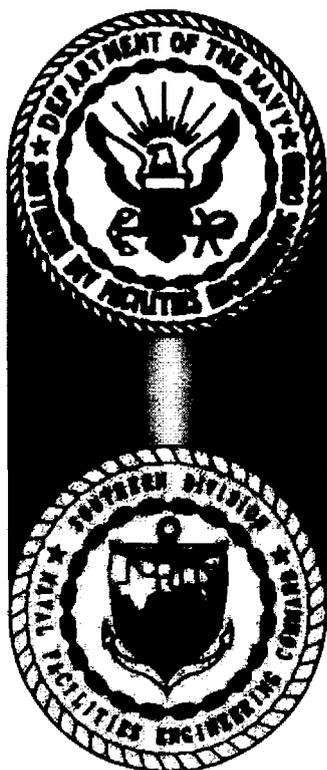


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RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION REPORT
ADDENDUM SOLID WASTE MANAGEMENT UNIT 173 (SWMU 173) ZONE E CNC
CHARLESTON SC
7/23/2002
CH2M HILL

RFI REPORT ADDENDUM

SWMU 173. 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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July 23, 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 (Revision 0) – SWMU 173, Zone E

Dear Mr. Scaturo:

Enclosed please find four copies of the RFI Report Addendum (Revision 0) for SWMU 173 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 Sam Naik. Please do not hesitate to contact him at 770/604-9182, extension 255, should 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

SWMU 173, 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) – SWMU 173, 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.

2/18/2002
Date

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2 **Appendix**

3 **A** Excerpts from the *Zone E RFI Report, Revision 0* (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 | CA | corrective action |
| 7 | CMS | corrective measures study |
| 8 | CNC | Charleston Naval Complex |
| 9 | COC | chemical of concern |
| 10 | COPC | chemical of potential concern |
| 11 | CSI | confirmatory sampling investigation |
| 12 | DAF | dilution attenuation factor |
| 13 | EnSafe | EnSafe Inc. |
| 14 | EPA | U.S. Environmental Protection Agency |
| 15 | ft bls | feet below land surface |
| 16 | IM | interim measure |
| 17 | HI | hazard index |
| 18 | LUC | land use control |
| 19 | MCL | maximum contaminant level |
| 20 | mg/kg | milligram per kilogram |
| 21 | NAVBASE | Naval Base |
| 22 | NFA | no further action |
| 23 | OWS | oil/water separator |
| 24 | PCB | polychlorinated biphenyl |
| 25 | RBC | risk-based concentration |
| 26 | RCRA | Resource Conservation and Recovery Act |
| 27 | RFI | RCRA Facility Investigation |
| 28 | SCDHEC | South Carolina Department of Health and Environmental Control |
| 29 | SSL | soil screening level |
| 30 | SVOC | semivolatile organic compound |

1 Acronyms and Abbreviations, Continued

- | | | |
|---|------|-----------------------------|
| 2 | SWMU | solid waste management unit |
| 3 | UST | underground storage tank |
| 4 | VOC | volatile organic compound |

Section 1.0

1 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 solid waste management unit (SWMU)
14 173 in Zone E of the CNC. The location of this site in Zone E is shown in Figure 1-1. Figure
15 1-2 shows an aerial view of the site.

16 1.1 Background

17 SWMU 173 consists of former storage areas for lead ingots and hazardous materials in
18 Building 1297. The building has concrete floors and is divided into 10 storage areas. The
19 roof over the lead ingot storage area is a non-watertight wooden cover. The hazardous
20 materials storage area is now empty. The building is currently used to store former Naval
21 surplus equipment, such as tires, fork lifts, generators, exhaust blowers, and switching
22 units. Three drop culvert-style storm drains are located along the eastern side of the
23 building.

24 Metals (lead), volatile organic compounds (VOCs), and semivolatile organic compounds
25 (SVOCs) are the materials of concern identified for SWMU 173 in the *Final Zone E RFI Work*
26 *Plan* (EnSafe Inc. [EnSafe]/Allen & Hoshall, 1995). This area of Zone E is zoned M2
27 (industrial). The CNC RCRA Permit identified SWMU 173 as requiring a confirmatory
28 sampling investigation (CSI).

29 The RFI was initially conducted by the Navy/EnSafe Inc. (EnSafe) team. The RFI activities
30 were documented in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Regulatory review was

1 conducted on this document and a draft responses to comments from SCDHEC on the RFI
2 were prepared by the Navy/EnSafe team. There were no regulatory comments made with
3 respect to SWMU 173. Therefore, no response to comments is provided with this RFI
4 Report Addendum.

5 **1.2 Purpose of the RFI Report Addendum**

6 The purpose of this RFI Report Addendum is to document the results of previous RFI
7 investigations conducted by the Navy/EnSafe team at SWMU 173. This RFI Report
8 Addendum also discusses various closeout issues and the findings of previous
9 investigations, existing site conditions, and the surrounding area land use.

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

- 12 • Status of the RFI
- 13 • Presence of metals (inorganics) in groundwater
- 14 • Potential linkage to SWMU 37, Investigated Sanitary Sewers at the CNC
- 15 • Potential linkage to Area of Concern (AOC) 699, Investigated Storm Sewers at the CNC
- 16 • Potential linkage of AOC 504, Investigated Railroad Lines at the CNC
- 17 • Potential linkage to surface water bodies (Zone J)
- 18 • Potential contamination associated with oil/water separators (OWSs)
- 19 • Relevance or need for land use controls (LUCs) at the site

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

22 **1.3 Report Organization**

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

25 **1.0 Introduction** – Presents the purpose of and the background information relating to the
26 RFI Report Addendum.

27 **2.0 Summary of RFI Conclusions for SWMU 173** – Summarizes the conclusions from the
28 RFI investigations and risk evaluations for SWMU 173.

- 1 **3.0 Interim Measures and UST/AST Removals** – Summarizes any interim measures (IMs)
2 or underground storage tank (UST)/aboveground storage tank (AST) removal activities
3 conducted at the site.
- 4 **4.0 Summary of Additional Investigations** – Summarizes any information collected after
5 completion of the RFI report.
- 6 **5.0 COPC/COC Refinement** – Identifies and evaluates chemicals of potential concern
7 (COPCs) based on current screening criteria using all RFI and additional data.
- 8 **6.0 Summary of Information Related to Site Closeout Issues** – Discusses the various
9 issues that the BRAC Cleanup Team (BCT) agreed to evaluate prior to site closeout.
- 10 **7.0 Recommendations** – Provides recommendations for proceeding with site closure.
- 11 **8.0 References** – Lists the references used in this document.
- 12 **Appendix A** contains excerpts from the RFI report.
- 13 All figures and tables appear at the end of their respective sections.



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

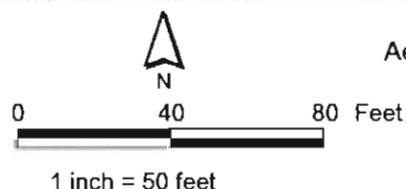


Figure 1-2
Aerial Photograph of SWMU 173, Zone E
Charleston Naval Complex

Section 2.0

2.0 Summary of RFI Conclusions for SWMU 173

This section summarizes the results and conclusions from the soil and catch-basin sediment investigations conducted at SWMU 173, which were reported in the *Zone E RFI Report, Revision 0* (EnSafe, 1997). Figure 2-1 shows soil and sediment sampling locations.

As part of the Zone E RFI, soil and catch-basin sediment investigations were conducted at SWMU 173 in October 1995. Appendix A contains the tables of detected compounds in soil and sediment, as well as a groundwater flow map for the vicinity. The RFI report presented the results of these investigations and conclusions concerning contamination and risk, as summarized in the following sections. A further evaluation of chemicals of concern (COCs) at this site is provided in Section 5.0.

2.1 Soil Sampling and Analysis

The RFI at SWMU 173 involved collection and analysis of two surface and two subsurface soil samples from locations under concrete and asphalt pavement. Figure 2-1 shows RFI sampling locations. All samples were analyzed for VOCs, SVOCs, metals, pesticides/polychlorinated biphenyls (PCBs), cyanide, and organotins. No duplicate samples were collected at SWMU 173.

2.1.1 Surface Soil Results

During the RFI, surface soil detections of organic compounds 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 analytes exceeding their respective criteria are as follows:

VOCs: There were no VOC detections above laboratory detection limits in surface soil samples.

SVOCs: There were no SVOC detections above laboratory detection limits in surface soil samples.

Inorganics: No inorganic detections exceeded the screening criteria in surface soils.

1 **Pesticides/PCBs:** There were no detections of pesticides/PCBs above laboratory detection
2 limits in surface soil samples.

3 **Organotins:** There were no detections of organotins above laboratory detection limits in
4 surface soil samples.

5

6 **2.1.2 Subsurface Soil Results**

7 During the RFI, subsurface soil detections of organic compounds were compared with
8 generic soil screening levels (SSLs) (using a dilution attenuation factor [DAF]=10).

9 Subsurface soil detections of inorganic compounds were compared with generic SSLs (using
10 a DAF=10) and the Zone E BRCs.

11 Detected concentrations of organic and inorganic compounds from subsurface soil samples
12 are as follows:

13 **VOCs:** There were no VOC detections above laboratory detection limits in subsurface soil
14 samples.

15 **SVOCs:** There were no SVOC detections above laboratory detection limits in subsurface soil
16 samples.

17 **Inorganics:** No inorganic detections exceeded the screening criteria in subsurface soils.

18 **Pesticides/PCBs:** There were no pesticides/PCBs detections above laboratory detection limits
19 in subsurface soil samples.

20 **Organotins:** There were no detections of organotins above laboratory detection limits in
21 subsurface soil samples.

22 **2.2 Sediment Sampling and Analysis**

23 The RFI sediment investigation consisted of three sediment samples as shown in Figure 2-1.

24 The samples were analyzed for organotins, VOCs, SVOCs, metals, cyanide, and
25 pesticides/PCBs. Sediment detections of organic and inorganic compounds were evaluated
26 against the EPA Region III industrial RBCs for soil.

27 The following detections were found in the sediment samples at the site:

28 **VOCs:** No VOC detections exceeded the screening criteria in sediment samples.

29 **SVOCs:** No SVOC detections exceeded the screening criteria in sediment samples.

30 **Inorganics:** The RFI reported detections of arsenic and lead, exceeding the screening criteria.

- 1 • Arsenic was detected at a concentrations of 15.9 milligram per kilogram (mg/kg) in
2 173M0001, 5.8 mg/kg in 173M0002 and 7.5 mg/kg in 173M0003, exceeding its industrial
3 RBC of 3.8 mg/kg.
- 4 • Lead was detected at a concentration of 4,270 mg/kg in 173M0001, 811 mg/kg in
5 173M0002 and 721 mg/kg in 173M0003, exceeding its industrial RBC of 400 mg/kg.

6 **Pesticides/PCBs:** No pesticide/PCB detections exceeded the screening criteria in sediment
7 samples.

8 **Organotins:** There were no detections of organotins above laboratory detection limits in
9 sediment samples.

10 Subsequent to the RFI field investigation, the sediments that were present in the storm
11 drains at SWMU 173 were removed during the IM for AOC 699, conducted by the
12 Environmental Detachment Charleston (DET) in 1998. As a result, these sediments are no
13 longer present at this site. The IM activities are documented in *Interim Measure Completion*
14 *Report for AOC 699 Storm Drain Cleaning* (DET, 1999).

15 **2.3 RFI Human Health Risk Assessment (HHRA)**

16 The RFI report used a fixed-point risk evaluation (FRE) approach at this site, which
17 considered site resident and site worker scenarios. The detailed risk assessment for the
18 SWMU 173 site is presented in Section 10.18.6 of the RFI report.

19 **2.3.1 Soils**

20 No COCs were identified for surface soils and subsurface soils at SWMU 173, based on both
21 the unrestricted and industrial land use scenarios.

22 **2.3.2 Sediment**

23 The sediment sample results were not carried forward in the risk analysis presented in the
24 RFI report. However, these sediments were removed during the DET IM and no longer
25 pose a risk at this site.

26 **2.4 RFI Conclusions and Recommendations**

27 The RFI report concluded that there were no COCs for soils, and recommended No Further
28 Action (NFA) for the soils.

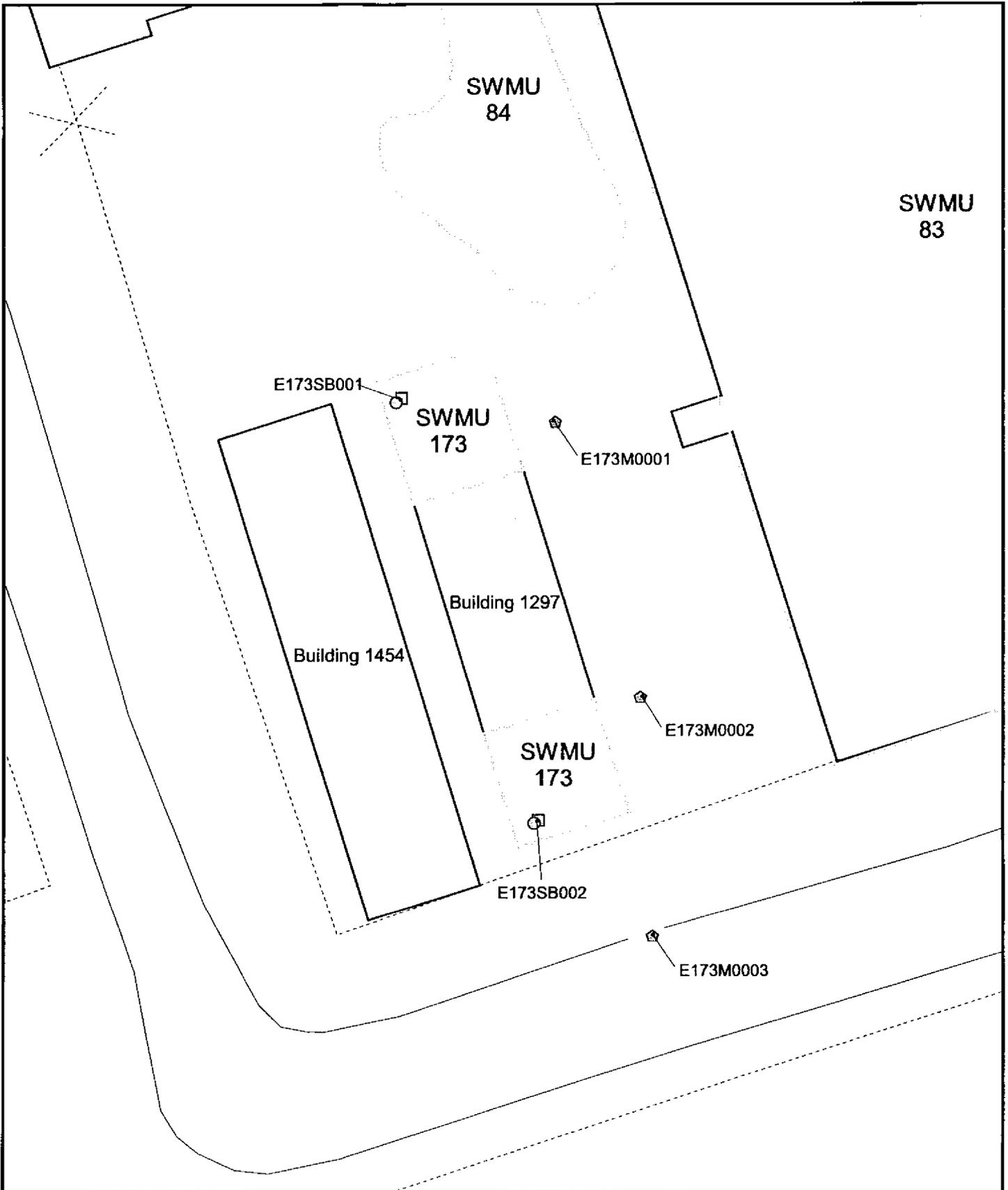


Figure 2-1
RFI Sampling Locations
SWMU 173, Zone E
Charleston Naval Complex

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

2 An IM was conducted by the DET for AOC 699 (January, 1999), which included portions of
3 the storm sewer system associated with SWMU 173. The activities conducted for the IM
4 included hydro-blast cleaning of catch basins, manholes, and associated interconnecting
5 piping. The IM activities are documented in *Interim Measure Completion Report for AOC 699*
6 *Storm Drain Cleaning* (DET, 1999).

7 During this IM, three storm drains located at SWMU 173 (sediment sampling locations,
8 E173M0001, E173M0002, and E173M0003) were cleaned. As a result, CA for the sediments
9 in the catch basins has already been completed for SWMU 173.

10 There are no known USTs or ASTs associated with SWMU 173.

1 **4.0 Summary of Additional Investigations**

- 2 No additional investigations have been conducted at SWMU 173 since the RFI field
3 investigations conducted in November 1995 and January 1996.

1 **5.0 COPC/COC Refinement**

2 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) did not identify any COCs for the soil and
3 sediment samples collected at SWMU 173, for either the unrestricted or industrial land use
4 scenarios.

5 In addition to the original screening criteria, current screening criteria for Zone E includes
6 comparing VOC concentrations in soil to SSLs with a DAF of 1. No VOCs were detected
7 above laboratory detection limits in soil samples collected from SWMU 173. Therefore, no
8 COCs are identified at the site.

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
5 of the CNC, including SWMU 173.

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 for SWMU 173 identified no
9 COCs for surface or subsurface soil. Based on the RFI conclusion and discussion presented
10 in Section 5.0 above, there are no COCs present at SWMU 173; therefore, no further
11 investigation or active corrective measures are needed.

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

14 **6.2 Presence of Inorganics in Groundwater**

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

20 Groundwater was not a media of concern in the RFI investigation for SWMU 173. Further
21 evaluation of this issue is not warranted.

22 **6.3 Potential Linkage to SWMU 37, Investigated Sanitary** 23 **Sewers at the CNC**

24 There are no data suggesting that there was an impact to the sanitary sewers from this site.
25 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 investigated as part of the AOC 699 investigations. An IM was conducted by the DET for AOC 699 (January, 1999), which included cleaning the three storm drains located adjacent to SWMU 173, and disposal of collected sediments at an offsite disposal facility. Based on these actions, further evaluation of this linkage is not warranted.

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

The nearest existing railroad line to SWMU 173 is approximately 370 feet to the south of Building 1297. However, the area around the building is fully covered in concrete or asphalt and the storage area was an indoor operation. There are no apparent interactions between SWMU 173 and the nearby railroad lines. In addition, there is no known linkage between SWMU 173 and the investigated railroad lines of AOC 504. 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 173 is the Cooper River, which lies approximately 550 feet to the northeast. The only potential migration pathway from the site to surface water is via overland flow via stormwater runoff. The entire site is covered with buildings and pavement, which eliminates contact of surface soils 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 requiring further evaluation are present at this site, no further evaluation of a potential pathway for contaminant migration via stormwater runoff is warranted.

The groundwater is not a media of concern at this unit; consequently, the potential for groundwater contamination associated with SWMU 173 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 oil/water separators (OWSs) associated with SWMU 173. In addition, there is
3 no reference to an OWS at this facility made in the *Oil Water Separator Data* report
4 (Department of the Navy, September 2000). Therefore, further evaluation of this issue is not
5 warranted.

6 **6.8 Land Use Controls (LUCs)**

7 The CNC BCT has agreed that all of Zone E will have at least some LUCs and restrictions.
8 At a minimum, these LUCs are likely to include restrictions against residential land use.
9 Site-specific LUCs are also expected to be required at specific sites within Zone E,
10 depending on the results of the site-specific investigations.

11 No COCs were identified for the unrestricted or industrial use scenarios. LUCs will be
12 applied to limit reuse of this site to industrial use.

13 No COCs have been identified at SWMU 173. This evaluation was based on unrestricted
14 risk-based criteria land use classification. Therefore, LUCs are not necessary.

15 However, the BCT has agreed that LUCs will be applied across all of Zone E at the CNC.
16 These LUCs are expected to include, at a minimum, restrictions for future land use to non-
17 residential use only. These LUCs will apply at SWMU 173 due to its location within Zone E.

Section 7.0

1 **7.0 Recommendations**

2 SWMU 173 consists of former storage areas for lead ingots and hazardous materials in
3 Building 1297. The building has concrete floors and is divided into 10 separate storage
4 areas. One area was used to store lead ingots and its roof is a non-watertight wooden cover.
5 The hazardous materials storage area is now empty. The facility is currently used to store
6 former Naval surplus equipment, such as tires, fork lifts, generators, exhaust blowers, and
7 switching units. Three drop culvert-style storm drains are located along the eastern side of
8 the building.

9 The CNC RCRA Permit identified SWMU 173 as requiring a CSI.

10 The *Zone E RFI Report, Revision 0* (EnSafe, 1997) identified no COCs in surface and
11 subsurface soil or sediment at SWMU 173, based on both the unrestricted and industrial
12 land use scenarios and recommended no corrective measures. Therefore, this site is suitable
13 for continued industrial reuse without any active corrective measures. LUCs to limit site use
14 to industrial will be implemented as part of the overall Zone E LUCs.

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

1 **8.0 References**

- 2 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston. 1997.*
- 3 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, NAVBASE Charleston. July*
4 *1995.*
- 5 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1, NAVBASE Charleston.*
6 *June 1995.*
- 7 Navy Environmental Detachment. *Interim Measure Completion Report for AOC 699 Storm*
8 *Drain Cleaning. U.S. Naval Detachment. March 1999.*
- 9 *Oil Water Separator Data (Department of the Navy, September 2000).*
- 10 South Carolina Department of Health and Environmental Control, *Final RCRA Part B*
11 *Permit No. SC0 170 022 560.*
- 12 U.S. Environmental Protection Agency. *Soil Screening Guidance: Technical Background*
13 *Document. May 1996.*

Appendix A

Chemicals Detected in Zone E Soil Samples
SWMU 173

| Name | ID | Surface Conc. | Subsurface Conc. | RBC (THQ=.1) | Surface UTL | Subsurface UTL * |
|---|----------|------------------|---------------------|-----------------|----------------|---------------------|
| <i>Inorganic Compounds (mg/kg)</i> | | | | | | |
| Aluminum (Al) | 173SB001 | 1670.00 | 6800.00 | 7800.00 | 26000.00 | 41100.00 |
| Aluminum (Al) | 173SB002 | 5600.00 | 6570.00 | | | |
| Arsenic (As) | 173SB001 | 0.67 | 6.20 | 0.43 | 23.90 | 19.90 |
| Arsenic (As) | 173SB002 | 5.80 | 5.60 | | | |
| Barium (Ba) | 173SB001 | 21.90 | 38.90 | 550.00 | 130.00 | 94.10 |
| Barium (Ba) | 173SB002 | 25.50 | 37.80 | | | |
| Beryllium (Be) | 173SB001 | 0.17 | 0.16 | 0.15 | 1.70 | 2.71 |
| Beryllium (Be) | 173SB002 | 0.19 | 0.37 | | | |
| Calcium (Ca) | 173SB001 | 462.00 | 3080.00 | NA | NA | NA |
| Calcium (Ca) | 173SB002 | 1540.00 | 1210.00 | | | |
| Chromium (Cr) | 173SB001 | ND | 13.90 | 39.00 | 94.60 | 75.20 |
| Chromium (Cr) | 173SB002 | 10.80 | 10.40 | | | |
| Cobalt (Co) | 173SB001 | 23.10 | 9.90 | 470.00 | 19.00 | 14.90 |
| Cobalt (Co) | 173SB002 | 10.70 | 2.50 | | | |
| Copper (Cu) | 173SB001 | 40.90 | 60.60 | 310.00 | 66.00 | 152.00 |
| Copper (Cu) | 173SB002 | 1.10 | 0.83 | | | |
| Iron (Fe) | 173SB001 | 1570.00 | 12900.00 | 2300.00 | NA | NA |
| Iron (Fe) | 173SB002 | 12600.00 | 11000.00 | | | |
| Lead (Pb) | 173SB001 | 3.00 | 6.10 | 400.00 | 285.00 | 173.00 |
| Lead (Pb) | 173SB002 | 3.40 | 4.10 | | | |
| Magnesium (Mg) | 173SB001 | 107.00 | 743.00 | NA | NA | NA |
| Magnesium (Mg) | 173SB002 | 517.00 | 608.00 | | | |
| Manganese (Mn) | 173SB001 | 90.00 | 28.00 | 180.00 | 302.00 | 881.00 |
| Manganese (Mn) | 173SB002 | 48.90 | 113.00 | | | |
| Mercury (Hg) | 173SB002 | 0.03 | 0.03 | 2.30 | 2.60 | 1.59 |
| Nickel (Ni) | 173SB001 | 2.60 | 2.10 | 160.00 | 77.10 | 57.00 |
| Nickel (Ni) | 173SB002 | 1.60 | 2.10 | | | |
| Potassium (K) | 173SB001 | ND | 429.00 | NA | NA | NA |
| Selenium (Se) | 173SB001 | ND | 0.66 | 39.00 | 1.70 | 2.40 |
| Sodium (Na) | 173SB002 | 63.10 | ND | NA | NA | NA |
| Vanadium (V) | 173SB001 | 1.70 | 25.30 | 55.00 | 94.30 | 155.00 |
| Vanadium (V) | 173SB002 | 20.20 | 15.60 | | | |
| Zinc (Zn) | 173SB001 | 25.50 | 42.40 | 2300.00 | 827.00 | 886.00 |
| Zinc (Zn) | 173SB002 | 5.70 | 5.90 | | | |

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.

Table 10.18.4.1
SWMU 173
Organic Compounds Detected in Sediment (µg/kg)

| Compound | Sample Interval | Freq. Of Detection | Range of Detected Conc. | Mean of Detected Conc. | Industrial Soil RBC | Number of Samples Exceeding RBC |
|---------------------------------|-----------------|--------------------|-------------------------|------------------------|---------------------|---------------------------------|
| VOCs | | | | | | |
| Toluene | Upper | 1/3 | 1.000 | 1.000 | 410,000 | 0 |
| SVOCs | | | | | | |
| Acenaphthene | Upper | 1/3 | 160 | 160 | 470,000 | 0 |
| Anthracene | Upper | 1/3 | 97.0 | 97.0 | 61,000,000 | 0 |
| Benzo(g,h,i)perylene | Upper | 1/3 | 340 | 340 | 8,200,000 | 0 |
| Benzoic acid | Upper | 1/3 | 220 | 220 | 100,000,000 | 0 |
| bis(2-Ethylhexyl)phthalate | Upper | 3/3 | 330 - 720 | 477 | 410,000 | 0 |
| Butylbenzylphthalate | Upper | 1/3 | 110 | 110 | 41,000,000 | 0 |
| 4-Chloro-3-methylphenol | Upper | 2/3 | 200 - 320 | 260 | NA | NA |
| Di-n-butylphthalate | Upper | 1/3 | 87.0 | 87.0 | NA | NA |
| Fluoranthene | Upper | 3/3 | 120 - 450 | 233 | 8,200,000 | 0 |
| Fluorene | Upper | 1/3 | 110 | 110 | 8,200,000 | 0 |
| Phenanthrene | Upper | 2/3 | 110 - 640 | 375 | 410,000 | 0 |
| Pyrene | Upper | 3/3 | 130 - 930 | 400 | 6,100,000 | 0 |
| SVOCs (B(a)P Equivalent) | | | | | | |
| B(a)P Equiv. | Upper | 3/3 | 9.39 - 533 | 261 | 780 | 0 |
| Benzo(b)fluoranthene | Upper | 2/3 | 93.0 - 300 | 197 | 7,800 | 0 |
| Benzo(k)fluoranthene | Upper | 1/3 | 260 | 260 | 78,000 | 0 |
| Benzo(a)pyrene | Upper | 2/3 | 240 - 500 | 370 | 780 | 0 |
| Chrysene | Upper | 1/3 | 94.0 | 94.0 | 780,000 | 0 |
| Pesticides/PCBs | | | | | | |

Table 10.18.4.1
SWMU 173
Organic Compounds Detected in Sediment (µg/kg)

| Compound | Sample Interval | Freq. Of Detection | Range of Detected Conc. | Mean of Detected Conc. | Industrial Soil RBC | Number of Samples Exceeding RBC |
|------------------------|-----------------|--------------------|-------------------------|------------------------|---------------------|---------------------------------|
| gamma-Chlordane | Upper | 2/3 | 2.00 - 2.10 | 2.05 | 4,400 | 0 |
| 4,4'-DDD | Upper | 1/3 | 8.50 | 8.50 | 24 | 0 |
| Pesticides/PCBs | | | | | | |
| 4,4'-DDE | Upper | 2/3 | 3.60 - 5.10 | 4.35 | 17 | 0 |
| 4,4'-DDT | Upper | 1/3 | 8.20 | 8.20 | 17 | 0 |
| Aroclor-1260 | Upper | 2/3 | 110 | 110 | 740 | 0 |

Notes:

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

Table 10.18.4.2
SWMU 173
Inorganic Detections in Sediment (mg/kg)

| Element | Sample Interval | Freq. of Detection | Range of Detected Conc. | Mean of Detected Conc. | Industrial RBC | Number of Samples Exceeding RBC |
|----------------|-----------------|--------------------|-------------------------|------------------------|----------------|---------------------------------|
| Aluminum (Al) | Upper | 3/3 | 1,320 - 2,110 | 1,690 | 100,000 | 0 |
| Antimony (Sb) | Upper | 3/3 | 1.30 - 14.9 | 6.20 | 82 | 0 |
| Arsenic (As) | Upper | 3/3 | 5.80 - 15.9 | 9.73 | 3.8 | 3 |
| Barium (Ba) | Upper | 3/3 | 64.1 - 105 | 82.4 | 14,000 | 0 |
| Beryllium (Be) | Upper | 3/3 | 0.140 - 0.540 | 0.300 | 1.3 | 0 |
| Cadmium (Cd) | Upper | 3/3 | 1.30 - 3.50 | 2.23 | 100 | 0 |
| Calcium (Ca) | Upper | 3/3 | 1,830 - 43,800 | 17,700 | NA | NA |
| Chromium (Cr) | Upper | 3/3 | 42.5 - 70.1 | 59.1 | 1,000 | 0 |
| Cobalt (Co) | Upper | 3/3 | 3.80 - 8.30 | 6.47 | 12,000 | 0 |

Table 10.18.4.2
SWMU 173
Inorganic Detections in Sediment (mg/kg)

| Element | Sample Interval | Freq. of Detection | Range of Detected Conc. | Mean of Detected Conc. | Industrial RBC | Number of Samples Exceeding RBC |
|----------------|-----------------|--------------------|-------------------------|------------------------|----------------|---------------------------------|
| Copper (Cu) | Upper | 3/3 | 1,670 - 5,420 | 3,080 | 8,200 | 0 |
| Cyanide (CN) | Upper | 1/3 | 0.390 | 0.390 | NA | NA |
| Iron (Fe) | Upper | 3/3 | 21,500 - 69,700 | 38,100 | 61,000 | 0 |
| Lead (Pb) | Upper | 3/3 | 721 - 4,270 | 1,930 | 400 | 3 |
| Magnesium (Mg) | Upper | 3/3 | 342 - 1,100 | 681 | NA | NA |
| Manganese (Mn) | Upper | 3/3 | 224 - 435 | 308 | 4,700 | 0 |
| Mercury (Hg) | Upper | 3/3 | 0.0300 - 0.370 | 0.153 | 61 | 0 |
| Nickel (Ni) | Upper | 3/3 | 119 - 861 | 441 | 4,100 | 0 |
| Potassium (K) | Upper | 1/3 | 208 | 208 | NA | NA |
| Selenium (Se) | Upper | 2/3 | 0.650 - 1.20 | 0.925 | 1,000 | 0 |
| Silver (Ag) | Upper | 1/3 | 1.10 | 1.10 | 1,000 | 0 |
| Sodium (Na) | Upper | 2/3 | 95.3 - 137 | 116 | NA | NA |
| Tin (Sn) | Upper | 3/3 | 73.3 - 251 | 134 | 100,000 | 0 |
| Vanadium (V) | Upper | 3/3 | 8.60 - 17.4 | 12.1 | 1,400 | 0 |
| Zinc (Zn) | Upper | 3/3 | 580 - 4,560 | 1,950 | 61,000 | 0 |

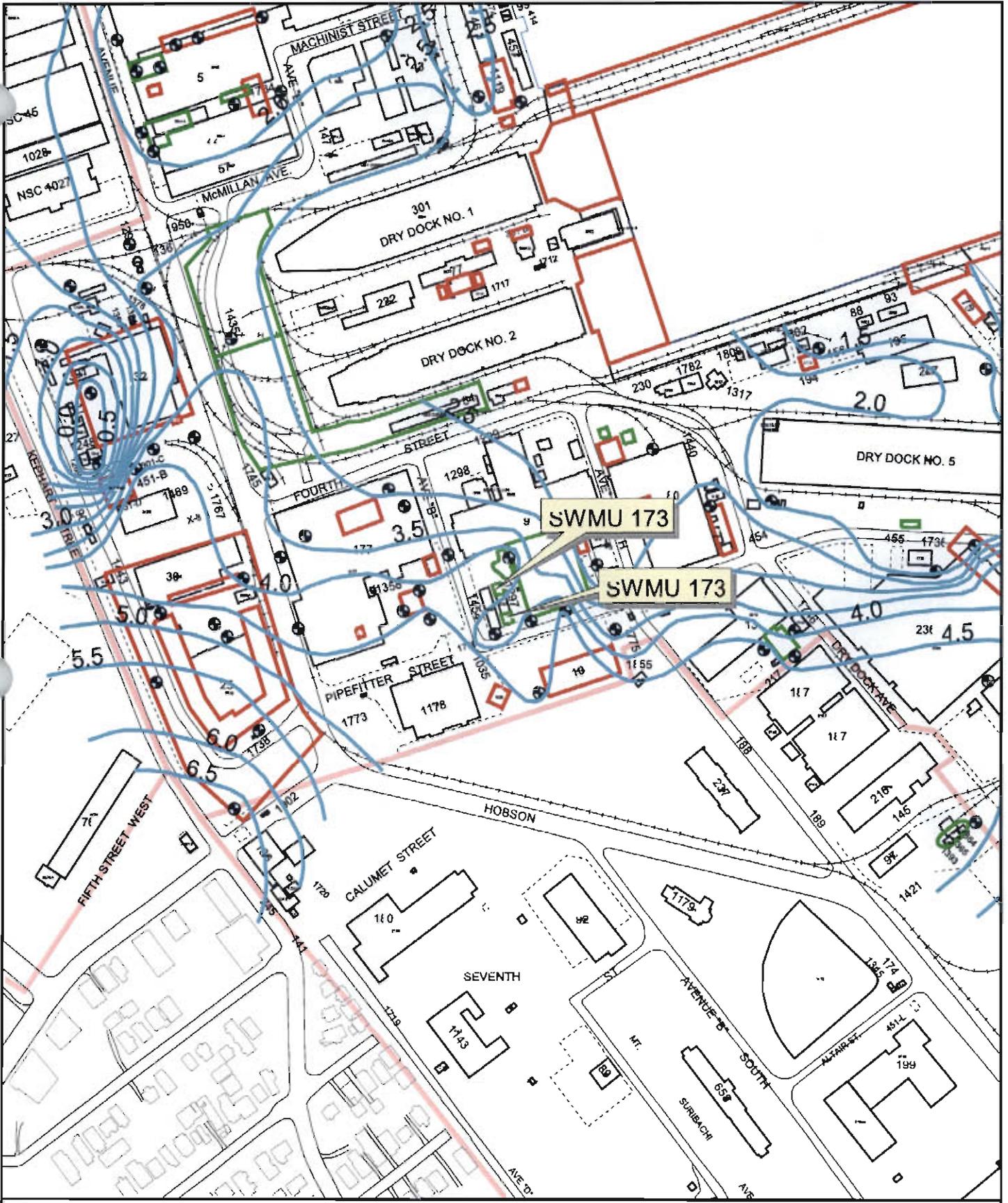
Notes:

mg/kg = Milligrams per kilogram

RBC = Risk-based concentration

NA = No industrial soil RBC established

* = For the purposes of this investigation, sediment collected from storm and floor drain catch basins are treated as soil and compared to industrial RBCs instead of RAGS SSVs.



- 2.0 Shallow Groundwater Elevation (ft. above msl)
- Shallow Groundwater Well
- AOC Boundary
- SWMU Boundary
- Fence
- Railroads
- Roads
- Buildings
- Zone Boundary

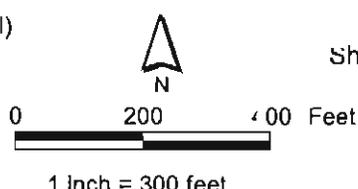


Figure A-1
 Shallow Groundwater Contour Map, May 2002
 SWMU 173, Zone E
 Charleston Naval Complex