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SAMPLING AND ANALYSIS PLAN ADDENDUM AREA OF CONCERN 701 (AOC 701) ZONE  
E WITH TRANSMITTAL CNC CHARLESTON SC

5/10/2002  
CH2M HILL

AOC 701 Zone E

SAMPLING and ANALYSIS PLAN (RO)

**CH2MHILL**

**CH2M HILL**  
115 Perimeter Center Place N.E.  
Suite 700  
Atlanta, GA 30346-1278  
Tel 770.604.9095  
Fax 770.604.9183

May 10, 2002

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

Re: Sampling and Analysis Plan Addendum (Revision 0) – AOC 701, Zone E

Dear Mr. Scaturo:

Enclosed are four copies of the Sampling and Analysis Plan Addendum (Revision 0) for AOC 701 in Zone E of the Charleston Naval Complex (CNC). This sampling plan has been prepared to complete the RCRA Facility Investigation (RFI) activities for AOC 701 and to provide information that can be used to make decisions regarding the need for corrective measures at the site.

The principal author of this document is Kris Garcia. Please contact Ms. Garcia at 770/604-9182, extension 476, 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

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*Sampling and Analysis Plan  
Addendum*

**Area of Concern 701, Zone E**

**Charleston Naval Complex  
North Charleston, SC**

Prepared for  
**U.S. Navy Southern Division  
Naval Facilities Engineering Command**

Prepared by  
**CH2M-Jones**

May 2002

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28 <b>B</b> Results of Geophysical Survey of AOC 701	

# 1 **Acronyms and Abbreviations**

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2	AOC	area of concern
3	BCT	BRAC Cleanup Team
4	BEQ	benzo(a)pyrene equivalent
5	BRAC	Base Realignment and Closure Act
6	BRC	background reference concentration
7	CNC	Charleston Naval Complex
8	COC	chemical of concern
9	COPC	chemical of potential concern
10	CSAP	Comprehensive Sampling and Analysis Plan
11	EGIS	Environmental Geographic Information System
12	EnSafe	EnSafe Inc.
13	EPA	U.S. Environmental Protection Agency
14	ft bls	feet below land surface
15	PCB	polychlorinated biphenyls
16	RCRA	Resource Conservation and Recovery Act
17	RFA	RCRA Facility Assessment
18	RFI	RCRA Facility Investigation
19	SAP	Sampling and Analysis Plan
20	SCDHEC	South Carolina Department of Health and Environmental Control
21	SSL	soil screening level
22	SVOC	semivolatile organic compound
23	UST	underground storage tank
24	VOC	volatile organic compound

# 1.0 Introduction

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## 1.1 Background

Area of Concern (AOC) 701 was not investigated at the time of the initial Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) field work conducted in Zone E of the Charleston Naval Complex (CNC) from 1995 to 1997, because it had not yet been identified as an AOC. CH2M-Jones completed a geophysical survey at AOC 701 to determine the approximate location of underground storage tanks (USTs) and associated equipment. This Sampling and Analysis Plan (SAP) Addendum amends the sampling approach proposed for AOC 701 in the *RFI Addendum Sampling Plan – Uninvestigated Sites, Zone E, Revision 1* (CH2M-Jones, December 2001).

This SAP Addendum will be implemented to evaluate whether historical operations at AOC 701 may have had an impact on the environment and, if so, the nature and extent of any impacts. The investigation will provide information that can be used to make decisions regarding the need for any corrective measures at this site. Figure 1-1 illustrates the location of Zone E within the CNC and Figure 1-2 is an aerial photograph of AOC 701.

## 1.2 Organization of the Sampling and Analysis Plan

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

**1.0 Introduction** – Presents the purpose of the SAP and background information regarding the site.

**2.0 Site History** – Provides a brief description of AOC 701 and the findings of previous investigation activities.

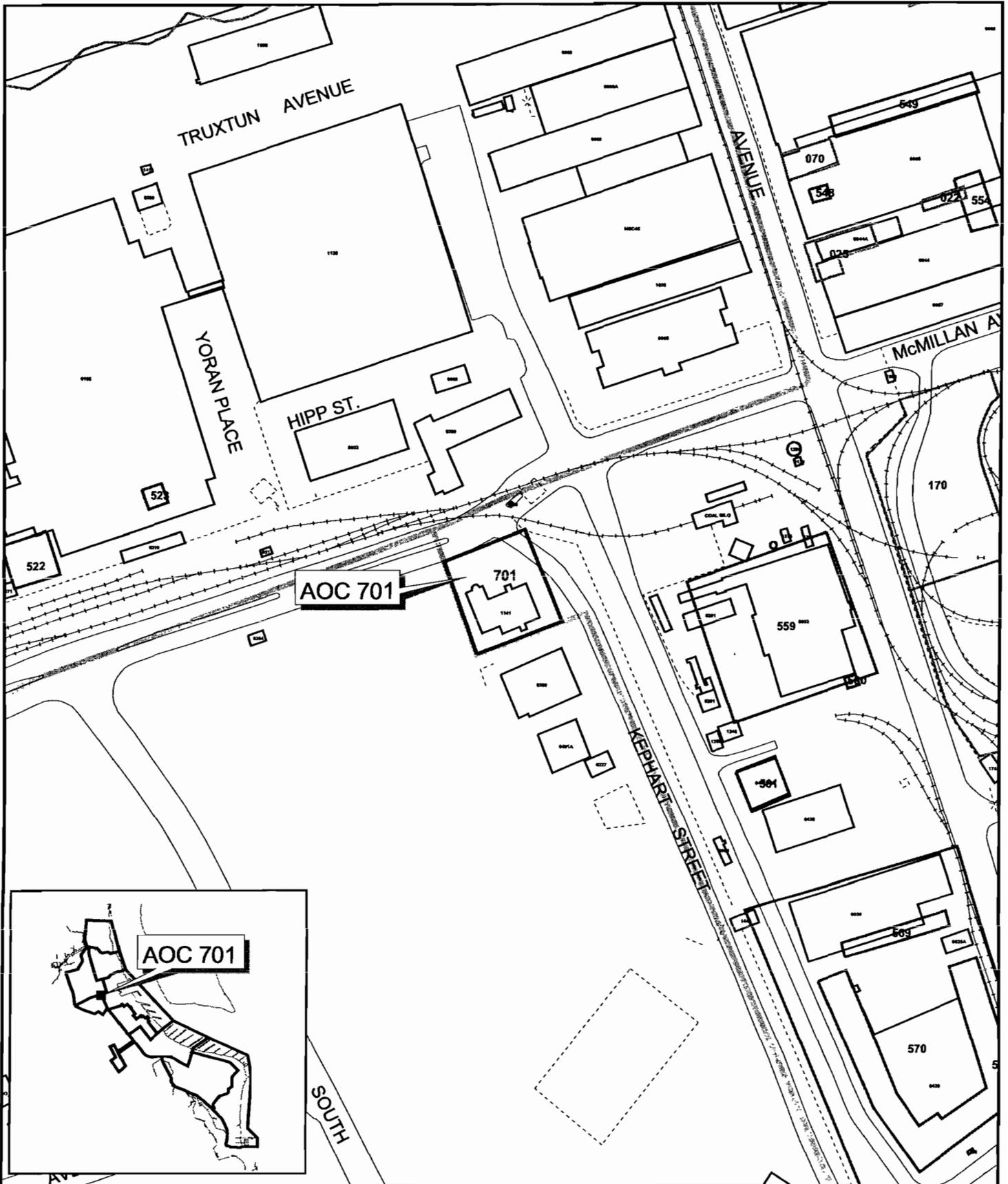
**3.0 Proposed Sampling and Analysis** – Describes the investigative approach for delineation of chemicals of potential concern (COPCs) to complete the RFI.

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

**Appendix A** contains the 1942 as-built drawings of the original structure at AOC 701.

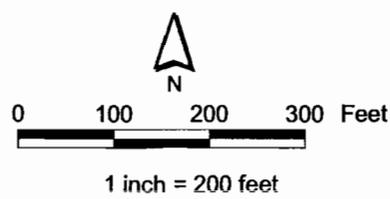
**Appendix B** contains the results of geophysical survey of AOC 701.

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



**Figure 1-1**  
**AOC 701**  
 Location Map  
 Charleston Naval Complex

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

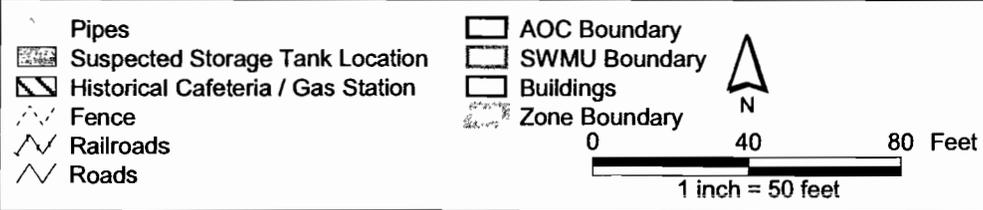




RFI Tank Placement

701

0209



**Figure 1-2**  
Aerial Photograph of AOC 701  
AOC 701, Zone E  
Charleston Naval Complex

## 1 **2.0 Site History**

---

### 2 **2.1 Site Background**

3 AOC 701 is the former McMillan Avenue gasoline station which was located in Building  
4 1141 (see Figures 1-1 and 1-2). A station/cafeeteria combination was built in 1941 and the gas  
5 station was operational until 1979, when the building was expanded, renovated, and  
6 converted into a security building. According to CNC personnel, two USTs were located at  
7 the northwestern corner of AOC 701 and were closed in place by filling with sand in 1973.  
8 Conflicting information provided in the *Final RCRA Facility Assessment Report* (EnSafe Inc.  
9 [EnSafe]/Allen & Hoshall, June 1995) indicated that a tank removal was conducted at the  
10 site in 1973. In reviewing the 1942 as-built drawings of the original structure, the actual  
11 location of these tanks was reportedly near the front door of Building 1141, along the  
12 northern side of the building. The as-built drawings also indicate that there were onsite  
13 vehicle maintenance operations that included a grease pit, wash rack, and four vehicle bays.  
14 A copy of the as-built drawings is provided in Appendix A.

15 The RCRA Facility Assessment (RFA) recommended that a Confirmatory Site Investigation  
16 (CSI) be conducted at AOC 701.

17 In January 2002, CH2M-Jones subcontracted with Associated Technical Support, a firm  
18 specializing in locating underground utilities, metallic anomalies and other buried  
19 anomalies, to perform a geophysical survey at the site to verify the presence or absence of  
20 USTs (see Attachment B). As a result of the geophysical investigation and the historical  
21 references to an existing tank removal report, it appears that USTs may have existed at two  
22 locations at AOC 701: 1) the area identified in the RFA, which is the probable site of the UST  
23 removal action, and 2) along the northern side of Building 1141, where the original tanks  
24 were installed and still appear to be present.

25 CH2M-Jones is submitting this addendum to the *RFI Addendum Sampling Plan* for Zone E for  
26 the investigation of AOC 701. This SAP is being amended with the expectation that the  
27 information collected will be adequate to determine if impacts have occurred at AOC 701. If  
28 no significant contamination associated with the operation of this unit is present (i.e., any  
29 analytes detected are below established screening criteria), the Base Realignment and  
30 Closure Act (BRAC) Cleanup Team (BCT) can decide there is no need for further

1 investigation. The data collected, as outlined in this SAP Addendum, will be adequate to  
2 make decisions regarding the future disposition of AOC 701.

## 3 **2.2 Previous Soil Investigations**

4 According to the RFA site description, a tank closure memorandum was prepared by the  
5 CNSY Occupational Safety, Health, and Environmental Office. It contained pictures and  
6 analytical results from the soil samples taken at the time of the tank closure in 1973. The  
7 analytical results indicated that the surrounding soil was clean at the time of closure. Efforts  
8 to locate a copy of this report have been unsuccessful.

## 9 **2.3 Site Inspection by CH2M-Jones**

10 A pre-field investigation visual site inspection was performed by CH2M-Jones personnel on  
11 July 11, 2001. The inspection confirmed that the former gas station/cafeteria is still being  
12 used as a security office and that an addition, which was added to the northeastern side of  
13 the building in 1987, is still in use. The area surrounding the building is covered with  
14 asphalt.

15 The investigation did not reveal any visual evidence that USTs are present at the site, such  
16 as stand pipes, fill ports, or other features associated with a gas station. In addition, there  
17 was no visual evidence of the existence of the old USTs that were installed along the  
18 northern side of the building during construction of the service station/gas station in 1942.  
19 However, there is a large square cut in the asphalt in the northwestern corner of AOC 701,  
20 where a UST was reported in the RFA to be located.

## 21 **2.4 Geophysical Investigation**

22 On January 11, 2002, Mr. Keith Jackson of Associated Technical Support conducted a  
23 geophysical survey of the area shown in Figure 2-1 using electromagnetic resonance-  
24 imaging technology. The results of the survey indicated that there are no remaining  
25 subsurface structures in the northwestern portion of AOC 701, though the original pump  
26 island, supply lines, and USTs apparently remain beneath the existing pavement along the  
27 northern end of Building 1141. All points indicating the potential presence of a significant  
28 buried object were marked in the field during the geophysical survey (see Appendix B).



Proposed Survey Area	N	<b>Figure 2-1</b> Area of Geophysical Investigation for USTs AOC 701, Zone E Charleston Naval Complex
Fence	0      40      80 Feet	
Railroads		
Roads - Lines	1 inch = 50 feet	
AOC Boundary	Buildings	
SWMU Boundary	Zone Boundary	<b>CH2MHILL</b>

## 1 **3.0 Proposed Sampling and Analysis**

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### 2 **3.1 Sampling Scope Summary**

3 Based on an evaluation of the data collected during the geophysical investigation and a  
4 comparison to the 1942 as-built drawings, surface and subsurface soil samples will be  
5 collected for analysis, as described below, to characterize shallow features, such as the  
6 delivery pipelines and the dispenser island. In addition, shallow and deep groundwater  
7 samples will be collected to assess whether the historical presence of USTs at this site has  
8 resulted in an environmental release. A full evaluation and presentation of the COPC  
9 screening against current criteria, as well as a COPC/chemical of concern (COC) refinement  
10 analysis, will be provided in an RFI report after collection and analyses of the samples  
11 proposed herein is complete.

### 12 **3.2 Sampling and Analysis Plan**

13 This section describes the proposed CSI sampling for soil and groundwater at AOC 701. The  
14 test results will be presented in an RFI report. The results will be evaluated to determine the  
15 nature and extent of site-related constituents, if any, and whether corrective measures are  
16 necessary at the unit.

17 Due to the history of this site as a gas station and the nature of the potential contaminants  
18 that could be present, the RCRA CSI sampling approach has followed the guidelines set  
19 forth in the South Carolina Department of Health and Environmental Control (SCDHEC)  
20 *Underground Storage Tank Assessment Guidelines for Permanent Closure and Change-in-Service*  
21 (SCDHEC UST Guidelines) (SCDHEC, August 2000).

22 It should be noted that current knowledge of the locations of the existing USTs, pipelines  
23 and dispenser island are based on an as-built drawing from 1942 and on the results of a  
24 geophysical survey. Therefore any subsurface investigations, including piezometer  
25 installation, should be conducted only after each location has been probed for buried  
26 obstructions.

27 Surface and subsurface soil samples will be collected for characterization of what appeared  
28 in the geophysical survey to represent residual structures from the pump island and  
29 pipelines. However, given the shallow nature of the water table in this area and the

1 expected depth to the base of the USTs, CH2M-Jones has elected to collect groundwater  
2 samples in lieu of soil samples for characterization of subsurface conditions associated with  
3 the USTs, per Section III (E) of the SCDHEC UST Guidelines.

4 All investigative work will be performed in accordance with the Comprehensive Sampling  
5 and Analysis Plan (CSAP) portion of the *Final Zone E RFI Work Plan, Revision 1*  
6 (EnSafe/Allen & Hoshall, 1995).

7 All sample locations will be surveyed for positioning in the CNC Environmental  
8 Geographic Information System (EGIS).

### 9 **3.2.1 Soil Investigation**

10 To evaluate the nature and extent of potential impacts that the historical pipelines, dispenser  
11 island operations, and maintenance operations may have had at AOC 701, a total of 10 soil  
12 borings will be advanced (see Figure 3-1). Both shallow (0 to 1 ft) and deep (3 to 5 ft ) soil  
13 samples will be collected at each location. Sample sites have been selected to evaluate each  
14 side of the dispenser island, along the pipeline, and along the eastern side of Building 1141  
15 where the service bays were located. The proposed analyte list is presented in Table 3-1 and  
16 the geographic coordinates of sample locations are presented in Table 3-2.

17 All sample locations will be surveyed for positioning in the CNC EGIS.

### 18 **3.2.2 Groundwater Investigation**

#### 19 **Groundwater Sampling**

20 Groundwater samples will be collected from six locations (see Figure 3-2) and analyzed for  
21 the parameters listed in Table 3-1. The geographic coordinates of sample locations are  
22 presented in Table 3-2. Two wells will be placed at each of the six locations: one shallow  
23 (across the water table) and one deeper (screen midpoint approximately 15 ft below ground  
24 surface [bgs]). The wells will be screened with a 5-ft screen (or shorter, if necessary,  
25 depending on the depth to groundwater). Sand will be installed to a minimum of 2 feet  
26 above the screen, if possible, and a bentonite seal will be added. The remainder of the  
27 annular space will be grouted to within 18-inches of land surface. The wells will be  
28 completed using flush-mount casings with locking caps. The wells will be developed and  
29 allowed to equilibrate for 24 hours prior to sampling. The wells will also be checked for  
30 signs of free product using an oil/water interface probe prior to sampling.

31 If no free product is encountered, the wells will be purged using the low flow method and  
32 sampled in accordance with South Carolina regulations.

1 **Water Level Elevation Piezometers**

2 Based on existing information, there are very few water level elevation measuring points  
3 available near AOC 701 to provide adequate detail of local hydrogeologic characteristics  
4 and groundwater flow patterns. There are also known areas east of AOC 701 where existing  
5 stormwater drainage lines are causing localized dewatering of the shallow aquifer and may  
6 be creating an artificial groundwater trough to some degree.

7 In addition to the monitoring wells, four new piezometers will be installed in the vicinity of  
8 AOC 701 (see Figure 3-2) to assist in clarifying the local direction of groundwater flow at  
9 this site.

10 All piezometers will be constructed of 1-inch diameter PVC riser with a 5-ft screen  
11 positioned across the water table. The piezometers will be completed in accordance with  
12 the procedures described above for monitoring wells.

13 **Water Level Elevation Measurements**

14 Water level elevation measurements will be collected from the six new monitoring well  
15 pairs, the two existing onsite grid wells, and the four piezometers. Water level elevation  
16 data will also be collected from several existing shallow wells in the vicinity of AOC 701 to  
17 define the localized direction of groundwater flow in the event that COPCs are identified.

18 Water level elevations will be measured in the following wells:

- 19 • E523GW001
- 20 • E523GW002
- 21 • E559GW001
- 22 • E559GW002
- 23 • E559GW003
- 24 • E559GW004
- 25 • E559GW005
- 26 • EGDEGW014
- 27 • EGDEGW015
- 28 • EGDEGW028

29

30 All sampling and related work activities will be conducted as previously described in the  
31 *RFI Addendum Sampling Plan – Zone E Uninvestigated Units, Revision 1.*

32

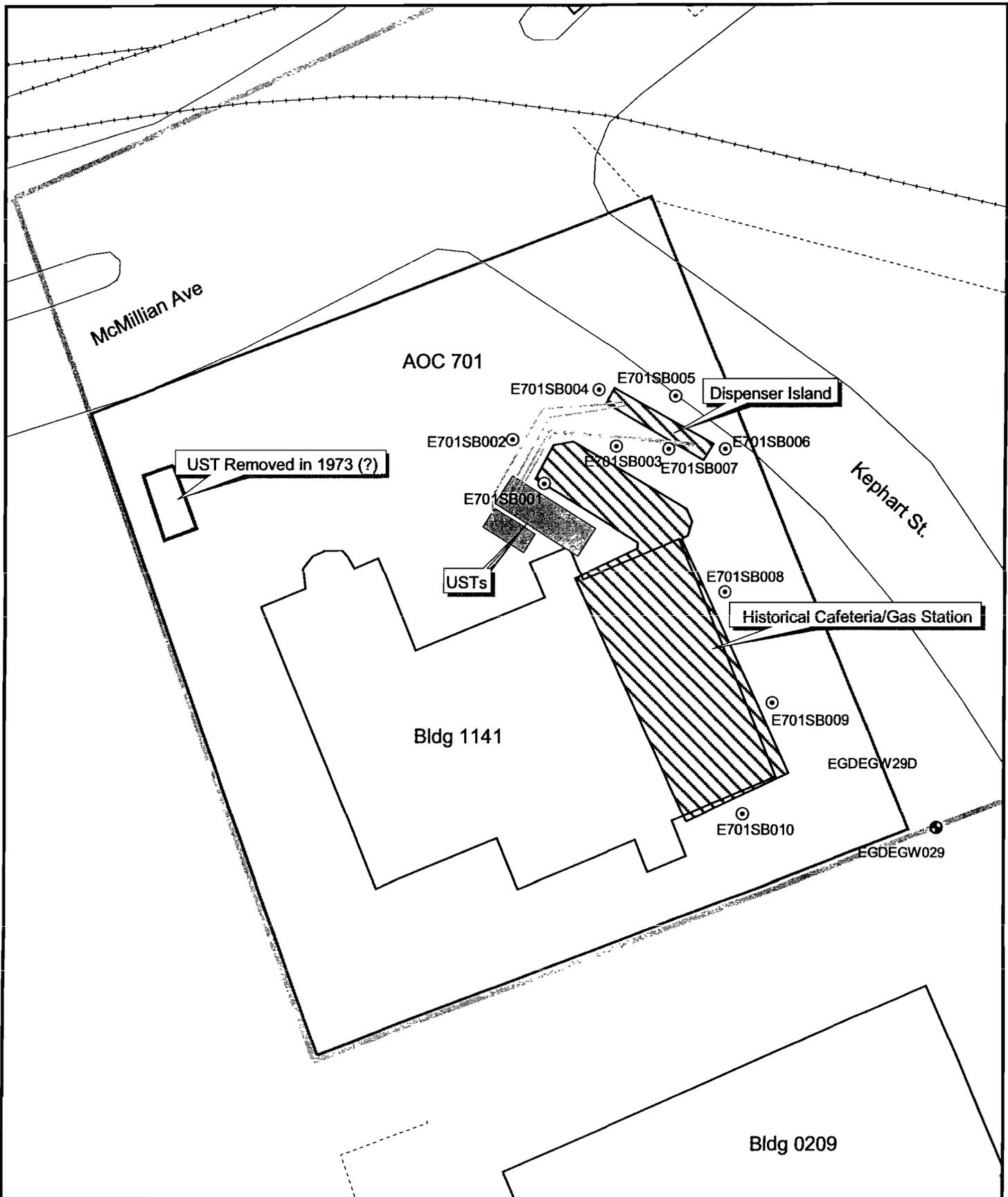
**TABLE 3-1**  
 Analytical Summary for Supplemental Soil Sampling Activities  
 Sampling and Analysis Plan Addendum, AOC 701, Zone E, Charleston Naval Complex

New Sample ID	Number of Sample Locations	Analytes	Analytical Methods
<b>Surface and Subsurface Soils – Nature and Extent</b>			
E701SB001	10 locations, with 2 depth intervals (0-1 ft bgs and 3-5 ft bgs) – 20 samples total	Volatile Organic Compounds (VOCs)	Method 8260
E701SB002			
E701SB003		Semivolatile Organic Compounds (SVOCs)	Method 8270C
E701SB004			
E701SB005		Metals	SW 846, as appropriate
E701SB006			
E701SB007		Polychlorinated Biphenyls (PCBs)	Method 8082
E701SB008			
E701SB009		Pesticides	Method 8081A
E701SB010			
E701SB011			
E701SB012			
<b>Groundwater</b>			
New shallow temporary wells:	6 locations total, screened across the water table	VOCs	Method 8260
E701TW001		SVOCs	Method 8270C
E701TW002		Metals	SW 846, as appropriate
E701TW003			
E701TW004			
E701TW005			
E701TW006			
New deep temporary wells:	6 locations total, collocated with the new shallow wells, screened with the midpoint approximately 15 ft bgs	VOCs	Method 8260
E701TW001D		SVOCs	Method 8270C
E701TW002D		Metals	SW 846, as appropriate
E701TW003D			
E701TW004D			
E701TW005D			
E701TW006D			

**TABLE 3-2**  
 Coordinates for Proposed Sampling Locations  
*Sampling and Analysis Plan addendum, AOC 701, Zone E, Charleston Naval Complex*

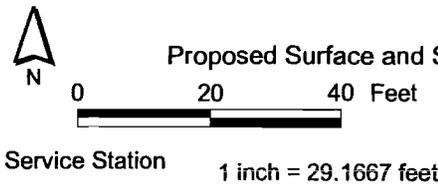
<b>New Sample ID</b>	<b>Northing</b>	<b>Easting</b>
<b>New Soil Borings to be Sampled</b>		
E701SB001	376,062	2,316,125
E701SB002	367,072	2,316,121
E701SB003	367,070	2,316,143
E701SB004	367,082	2,316,141
E701SB005	367,078	2,316,156
E701SB006	367,069	2,316,165
E701SB007	367,070	2,316,155
E701SB008	367,039	2,316,165
E701SB009	367,165	2,316,176
E701SB010	367,013	2,316,172
<b>New Groundwater Wells to be Installed, Developed, and Sampled</b>		
E701MW001	367,066	2,316,057
E701MW002	367,112	2,316,066
E701MW003	367,088	2,316,123
E701MW004	367,075	2,316,158
E701MW005	367,069	2,316,136
E701MW006	367,025	2,316,171
<b>New Groundwater Wells to be Installed, Developed, and Sampled</b>		
E701PZ001	367,165	2,316,033
E701PZ002	367,145	2,316,191
E701PZ003	367,036	2,316,024
E701PZ004	367,946	2,316,080

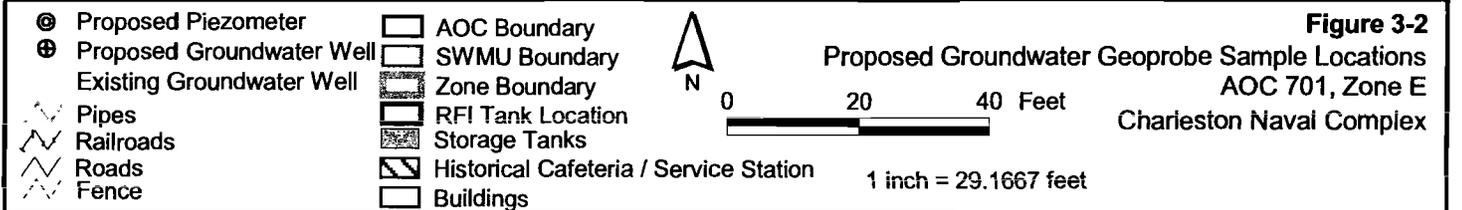
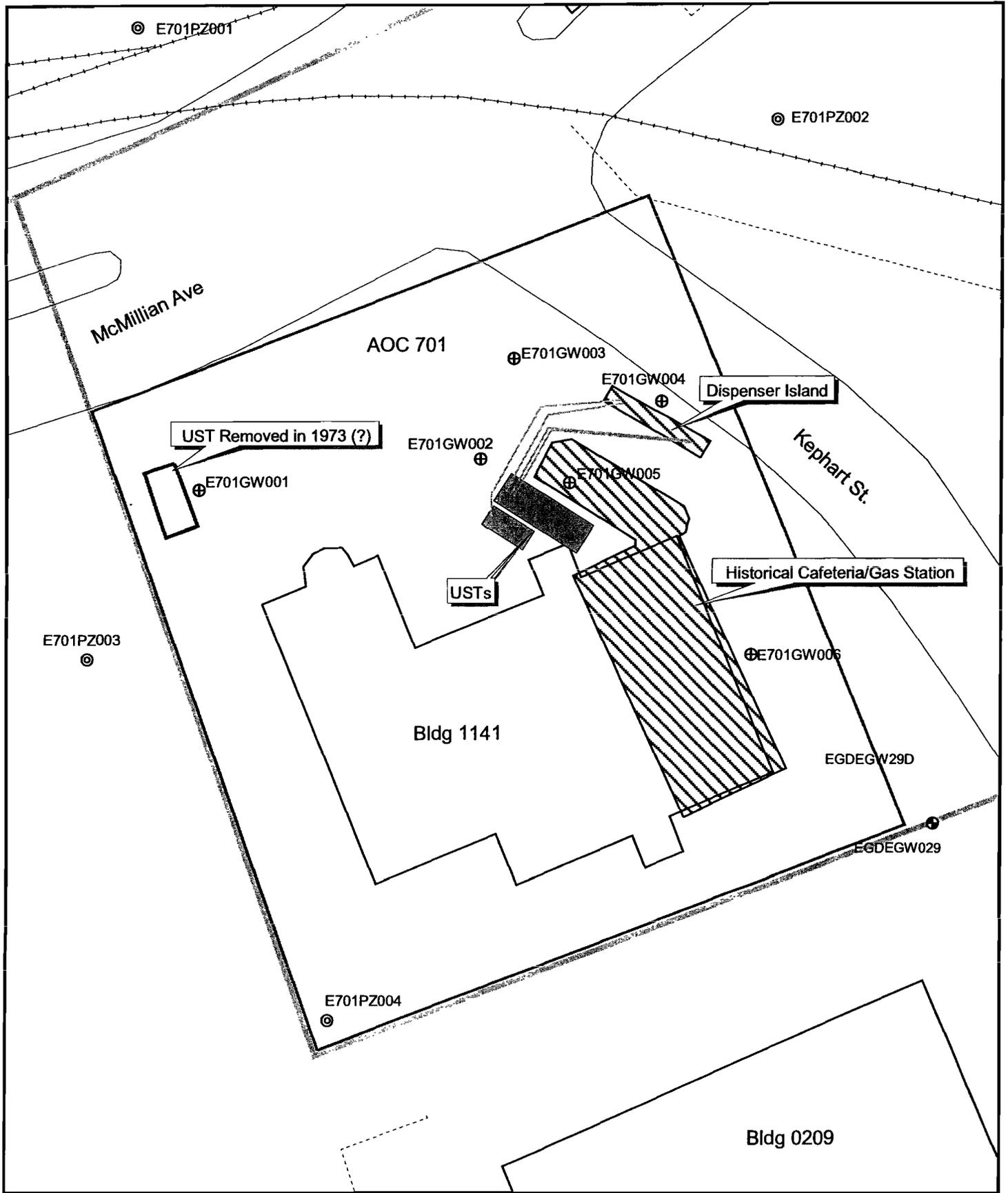
**IMPORTANT NOTE:** *These coordinates have been selected based on scaled drawings and geophysical reports. However, field verification will be necessary at all locations prior to drilling or augering. Sample locations may be adjusted in the field relative to known subsurface features or based on information obtained during probing.*



**Figure 3-1**  
 Proposed Surface and Subsurface Sample Locations  
 AOC 701, Zone E  
 Charleston Naval Complex

- |                            |  |
|----------------------------|--|
| ⊙ Proposed Sample Location | ▭ AOC Boundary                           |
| ⊙ Groundwater Well         | ▭ SWMU Boundary                          |
| ∧ Pipes                    | ▭ Zone Boundary                          |
| ∧ Railroads                | ▭ RFI Tank Location                      |
| ∧ Roads                    | ▭ Storage Tanks                          |
| ∧ Fence                    | ▭ Historical Cafeteria / Service Station |
|                            | ▭ Buildings                              |



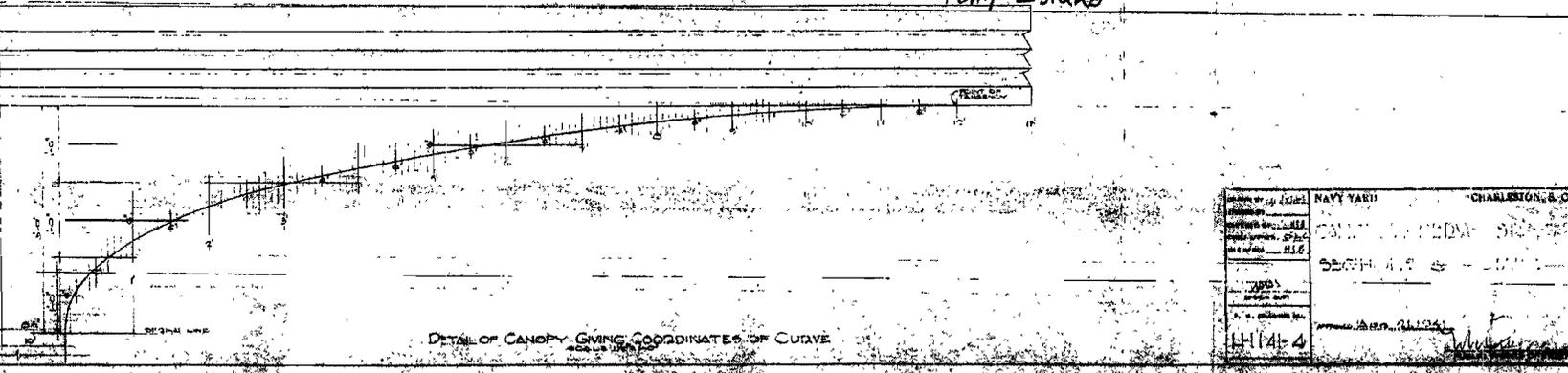
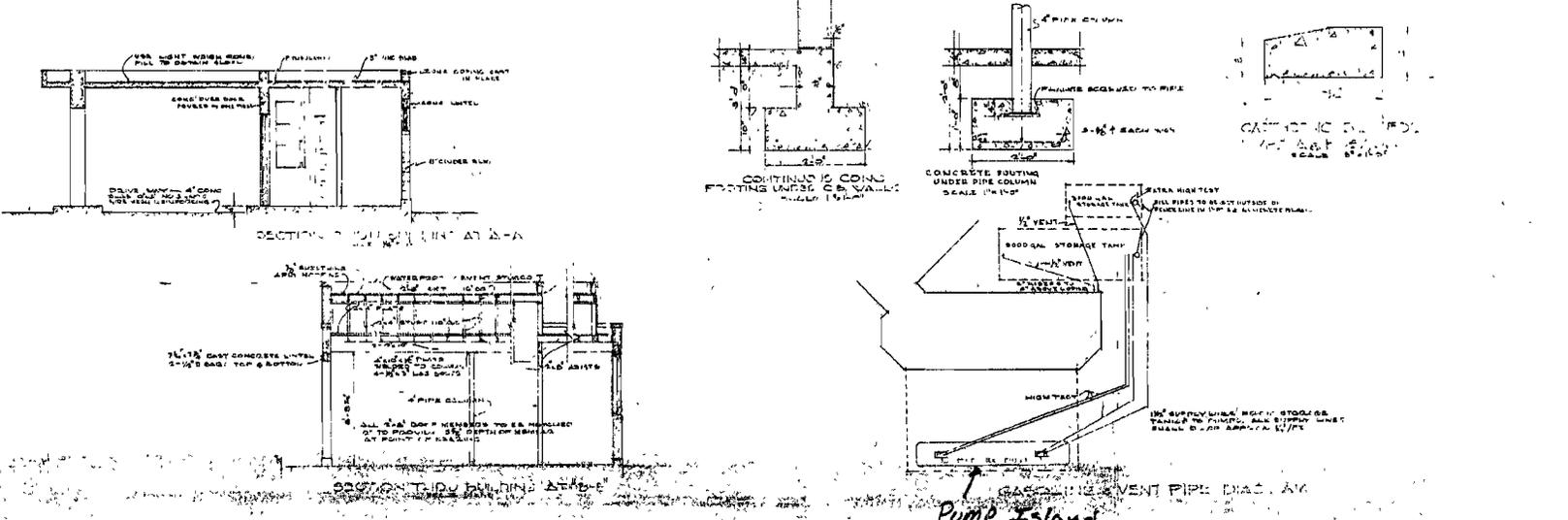
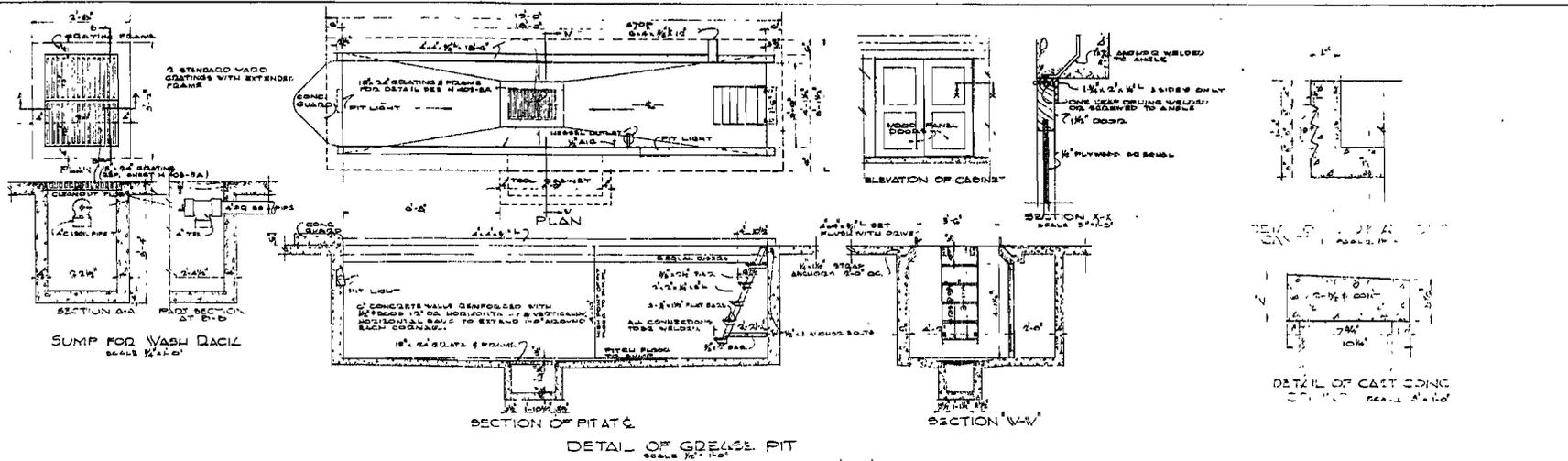


## 1 4.0 References

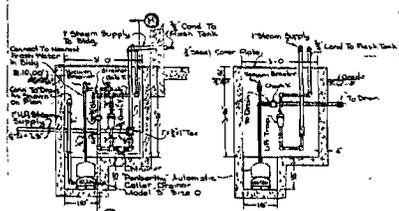
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- 2 CH2M-Jones. *RFI Addendum Sampling Plan – Uninvestigated Sites, Zone E, Revision 1.*  
3 December 2001.
- 4 EnSafe Inc. *Zone E RFI Report, Revision 0. NAVBASE Charleston.* November 1997.
- 5 EnSafe Inc. *Zone E RFI Work Plan, Revision 0.* 1995.
- 6 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment Report, NAVBASE Charleston.*  
7 June 6, 1995.
- 8 EnSafe Inc./Allen & Hoshall. *Final Comprehensive RFI Work Plan.* 1994.
- 9 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Revision 1.* 1995.
- 10 South Carolina Department of Health and Environmental Control (SCDHEC). *Underground*  
11 *Storage Tank Assessment Guidelines for Permanent Closure and Change-in-Service.* August 30,  
12 2000.

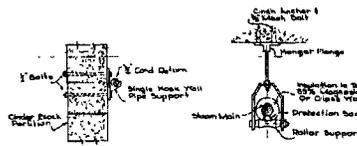




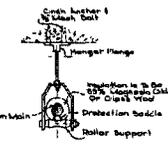
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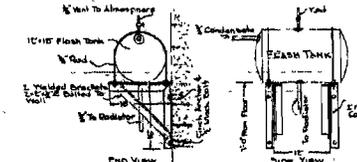
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DETAIL OF SIBR  
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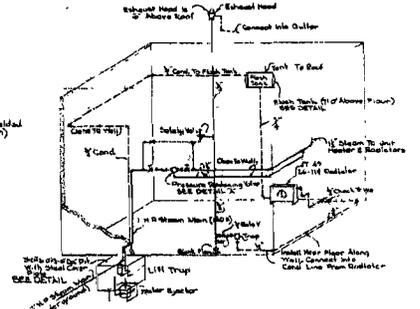
DETAIL OF RETURN MAIN SUPPORT  
Scale 1/4" = 1'-0"



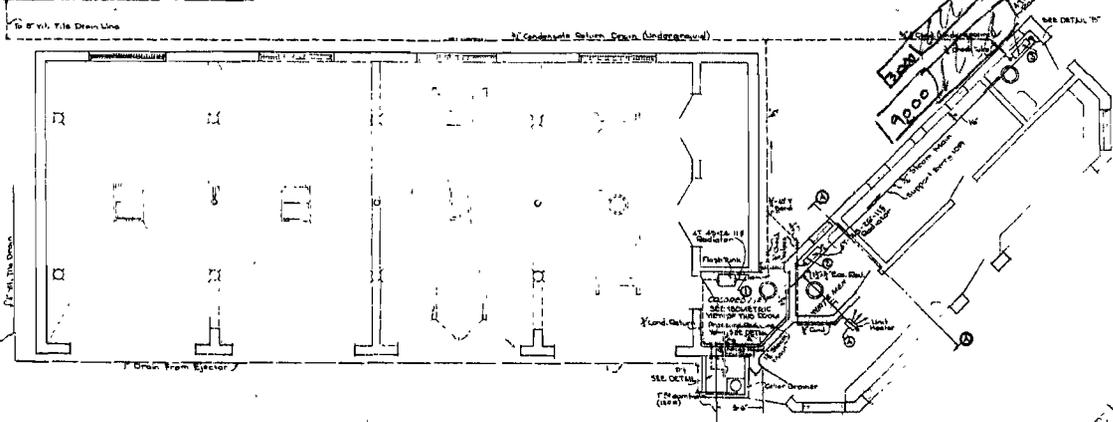
DETAIL OF SUPPLY MAIN SUPPORT  
Scale 1/4" = 1'-0"



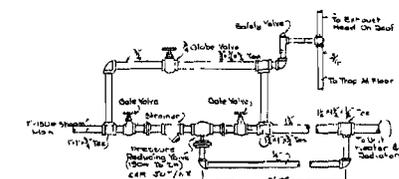
DETAIL OF FLASH TANK  
Scale 1/4" = 1'-0"



ISOMETRIC VIEW OF DISHS IN CALORIC TOILET  
Scale 1/4" = 1'-0"

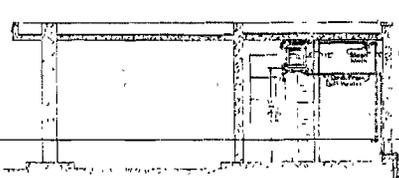


PLAN  
Scale 1/4" = 1'-0"

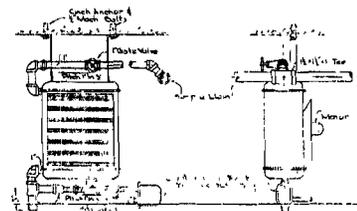


DETAIL X CONNECTION AT DISBURSE RETURN VALVE  
Scale 1/4" = 1'-0"

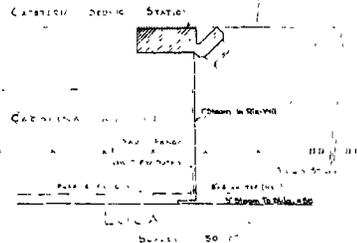
**NOTES**  
 1. High Pressure Steam Supply Piping is Steel, Flanges are Wrought with Cast Iron Fittings.  
 2. High Pressure Steam Supply Piping up to Pressure Reducing Valve is Steel, Extra Strength Weight with Cast Iron Flanged Fittings (150# Class).  
 3. Condensate Return Piping is Galvanized Wrought Iron, Standard Weight, with Cast Iron Fittings.



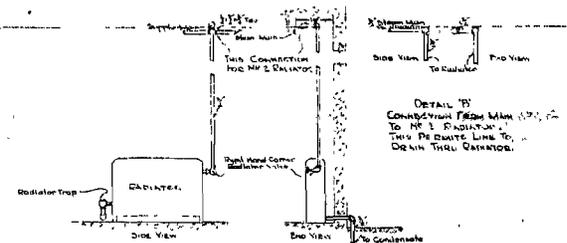
SECTION THRU SIBR  
Scale 1/4" = 1'-0"



DETAIL Y CONNECTION FROM MAIN TO RADIATOR  
Scale 1/4" = 1'-0"



CATERINA SERVICE STATION  
Scale 1/4" = 1'-0"



TYPICAL CONNECTION AT RADIATOR  
Scale 1/4" = 1'-0"

LIMIT HEIGHTS	
WATER	100'
STEAM	100'
CONDENSATE	100'
VENT	100'

Drawn by: *AWB*  
 Checked by: *AWB*  
 Date: *1/14/11*  
 DW Drawing No: **H114-11**  
 U.S. NAVY YARD, CHINA BARRACKS  
**CAFETERIA SERVICE STATION**  
**HEATING LAYOUT & DETAILS**  
 Approved: *[Signature]*



## Charleston Naval Complex - AOC 701, Zone E - Geophysical Investigation Results

PREPARED FOR: Kris Garcia/CH2M-Jones  
PREPARED BY:  Jed Heames, Site Superintendent/CH2M-Jones  
DATE: April 8, 2002

CH2M-JONES, LLC, subcontracted the services of *Associated Technical Support*, a firm specializing in locating underground utilities, metallic objects, and anomalies. *Associated Technical Support* was contacted for their technical expertise to verify the location of an Underground Storage Tank (UST) system at Building 1141 (former gas station). The RCRA Facility Investigation at Charleston Naval Base, Charleston SC showed the UST located on the northwest side of Building 1141 while the as-built drawing showed the tank system near the northeast corner of the building (See Figure 7-1). On 11 January 2002, Mr. Keith Jackson of *Associated Technical Support* performed an electromagnetic resonance-imaging scan of the parking area on the northeast, north, and northwest sides of Building 1141. The CH2M-Jones' Site Superintendent was present while Mr. Jackson conducted the geophysical investigation.

Mr. Jackson's survey revealed underground anomalies on the northeast corner of Building 1141 that he marked with paint. Following the survey, Mr. Jackson's markings coincided with the as-built drawing, i.e., they revealed the gas pump island, the supply lines to the pump island, and a large anomaly believed to be the UST. Mr. Jackson's survey of the northwest area where the RFI showed the UST did not detect any anomalies below ground surface. Based on the survey's findings, Mr. Jackson felt confident that the as-built drawing was representative of the actual conditions.

Distribution: Dean Williamson/GNV  
Sam Naik/ATZ  
Tom Beisel/ATZ



Pipes	AOC Boundary	N	<b>Figure 1</b> Historical Gas Station / Cafeteria Building Location AOC 701, Zone E Charleston Naval Complex
Suspected Storage Tank Location	SWMU Boundary		
Historical Cafeteria / Gas Station	Buildings	0 40 80 Feet 1 inch = 50 feet	
Fence	Zone Boundary		
Railroads			
Roads			