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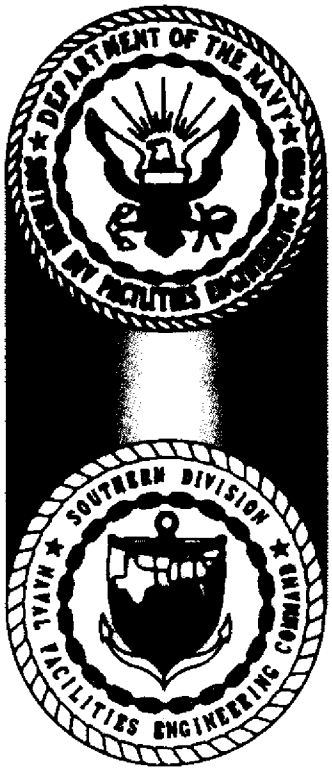
RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT ADDENDUM CORRECTIVE MEASURES STUDY WORK PLAN AREA OF CONCERN 597 (AOC 597) ZONE E CNC CHARLESTON SC

7/30/2002

CH2M HILL

RFI REPORT ADDENDUM

RFI Report Addendum and CMS Work Plan
AOC 597 Zone E



Charleston Naval Complex
North Charleston, South Carolina

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

CH2M Jones

July 2002

Contract N62467-99-C-0960

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CH2MHILL

July 30, 2002

Mr. David Scaturo
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: RFI Report Addendum and CMS Work Plan (Revision 0) – AOC 597, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum and CMS Work Plan (Revision 0) for AOC 597 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 Jason Kase. Please contact him at 850/939-8300, 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

RFI Report Addendum and CMS Work Plan
AOC 597, Zone E

Charleston Naval Complex
North Charleston, South Carolina

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

PREPARED BY
CH2M-Jones

July 2002

Revision 0
Contract N62467-99-C-0960
158814.ZE.PR.01

Certification Page for RFI Report Addendum (Revision 0) – AOC 597, 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

P.E. No. 21428

Dean Williamson, P.E.

7/14/2002

Date

Contents

Contents, Continued

Acronyms and Abbreviation

AOC	Area of concern
AST	Aboveground storage tank
BCT	BRAC Cleanup Team
BEQ	Benzo(a)pyrene equivalent
BRAC	Base Realignment and Closure Act
BRC	Background reference concentration
CA	Corrective action
cm^2	Square centimeters
CMS	Corrective measures study
CNC	Charleston Naval Complex
COC	Chemical of concern
COPC	Chemical of potential concern
CSI	Corrective Study Investigation
DAF	Dilution attenuation factor
DET	Environmental Detachment Charleston
EnSafe	EnSafe Inc.
EPC	Exposure point concentration
FRE	Fixed-point risk evaluation
EPA	U.S. Environmental Protection Agency
HHRA	Human Health Risk Assessment
HI	Hazard index
ILCR	Incremental lifetime cancer risk
IM	Interim measure
LUC	Land use control
MCL	Maximum contaminant level
MCS	Media cleanup standard
µg	Micrograms
mg/kg	Milligrams per kilogram

Acronyms and Abbreviations, Continued

NAVBASE	Naval Base
OP	Organo-phosphate
OWS	Oil/water separator
PCB	Polychlorinated biphenyl
RAO	Remedial action objective
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RGO	Remedial goal option
RI	Remedial investigation
SCDHEC	South Carolina Department of Health and Environmental Control
SSL	Soil screening level
SWMU	Solid waste management unit
VOC	Volatile organic compound
UCL_{95}	95-percent Upper Confidence Limit
UST	Underground storage tank

Section 1.0

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 RCRA Part B 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) for Area of Concern (AOC) 597 in Zone E of the CNC. The location of AOC 597 in Zone E is shown in Figure 1-1. Figure 1-2 shows a 1997 aerial photograph of AOC 597.

AOC 597 consists of an electrical substation in Building 91. Building 91 is located at the east end of Tenth Street in Zone E of the CNC. Building 91 has served as an electrical substation since it was built in 1942 and currently contains two transformers, several high voltage switches, and breakers which are currently not in service.

Minor leaks were reported in one of the transformers in 1981 and 1982. A moderate leak was reported in the same transformer during a polychlorinated biphenyl (PCB) audit conducted in 1985 and oil stains were observed on the concrete floor of the building near the transformer. This transformer was removed and replaced in 1989. Two additional transformers are located in weatherproof metal enclosures adjacent to the southwest side of the building.

Building 91 is surrounded by asphalt and concrete pavement with the exception of two small grass-covered strips along the northwest and southeast sides of the building. Railroad lines are located near the southwest and southeast sides of the building. Building 91 is currently being used as an electrical substation by the South Carolina Electric & Gas

Company. A battery bank that provides emergency power for Building 91 is located in the building.

Materials of concern identified based on historical operations for AOC 597 in the *Zone E RFI Work Plan, Revision 1* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995) include dielectric fluid and lead-acid batteries. This area of Zone E is zoned M-2 (industrial). The CNC RCRA Permit identified AOC 597 as requiring a Corrective Study Investigation (CSI). Although the site is zoned for industrial land use, a focused Corrective Measures Study (CMS) Work Plan is also provided in this submittal, in order to address potential remedies for chemicals of concern (COCs) detected in site surface soils, should the planned future land use scenario be revised.

The RFI was initially conducted by the Navy/EnSafe team, and the *Zone E RFI Report, Revision 0* (EnSafe, 1997) was prepared and submitted during 1997. Regulatory review was conducted on this document and responses to the comments from SCDHEC were prepared by the Navy/EnSafe team.

1.1 Purpose of the RFI Report Addendum

The purpose of this RFI Report Addendum is to document the results of the previous RFI investigation conducted by the Navy/EnSafe team at AOC 597. This RFI Report Addendum also discusses the findings of previous investigations, existing site conditions, and the surrounding area land use.

Prior to changing the status of any site 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 of 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 (LUCs) at the site

Information regarding these issues is also provided in this RFI Report Addendum to expedite evaluation of closure of the site.

1.2 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 597 – Summarizes the conclusions from the original RFI and risk evaluation for AOC 597 as presented in the *Zone E RFI Report, Revision 0.*

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

4.0 Summary of Additional Investigations – Summarizes information, if any, collected after completion of the *Zone E RFI Report, Revision 0.*

5.0 COPC/COC Refinement – Provides further evaluation of chemicals of potential concern (COPCs) based on the RFI and additional data used to assess them as COCs.

6.0 Summary of Information Related to Site Closeout Issues – Discusses the various site closeout issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site closeout.

7.0 Recommendations – Provides recommendations for a CMS at AOC 597, in order to proceed with site closure.

8.0 CMS Workplan – Provides a focused workplan for a CMS recommended for AOC 597.

9.0 References – Lists the references used in this document.

Appendix A – Contains excerpts from the *Zone E RFI Report, Revision 0,* including a summary of detections of chemicals at the site.

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

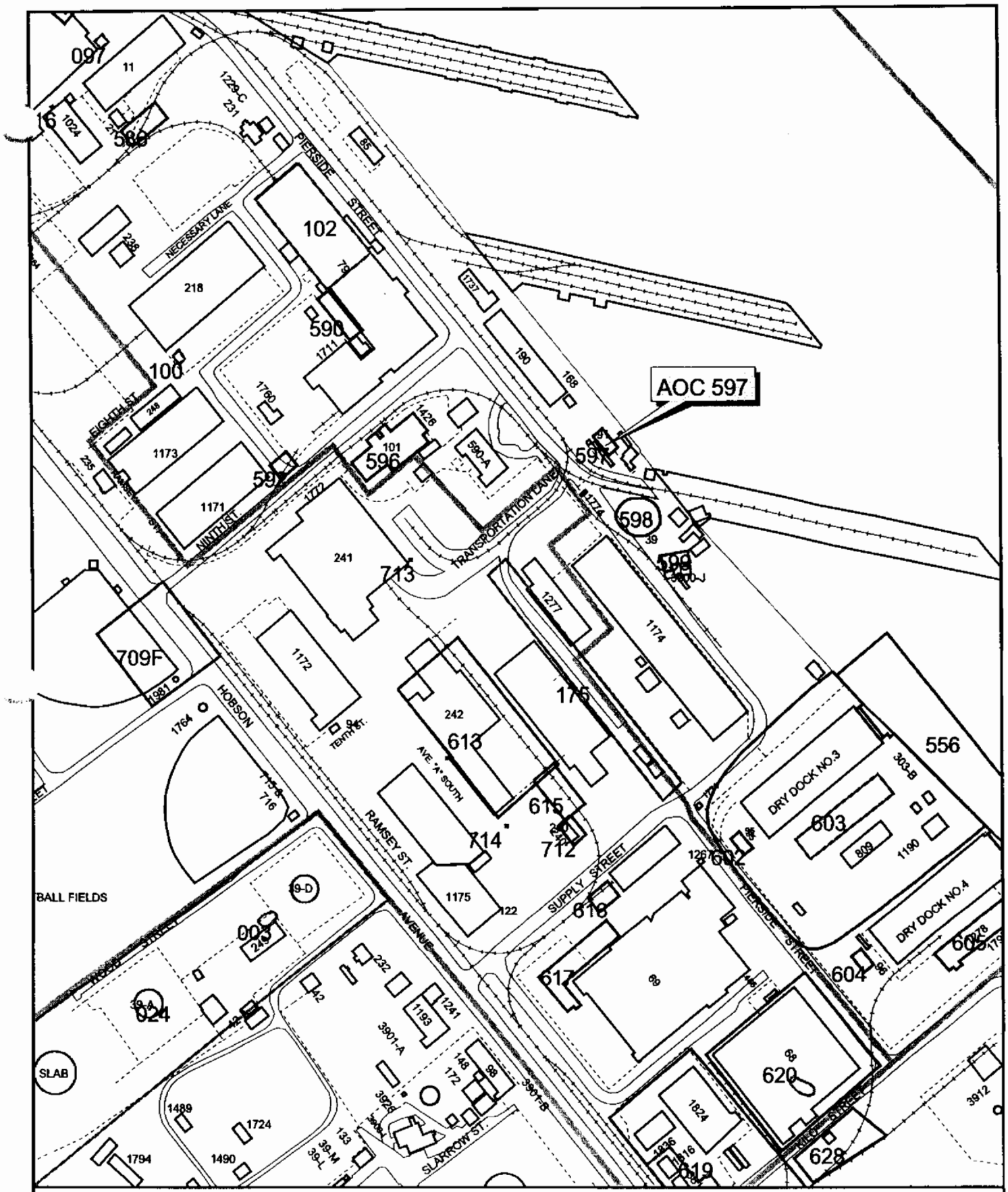

Figure 1-1
Location of AOC 597 in Zone E
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\non_priority\non_pri_figs.apr, Date: 25 Jun 2002 11:59, User: NMOUDRY, Figure 1-1 Location of AOC 597 in Zone E

NOTE: Aerial Photo Date is 1997

Fence
Railroads
Roads
Shoreline
AOC/SWMU Boundary
Buildings
Zone Boundary

N

0 40 80 Feet

1 inch = 50 feet

Figure 1-2
Site Map
AOC 597
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\non_priority\non_pro_fig2.apr, Date: 25 Jun 2002 12:19, User: NMOUDRY, AOC 597

Section 2.0

2.0 Summary of RFI Conclusions for AOC 597

This section summarizes the results and conclusions from the RFI conducted at AOC 597 which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). No groundwater investigation was conducted at AOC 597. Figures 2-1 through 2-3 show the soil, concrete, and wipe sampling locations.

As part of the Zone E RFI, a soil and concrete investigation was conducted at AOC 597 during 1995-1997. The RFI report presented the results of this investigation and conclusions concerning contamination and risk, as summarized in the following sections. A further refinement of the COCs identified for AOC 597 is provided in Section 5.0.

2.1 Soil Sampling and Analysis

Soil was sampled during one sampling event at AOC 597. Surface and subsurface soil samples were collected from four soil boring locations on the southwest side of Building 91. Figure 2-1 shows the soil boring locations. A summary of detections from the *Zone E RFI Report, Revision 0* is presented in Appendix A. The soil boring locations were identified as E597SB001 through E597SB004. The soil samples were analyzed for PCBs, metals, and pH. One surface soil sample was collected as a field duplicate and analyzed for an extended list of analytes, including herbicides, organo-phosphate (OP) pesticides, hexavalent chromium, and dioxins.

2.1.1 Surface Soil

During the RFI, surface soil detections of organic chemicals were evaluated against the U.S. Environmental Protection Agency (EPA) Region III industrial risk-based concentrations (RBCs) (with a hazard index [HI]=0.1 for noncarcinogens). Surface soil detections of inorganic compounds were evaluated against the EPA Region III industrial RBCs (HI=0.1 for noncarcinogens) and the Zone E background reference concentrations (BRCs).

Detected concentrations of organic and inorganic chemicals for surface soil samples were as follows:

- **PCBs:**
  Aroclor-1248: Aroclor-1248 was detected in two samples (E597SB001 and E597SB002) at concentrations of 0.28 and 1.6 milligrams per kilogram (mg/kg), respectively. Both

samples exceeded the residential RBC in use at the time of 0.08 mg/kg. Only one sample exceeded the industrial RBC that was in use at the time of 0.74 mg/kg.

Aroclor-1254: The field duplicate collected at E597SB002 had an Aroclor-1254 concentration of 1.6 mg/kg, which exceeded the residential and industrial RBCs that were in use at the time of 0.08 and 0.74 mg/kg.

Aroclor-1260: Three samples had detected concentrations of Aroclor-1260 that ranged from 0.19 to 0.34 mg/kg. All three samples exceeded the residential RBC that was in use at the time of 0.08 mg/kg but were below the industrial RBC in use at the time of 0.74 mg/kg.

- **Inorganics:**
  Antimony: The surface soil samples collected at soil boring locations E597SB001, E597SB002, and E597SB004 had antimony concentrations of 2.3 mg/kg, 2.2 mg/kg, and 4.3 mg/kg, respectively. One sample exceeded the EPA Region III residential RBC of 3.1 mg/kg (HI=0.1) but none exceeded the industrial RBC of 82 mg/kg (HI=0.1).

  Arsenic: The surface soil samples collected at soil boring locations E597SB001 and E597SB002 had arsenic concentrations of 26.2 mg/kg and 49.3 mg/kg, respectively, that exceeded the EPA Region III industrial RBC of 3.8 mg/kg and the Zone E BRC of 23.9 mg/kg.

- **Hexavalent chromium:** Hexavalent chromium was not detected above laboratory detection limits.
- **Herbicides:** Herbicides were not detected above laboratory detection limits.
- **Pesticides:** OP pesticides were not detected above laboratory detection limits.

2.1.2 Subsurface Soil

During the RFI, a two-tier screening evaluation was performed. In Tier I, subsurface soil detections of organic compounds were compared with generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10). Subsurface soil detections of inorganic compounds were compared with generic SSLs (using a DAF=10) and the Zone E BRCs. Chemicals exceeding the Tier I criteria were carried forward to the Tier II evaluation. In Tier II, chemicals were compared to a calculated SSL based on adjusted RBCs and a DAF=1 to identify COPCs for surface water quality. Any chemical exceeding the adjusted SSL was considered a COPC based on leaching potential.

Based on the screening process in the *Zone E RFI Report, Revision 0*, no chemicals were identified as COPCs in subsurface soil based on leachability concerns.

2.2 Wipe Sampling

The RFI Work Plan for AOC 597 (EnSafe/Allen & Hoshall, 1995) proposed collecting three wipe samples based on the location of PCB-containing equipment and visual evidence of spills and leaks. Three wipe samples were collected from the concrete floor at the locations shown in Figure 2-2. Concrete wipe samples were analyzed for PCBs.

Detected concentrations of PCBs from concrete wipe samples are as follows:

- **PCBs:**
  PCBs were detected in two out of three wipe samples with a concentration range of 2.7 micrograms per 100 square centimeters) µg/100 cm^2 to 2.8 µg/100 cm^2. EPA Region III RBCs have not been established for wipe samples.

2.3 Concrete Core Sampling

The RFI Work Plan for AOC 597 proposed collecting one concrete core sample on the northeast side of Building 91. One concrete core sample was collected from the pavement at the location shown in Figure 2-3. The concrete core sample was analyzed for PCBs, metals, and pH. A duplicate concrete core sample was not collected.

Detected concentrations of organic and inorganic compounds from the concrete core sample are as follows:

- **PCBs:**
  PCBs were not detected in the concrete core sample above laboratory detection limits.
- **Inorganics:**
  Metals were not detected in the concrete core sample above the screening criteria. The RFI reported that RBCs have not been established for concrete.

2.4 Groundwater Sampling

A groundwater investigation was not conducted for AOC 597. A groundwater contour map is provided as Figure 2-4. The Cooper River is approximately 30 feet to the northeast of AOC 597 and groundwater flow is predominately in that direction.

2.5 RFI Human Health Risk Assessment (HHRA)

The *Zone E RFI Report Revision 0* used a fixed-point risk evaluation (FRE) approach at AOC 597. The FRE considered a site resident and site worker scenarios. The detailed risk assessment for the AOC 597 site is presented in Sections 10.46.8 of the *Zone E RFI Report, Revision 0.*

2.5.1 Soil

The HHRA for AOC 597 identified Aroclor-1248, Aroclor-1254, Aroclor-1260, antimony, and arsenic as COCs for surface soil under the residential land use screnario. For a site worker, Aroclor-1248, Aroclor-1254, and arsenic contributed to industrial risk estimates.

2.6 RFI Conclusions and Recommendations

The *Zone E RFI Report, Revision 0* concluded that based on the analytical results and the FRE, a CMS should be conducted for surface soil COCs Aroclor-1248, Aroclor-1254, Aroclor-1260, antimony, and arsenic at AOC 597.

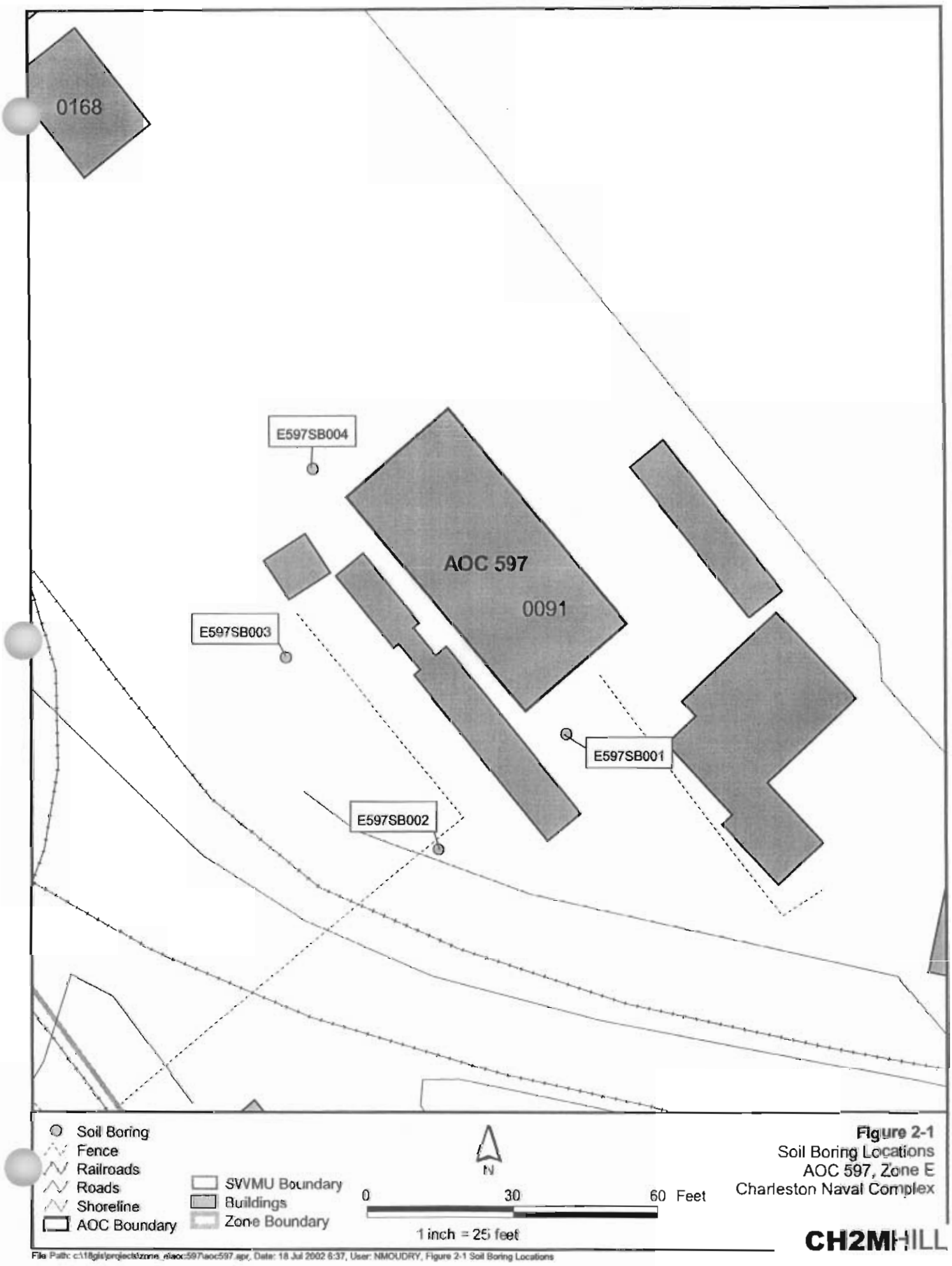

Figure 2-1
Soil Boring Locations
AOC 597, Zone E
Charleston Naval Complex

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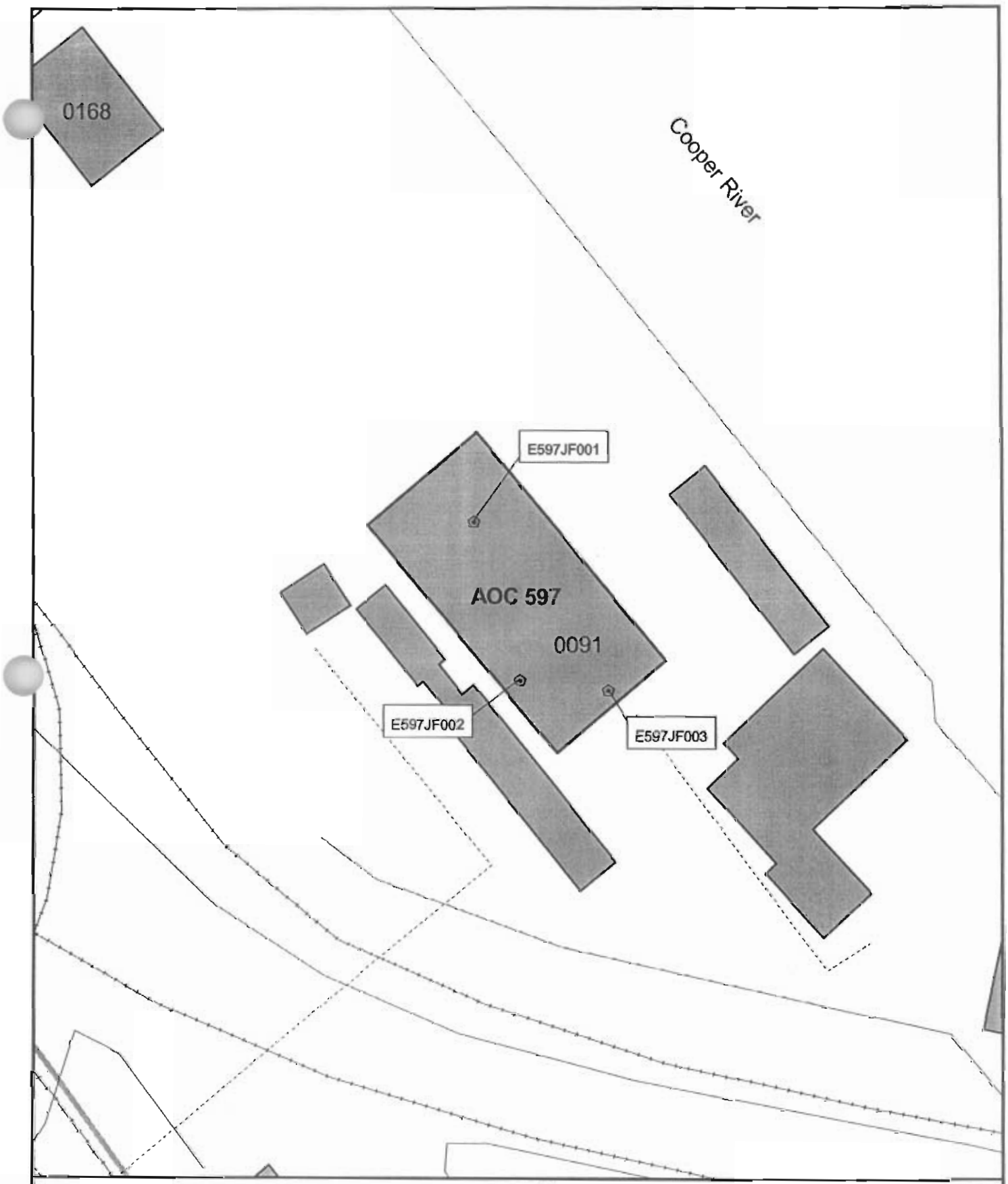

Figure 2-2
Wipe Sample Location
AOC 597, Zone E
Charleston Naval Complex

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File Path: c:\18gis\projects\zone_e\aoc597\aoc597.apr, Date: 18 Jul 2002 6:33, User: HMOUDRY, Figure 2-2 Wipe Sample Location

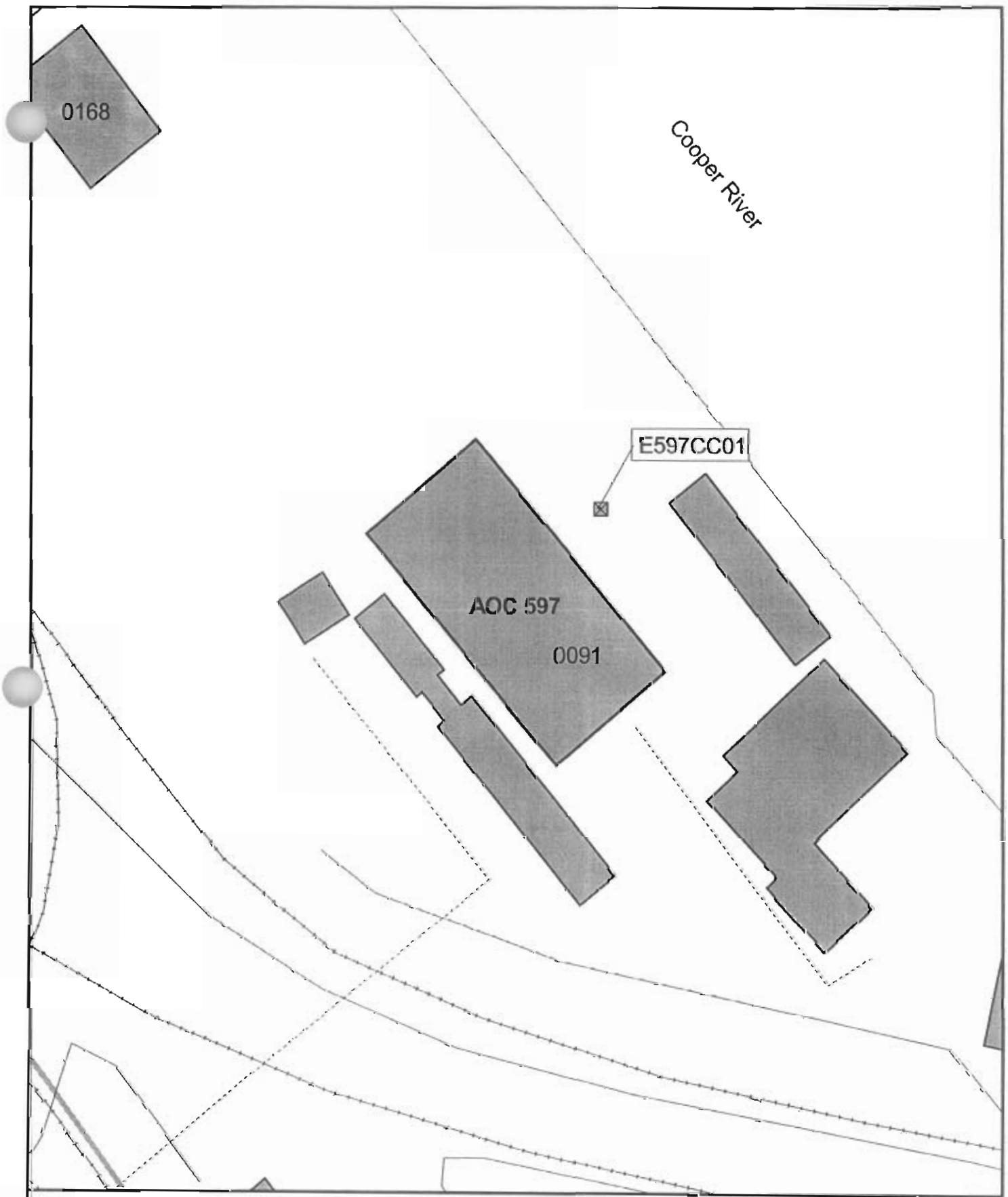

Figure 2-3
Concrete Sample Location
AOC 597, Zone E
Charleston Naval Complex

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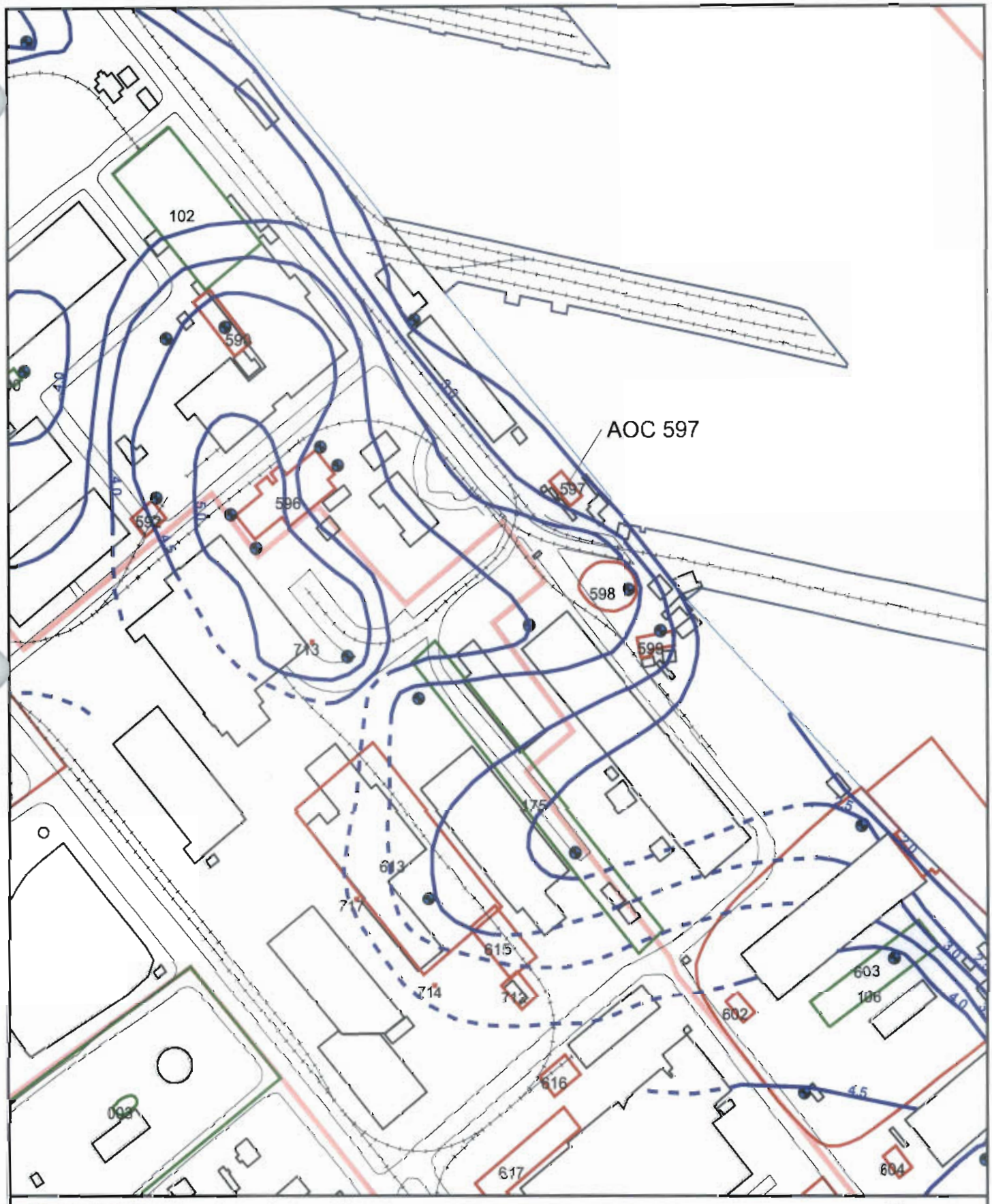

Figure 2-4
Shallow Groundwater Contours
AOC 597, Zone E
Charleston Naval Complex

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Section 3.0

3.0 Interim Measures and UST/AST Removals

3.1 UST/AST Removals

There is no indication of an underground storage tank (UST) or above ground storage tank (AST) being present at AOC 597.

3.2 Interim Measures

There were no interim measures (IMs) conducted at AOC 597.

Section 4.0

4.0 Summary of Additional Investigations

No additional investigations have been conducted at AOC 597 since the RFI was completed by the Navy/EnSafe team during 1995-1997.

Section 5.0

5.0 COPC/COC Refinement

The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified Aroclor-1248, Aroclor-1254, Aroclor-1260, antimony, and arsenic as COCs for surface soil at AOC 597 based on the fixed-point risk evaluation (FRE). Each of these chemicals is re-evaluated in this section to determine whether it is a COC.

In addition, the BCT has agreed to res-creen detections of volatile organic compounds (VOCs) in soil using an SSL based on a DAF=1. However, because VOCs were not a target analyte, VOC data were not collected and, therefore, no re-screening was needed.

5.1 Surface Soil

5.1.1 PCBs

The residential and industrial soil RBCs for Aroclor-1254, Aroclor-1260, and Aroclor–1248 have been modified sincethe *Zone E RFI Report, Revision 0* was originally written. The residential and industrial RBCs in the October 2000 EPA Region III RBC table for each of these PCBs are 0.32 and 2.9 mg/kg, respectively.

Aroclor-1248

Aroclor-1248 was detected at a concentration of 1.6 mg/kg in surface soil at sample location E597SB002. This detection exceeds the EPA Region III residential RBC of 0.32 mg/kg and the EPA remediation goal of 1.0 mg/kg for unrestricted land use. However, it is below the EPA Region III industrial RBC of 2.9 mg/kg and is not considered a COC for non-residential uses. This site is located in the industrial portion of Zone E and its preliminary zoning designation is M-2 (industrial); its anticipated future land use is expected to be non-residential.

Because of the lmited number of surface soil samples, the exposure point value, using a 95-percent Upper Confidence Limit (UCL_{95}) calculation approach, would default to the maximum detected value (1.6 mg/kg). This value exceeds the residential RBC; thus Aroclor-1248 is considered a surface soil COC for unrestricted (i.e., residential) land use.

Aroclor-1254

Aroclor-1254 was detected at a concentration of 1.6 mg/kg in the field duplicate sample collected at E597SB002. This PCB was not detected in the normal sample collected at the

same location. Aroclor-1254 was not detected at any other sampling location at this site. As with Aroclor-1248, because of the limtied number of samples, the default exposure concentration would be the maximum reported value, or 1.6. mg/kg, which exceeds the residential RBC of 0.32 mg/kg but does not exceed the industrial RBC of 2.9 mg/kg. Aroclor-1254 is considered a surface soil COC for unrestricted land use but not for industrial land use.

Aroclor-1260

Aroclor-1260 was detected at a maximum concentration of 0.34 mg/kg, which slightly exceeds the residential RBC of 0.32 mg/kg but is below the industrial RBC of 2.9 mg/kg. As with Aroclor-1248, because of the limtied number of samples, the default exposure concentration would be the maximum reported value, or 0.34 mg/kg, which exceeds the residential RBC of 0.32 mg/kg but does not exceed the industrial RBC of 2.9 mg/kg. Aroclor-1260 is considered a surface soil COC for unrestricted land use but not for industrial land use.

5.1.2 Inorganics

Antimony

The RFI report identified antimony as a surface soil COC based on its contribution to noncarcinogenic risk in the FRE. However, detected antimony concentrations of 2.2 to 4.3 mg/kg are below the maximum surface soil background (grid sample) antimony concentration in Zone E of 7.4 mg/kg. Thus, site conditions for antimony are related to CNC background conditions and not AOC 597 site-related activities. In addition, antimony's contribution to the HI for an unrestricted land use scenario in the The *Zone E RFI Report, Revision 0* FRE falls below an HI=0.1, which provides for minimal health hazard. As a result, antimony is not considered a surface soil COC for AOC 597.

Arsenic

The RFI report identified arsenic as a surface soil COC based on its contribution to risk in the FRE. Arsenic detections of 26.2 mg/kg and 49.3 mg/kg exceed the EPA Region III industrial RBC of 3.8 mg/kg, but are below the maximum surface soil background arsenic concentration in Zone E of 68 mg/kg. Arsenic concentrations at AOC 597 are not site-related but are part of the CNC background conditions. Therefore, arsenic is not considered a surface soil COC for AOC 597.

5.2 Subsurface Soil

No COCs were identified for subsurface soil at AOC 597.

5.3 Wipe Samples

No COCs were identified for wipe samples at AOC 597.

5.4 Concrete Core Samples

No COCs were identified for the concrete core sample at AOC 597.

5.5 COC Summary

The default exposure point concentrations (EPCs) of Aroclor-1248, Aroclor-1254, and Aroclor-1260 in surface soil exceed the EPA Region III residential RBC, and thus these chemicals are considered surface soil COCs for the unrestricted land scenario. There are no surface soil COCs identified for the industrial land use scenario at AOC 597. There are no COCs identified for subsurface soil. No COCs were identified in the wipe samples or concrete core samples at AOC 597.

As a result, a CMS is recommended for PCBs in surface soil for the unrestricted land use scenario.

Section 6.0

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 AOC 597.

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 CMS. The RFI report identified PCBs as COCs in surface soil for the unrestricted land use scenario at AOC 597. There were no COCs identified based on industrial use criteria or leachability concerns. This site is located in the industrial portion of Zone E and its preliminary zoning designation is M-2 (industrial). Groundwater sampling was not recommended by the *Zone E RFI Work Plan, Revision 1* (EnSafe/Allen & Hoshall, 1995), therefore, no groundwater investigation was conducted at this site.

The remaining subsections address the issues that the 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 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. There are no data suggesting that there was an impact to groundwater from site-related activities at AOC 597. Therefore, further evaluation of this issue is not warranted.

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

There are no data suggesting that there was an impact to the sanitary sewers from this site. 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 AOC 597 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 nearest railroad line to AOC 597 is approximately 50 feet southwest of the site. There are no known connections between AOC 597 and the investigated railroad lines in Zone E at the CNC.

6.6 Potential Migration Pathways to Surface Water Bodies at the CNC

The nearest surface water body to AOC 597 is the Cooper River, which lies approximately 50 feet east-northeast of the site. The only potential migration pathway from the site to surface water is by overland flow from stormwater 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 the PCB detections at AOC 597 are under concrete and asphalt pavement or inside Building 91, no further evaluation of a potential pathway for contaminant migration by stormwater runoff is warranted.

6.7 Potential Contamination in Oil/Water Separators (OWSs)

There are no OWSs associated with AOC 597. In addition, there is no reference to an OWS at the site in the *Oil Water Separator Data* report, Department of the Navy, September 2000. Therefore, further evaluation of this issue is not warranted.

6.8 Land Use Controls (LUCs)

PCBs were identified as surface soil COCs at AOC 597 for the unrestricted (i.e., residential) land use scenario, but none were identified for the non-residential use scenario. Therefore, LUCs should be considered to allow for non-residential uses only. The BCT has previously agreed that land us controls will be applied across all of Zone E at the CNC. These LUCs are expected to include, at a minimum, restrictions to allow only non-residential use in this area. Because AOC 597 is within Zone E, these LUCs will be applied at this site.

Section 7.0

7.0 Recommendations

AOC 597 consists of an electrical substation in Building 91. Building 91 is located at the east end of Tenth Street in Zone E of the CNC. Building 91 has served as an electrical substation since it was built in 1942 and currently contains two transformers, several high voltage switches, and breakers, which are currently not in service. Building 91 is currently being used as an electrical substation by the South Carolina Electric & Gas Company. A battery bank that provides emergency power for Building 91 is located in the building. The CNC RCRA Permit identified AOC 597 as requiring a CSI.

The *Zone E RFI Report, Revision 0* identified Aroclor-1248, Aroclor-1254, Aroclor-1260, antimony, and arsenic as COCs for surface soil at AOC 597. Based on an evaluation of the RFI data against screening criteria adopted by the CNC BCT, as well as the site conditions as discussed above, Aroclor-1248, Aroclor-1254, and Aroclor-1260 are still considered surface soil COCs for the unrestricted land use scenario. No COCs were identifed for non-residential future land use scenarios or for subsurface soil or other environmental media. Therefore, AOC 597 is suitable for projected future land use under the assumed future land use controls for the M-2 (industrial) preliminary zoning designation for Zone E.

AOC 597 is recommended for a CMS to evaluate potential corrective remedies for this site to meet unrestricted land use requirements.

Section 8.0

8.0 CMS Work Plan for AOC 597

PCBs at AOC 597 were identified as COCs in surface soils for the unrestricted (i.e, residential) land use scenario. Because the property is not being used for residential purposes, there is currently no unacceptable exposure or risk from these COCs. However, it is feasible that in the future, should site conditions change, some exposure could occur. Therefore, a CMS should be conducted to evaluate potential corrective measures and identify an appropriate remedy for the site.

This section presents a focused CMS work plan. Media cleanup standards (MCSs) are identified for COCs, and potential remedies that should be evaluated are also presented.

8.1 Remedial Action Objectives

Remedial action objectives (RAOs) are medium-specific goals that the remedial actions are designed to accomplish in order to protect human health and the environment, by preventing or reducing exposures under current and future land use conditions. The RAOs identified for surface soil at Combined AOC 597 are being chosen to prevent ingestion and direct/dermal contact with surface soil containing COCs at unacceptable levels.

8.2 Remedial Goal Options and Media Cleanup Standards

Throughout the process of remediating a hazardous waste site, a risk manager uses a progression of increasingly acceptable site-specific media levels in considering remedial alternatives. Under the RCRA program, remedial goal options (RGOs) and MCSs are developed at the end of the risk assessment in the RFI/Remedial Investigation (RI) programs, before completion of the CMS.

RGOs can be based on a variety of criteria, such as specific incremental lifetime cancer risk (ILCR) levels (e.g., 1E-04, 1E-05, or 1E-06), HI levels (e.g., 0.1, 1.0, 3.0), or site background concentrations. For a particular RGO, specific MCSs can be determined as target concentration values. Achieving these MCSs is accepted as demonstrating that RGOs and RAOs have been achieved. Achieving these goals should promote the protection of human health and the environment, while achieving compliance with applicable state and federal standards.

The exposure medium of concern for AOC 597 is surface soil impacted by PCBs. Because AOC 597 is located within a highly developed area of the CNC, ecological exposures were not considered applicable for evaluation.

For PCBs, the target MCS for surface soil should be the EPA action level of 1 mg/kg for unrestricted land use.

8.3 Potential Remedies to Evaluate

Because of the relatively small quantity of contaminated soil, and the presence of several subsurface utilities, vaults, and other unknown obstructions at the site, the list of practicable remedial alternatives for this site is limited. The two presumptive remedies that will be evaluated as part of the CMS include:

- Soil excavation and offsite disposal
- LUCs

8.4 Focused CMS Approach

The focused CMS will consist of the following tasks that will be performed in the order presented below:

1. The corrective measure alternatives described above will be screened using several criteria and decision factors.
2. A preferred corrective measure alternative will be selected.
3. The CMS and preferred corrective measure alternative will be documented in the CMS report.

8.5 Approach to Evaluating Corrective Measure Alternatives

According to the RCRA permit issued by SCDHEC (SCDHEC, 1998), the alternatives will be evaluated with the following five standards:

1. Protecting human health and the environment.
2. Attaining MCSs (RGOs).
3. Controlling the source of releases to minimize future releases that may pose a threat to human health and the environment.

4. Complying with applicable standards for the management of wastes generated by remedial activities.
5. Other factors include (a) long-term reliability and effectiveness; (b) reduction in toxicity, mobility, or volume of wastes; (c) short-term effectiveness; (d) implementability; and (e) cost.

Each of the five standards is defined in more detail below:

1. **Protecting human health and the environment.** The alternatives will be evaluated on the basis of their ability to protect human health and the environment. The ability of an alternative to achieve this standard may or may not be independent of its ability to achieve the other four standards. For example, an alternative may be protective of human health, but may not be able to attain the MCSs if the MCSs are not directly tied to protecting human health.
2. **Attaining MCSs (RGOs).** The alternatives will be evaluated on the basis of their ability to achieve the RGOs defined in this CMS Work Plan. Another aspect of this standard is the timeframe to achieve the RGOs. Estimates of the timeframe for the alternatives to achieve RGOs will be provided.
3. **Controlling the source of releases.** This standard deals with the control of releases of contamination from the source (the area in which the contamination originated).
4. **Complying with applicable standards for management of wastes.** This standard deals with the management of wastes derived from implementing the alternatives, for example, treatment or disposal of excavated material. The soil removal alternative will be designed to comply with all applicable standards for management of remediation wastes. Consequently, this standard will not be explicitly included in the detailed evaluation presented in the CMS but will be part of a work plan specific to the removal action should a removal action become the chosen alternative.
5. **Other factors.** Five other factors are to be considered if an alternative is found to meet the four standards described above. These other factors are as follows:

a. Long-term reliability and effectiveness

The two alternatives will be evaluated on the basis of their reliability, and the potential impact should the chosen alternative fail. In other words, a qualitative assessment will be made as to the chance of the alternative's failure and the consequences of that failure.

b. Reduction in the toxicity, mobility, or volume of wastes

Alternatives with technologies that reduce the toxicity, mobility, or volume of the contamination will be generally favored over those that do not. Consequently, a qualitative assessment of this factor will be performed for each alternative.

c. Short-term effectiveness

Alternatives will be evaluated on the basis of the risk they create during the implementation of the remedy. Factors that may be considered include fire, explosion, and exposure of workers to hazardous substances.

d. Implementability

The alternatives will be evaluated for their implementability by considering any difficulties associated with conducting the alternatives (such as the construction disturbances they may create), operation of the alternatives, and the availability of equipment and resources to implement the technologies comprising the alternatives.

e. Cost

A net present value of each alternative will be developed. These cost estimates will be used for the relative evaluation of the alternatives, not to bid or budget the work. The estimates will be based on information available at the time of the CMS and on a conceptual design of the alternative. They will be "order-of-magnitude" estimates with a generally expected accuracy of -50 percent to +50 percent for the scope of action described for each alternative. The estimates will be categorized into capital costs and operations and maintenance costs for each alternative.

In addition to the criteria described above, the alternatives will be evaluated for their ability to achieve all contractual obligations of CH2M-Jones and the Navy.

8.6 Focused CMS Report

A focused CMS report will be prepared to present the identification, development, and evaluation of potential corrective measures for AOC 597. A proposed outline of the report, as shown in Table 8-1, provides an example of the report format and content.

TABLE 8-1
Outline of Focused CMS Report for AOC 597
RFI Report Addendum & CMS Work Plan, AOC 597, Zone E, Charleston Naval Complex

Section No.	Section Title
1.0	**Introduction**
1.1	Corrective Measures Study Purpose and Scope
1.2	Report Organization
1.3	Background Information
1.3.1	Facility Description
1.3.2	Site History and Background
1.3.2.1	Nature and Extent of Contamination
1.3.2.2	Summary of Risk Assessment
2.0	**Remedial Goal Objectives**
3.0	**Detailed Analysis of Focused Alternatives**
3.1	Approach
3.2	Evaluation Criteria
3.3	Description of Alternatives
3.3.1	Alternative 1: Soil removal and Offsite Disposal
3.3.2	Alternative 2: Land Use Controls
3.4	Detailed Analysis of Alternatives
3.4.1	Analysis of Alternative 1
3.4.2	Analysis of Alternative 2
3.5	Comparative Analysis of Alternatives
4.0	**Recommended Remedial Alternative**
5.0	**References**
Appendix A	**Corrective Measure Alternative Cost Estimates**[b]
List of Tables	
List of Figures	

[a] Additional alternatives will be analyzed as found necessary.

[b] Additional appendices will be added, if necessary.

Section 9.0

9.0 References

EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston.* November 1997.

EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston.* July 1995.

EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston.* June 1995.

CH2M-Jones. *Technical Memorandum: A Summary of Inorganic Chemical Concentrations in Background Soil and Groundwater at the CNC.* 2001.

CH2M-Jones. *Technical Memorandum: Results from Additional Background Sampling of the CNC Railroad Lines and Naval Annex (Zone K). CNC.* August 2001.

South Carolina Department of Health and Environmental Control, Final RCRA Part B Permit No. SC0 170 022 560. 1998.

Appendix A

Table 10.46.2.1
AOC 597
Organic Compounds Detected in Soil

Compound	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Number of Samples Exceeding RBC
Dioxins (ng/kg)						
Dioxin Equiv.	Upper	1/1	5.46	5.46	1,000	0
1234678-HpCDD	Upper	1/1	93.3	93.3	NA	NA
1234678-HpCDF	Upper	1/1	38.5	38.5	NA	NA
123678-HxCDD	Upper	1/1	3.46	3.46	NA	NA
123678-HxCDF	Upper	1/1	8.81	8.81	NA	NA
234678-HxCDF	Upper	1/1	1.54	1.54	NA	NA
OCDD	Upper	1/1	872	872	NA	NA
OCDF	Upper	1/1	117	117	NA	NA
23478-PeCDF	Upper	1/1	1.66	1.66	NA	NA
2378-TCDF	Upper	1/1	9.42	9.42	NA	NA

Notes:
µg/kg = Micrograms per kilogram
ng/kg = Nanograms per kilogram
RBC = Risk-based concentration
NA = No industrial RBC established

Table 10.46.2.2
AOC 597
Inorganic Detections for Soil (mg/kg)

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Inorganic Elements (mg/kg)							
Aluminum (Al)	Upper	4/4	1,600 - 4,150	2,900	100,000	26,600	0
	Lower	4/4	1,010 - 5,510	3,370	NA	41,100	NA
Antimony (Sb)	Upper	4/4	1.60 - 4.30	2.60	82.0	1.77	0
	Lower	3/4	0.560 - 4.70	1.99	NA	1.60	NA

Table 10.46.2.2
AOC 597
Inorganic Detections for Soil (mg/kg)

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Inorganic Elements (mg/kg)							
Arsenic (As)	Upper	4/4	0.640 - 49.3	22.0	3.80	23.9	2
	Lower	4/4	0.770 - 7.50	4.39	NA	19.9	NA
Barium (Ba)	Upper	4/4	6.30 - 41.1	29.1	14,000	130	0
	Lower	4/4	4.70 - 36.8	16.0	NA	94.1	NA
Beryllium (Be)	Upper	4/4	0.110 - 0.470	0.303	1.30	1.70	0
	Lower	2/4	0.280 - 0.490	0.385	NA	2.71	NA
Cadmium (Cd)	Upper	4/4	0.140 - 0.950	0.490	100	1.50	0
	Lower	3/4	0.160 - 0.200	0.177	NA	0.960	NA
Calcium (Ca)	Upper	4/4	652 - 7,470	4,540	NA	NA	NA
	Lower	4/4	663 - 12,100	5,100	NA	NA	NA
Chromium (Cr)	Upper	4/4	4.50 - 22.1	16.5	1,000	94.6	0
	Lower	4/4	3.20 - 11.7	7.80	NA	75.2	NA
Cobalt (Co)	Upper	4/4	0.390 - 7.50	3.40	12,000	19.0	0
	Lower	3/4	0.380 - 1.90	1.19	NA	14.9	NA
Copper (Cu)	Upper	4/4	7.60 - 151	62.5	8,200	66.0	0
	Lower	4/4	9.50 - 16.5	12.9	NA	152	NA
Iron (Fe)	Upper	4/4	2,060 - 11,200	6,990	61,000	NA	0
	Lower	4/4	806 - 16,200	6,460	NA	NA	NA
Lead (Pb)	Upper	4/4	38.8 - 230	134	1,300	265	0
	Lower	4/4	17.5 - 39.3	26.9	NA	173	NA
Magnesium (Mg)	Upper	4/4	73.0 - 628	381	NA	NA	NA
	Lower	4/4	36.0 - 932	481	NA	NA	NA

Table 10.46.2.2
AOC 597
Inorganic Detections for Soil (mg/kg)

Element	Sample Interval	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.	Industrial RBC	Reference Conc.	Number of Samples Exceeding RBC and RC
Inorganic Elements (mg/kg)							
Manganese (Mn)	Upper	4/4	6.90 - 64.9	45.5	4,700	302	0
	Lower	4/4	3.50 - 48.4	25.9	NA	881	NA
Mercury (Hg)	Upper	4/4	0.0200 - 1.000	0.365	61	2.60	0
	Lower	4/4	0.0800 - 1.20	0.663	NA	1.59	NA
Nickel (Ni)	Upper	4/4	1.50 - 14.2	8.88	4,100	77.1	0
	Lower	4/4	0.850 - 4.80	3.11	NA	57.0	NA
Potassium (K)	Upper	1/4	593	593	NA	NA	NA
	Lower	2/4	942 - 1,030	986	NA	NA	NA
Selenium (Se)	Upper	2/4	0.780	0.780	1,000	1.70	0
	Lower	1/4	0.850	0.850	NA	2.40	NA
Sodium (Na)	Upper	1/4	148	148	NA	NA	NA
	Lower	1/4	387	387	NA	NA	NA
Tin (Sn)	Upper	4/4	3.10 - 13.8	8.80	100,000	59.4	0
	Lower	4/4	3.60 - 4.50	4.05	NA	9.23	NA
Vanadium (V)	Upper	4/4	3.30 - 17.5	11.6	1,400	94.3	0
	Lower	4/4	2.30 - 24.8	11.6	NA	155	NA
Zinc (Zn)	Upper	4/4	56.3 - 499	247	61,000	827	0
	Lower	4/4	30.3 - 62.4	47.4	NA	886	NA
pH (SU)							
	Upper	4/4	7.63 - 8.39	8.06	NA	NA	NA
	Lower	4/4	7.46 - 8.05	7.85	NA	NA	NA

Notes:
mg/kg = Milligrams per kilogram
RBC = Risk-based concentration
RC = Reference concentration
NA = No industrial RBC or RC established
SU = Standard Units

Table 10.46.4.1
AOC 597
Wipe Sampling Analytical Results

Parameter	Frequency Of Detection	Range of Detections (μg/wipe)
PCB	2/3	2.7 - 2.8

Note:
μg/wipe = Micrograms per wipe sample

PCBs Detected on Surfaces

PCBs were detected in two of three surface wipe samples with a range of 2.7 to 2.8 μg\ 100 cm^2. No residential or industrial RBCs exist for wipe samples.

10.46.5 Concrete Core Sampling and Analysis

The *Final Zone E RFI Work Plan* proposed collecting one concrete core sample at AOC 597 from the location shown in Figure 10.46.3. One concrete core sample was collected and submitted for analysis at DQO Level III for PCBs, metals, and pH. No samples were selected as duplicates at this site. Table 10.46.5.1 summarizes concrete core sampling and analysis at AOC 597.

Table 10.46.5.1
AOC 597
Concrete Core Sampling Summary

Samples Proposed	Samples Collected	Analyses Proposed	Analyses Collected	Deviation
1	1	PCBs, metals, pH	PCBs, metals, pH	None

10.46.6 Nature of Contamination in Concrete

Inorganic analytical results for concrete are summarized in Table 10.46.6.1. Appendix H contains the complete data report for all samples collected in Zone E.

Table 10.46.6.1
AOC 597
Inorganics Detected in Concrete Samples

Element	Freq. of Detection	Range of Detected Conc.	Mean of Detected Conc.
Inorganic Elements (mg/kg)			
Aluminum (Al)	1/1	6,760	6,760
Arsenic (As)	1/1	4.50	4.50
Barium (Ba)	1/1	90.0	90.0
Beryllium (Be)	1/1	0.540	0.540
Cadmium (Cd)	1/1	1.10	1.10
Calcium (Ca)	1/1	63,400	63,400
Chromium (Cr)	1/1	17.6	17.6
Cobalt (Co)	1/1	2.90	2.90
Copper (Cu)	1/1	156	156
Iron (Fe)	1/1	6,030	6,030
Lead (Pb)	1/1	27.7	27.7
Magnesium (Mg)	1/1	2,240	2,240
Manganese (Mn)	1/1	86.9	86.9
Nickel (Ni)	1/1	8.30	8.30
Potassium (K)	1/1	2,150	2,150
Sodium (Na)	1/1	244	244
Vanadium (V)	1/1	18.4	18.4
Zinc (Zn)	1/1	275	275
pH (SU)			
pH	1/1	12.2 SU	12.2 SU

Notes:
mg/kg = Milligrams per kilogram
SU = Standard Units