence
- ≡ Roads
- ▭ AOC Boundary
- - - SWMU Boundary
- ⋯ Zone Boundary
- ▭ Buildings

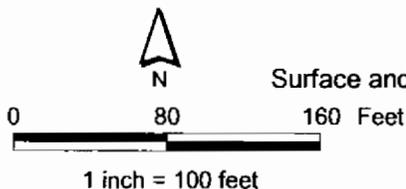
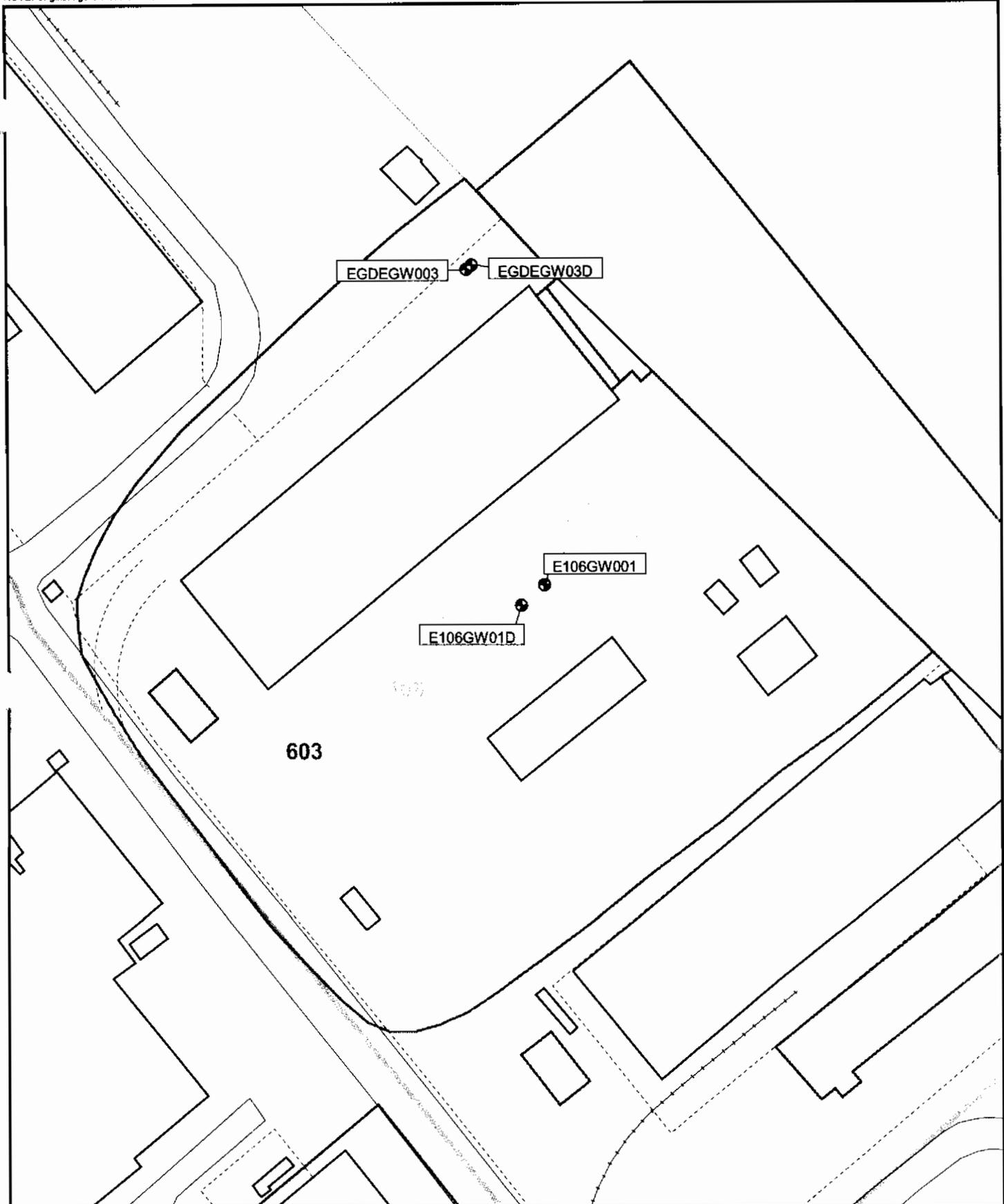


Figure 2-1
SWMU 106 and AOC 603
Surface and Subsurface Soil Sample Location Map
Charleston Naval Complex

NOTE: Original figure created in color



- Groundwater Sample
- - - Zone Boundary
- - - Fence
- - - Roads
- ▭ AOC Boundary
- ▭ SWMU Boundary
- ▭ Buildings

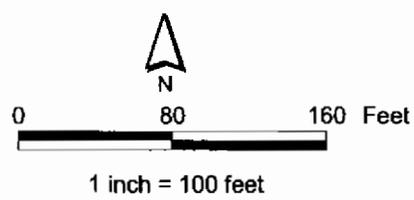


Figure 2-2
SWMU 106 and AOC 603
Groundwater Sample Location Map
Charleston Naval Complex

CH2MHILL

Section 3.0

1 **3.0 Summary of Interim Measures and**
2 **UST/ AST Removals**

3 No IMs have been performed at SWMU 106 or AOC 603. In addition, no underground
4 storage tanks (USTs) or aboveground storage tanks (ASTs) are known to have been located
5 at or removed from SWMU 106 or AOC 603.

1 **4.0 Summary of Additional Investigations**

- 2 No additional investigations have been conducted at SWMU 106 or AOC 603 since the RFI
- 3 field investigation conducted by EnSafe.

1 **5.0 COPC/COC Refinement**

2 The COCs identified in the RFI included BEQs and arsenic in surface soils, arsenic in
3 shallow groundwater, and beryllium and manganese in deep groundwater. Each of these
4 COCs are further evaluated in the following subsections. In addition, concentrations of
5 VOCs in soils were re-screened using an SSL based on a DAF = 1.

6 **5.1 Surface Soil**

7 **5.1.1 Rescreening of VOC Soil Data Based on SSL (DAF = 1)**

8 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) evaluated the potential of constituents
9 identified in the surface soils to impact groundwater quality by providing a comparison to
10 SSL values. The RFI compared maximum detected concentrations of all constituents to SSL
11 values based on a DAF of 10. This approach is appropriate for non-volatile constituents, but
12 given the mobility of VOCs, a comparison to an SSL with a DAF of 1 is considered to be
13 more appropriate. Therefore, VOCs detected in surface soil were rescreened using an SSL
14 with a DAF of 1. SSL values provided in the *EPA Soil Screening Guidance: Technical*
15 *Background Document* (EPA, 1996) were used to complete the screening.

16 Acetone was the only VOC detected in surface soil. It was detected at a maximum
17 concentration of 0.058 mg/kg, which is below the SSL of 0.8 mg/kg (DAF = 1). Therefore,
18 the surface soil-to-groundwater leachability pathway for acetone is not considered to be
19 complete.

20 In the RFI report, none of the non-volatile constituents in surface soil were found to exceed
21 the site-specific (Tier 2) SSL values.

22 Therefore, no COCs were identified for the soil-to-groundwater leachability pathway.

23 **5.1.2 Arsenic**

24 Arsenic was detected in all of the seven surface soil samples with a maximum detected
25 value of 26.8 mg/kg. Although this value exceeds both the unrestricted land use RBC of
26 0.43 mg/kg and the industrial RBC of 3.8 mg/kg, it falls within the range of base-wide
27 background concentrations (0.4 to 68 mg/kg). Therefore, the arsenic detected in surface soil
28 is likely indicative of natural background conditions at the installation and is not identified
29 as a COC at the site.

1 **5.1.3 BEQs**

2 BEQs were detected in four of the seven surface soil samples with a maximum detected
3 value of 0.338 mg/kg, as reported in the RFI report. Although this value exceeds the
4 unrestricted land use RBC of 0.087 mg/kg, it does not exceed the industrial RBC of 0.78
5 mg/kg. The maximum value of BEQs, however, is below the BEQ site-wide reference
6 concentration of 1.304 mg/kg in surface soil. Therefore, the BEQs detected in surface soil
7 are likely indicative of anthropogenic background conditions at the CNC and are not
8 identified as COCs at the site.

9 **5.2 Subsurface Soil**

10 **5.2.1 Rescreening of VOC Soil Data Based on SSL (DAF = 1)**

11 In the *Zone E RFI Report, Revision 0*, the potential for identified subsurface soil constituents
12 to impact groundwater quality was presented, based on a comparison to SSL values. The
13 maximum detected concentrations of all constituents were compared to SSL values based
14 on a DAF = 10. This approach is appropriate for non-volatile constituents, but, as with the
15 surface soils, comparison to an SSL with a DAF = 1 is considered to be more appropriate for
16 VOCs due to their mobility.

17 Acetone was the only VOC detected in subsurface soil, and it was detected at a maximum
18 concentration of 0.084 mg/kg, which is below the SSL of 0.8 mg/kg (DAF = 1). Therefore,
19 the subsurface soil-to-groundwater leachability pathway for acetone is not considered to be
20 complete for acetone.

21 In the RFI report, none of the non-volatile constituents detected in the subsurface soils were
22 determined to exceed the site-specific (Tier 2) SSL values presented in Section 5 of the *Zone
23 E RFI Report, Revision 0*. Therefore, no COCs were identified for the subsurface soil-to-
24 groundwater leachability pathway.

25 **5.3 Groundwater**

26 Arsenic was identified as a COC in shallow groundwater at SWMU 106 and AOC 603, and
27 beryllium and manganese were identified as COCs for deep groundwater. These
28 constituents in groundwater were evaluated to determine whether they should be
29 considered COCs to undergo corrective action at this site.

1 **5.3.1 Arsenic in Shallow Groundwater**

2 Arsenic was detected in one shallow groundwater sample collected during the first quarter
3 groundwater sampling event. The detected concentration of 36.3 µg/L exceeded the RBC
4 and the BRC, but was below the MCL of 50 µg/L. No groundwater samples analyzed at the
5 site exceeded the MCL for arsenic. Therefore, arsenic is not considered to be a COC for
6 shallow groundwater at SWMU 106 and AOC 603.

7 **5.3.2 Beryllium in Deep Groundwater**

8 Beryllium was detected in one deep groundwater sample collected during the first quarter
9 groundwater sampling event. The detected concentration of 1.3 µg/L exceeded the RBC and
10 the BRC, but was below the MCL of 2 µg/L. Therefore, beryllium is not considered to be a
11 COC for deep groundwater at SWMU 106 and AOC 603.

12 **5.3.3 Manganese in Deep Groundwater**

13 Manganese was detected in one deep groundwater sample collected during the first quarter
14 groundwater sampling event. The detected concentration of 949 µg/L exceeded the RBC,
15 but was within the installation-wide background range of 3.6 µg/L to 4,200.54 µg/L.
16 Therefore, manganese's presence is at concentrations consistent with the background range
17 of values and is not considered to be a COC for deep groundwater at SWMU 106 and AOC
18 603.

19 **5.4 Summary**

20 There are no COCs requiring further action in surface soils, subsurface soils, or
21 groundwater at SWMU 106 and AOC 603.

6.0 Summary of Information Related to Site Closeout Issues

6.1 RFI Status

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) addressed SWMUs/AOCs within Zone E of the CNC, including SWMU 106 and AOC 603.

In accordance with the RFI completion process, if a determination of No Further Investigation (NFI) is made upon completion of the RFI, then a site may proceed to either NFA status or to a corrective measures study (CMS). The RFI investigation concluded that COCs for surface soils, shallow groundwater, and deep groundwater related to SWMU 106 and AOC 603 are present. However, after refinement of the risk assessment as presented in Section 5 of the RFI report, CH2M-Jones recommends this site for NFA for surface and subsurface soils, only. Groundwater issues will be address separately on a comprehensive zone-wide basis.

The remaining subsections address the issues that BCT agreed to evaluate prior to site closeout.

6.2 Presence of Inorganics in Groundwater

For the purpose of site closeout documentation, the inorganics in groundwater issue refers to the occasional or intermittent detection of several metals (primarily arsenic, thallium, and antimony) in groundwater at concentrations above the applicable MCL, preceded or followed by detections of these same metals below the MCL or below the practicable quantitation limit.

No groundwater samples exceed the MCL for arsenic, thallium, or antimony. Further evaluation of this issue is not warranted.

6.3 Potential Linkage to SWMU 37, Investigated Sanitary Sewers at the CNC

Data indicate that SWMU 106 and AOC 603 was never connected to the sanitary sewer system, so there are no concerns regarding connections to the sanitary sewer. Therefore, further evaluation of this issue is not warranted.

6.4 Potential Linkage to AOC 699, Investigated Storm Sewers at the CNC

No direct connection from these sites to the storm sewers are known to exist. No COCs requiring further evaluation are present at the site. Based on these findings, further evaluation of this issue is not warranted.

6.5 Potential Linkage to AOC 504, Investigated Railroad Lines at the CNC

The area associated with SWMU 106 and AOC 603 is bounded on the west, north, and south sides by railroad lines. However, there is no known linkage between SWMU 106 and AOC 603 and the investigated railroad lines of AOC 504, so further evaluation of this issue is not warranted.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to SWMU 106 and AOC 603 is the Cooper River, which lies approximately 90 feet northeast of SWMU 106 and adjoins AOC 603 along its eastern boundary. The only potential migration pathway from the site to surface water is via overland flow via storm water runoff. The entire site is covered with buildings and pavement, which eliminates contact of surface soil with stormwater. Similarly, runoff directed to the storm sewer system, which discharges to the Cooper River, does not contact the surface soil. Since no COCs were identified at the site, further evaluation of a potential pathway for contaminant migration via stormwater runoff is not warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There are no OWSs associated with SWMU 106 and AOC 603. In addition, there is no reference to an OWS at this facility in the *Oil Water Separator Data*, Department of the Navy, September 2000, report. Therefore, further evaluation of this issue is not warranted.

6.8 Land Use Control Management Plan

The COC refinements screening did not identify any COCs for soils at SWMU 106 and AOC 603. This evaluation was based on an unrestricted land use classification. Therefore, land use controls for soils are not necessary.

1 **7.0 Recommendations**

2 SWMU 106 is an abrasive blasting area near Dry Docks 3 and 4. AOC 603 is a former
3 burning dump which was used in the 1920s and 1930s, and was located approximately
4 where Dry Dock 3 currently exists.

5 Evaluation of the primary media of concern (surface soils and subsurface soils) indicated
6 that there were no issues associated with the historical operation of or releases from this
7 unit. Based on a review of COPCs and COCs in Section 5.0 of this RFI Report Addendum,
8 no COCs were identified in groundwater.

9 The *Zone E RFI Report, Revision 0* (EnSafe, 1997), concluded that no further investigation was
10 necessary. A recommendation, based on current site conditions, was also made for NFA for
11 soils for SWMU 106 and AOC 603; evaluation of COPCs by CH2M-Jones confirmed this
12 assessment. Therefore, this site is recommended for NFA.

13 Once the BCT concurs that NFA is appropriate for the site, a Statement of Basis will be
14 prepared that will be made available for public comment in accordance with SCDHEC
15 policy. This will allow for public participation in the final remedy selection.

1 **8.0 References**

- 2 EnSafe Inc./Allen & Hoshall. *Zone E RFI Report Workplan*. 1995.
- 3 EnSafe Inc. *Zone E RFI Report, NAVBASE Charleston, Revision 0*. November 1997.
- 4 U.S. Navy. *Oil Water Separator Data*. September 2000.
- 5 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*
- 6 *Document*. May 1996.

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Appendix A

Page 3

**Responses to Comments from Charles B. Watson — SCDHEC
for the Draft Zone E RCRA Facility Investigation Report
Charleston Naval Complex**

SCDHEC Comment 32:

The investigation of Dry Dock #3 would benefit greatly through the collection of a sediment sample from the drain. The Navy should collect a sediment sample if possible.

Navy/EnSafe Response 32:

A representative sediment sample will be collected from the drain of Dry Dock #3, if possible.

CH2M-Jones Response:

Discharges to the Cooper River from Dry Dock 3 and related sediment sampling are addressed under AOC 556, which is a Zone J unit. No further sediment sampling is necessary for AOC 603.

SCDHEC Comment 33:

Section 10.15.3 states that existing grid wells NBCEGDE03D and NBCEGDE 03 will be used rather than installing additional wells; however, no data from the wells exists in the report. Please provide.

Navy/EnSafe Response:

Soil and groundwater analytical results which exhibited concentrations exceeding reference concentrations, RBCs, and MCLs in these grid wells, are presented the nature and extent write-ups in Section 10.50. Soil and groundwater results for all grid wells can be found in Appendix H, part 1 of the draft report. The Final Zone E RFI Report will be amended to include the results for grid wells NBCEGDE003 and 03D in Section 10.15.

CH2M-Jones Response:

CH2M-Jones concurs with the Navy/EnSafe response. However, groundwater was evaluated at SWMU 106 and AOC 603, and no COCs were identified for surface soils, subsurface soils, or groundwater. As a result, there are no identifiable sources associated with SWMU 106 and AOC 603 that would impact the two grid wells (see Section 5.0 of the Zone E RFI Addendum for SMWU 106 and AOC 603). Therefore, direct revision of the Zone E RFI Report, Revision 0 is not necessary. However, grid wells NBCEGDE 03 and NBCEGDE 03D have been included on the monitoring well location map in Section 2.0 of the Zone E RFI Addendum for SMWU 106 and AOC 603 and the data are presented in Appendix H of Zone E RFI Report Revision 0.

SCDHEC Comment 34:

Aerial photographs reveal the existence of relict tidal creeks in the area of Dry Dock #3 trending from the Cooper River to the southwest. The Department therefore recommends the installation of one well pair along the southwest border of Dry Dock #3. High soil contaminant values at 603SB003 supports a well in this area.

Navy/EnSafe Response 34:

Grid well pair NBCEGDE001/01D are located to the south of Dry Dock #3, but are approximately 200 feet from the southwest edge. The Navy will collect additional soil samples at several locations which exceeded generic SSLs. These samples will be analyzed for the constituents which exceeded their respective SSLs according to the Synthetic Precipitation Leaching Procedure (SPLP), and for TOC content. Results will be reviewed and additional monitoring wells will be installed in this area, if necessary.

CH2M-Jones Response:

The groundwater data from the field investigation have been fully evaluated and there is no suggestion that groundwater impacts have occurred at SWMU 106 and AOC 603 as a result of historical operations. In addition, no COCs were retained following evaluation of the surface soils, subsurface soils, or groundwater. This is especially important because both the surface soils and the subsurface soils were screened against the site-specific SSLs (DAF=10) and all VOCs were again screened against the EPA SSLs (DAF = 1). Under this conservative scenario, there is no reason to conduct further investigations of groundwater for impacts from SWMU 106 or AOC 603 (see Section 5.0 of the Zone E RFI Addendum for SMWU 106 and AOC 603).

SCDHEC Comment 35:

Section 10.15.5.1 Four organic compounds were detected in 106SB003. The report states that “none of the four compounds was detected in groundwater samples, indicating that the current soil-groundwater equilibrium is sufficiently protective of the surficial aquifer.” The Department disagrees. Soil boring 106SB003 is located more than 200 feet from well NBCE10601 and will not support this statement. The Department therefore recommends the installation of an additional well directly next to soil boring 106SB003.

Navy/EnSafe Response 35:

The Navy will collect additional soil samples at several locations which exceeded generic SSLs. These samples will be analyzed for the constituents which exceeded their respective SSLs according to the Synthetic Precipitation Leaching Procedure (SPLP), and for TOC content. Results will be reviewed and additional monitoring wells will be installed in this area, if necessary.

CH2M-Jones Response:

CH2M-Jones understands that the absence of a constituent in groundwater is not considered a justifiable basis for eliminating a soil COPC. The Zone E RFI Report, Revision 0 text was silent regarding these four organic compounds once they were eliminated on the basis of an absence of an observed impact to groundwater. However, none of them exceeded their respective site-specific (Tier 2) SSLs, as presented the evaluation of soil-to-groundwater cross-media transport (Section 10.15.5.1 in the report Zone E RFI Report, Revision 0). As a result, these compounds were properly screened out as COPCs, because they did not exceed their respective SSL values (see Section 2.1.2 of the Zone E RFI Addendum for SMWU 106 and AOC 603).

SCDHEC Comment 36:

Figure 10.15.6 did not include grid wells NBCEGDE03 and NBCEGDE03D. Please revise.

Navy/EnSafe Response 36:

Figure 10.15.6 will be revised to include both grid well pairs NBCEGDE003/03D and NBCEGDE001/01D. These will be included in the Final Zone E RFI Report.

CH2M-Jones Response:

Following reanalysis of the surface and subsurface soils, it was found that there are no COCs for SWMU 106 (see Section 5.0 of the Zone E RFI Addendum for SMWU 106 and AOC 603). However, grid wells NBCEGDE03 and NBCEGDE03D are included in Figure 2-2 of the Zone E RFI Addendum for SMWU 106 and AOC 603).

**Responses To Comments from Susan K. Byrd — SCDHEC
for Draft Zone E RCRA Facility Investigation Report
Charleston Naval Complex**

SCDHEC Comment 12 - Section 10.15.7, Page 10.15-44, Lines 10-13:

The site is recommended for no further action for soil since the site is covered with asphalt. The soil exposure residential risk range is above SCDHEC's recommended value of 1E-06; therefore, alternative corrective or interim measures should be included in the text.

Navy/EnSafe Response 12:

The Final Zone E RFI Report will recommend SWMU 106 and AOC 603 for CMS. Section 10.15.7 of the Draft Zone E RFI Report errantly recommended NFA; however, surface soil was recommended for CMS in Section 11 of the Draft Zone E RFI Report. The text in Section 10.15.17 will be corrected in the final report.

CH2M-Jones Response:

CH2M-Jones concluded that paving was not an acceptable reason to justify NFA at this site and these constituents were evaluated further. Per information presented in the Zone E RFI Report Addendum, the recommendation for NFA for the soils at SWMU 106 and AOC 603 still stands; however, this recommendation is now based on a re-evaluation that took into consideration at all constituents with respect to applicable criteria, as presented in Section 5 of the Zone E RFI Report Addendum. This recommendation is now based on an evaluation that showed no COCs for this site.

**Responses to Comments from Eric F. Cathcart — SCDHEC
for the Draft Zone E RCRA Facility Investigation Report
Charleston Naval Complex**

NOTE: The comments reported as being submitted by Mr. Eric F. Cathcart appear to be identical to those submitted by Mr. Charles B. Watson and are not repeated here.

Chemicals Detected in Zone E Soil Samples
SWMU 106

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
Acetone	106SB00201	58.00	84.00	780000	NA	NA
	106SB00301	28.00	79.00			
<i>Semi-volatile Compounds (ug/kg)</i>						
2-Methylnaphthalene	106SB00202	ND	410.00	NA	NA	NA
	106SB00302	ND	3500.00			
4-Chloro-3-methylphenol	106SB00301	100.00	ND	NA	NA	NA
Acenaphthene	106SB00101	220.00	ND	470000	NA	NA
	106SB00302	ND	1100.00			
Anthracene	106SB00202	ND	540.00	23000000	NA	NA
	106SB00302	ND	1600.00			
Benzo(a)anthracene	106SB00101	180.00	260.00	880	NA	NA
	106SB00201	120.00	520.00			
	106SB00302	ND	1000.00			
Benzo(a)pyrene	106SB00101	320.00	260.00	88	NA	NA
	106SB00201	120.00	370.00			
	106SB00302	ND	710.00			
Benzo(b)fluoranthene	106SB00202	ND	160.00	880	NA	NA
Benzo(g,h,i)perylene	106SB00101	300.00	150.00	310000	NA	NA
	106SB00201	430.00	260.00			
	106SB00301	380.00	640.00			
Benzo(k)fluoranthene	106SB00102	ND	280.00	8800	NA	NA
	106SB00201	120.00	ND			
	106SB00302	ND	280.00			
Chrysene	106SB00101	330.00	250.00	88000	NA	NA
	106SB00201	140.00	510.00			
	106SB00302	ND	1100.00			
Dibenzofuran	106SB00302	ND	390.00	31000	NA	NA
Fluoranthene	106SB00101	170.00	430.00	3100000	NA	NA
	106SB00301	79.00	ND			
Fluorene	106SB00202	ND	380.00	310000	NA	NA
	106SB00302	ND	1700.00			
Indeno(1,2,3-cd)pyrene	106SB00102	ND	240.00	880	NA	NA
	106SB00302	ND	220.00			
Naphthalene	106SB00302	ND	870.00	310000	NA	NA
Phenanthrene	106SB00101	110.00	ND	310000	NA	NA
	106SB00201	88.00	1600.00			
	106SB00302	ND	6300.00			
Pyrene	106SB00101	680.00	770.00	230000	NA	NA
	106SB00201	210.00	1700.00			
	106SB00301	130.00	4700.00			
bis(2-Ethylhexyl)phthalate (BEHP)	106SB00102	ND	140.00	4600	NA	NA
<i>Chlorinated Pesticides (ug/kg)</i>						
Heptachlor epoxide	106SB00302	ND	6.25	70	NA	NA
alpha-BHC	106SB00302	ND	8.39	350	NA	NA
delta-BHC	106SB00302	ND	29.00	350	NA	NA
gamma-BHC (Lindane)	106SB00302	ND	5.74	350	NA	NA
gamma-Chlordane	106SB00302	ND	8.36	490	NA	NA

Chemicals Detected in Zone E Soil Samples
SWMU 106

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Inorganic Compounds (mg/kg)</i>						
Cyanide (CN)	106SB00302	ND	0.82	73	1	NA
Aluminum (Al)	106SB00101	9370.00	12400.00	7800	26000	41100
	106SB00201	7210.00	33700.00			
	106SB00301	5650.00	34700.00			
Antimony (Sb)	106SB00101	0.64	ND	3	2	1.6
	106SB00201	0.51	1.20			
	106SB00301	0.52	1.50			
Arsenic (As)	106SB00101	26.80	27.50	0	24	19.9
	106SB00201	5.60	24.10			
	106SB00301	4.70	47.20			
Barium (Ba)	106SB00101	28.50	25.50	550	130	94.1
	106SB00201	411.00	40.90			
	106SB00301	17.00	43.20			
Beryllium (Be)	106SB00101	0.93	1.10	0	2	2.71
	106SB00201	0.26	1.40			
	106SB00301	0.22	1.50			
Cadmium (Cd)	106SB00201	1.90	ND	4	2	0.96
Calcium (Ca)	106SB00101	7070.00	17000.00	NA	NA	NA
	106SB00201	11400.00	11400.00			
	106SB00301	20800.00	12500.00			
Chromium (Cr)	106SB00101	23.00	28.70	39	95	75.2
	106SB00201	11.00	50.80			
	106SB00301	8.60	53.10			
Cobalt (Co)	106SB00101	6.50	6.40	470	19	14.9
	106SB00201	1.20	8.40			
	106SB00301	1.10	8.90			
Copper (Cu)	106SB00101	28.40	24.70	310	66	152
	106SB00201	21.10	31.00			
	106SB00301	6.50	31.60			
Iron (Fe)	106SB00101	19500.00	27200.00	2300	NA	NA
	106SB00201	7690.00	37900.00			
	106SB00301	7020.00	44200.00			
Lead (Pb)	106SB00101	42.90	51.10	400	265	173
	106SB00201	84.30	52.00			
	106SB00301	10.40	55.70			
Magnesium (Mg)	106SB00101	3320.00	4940.00	NA	NA	NA
	106SB00201	1300.00	6040.00			
	106SB00301	857.00	6270.00			
Manganese (Mn)	106SB00101	200.00	579.00	180	302	881
	106SB00201	85.20	843.00			
	106SB00301	51.70	1040.00			
Mercury (Hg)	106SB00101	0.35	0.32	2	3	1.59
	106SB00202	ND	0.06			
	106SB00302	ND	0.05			
Nickel (Ni)	106SB00101	8.90	10.00	160	77	57
	106SB00201	6.30	17.40			
	106SB00301	4.00	18.10			
Potassium (K)	106SB00101	1760.00	2140.00	NA	NA	NA

**Chemicals Detected in Zone E Soil Samples
SWMU 106**

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	106SB00201	1000.00	4660.00			
	106SB00301	861.00	4510.00			
Selenium (Se)	106SB00202	ND	0.97	39	2	2.4
Sodium (Na)	106SB00101	2340.00	4880.00	NA	NA	NA
	106SB00201	1950.00	5360.00			
	106SB00301	1350.00	6070.00			
Tin (Sn)	106SB00201	6.10	5.50	4700	59	9.23
	106SB00301	2.40	6.60			
Vanadium (V)	106SB00101	44.50	58.90	55	94	155
	106SB00201	15.50	81.20			
	106SB00301	13.00	88.50			
Zinc (Zn)	106SB00101	111.00	100.00	2300	827	886
	106SB00201	478.00	121.00			
	106SB00301	25.90	124.00			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

* Surface soil samples will be used for human health risk assessment for the Zone E report.

Chemicals Detected in Zone E Soil Samples
AOC 603

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
<i>Volatile Organic Compounds (ug/kg)</i>						
Acetone	603SB004	ND	44.0000	780000.00	NA	NA
<i>Semi-volatile Compounds (ug/kg)</i>						
Benzo(a)anthracene	603SB002	ND	120.0000	880.00	NA	NA
	603SB003	170.0000	ND			
	603SB004	ND	240.0000			
Benzo(a)pyrene	603SB001	88.0000	ND	88.00	NA	NA
	603SB002	ND	140.0000			
	603SB003	170.0000	ND			
Benzo(b)fluoranthene	603SB004	ND	200.0000			
	603SB002	82.0000	ND	880.00	NA	NA
	603SB004	ND	190.0000			
Benzo(g,h,i)perylene	603SB001	120.0000	ND	310000.00	NA	NA
	603SB002	ND	100.0000			
	603SB003	160.0000	ND			
Benzo(k)fluoranthene	603SB004	ND	160.0000			
	603SB001	110.0000	ND	8800.00	NA	NA
	603SB002	ND	190.0000			
Benzoic acid	603SB003	240.0000	ND			
	603SB001	120.0000	ND	31000000.00	NA	NA
	603SB002	180.0000	140.0000			
Chrysene	603SB001	80.0000	ND	88000.00	NA	NA
	603SB002	150.0000	180.0000			
	603SB003	180.0000	ND			
Dibenz(a,h)anthracene	603SB004	ND	310.0000			
	603SB001	100.0000	ND	88000.00	NA	NA
	603SB002	120.0000	110.0000			
Fluoranthene	603SB002	ND	110.0000	3100000.00	NA	NA
	603SB003	240.0000	ND			
	603SB004	ND	800.0000			
Indeno(1,2,3-cd)pyrene	603SB001	110.0000	ND	880.00	NA	NA
	603SB002	ND	140.0000			
	603SB003	99.0000	ND			
Phenanthrene	603SB004	ND	150.0000			
	603SB003	130.0000	ND	310000.00	NA	NA
	603SB004	ND	300.0000			
Pyrene	603SB002	120.0000	160.0000	230000.00	NA	NA
	603SB003	230.0000	ND			
	603SB004	ND	840.0000			
<i>Chlorinated Pesticides (ug/kg)</i>						
4,4'-DDT	603SB003	8.2300	ND	1900.00	NA	NA
Endrin aldehyde	603SB003	3.5500	ND	2300.00	NA	NA
alpha-Chlordane	603SB003	3.0100	ND	490.00	NA	NA
<i>Inorganic Compounds (mg/kg)</i>						
Aluminum (Al)	603SB001	1030.0000	6810.0000	7800.00	26000	41100

Chemicals Detected in Zone E Soil Samples
AOC 603

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
	603SB002	2580.0000	8000.0000			
	603SB003	6780.0000	8590.0000			
	603SB004	7840.0000	14400.0000			
Antimony (Sb)	603SB001	3.3000	ND	3.10	1.77	1.6
	603SB003	1.2000	2.0000			
	603SB004	0.6100	0.9000			
Arsenic (As)	603SB001	1.2000	4.6000	0.43	23.9	19.9
	603SB002	0.6100	9.5000			
	603SB003	6.7000	20.1000			
	603SB004	5.5000	15.8000			
Barium (Ba)	603SB001	3.8000	46.5000	550.00	130	94.1
	603SB002	8.4000	36.1000			
	603SB003	14.4000	14.4000			
	603SB004	11.0000	55.5000			
Beryllium (Be)	603SB001	ND	0.7300	0.15	1.7	2.71
	603SB002	ND	0.6500			
	603SB003	0.1600	0.3600			
	603SB004	0.1500	0.6800			
Cadmium (Cd)	603SB001	0.1600	0.3000	3.90	1.5	0.96
	603SB002	ND	0.2000			
	603SB004	ND	0.8600			
Calcium (Ca)	603SB001	22600.0000	20300.0000	NA	NA	NA
	603SB002	269.0000	15800.0000			
	603SB003	13100.0000	853.0000			
	603SB004	11300.0000	27900.0000			
Chromium (Cr)	603SB001	5.9000	28.0000	39.00	94.6	75.2
	603SB002	3.3000	19.9000			
	603SB003	12.6000	21.3000			
	603SB004	9.8000	42.9000			
Cobalt (Co)	603SB001	0.2900	2.6000	470.00	19	14.9
	603SB002	30.6000	2.6000			
	603SB003	1.5000	1.8000			
	603SB004	0.9300	2.7000			
Copper (Cu)	603SB001	13.5000	5.2000	310.00	66	152
	603SB002	2.5000	8.0000			
	603SB003	24.1000	9.5000			
	603SB004	6.7000	15.0000			
Iron (Fe)	603SB001	1360.0000	8910.0000	2300.00	NA	NA
	603SB002	1580.0000	11200.0000			
	603SB003	9520.0000	27400.0000			
	603SB004	9660.0000	18700.0000			
Lead (Pb)	603SB001	21.7000	6.1000	400.00	265	173
	603SB002	3.4000	38.6000			
	603SB003	34.1000	14.2000			
	603SB004	7.1000	272.0000			
Magnesium (Mg)	603SB001	280.0000	1940.0000	NA	NA	NA
	603SB002	58.2000	1930.0000			
	603SB003	527.0000	454.0000			
	603SB004	432.0000	3250.0000			

Chemicals Detected in Zone E Soil Samples
AOC 603

Name	ID	Surface Conc.	Subsurface Conc.	RBC (THQ=.1)	Surface UTL	Subsurface UTL *
Manganese (Mn)	603SB001	19.8000	76.9000	180.00	302	881
	603SB002	5.4000	115.0000			
	603SB003	95.8000	47.0000			
	603SB004	17.9000	97.9000			
Mercury (Hg)	603SB001	0.0300	ND	2.30	2.6	1.59
Nickel (Ni)	603SB001	2.6000	9.6000	160.00	77.1	57
	603SB002	13.2000	8.1000			
	603SB003	4.6000	4.8000			
	603SB004	2.7000	14.2000			
Potassium (K)	603SB001		1530.0000	NA	NA	NA
	603SB002		1570.0000			
	603SB003	651.0000	601.0000			
	603SB004	724.0000	1480.0000			
Selenium (Se)	603SB001	ND	0.9900	39.00	1.7	2.4
	603SB002	ND	0.8300			
	603SB003	ND	0.7200			
	603SB004	ND	1.2000			
Silver (Ag)	603SB002	0.2800	ND	39.00	NA	NA
Sodium (Na)	603SB001	216.0000	876.0000	NA	NA	NA
	603SB002	190.0000	579.0000			
	603SB003	105.0000	85.2000			
	603SB004	431.0000	1320.0000			
Thallium (Tl)	603SB003	ND	0.8000	0.29	2.8	NA
Tin (Sn)	603SB001	2.7000	ND	4700.00	59.4	9.23
	603SB002	ND	2.7000			
	603SB003	2.9000	3.0000			
	603SB004	2.7000	3.5000			
Vanadium (V)	603SB001	2.2000	20.3000	55.00	94.3	155
	603SB002	4.2000	22.9000			
	603SB003	15.5000	29.3000			
	603SB004	16.1000	40.5000			
Zinc (Zn)	603SB001	39.2000	33.1000	2300.00	827	886
	603SB002	2.6000	39.5000			
	603SB003	51.7000	60.5000			
	603SB004	13.4000	507.0000			

Notes:

ND: Not Detected

NS: No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.

* Surface soil samples will be used for human health risk assessment for the Zone E report.

Chemicals Detected in Zone E Groundwater Samples
SWMU 106

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL
<i>Volatile Organic Compounds (ug/l)</i>							
Acetone	106GW01D	13.00	NS	NS	NS	370	NA
<i>Semi-volatile Compounds (ug/l)</i>							
4-Methylphenol (p-Cresol)	106GW001	1.00	ND	NS	NS	18	NA
Benzoic acid	106GW01D	ND	2.00	NS	NS	15000	NA
bis(2-Ethylhexyl)phthalate (BEHP)	106GW001	ND	1.00	NS	NS	4.8	NA
	106GW01D	ND	1.00	NS	NS		
<i>Other Compounds (mg/l)</i>							
Chloride	106GW001	11300.00	10000.00	11300.00	9710.00	NA	NA
	106GW01D	16400.00	16000.00	15200.00	15900.00		
Sulfate	106GW001	750.00	506.00	513.00	552.00	NA	NA
	106GW01D	2010.00	1740.00	1780.00	1810.00		
Total Dissolved Solids (TDS)	106GW001	21200.00	19900.00	20100.00	19500.00	NA	NA
	106GW01D	29900.00	30300.00	29500.00	29200.00		
<i>Inorganic Compounds (ug/l)</i>							
Arsenic (As)	106GW001	36.30	35.80	35.30	33.60	0.05	18.7
	106GW01D	ND	3.60	ND	ND		16.4
Barium (Ba)	106GW001	ND	72.20	71.60	68.10	260	211
	106GW01D	77.30	63.60	64.60	61.70		218
Beryllium (Be)	106GW001	ND	0.77	0.95	ND	0.02	0.43
	106GW01D	1.30	0.96	ND	ND		1.2
Cadmium (Cd)	106GW01D	ND	0.54	ND	ND	1.8	NA
Calcium (Ca)	106GW001	179000.00	149000.00	142000.00	136000.00	NA	NA
	106GW01D	429000.00	432000.00	396000.00	401000.00		NA
Chromium (Cr)	106GW001	ND	1.30	ND	2.20	3700	12.3
	106GW01D	ND	2.60	ND	ND		15.5
Cobalt (Co)	106GW001	4.10	5.80	ND	3.20	220	2.5
Copper (Cu)	106GW01D	3.90	ND	ND	ND	150	2.7
Iron (Fe)	106GW001	20400.00	19200.00	19100.00	16700.00	1100	NA
	106GW01D	1430.00	331.00	783.00	269.00		NA
Magnesium (Mg)	106GW001	483000.00	451000.00	451000.00	408000.00	NA	NA
	106GW01D	1070000.00	958000.00	1110000.00	1190000.00		NA
Manganese (Mn)	106GW001	204.00	207.00	202.00	186.00	84	2560
	106GW01D	949.00	420.00	861.00	567.00		869
Nickel (Ni)	106GW001	11.90	10.90	ND	9.70	73	15.2
	106GW01D	8.60	9.00	6.10	6.00		42.2
Potassium (K)	106GW001	269000.00	176000.00	231000.00	245000.00	NA	NA
	106GW01D	298000.00	205000.00	193000.00	274000.00		NA
Sodium (Na)	106GW001	7940000.00	6700000.00	5370000.00	5960000.00	NA	NA
	106GW01D	8270000.00	9040000.00	8190000.00	8170000.00		
Thallium (Tl)	106GW001	ND	3.70	ND	ND	0.29	5.4
	106GW01D	ND	5.00	ND	ND		6.5
Tin (Sn)	106GW01D	ND	4.10	ND	ND	NA	NA
Vanadium (V)	106GW001	ND	ND	ND	0.58	26	11.4

**Chemicals Detected in Zone E Groundwater Samples
SWMU 106**

Name	Location	Round 1 Conc.	Round 2 Conc.	Round 3 Conc.	Round 4 Conc.	RBC (THQ=.1)	UTL	MC
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Notes:

ND: Not Detected

NS No Sample Taken/Sample Not Analyzed

NA: Not applicable

For compounds detected in both the primary and duplicate sample, the concentration for both detections are averaged and listed as one detection.

For compounds that were detected in only one of the primary or duplicate sample, the value of the detection was used.