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CORRECTIVE ACTION PLAN FOR SITE 44 ABOVEGROUND STORAGE TANK 601 ZONE H SITE IDENTIFICATION NUMBER 01537 CNC CHARLESTON SC

9/1/2001

CH2M HILL

CORRECTIVE ACTION PLAN
FOR
SITE 44, ABOVEGROUND STORAGE TANK 601, ZONE H
Site Identification # 01537

Charleston Naval Complex
Charleston, South Carolina

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND

Contract Number N62467-99-C-0960

September 2001

CORRECTIVE ACTION PLAN
FOR
Site 44, AST 601, ZONE H
Site Identification # 01537

Charleston Naval Complex
Charleston, South Carolina

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29406

Submitted by:
CH2M-JONES, LLC.
Charleston Navel Complex
1849 Avenue F
North Charleston, South Carolina 29405

Contract Number: N62467-99-C-0960

September 2001

CERTIFICATION

I certify that the information contained in this report is true, and complete to the best of my knowledge, information, and belief.

Approved By: Richard Greene Date: 9/17/01

South Carolina Registration No. 14220

ACRONYMS

AST	Aboveground storage tank
bls	below land surface
BTEX	benzene, toluene, ethylbenzene and xylenes
BRAC	Defense Base Realignment and Closure Act
CAP	Corrective Action Plan
CNC	Charleston Naval Complex
CoC	Chemical of Concern
DOT	Department of Transportation
EISOPQAM	Environmental Investigations Standard Operating Procedures and Quality Assurance Manual
EPA	Environmental Protection Agency
ft bls	feet below land surface
mg/kg	milligram per kilogram
mg/L	milligram per liter
OVA	Organic Vapor Analyzer
PAHs	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
RA	Rapid Assessment
RAR	Rapid Assessment Report
RBSL	Risk-Based Screening Level
RCRA	Resource Conservation Recovery Act
SCDHEC	South Carolina Department of Health and Environmental Control
SOUTHDIV	Southern Division Naval Facilities Engineering Command
SSTL	Site-Specific Target Level
SWMU	Solid Waste Management Unit
TtNUS	Tetra Tech NUS
UST	Underground Storage Tank
µg/L	micrograms per liter

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*** All Tables are from TtNUS July 2001 results**

Figures

1.0 INTRODUCTION

This Corrective Action Plan (CAP) has been prepared by CH2M-JONES, LLC. The plan is designed for Site 44, Aboveground Storage Tank (AST) 601, Zone H; located at the Charleston Naval Complex (CNC), Charleston, South Carolina. Site 44 contains the location of a former petroleum Aboveground Storage Tank (AST) system used to store fuel oil to operate boilers in Building NS69. The South Carolina Department of Health and Environmental Control (SCDHEC) has designated Site 44 with Identification Number 01537.

This CAP provides a method for active remediation of the sites by first removing petroleum (free product) from the groundwater and potentially removing affected soils identified in the vicinity of the former AST basin; conducting groundwater sampling to evaluate the active remediation of the site; and implementing intrinsic remediation and monitoring well abandonment as a corrective action in accordance with SCDHEC Corrective Action Guidance, June 1997. The CAP was developed using the information provided in the Rapid Assessment Report (RAR) for Site 44 prepared by Tetra Tech NUS, Inc. (TtNUS), dated July 2001. The applicable tables and figures from the RAR have been incorporated into this CAP.

1.1 GENERAL SITE DESCRIPTION

The CNC is located in the city of North Charleston, on the west bank of the Cooper River in Charleston County, South Carolina (Figure 1). This installation consists of two major areas: an undeveloped dredge materials area on the east bank of the Cooper River on Daniel Island in Berkley County, and a developed area on the west bank of the Cooper River. The developed portion of the base is on the peninsula bounded on the west by the Ashley River and on the east by the Cooper River. The site is located within the developed portion of the base (Figure 2).

The area surrounding CNC is "mature urban", having long been developed with commercial, industrial, and residential land use. Commercial areas are primarily west of CNC; industrial areas are primarily to the north of the base along Shipyard Creek. A site vicinity map, which exhibits adjacent properties and structures, vicinity roads, current utilities, and vicinity surface drainage, is included as Figure 2.

1.2 SITE BACKGROUND

The CNC began operations in 1901, when the Navy acquired the property. In 1993, the CNC was added to the list of bases schedule for closure under the Defense Base Realignment and Closure Act (BRAC). BRAC regulates the closure of the base and transition of the property back to the community. With the scheduled closure of the base, environmental cleanup has proceeded to make the property available for redevelopment after closure.

Building NS69 is a boiler facility providing steam to nearby buildings. AST 601 was a 1,200 gallon steel tank, which supplied fuel to the boilers. The tank was located in an earthen berm enclosure across from Vesole Street approximately 100 feet from Building NS69. Buried

feed and return lines ran from AST 601 to the northeast corner of Building NS 69. For more historical information on this site refer to the Rapid Assessment completed by TtNUS.

Notes

2.0 RAPID ASSESSMENT SUMMARY

TtNUS completed a Rapid Assessment Report (RAR), dated July 2001, for Site 44 Zone H. The assessment information was used to develop this CAP. The information from the RAR is summarized in this section.

2.1 RECEPTOR SURVEY

A receptor survey of the site vicinity was conducted by TtNUS personnel to identify potential receptors for petroleum hydrocarbon contamination. Figure 2 depicts the public utilities located within 250 feet of the former UST and AST study areas. The receptor utilities located on or near the site include sanitary sewer, potable water, saltwater distribution, compressed air, and electrical. Specific information concerning the depth of utilities below land surface is currently unavailable, however, utilities at this site generally are between 2 to 6 feet below land surface (ft bls).

A survey of groundwater users within a 7-mile radius of CNC was conducted by the South Carolina Water Resources Commission to ascertain the extent of any shallow groundwater usage. Results of the water use investigation revealed that no shallow potable water wells or irrigation wells within 1,000 feet of the site. Numerous monitoring wells are located within 1,000 feet of the site. The nearest surface water body to AST 601 is the Cooper River located approximately 1,750 feet to the north and northeast and the wetlands associated with Shipyard Creek, approximately 1,850 feet to the south.

There are no city, county or state-zoning ordinances, the property (CNC) is currently owned by the federal government. Information concerning zoning ordinances was obtained from the SOUTHDIV Remedial Project Manager located at 2155 Eagle Drive, North Charleston, South Carolina 29406.

2.2 SOIL AND GROUNDWATER ASSESSMENT RESULTS

TtNUS conducted field activities for the RA, which included the installation and sampling direct push soil borings, shallow monitoring wells, and temporary and permanent piezometers (vertical delineation wells). Six (6) previously installed wells (CNC44-M01, CNC44-M02, CNC44-M03, CNC44-M04, CNC44-M05, CNC44-M06, and CNC440M07D) were also included in the assessment.

As reported in the RAR, the site lithology consists of silty sand and gravel from ground surface to approximately 2 feet below land surface (ft bls), underlain by organic clay to silty clay to approximately 14 ft bls. Silty sands underlie the clay to approximately 30 feet bls. A silty clay with shell fragments was then encountered to approximately 38 feet bls, the maximum depth of the borings. Two geologic cross sections of the site are depicted in Figures 4 and 5. Groundwater levels ranged from 2 to 6 ft bls (Table 1). Groundwater is influenced on site by tidal fluctuations.

During the RA, naphthalene, chrysene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)fluoranthene, ethylbenzene, and benzene soil contaminant concentrations exceeded

Risk-Based Screening Levels (RBSLs) established by SCDHEC (Risk-Based Corrective Action For Petroleum Release, May 15, 2001) , Table 6.

Bezene and naphthalene were the only groundwater COCs detected at concentrations above the RBSLs (Table 7). Toluene, ethylbenzene, xylene, and MtBE were identified at concentrations above the laboratory detection limits, but below the RBSLs.

Following aquifer characterization, TtNUS determined the fate and transport parameters during the RA in order to assess the contaminant plume behavior (Appendix F, TtNUS, July 2001). As illustrated in Figure 10 of the RA, the Domenico model was used to predict the distance at which the tip of the contaminant plume is attenuated to SCDHEC RBSLs in 10 and 20 years, respectively.

2.3 DEVELOPMENT OF SITE-SPECIFIC TARGET LEVELS (SSTLS)

In the RA, TtNUS evaluated the receptor characterizations of the potentially exposed populations in the vicinity of the site for current and future land use scenarios and identified the potentially complete exposure pathways for those receptors. The evaluation resulted in two applicable scenarios for the calculation of SSTLs: on-site construction worker exposure to soil and groundwater and surface water exposure (Cooper River). No other exposure routes pathways were considered likely threats. The exposure pathway analysis is summarized in Tables 10 and 11.

Because the concentrations in the groundwater and soil exceed the minimum calculated SSTLs protective of a construction worker in a utility trench for this site, TtNUS recommended that a Corrective Action Plan be submitted.

Notes

3.0 PROPOSED CORRECTIVE ACTION

This CAP provides a method for active remediation of the site by removing free petroleum product identified in the vicinity of the former AST 601 area, and soil delineation in the areas identified to have elevated contaminates above the RBSLs. The active remediation will be split into two separate areas (Figure 14). The first area is located to the north and south of the former AST 601. This area has a history of contaminated soils above the RBSLs, which will be sampled and delineated and possibly followed by soil removal depending on the results. The second area is located just west of Building NS69 where the two fuel lines where cut. This area has a history of free product in groundwater. Active remediation includes removing all free product from the groundwater at the site. Once the active remediation is completed the intrinsic remediation (sampling plan) will be implemented followed by monitoring well abandonment in accordance with SCDHEC Corrective Action Guidance, June 1997. The proposed active remediation plan is described in Section 4.0, and the proposed intrinsic remediation plan is described in Section 5.0.

3.1 SOIL REMEDIATION

After the soil samples are collected, and the areas have been delineated, soils will be excavated (Figure 15). After excavation activities are completed, an excavation report will be submitted to SCDHEC showing pictures and volumes removed.

3.2 GROUNDWATER REMEDIATION

During the RA, two monitoring wells (CNC44-M01 and CNC44-M04) contained small amounts of free product (Figure 8). Because of those findings, groundwater will be monitored for a period of up to eighteen (18) months. During monitoring, an interface probe will be used to gauge all wells. If free product is identified no sample will be collected and the free product will be removed using one of the two methods listed below. The wells will be checked on a routine schedule and product will be removed as needed. Once all product has been removed from the area, the groundwater monitoring will proceed.

Step 1: A 2 inch hand bailer will be used to remove floating hydrocarbons (free product). A routine schedule will be implemented to monitor the free product. Each time the free product is gauged, it will be removed. Once free product is less than .01 feet thickness, the groundwater-sampling plan will be implemented.

Step 2: A passive removal/skimmer system will be implemented at the site to remove free product. A passive, floating skimmer with a product recovery filter canister is designed to remove free product down to a sheen or thickness of 0.01 feet thickness. Typically, the skimmer is lowered into the well until the midpoint of the skimmer is located at the fluid level in the well. Floating hydrocarbons (free product) enters the skimmer through the floating intake outer debris screen and then through an inner oileophilic hydrophobic screen, and down into a clear canister for storage. To empty the skimmer, the device is brought to the surface, and the canister is drained using the

discharge valve at the skimmer base. A dedicated, free product bailer will be utilized to remove free product from the top of the well if free product thickness is near or less than 0.01 feet.

Notes

4.0 PROPOSED ACTIVE REMEDIATION

Groundwater:
Active remediation of the groundwater at the site will include removing free product identified in the vicinity of the former AST 601, and conducting groundwater sampling to evaluate the active remediation of the site.

Soil:
Active remediation will include excavation of contaminated soils.

4.1 FREE PRODUCT RECOVERY SYSTEM

If the 2 inch hand bailers fail to recover a reasonable amount of free product from the monitoring wells, free product will be removed using a passive removal/skimmer system. A passive, floating skimmer with a product recovery filter canister will be used for the removal of free product in recovery wells with a product thickness greater than 0.01 feet. A Tidal Passive Skimmer™, developed by Clean Environmental Equipment with extra long strokes for sites with high and low tide considerations, or an equivalent device for a 2-inch diameter well with a capacity of 0.75 liter or greater should be adequate for the conditions at the site assuming that product levels are greater than 0.01 feet in the well (Appendix A). A minimum thickness of 0.01 feet is required for the Tidal Passive Skimmer™ and most passive skimmer devices. A dedicated, free product bailer will be utilized to remove free product from the top of the wells if free product thickness is near or less than 0.01 feet.

4.2 MONITORING WELL INSTALLATION

If any wells become unusable or new wells are warranted for any other reason, the wells will be installed to the same specification as existing monitoring wells unless site conditions change and warrant otherwise. The wells will be installed in accordance with South Carolina Well Standards and Regulations R.61-71. A utility locate will be completed prior to any well installation activities. Any necessary permits will be acquired prior to well installation activities.

4.3 SURVEYING

Surveying of any new well locations will be conducted as a part of this CAP.

4.4 SOIL BORING SCHEDULE

Currently a total of eight soil borings will be collected. Two intervals will be collected for each soil boring. The first interval will be from 0-1 feet below land surface (bls) and the second interval will be from 3-5 feet bls, or before the saturated zone (Figure 15). Samples will be analyzed for VOCs and SVOCs. If the first eight soil samples do not properly delineate the areas, additional sampling may be required.

4.5 SYSTEM OPERATION AND MAINTENANCE

Groundwater:
System operation and maintenance will be conducted every week for the first month, and a minimum of once per month thereafter. The actual frequency of site visits will depend on the free product removal rates. During scheduled site visits, free product will be removed by hand bailing. System operation and maintenance will include the measurement of the free product level in the recovery well, the estimate of free product amount removed from the recovery well, and the examination of the downgradient and nearby monitoring wells for free product.

Soil:
After the initial delineation sampling, no additional soil sampling will be conducted.

4.6 SAMPLING AND ANALYSIS PLAN

Groundwater:
Once all free product has been removed from the site, a groundwater monitoring will be implemented. Groundwater will be monitored for a period of up to eighteen months. The groundwater samples will be submitted to a certified laboratory for analysis of benzene, toluene, ethylbenzene and xylenes (BTEX) and Naphthalene by EPA Method 8260.

Groundwater level measurements will be collected from all monitoring wells prior to all groundwater sampling events. Measurements will be taken with an electrical water level indicator or interface probe if floating product is present. No groundwater samples will be collected if free product is measurable.

Three to six well volumes will be purged from each well prior to groundwater sampling. Field measurements of pH, groundwater temperature, specific conductance, dissolved oxygen, and turbidity will be taken during groundwater sampling events.

All sampling procedures will be conducted in accordance with EPA Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), 1996. Any contaminated groundwater collected during the well sampling events will be containerized in DOT-approved (Specification 7H) 55-gallon drums and disposed of at a later date pending fluid contents analysis.

Soil:
After the initial delineation sampling, no additional soil sampling will be conducted.

4.7 REPORTING

Monitoring reports will be submitted to SCDHEC following each sampling event. The reports will summarize and include copies of field and laboratory analytical data.

4.8 EQUIPMENT DECONTAMINATION

All drilling equipment, augers, well casing and screens, and soil and groundwater sampling equipment involved in field sampling activities will be decontaminated according to the EPA EISOPQAM.

4.9 SAMPLE HANDLING

Sample handling will be conducted in accordance to the following references: EPA EISOPQAM, Code of Federal Regulations 136, 1990, and EPA Users Guide to Contract Laboratory Program, 1988. The following forms will be completed for packing/shipping process: sample labels, chain-of-custody labels, appropriate labels applied to shipping coolers, and chain-of-custody forms.

4.10 QUALITY CONTROL

In addition to periodic calibration of field equipment and the completions of the appropriate documentation, quality control (QC) samples will be collected during sampling events. QC samples may include field blanks, field duplicates, and trip blanks. Definitions of each can be found below as described by the EPA EISOPQAM:

- **Field Blank:** A sample collected using organic-free water, which has been run over/through sample collection equipment. These samples are used to determine if contaminants have been introduced by contact of the sample medium with sampling equipment. Equipment field blanks are often associated with collecting rinse blanks of equipment that has been field cleaned.

- **Field Duplicates:** Two or more samples collected from a common source. The purpose of a duplicate sample is to estimate the variability of a given characteristic or contamination associated with a population.

- **Trip Blank:** A sample, which is prepared prior to the sampling event in the actual container and is stored with the investigative samples throughout the sampling event. They are often packaged for shipment with the other samples and submitted for analysis. At no time after their preparation are trip blanks to be opened before they reach the laboratory. Trip blanks are used to determine if samples were contaminated during storage and/or transportation back to the laboratory (a measure of sample handling variability resulting in positive bias in contaminant concentration). If samples are to be shipped, trip blanks are to be provided with each shipment but not for each cooler.

4.11 FIELD QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

All sampling procedures will be conducted in accordance with EPA EISOPQAM. More information on field QC can be found in Sections 4.8 through 4.10.

QA/QC specifications for selected field measurements are summarized below.

Analysis	Control Parameter	Control Limit	Corrective Action
Air Monitoring	Check Calibration of OVA daily	Calibrate to manufactures specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH = 7.0	Recalibrate. If unable to calibrate, replace electrode.
Specific Conductance of water	Continuing calibration check of standard solution	> 1% of standard	Recalibrate.

4.12 RECORD KEEPING

In addition to required sampling documentation (see Section 4.9), standardized forms, log sheets and logbooks will be completed during all field activities.

5.0 PROPOSED INTRINSIC REMEDIATION

Upon completion of active remediation, if warranted, intrinsic remediation will be implemented until contaminant concentrations decrease below RBSLs or other action levels approved by SCHDEC. This CAP provides a method for implementing intrinsic remediation and monitoring well abandonment as a corrective action in accordance with SCDHEC Corrective Action Guidance, June 1997. The intrinsic remediation method may be modified based upon the results of active remediation.

5.1 MONITORING WELL INSTALLATION

Assuming the wells from the active remediation method are in good condition, no monitoring wells will be installed for the CAP. If any wells are unusable or new wells are warranted for any other reason, the wells will be installed to the same specification as existing monitoring wells unless site conditions change and warrant otherwise.

5.2 SURVEYING

No new monitoring wells are scheduled to be installed as a part of the intrinsic CAP. Surveying of any new well locations will be conducted if warranted.

5.3 SOIL BORING SCHEDULE

No other soils borings are scheduled for the CAP unless site conditions change and warrant otherwise.

5.4 MONITORING WELL ABANDONMENT

All monitoring wells will be abandoned upon receiving approval by SCDHEC. The wells will be abandoned following the South Carolina Well Standards and Regulations R.61-71. The well abandonment will include grouting wells, removing stick-ups and removing all guard posts. Any well casing and screen removed will be decontaminated and disposed of as general refuse.

5.5 SAMPLING AND ANALYSIS PLAN

Groundwater:
Groundwater samples will be collected on a quarterly basis for a period of up to 18 months from monitoring wells CNC44-M01 thru CNC44-M09. The groundwater samples will be submitted to a certified laboratory for analysis of BTEX and naphthalene by EPA Method 8260. The following parameters may also be considered for analysis in order to evaluate the effectiveness of intrinsic remediation: nitrate (NO^{-3}), sulfate (SO^{-4}), total dissolved iron, methane (CH_4), and alkalinity.

Groundwater level measurements will be collected from all monitoring wells prior to all groundwater sampling events. Measurements will be taken with an electrical water level

indicator or interface probe if floating product is present. No groundwater samples will be collected if free product is measurable.

Three to six well volumes will be purged from each well prior to groundwater sampling. Field measurements of pH, groundwater temperature, specific conductance, dissolved oxygen, and turbidity will be taken during groundwater sampling events.

All sampling procedures will be conducted in accordance with EPA EISOPQAM. Any contaminated groundwater collected during the well sampling events will be containerized in DOT-approved (Specification 7H) 55-gallon drums and disposed of at a later date pending fluid contents analysis.

Soil:
No intrinsic monitoring will be used for soils at this site. For initial delineation sampling see Section 4.0.

5.6 REPORTING

Monitoring reports will be submitted to SCDHEC upon completing each sampling event. The reports will summarize and include copies of field and laboratory analytical data.

Notes

6.0 SITE MANAGEMENT AND BASE SUPPORT

Throughout the investigation activities, work on the CNC will be coordinated through SOUTHDIV and SCDHEC.

The primary contacts for each are as follows:

1. SOUTHDIV point of contact
   Gabe Magwood
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-7307

2. SOUTHDIV point of contact
   Tony Hunt
   Southern Division Engineering Command
   2155 Eagle Drive
   North Charleston, SC 29406
   (843) 820-5525

3. SCDHEC point of contact
   Michael Bishop
   South Carolina Department of Health and Environmental Control
   2600 Bull Street
   Columbia, SC 29201
   (843) 898-4300

Notes

7.0 REFERENCES

Comprehensive Sampling and Analysis Plan (Ensafe/ Allen & Hoshall. July 1996).

South Carolina Department of Health and Environmental Control. 1997. Corrective Action Guidance.

SPORTENVDETCHASN. 1996. UST Assessment Report.

SPORTENVDETCHASN. 1998. AST Assessment Report.

Tetra Tech NUS, Inc. July 2001. Rapid Assessment Report for Site 44, Building 601, Charleston, South Carolina.

United States Environmental Protection Agency. 1990. Code of Federal Regulations 136.

United States Environmental Protection Agency. 1996. EPA Environmental Investigations Standard Operating Procedures for Quality Assurance Manual.

United States Environmental Protection Agency. 1988. EPA How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites.

TABLE 1

GROUNDWATER ELEVATIONS
SITE 44, BUILDING NS69 / AST 601
ZONE H, CHARLESTON NAVAL BASE COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Well #	Total Depth of Well (ft)	Top of Casing Elevation, ft (MSL)	Date Measured	Depth to Water, ft (BTOC)	Depth to Product, ft (BTOC)	Product Thickness (ft)	Groundwater Elevation† (MSL)
CNC44-M01	11.85	9.37	11-Nov-00	5.15	ND	ND	4.22
			13-Mar-01	3.97	3.96	0.01	5.41
CNC44-M02	11.75	9.65	11-Nov-00	5.50	ND	ND	4.15
			13-Mar-01	4.21	ND	ND	5.44
CNC44-M03	11.55	8.40	11-Nov-00	4.18	ND	ND	4.22
			13-Mar-01	3.01	ND	ND	5.39
CNC44-M04	11.75	8.28	11-Nov-00	4.07	ND	ND	4.21
			13-Mar-01	3.00	2.75	0.25	5.48
CNC44-M05	11.93	9.46	11-Nov-00	5.25	ND	ND	4.21
			13-Mar-01	3.94	ND	ND	5.52
CNC44-M06	11.60	8.25	11-Nov-00	4.02	ND	ND	4.23
			13-Mar-01	2.82	ND	ND	5.43
CNC44-M07D	35.00	9.11	11-Nov-00	26.28	ND	ND	-17.17
			13-Mar-01	5.95	ND	ND	3.16
CNC44-M08	12.00	8.39	13-Mar-01	2.95	ND	ND	5.44
CNC44-M09		8.25	13-Mar-01	2.89	ND	ND	5.36

Notes:
MSL - Mean Sea Level
BTOC - Below Top of Casing
ND- Not Detected
ft - Feet
* Permanent Piezometer Well
† Corrected Depth to Water Measurements Based on Free Product Thickness

TABLE 2

GROUNDWATER FIELD MEASUREMENTS
SITE 44, BUILDING NS69 / AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Well I.D.	Date Sampled	Purge method	Volume (gallons)	Temp. (° C)	pH	Conductivity (mMHOS/cm)
CNC44-M01	10-Nov-00	PP	4.4	25.7	6.99	3.66
CNC44-M02	10-Nov-00	PP	5.0	23.1	7.17	1.54
CNC44-M03	11-Nov-00	PP	5.0	25.3	6.84	4.93
CNC44-M04	10-Nov-00	PP	4.4	26.0	6.64	5.74
CNC44-M05	10-Nov-00	PP	5.5	24.1	7.03	5.15
CNC44-M06	9-Nov-00	PP	4.5	24.2	6.68	6.71
CNC44-M07D	11-Nov-00	Bailer	5.0	NR	NR	NR
CNC44-M08	14-Mar-01	PP	5.2	17.6	6.92	6.70
CNC44-M09	14-Mar-01	PP	6.0	17.9	6.90	4.85

Notes:

(° C) - Degrees Celsius
PP - Peristaltic pump, low flow technique
uMHOS/cm - Micro MHOS per centimerter

TABLE 4

SUMMARY OF MOBILE LABORATORY SCREENING RESULTS FOR SOIL
SITE 44, BUILDING NS69 / AST 601
ZONE H, CHARLESTON NAVAL BASE COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

SOIL BORING/ SAMPLE NO.	SAMPLE DATE	SAMPLE INTERVAL	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	Xylenes (ug/kg)	Naphthalene (ug/kg)	DRO (mg/kg)
RBSL [1]			7	1,450	1,150	14,500	36	
CNC44-B01 / 44SFB0102	23-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B02 / 44SFB020506	23-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B03 / 44SFB0303	23-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B04 / 44SFB0403	23-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B05 / 44SFB0502	22-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B06 / 44SFB0602	23-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B07 / 44SFB0702	22-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B08 / 44SFB0803	22-Aug-00	2-3 FT	ND	ND	740	ND	**6,900**	600
CNC44-B09 / 44SFB0903	22-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B10 / 44SFB1002	22-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B12 / 44SFB1203	22-Aug-00	2-3 FT	ND	ND	ND	ND	**1,100**	120
CNC44-B13 / 44SFB1303	23-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B14 / 44SFB1402	23-Aug-00	1-2 FT	ND	ND	ND	ND	ND	ND
CNC44-B15 / 44SFB1501	23-Aug-00	0-1 FT	ND	ND	ND	ND	ND	ND
CNC44-B16 / 44SFB1603	24-Aug-00	2-3 FT	ND	ND	230	89	**400**	600
CNC44-B17 / 44SFB1703	24-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B18 / 44SFB1803	24-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B22 / 44SFB2203	25-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B23 / 44SFB2303	25-Aug-00	2-3 FT	ND	ND	ND	ND	ND	ND
CNC44-B24 / 44SFB2401	25-Aug-00	0-1 FT	ND	ND	ND	ND	ND	ND

Notes:

Shaded cells indicate analyte concentrations that exceed the RBSL.

ND - not detected

mg/kg - milligrams per kilogram

ug/kg - micrograms per kilogram

[1] RBSL - South Carolina Department of Health and Environmental Control Risk-Based Screening Levels for sand-rich soils,

TABLE 5

SUMMARY OF MOBILE LABORATORY SCREENING RESULTS FOR GROUNDWATER
SITE 44, AST 601/BUILDING NS69
ZONE C, CHARLESTON NAVAL BASE COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

SOIL BORING/ SAMPLE NO.	SAMPLE DATE	SAMPLE INTERVAL	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)	Naphthalene (ug/L)	DRO (mg/L)
RBSL [1]			5	1,000	700	10,000	25[2]	
CNC44-B01 / 44GFB0107	23-Aug-00	4-7 FT	ND	ND	**3,700**	**32,000**	**28,000**	63,000
CNC44-B02 / 44GFB0207	23-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B03 / 44GFB0307	22-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B04 / 44GFB0407	23-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B05 / 44GFB0507	22-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B06 / 44GFB0607	23-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B07 / 44GFB0712	22-Aug-00	4-12 FT	ND	ND	ND	ND	ND	ND
CNC44-B08 / 44GFB0806	22-Aug-00	4-6 FT	ND	ND	ND	ND	ND	ND
CNC44-B09 / 44GFB0912	22-Aug-00	4-12 FT	ND	ND	ND	ND	ND	ND
CNC44-B10 / 44GFB1012	22-Aug-00	4-12 FT	ND	ND	ND	ND	ND	ND
CNC44-B12 / 44GFB1206	22-Aug-00	3-6 FT	ND	ND	ND	ND	ND	ND
CNC44-B13 / 44GFB1307	23-Aug-00	4-7 FT	ND	ND	26.2	28.0	**94.4**	10
CNC44-B14 / 44GFB1407	23-Aug-00	4-7 FT	ND	ND	1.5	17.2	**63.7**	6
CNC44-B15 / 44GFB1507	23-Aug-00	4-7 FT	**16.9**	10.5	30.0	155	**158**	20
CNC44-B16 / 44GFB1607	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B17 / 44GFB1707	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B18 / 44GFB1807	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B19 / 44GFB1907	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B20 / 44GFB2007	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B21 / 44GFB2107	24-Aug-00	4-7 FT	ND	ND	ND	ND	ND	ND
CNC44-B22 / 44GFB2204	25-Aug-00	3-4 FT	ND	ND	ND	ND	ND	ND
CNC44-B24 / 44GFB2404	25-Aug-00	3-4 FT	ND	ND	ND	ND	ND	ND

Notes:

Shaded cells indicate analyte concentrations that exceed the RBSL.

ND - not detected

mg/L - milligrams per Liter

ug/L - micrograms per Liter

[1] SCDHEC RBSL - South Carolina Department of Health and Environmental Control Risk-Based Screening Levels

[2] Includes methylnaphthalenes.

TABLE 6

SUMMARY OF FIXED-BASE LABORATORY ANALYTICAL RESULTS FOR CHEMICALS OF CONCERN IN SOIL
SITE 44, BUILDING NS69 / AST 601
ZONE I, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA
PAGE 1 OF 2

Soil Boring / Sample No.	Sample Date	Sample Interval	Benzene (ug/kg)	Toluene (ug/kg)	Ethyl-benzene (ug/kg)	Xylenes (total) (ug/kg)	Benzo(a) anthracene (ug/kg)	Benzo(b) fluoranthene (ug/kg)	Benzo(k) fluoranthene (ug/kg)	Chrysene (ug/kg)	Dibenzo(a,h) anthracene (ug/kg)	Naphthalene (ug/kg)
RBSL [1]			7	1,450	1,150	14,500	66	66	66	66	66	36
CNC44-B01 / 44SLB0102	26-Aug-00	1-2 FT	< 5.6	< 5.6	< 5.6	< 5.6	584J	672J	515J	590J	< 3320	< 5.6
CNC44-B02 / 44SLB0203	26-Aug-00	2-3 FT	< 5.0	< 5.0	< 5.0	< 5.0	39.4J	52.1J	37.1J	45.6J	< 762	< 5.0
CNC44-B03 / 44SLB0303	26-Aug-00	2-3 FT	**9**	7	2.6J	3.4J	<7700	<7700	<7700	<7700	<7700	<5.8
CNC44-B05 / 44SLB0502	26-Aug-00	1-2 FT	< 5.4	< 5.4	< 5.4	< 5.4	< 748	< 748	< 748	< 748	< 748	< 5.4
CNC44-B06 / 44SLB0602	26-Aug-00	1-2 FT	< 5.4	< 5.4	< 5.4	< 5.4	< 2,990	< 2,990	< 2,990	< 2,990	< 2,990	< 5.4
CNC44-B08 / 44SLB0803	26-Aug-00	2-3 FT	< 638	80.3 J	**2,050**	< 638	< 313,000	< 313,000	< 313,000	< 313,000	< 313,000	**89,040 J**
CNC44-B12 / 44SLB1203	26-Aug-00	2-3 FT	< 615	94.9 J	730	75.3 J	< 77,100	< 77,100	< 77,100	< 77,100	< 77,100	**24,480 J**
CNC44-B12 / 44SLB1203D [2]	26-Aug-00	2-3 FT	< 521	89.6 J	**1,190**	< 521	< 77,800	< 77,800	< 77,800	< 77,800	< 77,800	**17,040 J**
CNC44-B16 / 44SLB1603	26-Aug-00	2-3 FT	< 537	< 537	165 J	64.4 J	< 31,500	< 31,500	< 31,500	< 31,500	< 31,500	**1,749 J**

Notes:

All concentrations are in micrograms per kilogram (ug/kg).

Shaded cells indicate analyte concentrations or reporting limits that exceed the RBSL.

NA - Not Analyzed

[1] South Carolina Department of Health and Environmental Control Risk-Based Screening Levels for leaching to groundwater from sandy soils.

[2] Duplicate Sample

(J) Indicates the presence of an analyte at a concentration less than the reporting limit and greater than the detection limit.

TABLE 6

SUMMARY OF FIXED-BASE LABORATORY ANALYTICAL RESULTS FOR CHEMICALS OF CONCERN IN SOIL SITE 44, BUILDING NS69 / AST 601 ZONE H, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SOUTH CAROLINA

Soil Boring / Sample No.	Sample Date	Sample Interval	TPH (mg/kg)	TOC (mg/kg)
CNC44-B011 / 44SLB1103	22-Sep-99	2-3 FT	NT	1,650
CNC44-B08 / 44SLB0803	22-Sep-99	2-3 FT	8,180	NT
CNC44-B16 / 44SLB1603	21-Sep-99	2-3 FT	168	NT

Notes:

NT - Analysis not performed.

TPH = Total Petroleum Hydrocarbons

TOC = Total Organic Carbon

TABLE 7

SUMMARY OF FIXED-BASE LABORATORY ANALYTICAL RESULTS FOR CHEMICALS OF CONCERN IN GROUNDWATER
SITE 44, BUILDING NS69 / AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Monitoring Well/ Sample No.	Sample Date	Benzene (ug/L)	Ethyl-benzene (ug/L)	Toluene (ug/L)	Xylenes (total) (ug/L)	Naphthalene (ug/L)	Benzo(a) anthracene (ug/L)	Benzo(b) fluoranthene (ug/L)	Benzo(k) fluoranthene (ug/L)	Chrysene (ug/L)	Dibenzo(a,h) anthracene (ug/L)	MTBE (ug/L)
RBSL[1]		5	700	1,000	10,000	25 [2]	10 [2]	10 [2]	10 [2]	10 [2]	10 [2]	40
CNC44M-01 / 44GLM0101	10-Nov-00	**13.7**	24.1	0.52J	156	**260**	< 9.8	< 9.8	< 9.8	< 9.8	< 9.8	0.34J
CNC44M-01 / 44GLM0101D	10-Nov-00	**7.0**	12.2	0.30J	89.3	**284.9**	< 9.8	< 9.8	< 9.8	< 9.8	< 9.8	0.14J
CNC44M-02 / 44GLM0201	10-Nov-00	0.16J	0.15J	< 5	< 5	< 5	< 9.8	< 9.8	< 9.8	< 9.8	< 9.8	<40
CNC44M-03 / 44GLM0301	11-Nov-00	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	0.13J
CNC44M-04 / 44GLM0401	10-Nov-00	**12.6**	13.8	7	67.6	**58.3**	< 10	< 10	< 10	< 10	< 10	5.4J
CNC44M-05 / 44GLM0501	10-Nov-00	< 5	< 5	< 5	< 5	< 5	< 9.7	< 9.7	< 9.7	< 9.7	< 9.7	< 40
CNC44M-06 / 44GLM0601	9-Nov-00	< 5	< 5	< 5	< 5	< 5	< 9.8	< 9.8	< 9.8	< 9.8	< 9.8	<40
CNC44M-07 / 44GLM0701	11-Nov-00	< 5	0.31J	0.45J	0.93J	1.62J	< 9.8	< 9.8	< 9.8	< 9.8	< 9.8	<40
CNC44M-08 / 44GLM0801	14-Mar-01	< 5	< 5	< 5	< 5	0.34JB	< 10	< 10	< 10	< 10	< 10	<40
CNC44M-09 / 44GLM0901	14-Mar-01	< 5	< 5	0.72J	< 5	0.44JB	< 10	< 10	< 10	< 10	< 10	<40

Notes:

All concentrations are in ug/L.

Shaded cells indicate analyte concentrations that exceed the RBSL.

NA - Not analyzed

[1] South Carolina Department of Health and Environmental Control Risk-Based Screening Levels for groundwater.

[2] The risk-based screening level for individual PAH CoC is 10 ug/L or 25 ug/L for total PAHs.

[3] Duplicate sample.

(B) Indicates the detection of analyte in laboratory method blank.

(J) Indicates presence of analyte at a concentration less than the reporting limit and greater than the detection limit.

methylnapthalenes + naphthalene

TABLE 8

FATE AND TRANSPORT INPUT PARAMETERS
SITE 44, BUILDING NS69/AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Parameter	Domenico Dilution/Attenuation Model[1]
Hydraulic Conductivity [m/sec]	2.20E-06
Hydraulic Gradient	0.0026
Porosity (effective)	0.1
Estimated Plume Length [ft]	NA
Soil Bulk Density[a] [kg/L]	1.6
Partition Coefficient [L/kg]	chemical specific
Fraction of Organic Carbon in soil [g/g]	1.65E-03
First Order Decay Rate [sec^{-1}]	0
Modeled Plume Length [ft]	NA
Modeled Plume Width [ft]	NA
Source Width[b] [m]	7.62
Source Thickness[b] [m]	0.91
Soluble Mass [kg]	Infinite[c]

Notes:

(1) - *South Carolina Risk-Based Corrective Action for Petroleum Releases,* South Carolina Department of Health and Environmental Control, 1998.

(a) - Determined from SCDHEC 1998, Tables C1 and C3

(b) - Site-specific data

(c) - Assumption of the Domenico model

TABLE 9

COMPARISON OF MAXIMUM CONCENTRATIONS TO RBSLs
SITE 36, BUILDING NS26
ZONE I, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

	SOIL			GROUNDWATER			
Chemical of Concern	Tier 1 RBSLs[a] mg/kg	RBSLs Protective of On-Site Construction Worker[b] mg/kg	Maximum CoC Concentration mg/kg	RBSLs[c] mg/L	RBSLs Protective of On-Site Construction Worker[d] mg/L	SSTLs Protective of Groundwater Discharge to the Cooper River mg/L	Maximum CoC Concentration mg/L
Benzene	0.005	200	<1.6	0.005	0.85	0.18	0.313[e]
Toluene	1.622	410,000	<1.6	1	23.98	3.628	4.65[e]
Ethybenzene	1.260	200,000	<1.6	0.7	6.05	2.539	0.105[e]
Xylenes	42.471	1,000,000	950 (J)	10	102.33	36.277	0.794[e]
Benzo(a)anthracene	73.084	3.9	0.680	0.010	-	-	<0.01
Benzo(b)fluoranthene	29.097	3.9	0.600	0.010	-	-	<0.01
Benzo(k)fluoranthene	231.109	39	0.230 (J)	0.010	-	-	<0.01
Chyrsene	12.998	390	0.600	0.010	-	-	<0.01
Dibenz(a,h)anthracene	87.866	0.39	<460	0.010	-	-	<0.01
Naphthalene	0.210	41,000	48	0.010	1.63	0.036	23.346[e]
Arsenic	NA	NA	7.8	0.050	-	-	0.039
Barium	NA	NA	48.1	2.000	-	-	0.103
Cadmium	NA	NA	0.76 (B)	0.005	-	-	<0.005
Total Chromium	NA	NA	178	0.100	-	-	<0.013
Lead	NA	NA	78.9	0.015	-	-	0.002 (B)
Mercury	NA	NA	0.17	0.002	-	-	<0.00003
Selenium	NA	NA	1.9	0.050	-	-	<0.0077
Silver	NA	NA	<0.31	0.005	-	-	<0.0076

(a) - From Risk-Based Corrective Action for Petroleum Releases, Table B3, Depth to GW - <5 ft, SCDHEC RBCA Guidelines, 1998.
(b) - From Risk-Based Corrective Action for Petroleum Releases, Table B6, Ingestion or Dermal Contact (Commercial) with soil.
(c) - From Risk-Based Corrective Action for Petroleum Releases, Table B1, SCDHEC RBCA Guidelines, 1998.
(d) - Calculated for dermal, incidental ingestion, and inhalation routes for the on-site construction worker.
(e) - Groundwater concentration in equilibrium with free product as calculated using Raoult's Law.
(B) Indicates the detection of anaylte in laboratory method blank.
(J) Indicates presence of analyte at a concentration less than the reporting limit and greater than the detection limit.
RBSLs - Risk Based Screening Levels
ND - Not detected
NA - No RBSL listed.
Shaded cell indicates the concentration exceeds one of the RBSLs.

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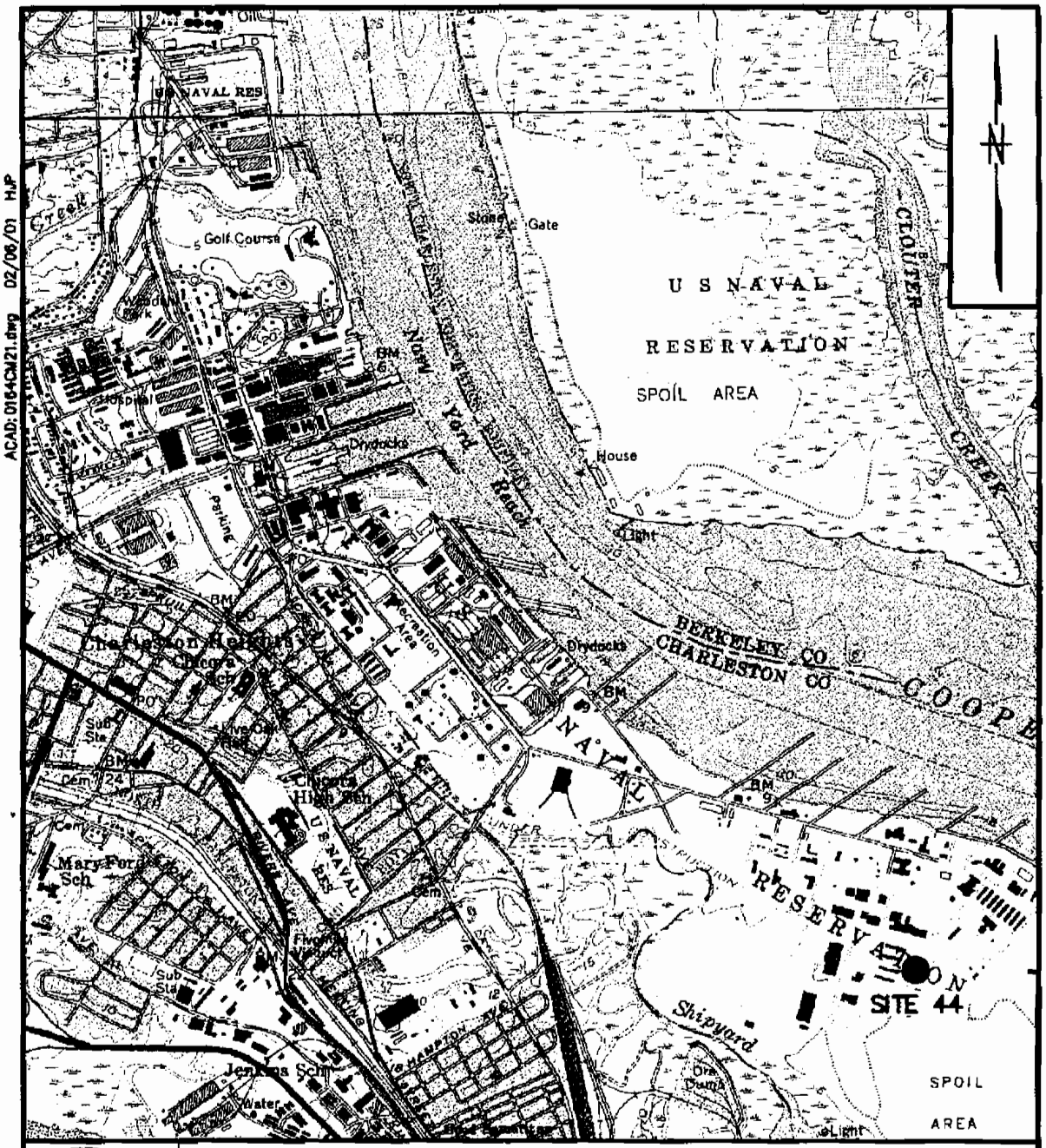

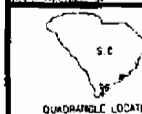

SOURCE: QUADRANGLE MAP SOUTH CAROLINA, REVISED 1979
QUADRANGLE MAP NORTH CHARLESTON REVISED, 1979

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CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
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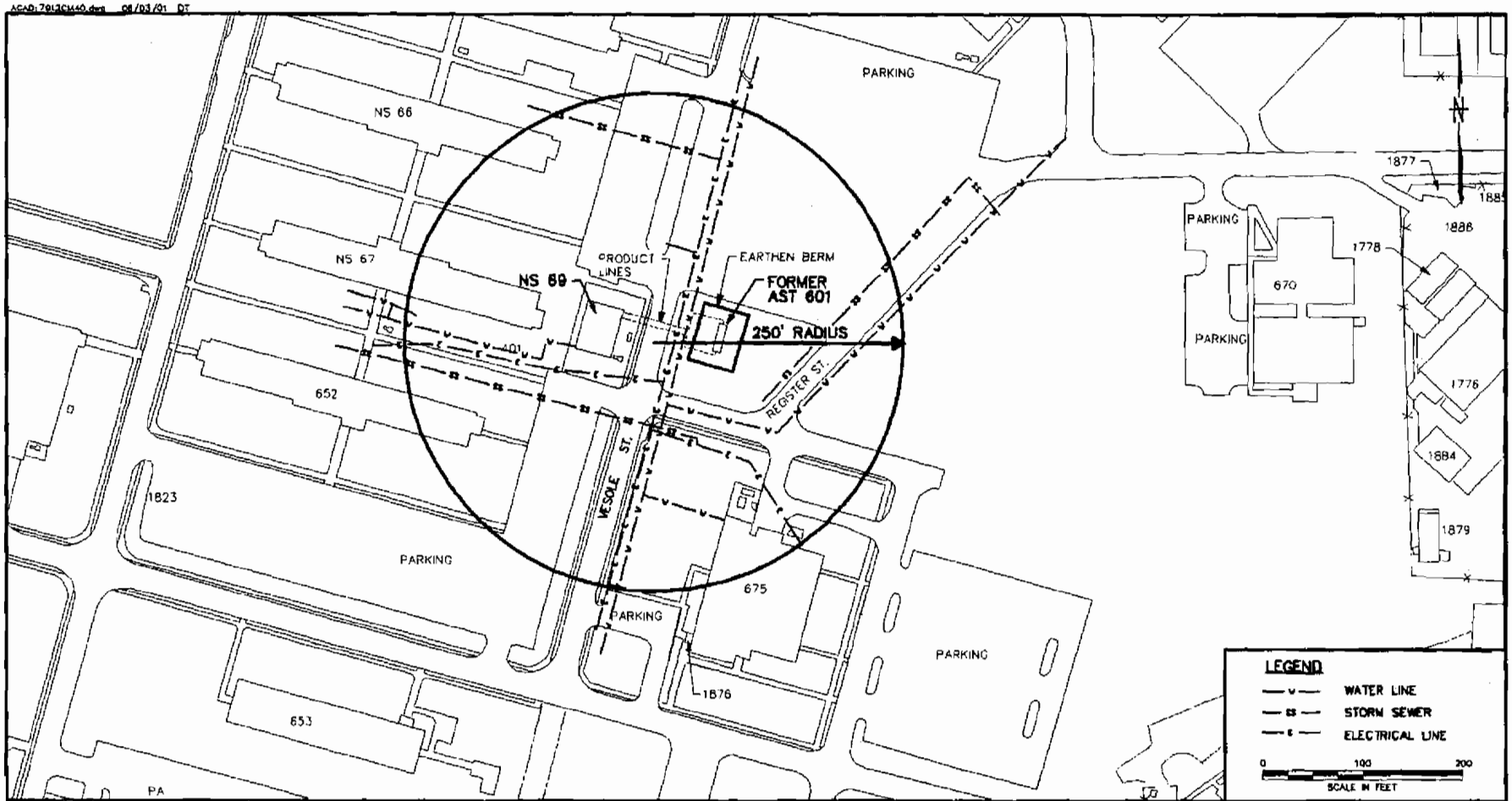

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SCALE AS NOTED

SITE VICINITY MAP
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SC

CONTRACT NO. 7912
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APPROVED BY DATE
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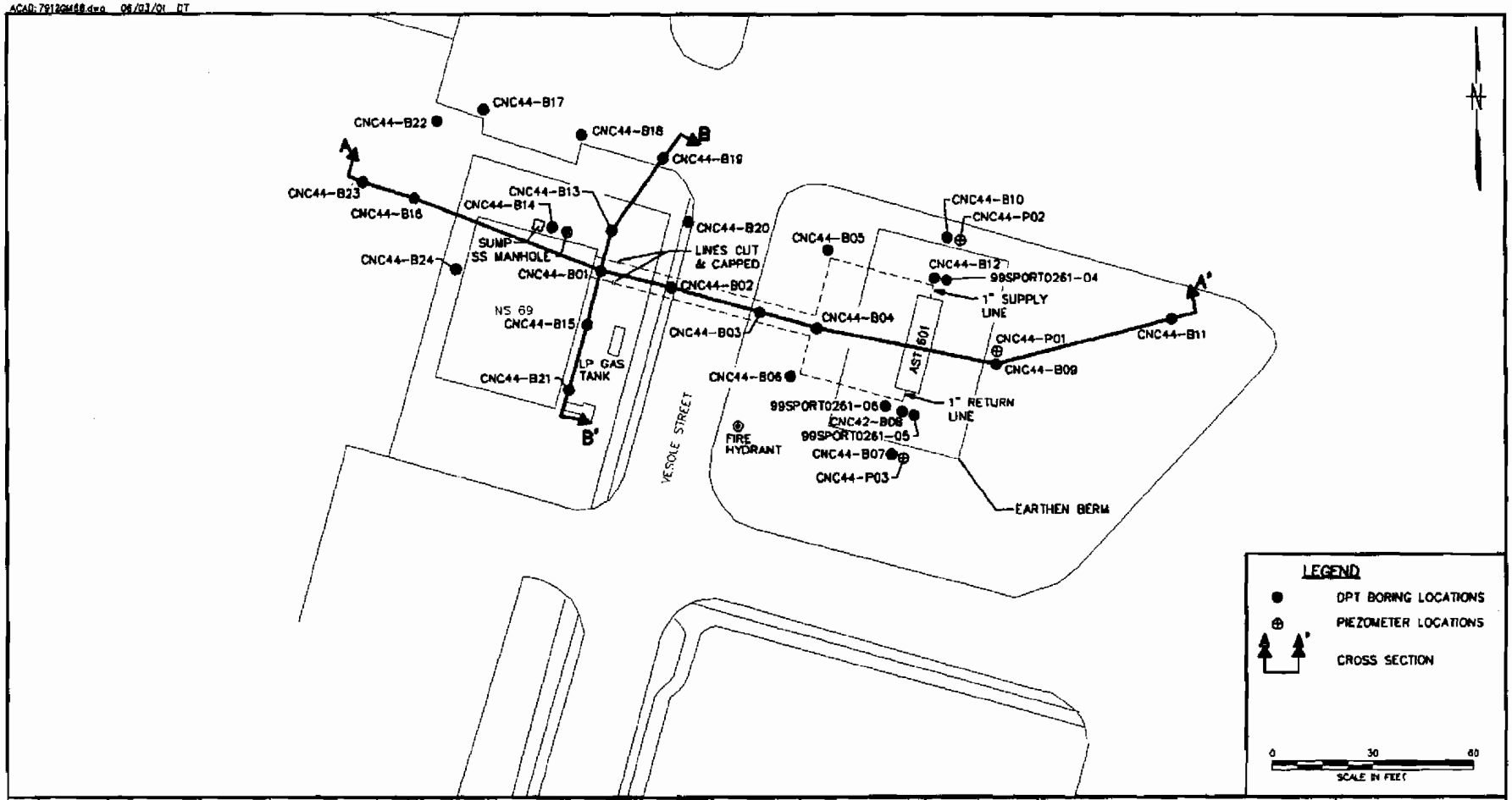

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COST/SCHED-AREA
SCALE AS NOTED

SOIL BORING LOCATIONS AND
CROSS SECTION LINES
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
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REV. 0

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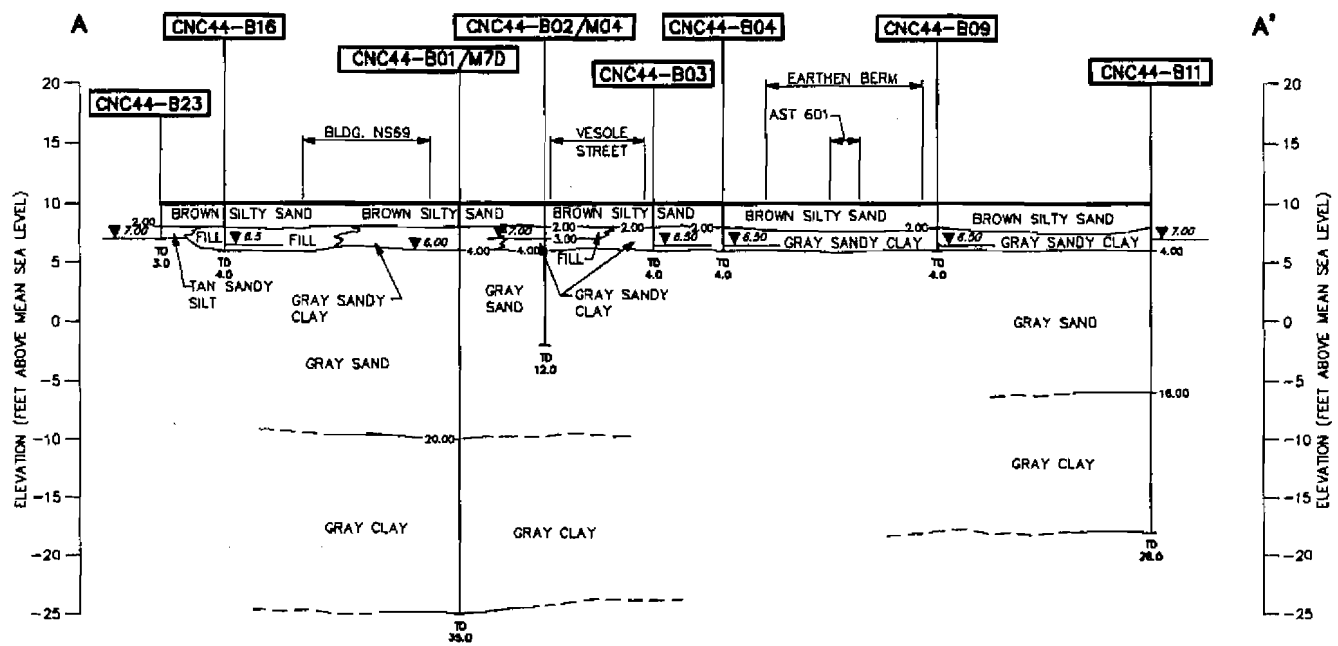

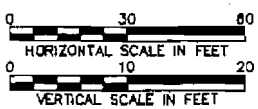

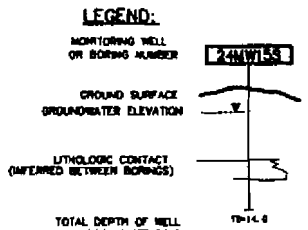

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CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION A-A'
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
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REV. 0

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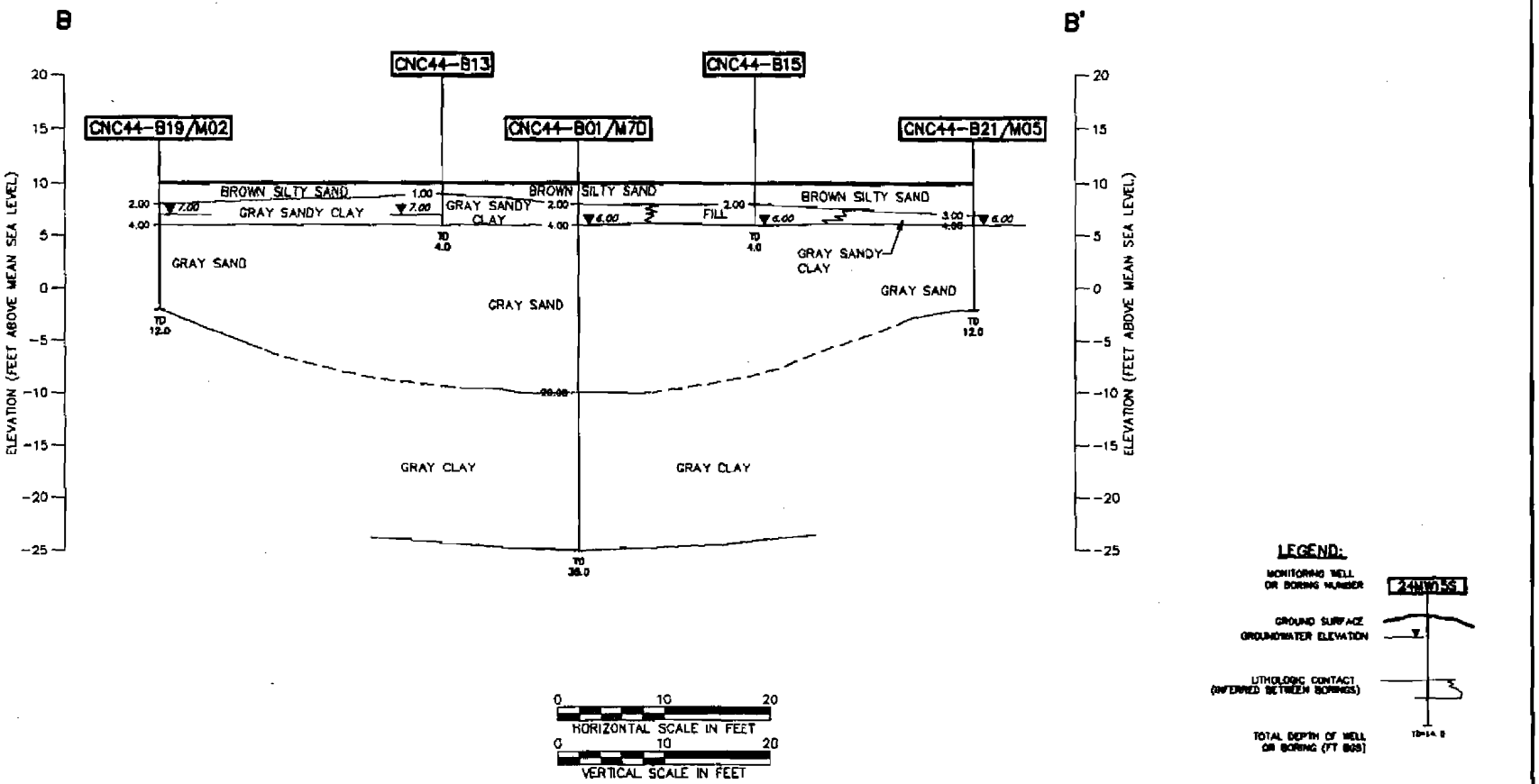

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DRAWN BY DLT DATE 6/7/01
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COST/SCHED-AREA
SCALE AS NOTED

CROSS SECTION B-B'
SITE 44, AST 801
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
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APPROVED BY DATE
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REV. 0

FORM CADD NO. SOUTH-BLDGN - REV 0 - 9/9/98

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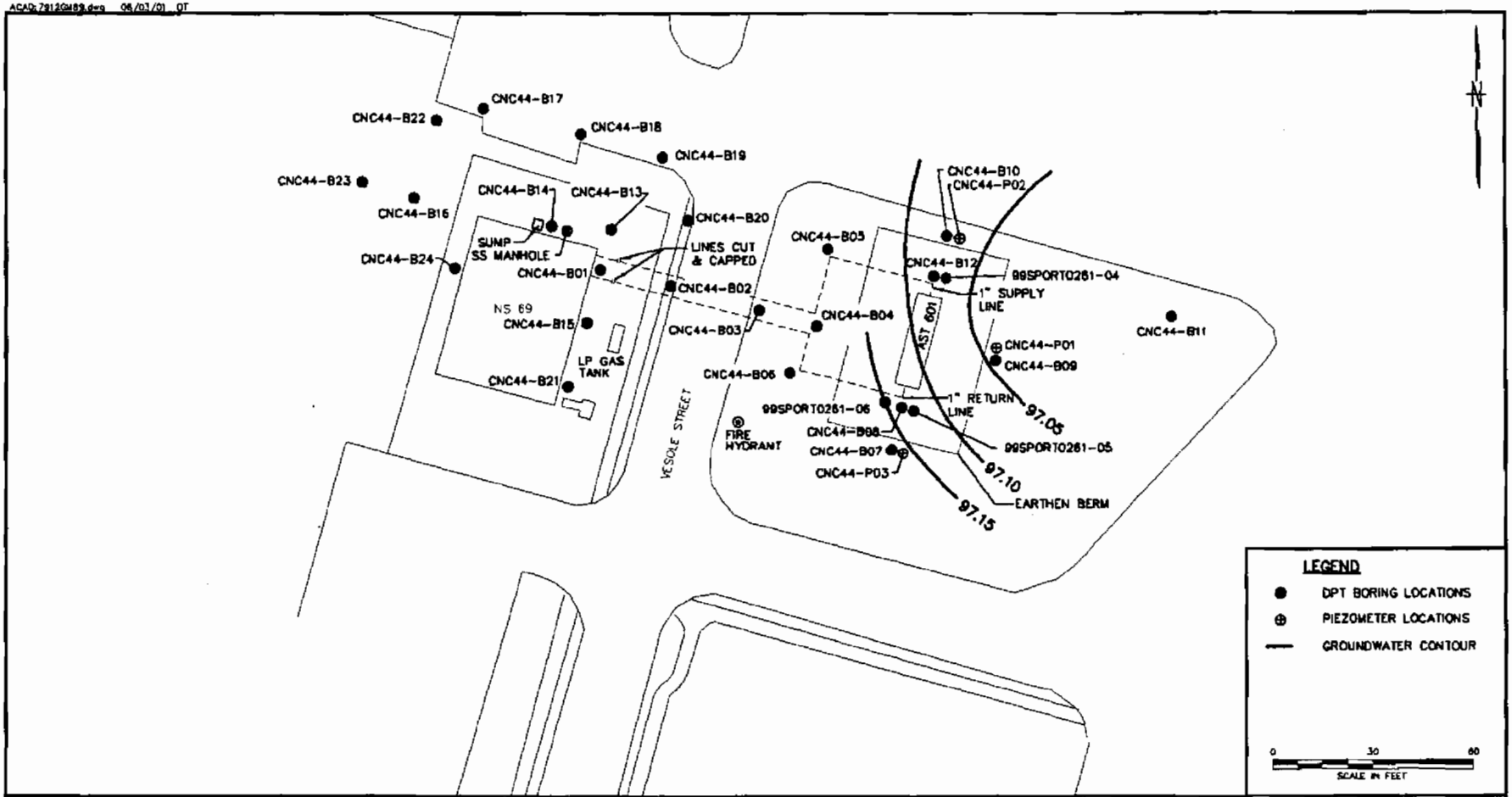

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CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

PRELIMINARY GROUNDWATER FLOW DIRECTION
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
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APPROVED BY DATE
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REV. 0

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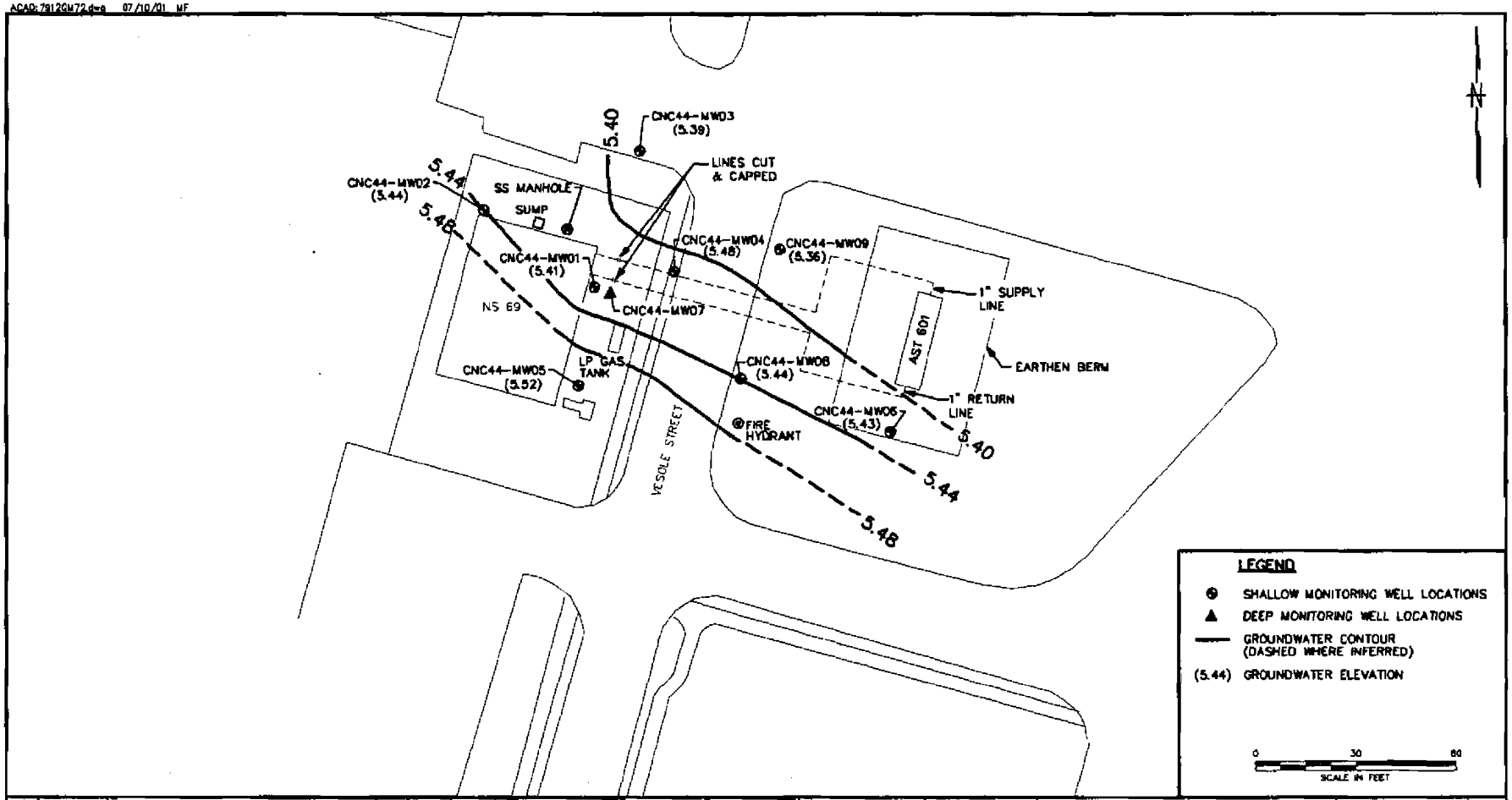

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DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

MONITORING WELL LOCATIONS
AND GROUNDWATER ELEVATIONS
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 7
REV. 0

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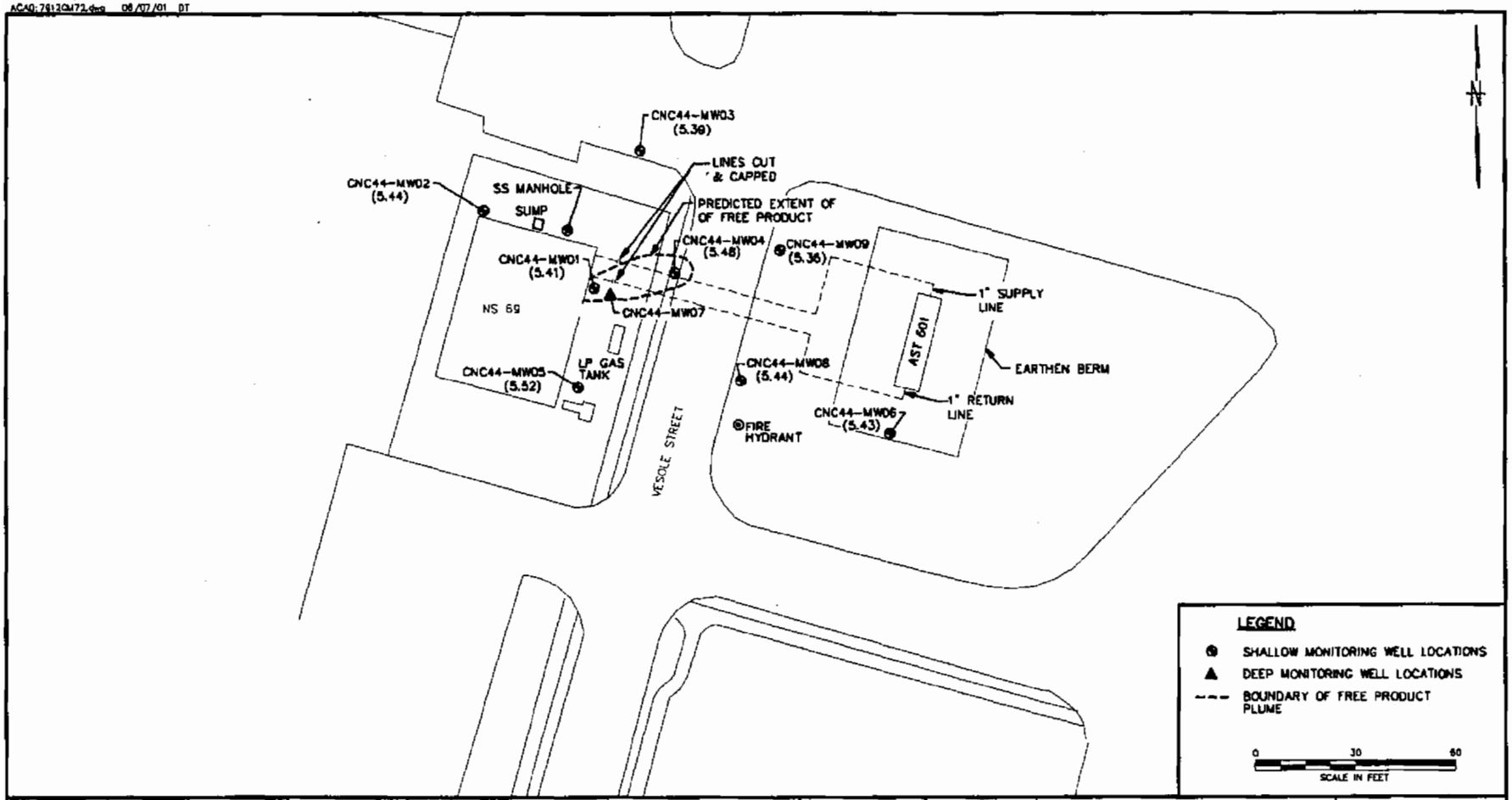

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DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

MONITORING WELL LOCATIONS
AND EXTENT OF FREE PRODUCT
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
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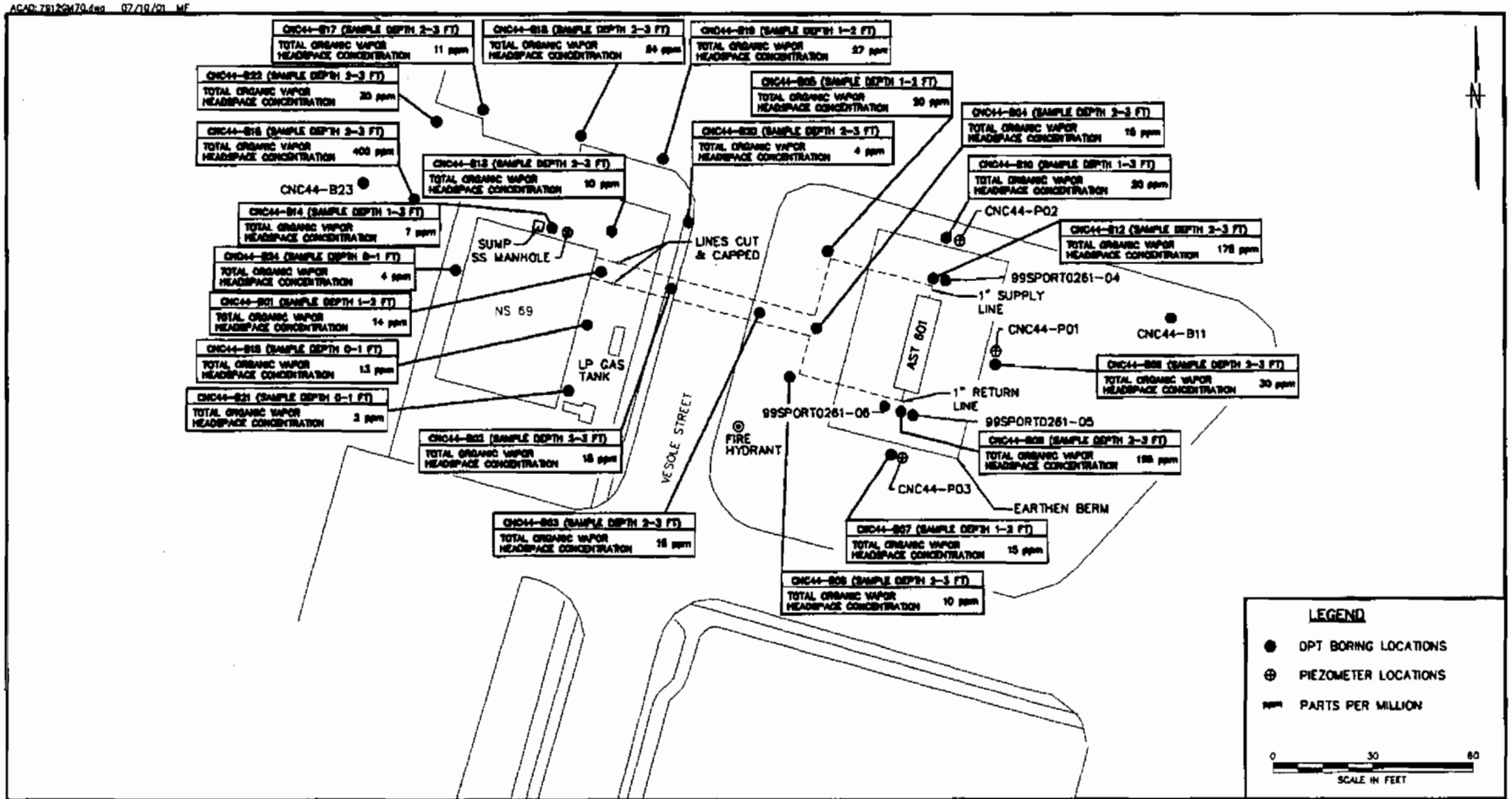

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DRAWN BY DLT DATE 6/3/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

SOIL VAPOR SCREENING RESULTS
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
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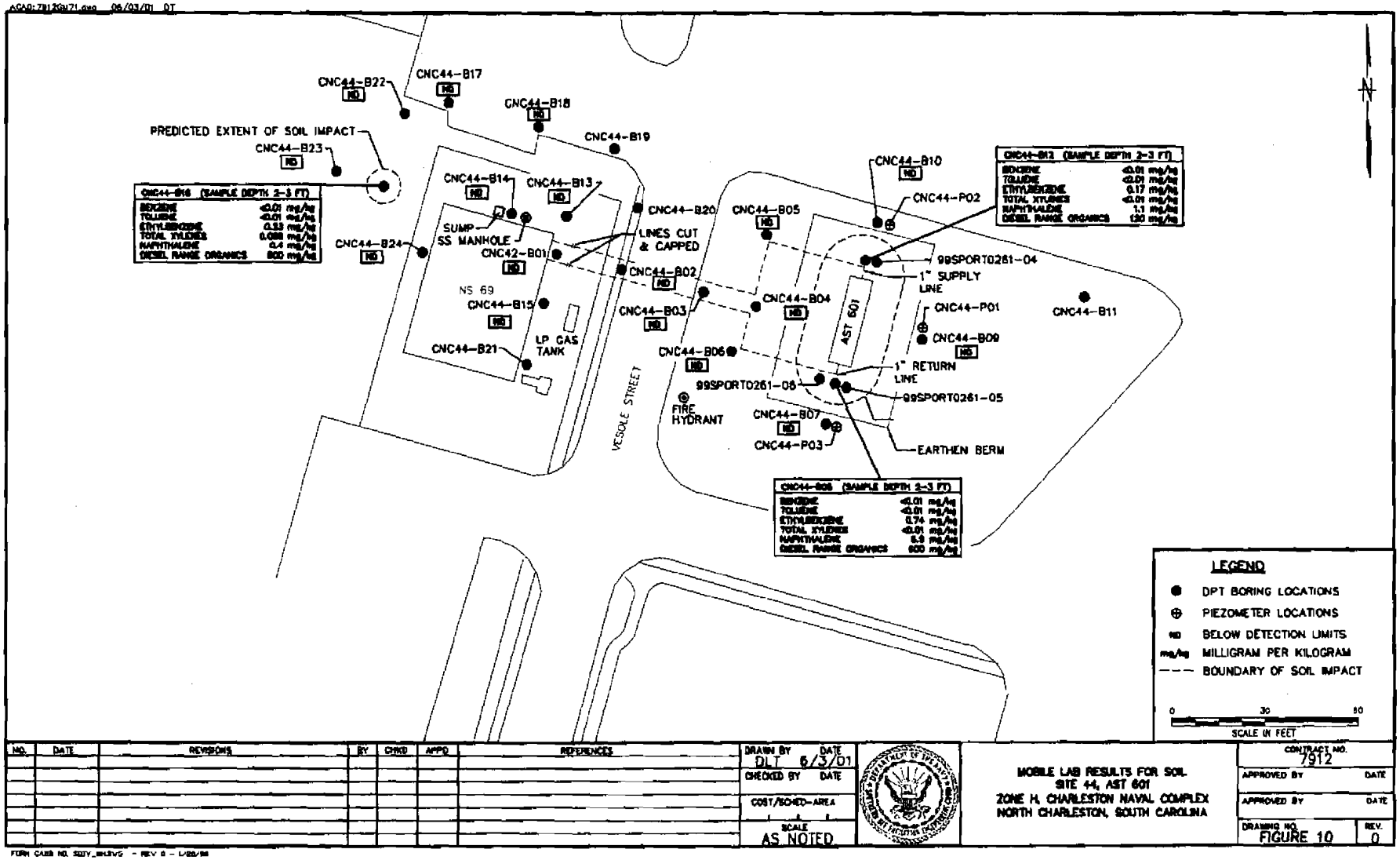
FORM CAD NO. SDIV_BLDVG - REV 0 - 1/20/98



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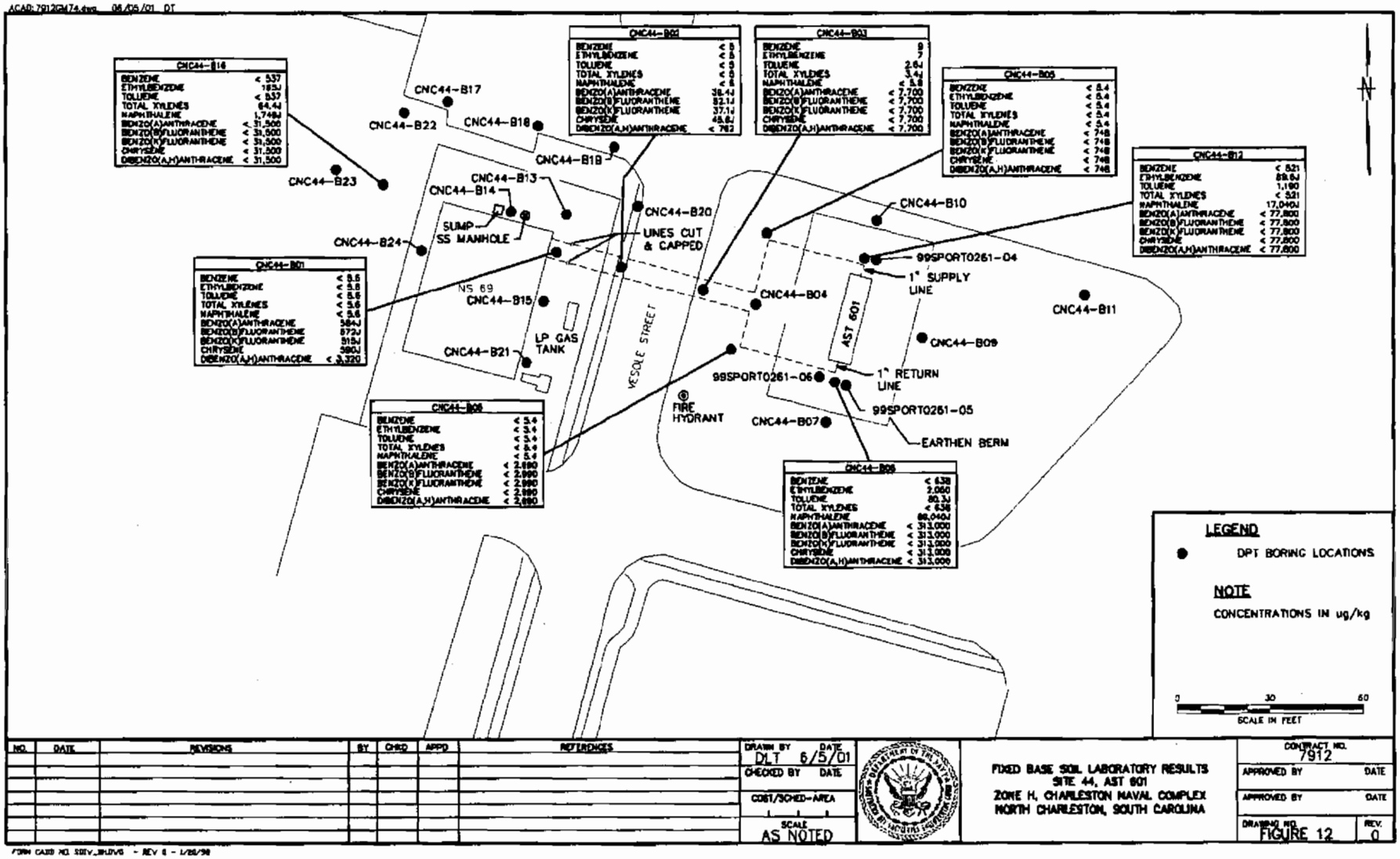
DRAWN BY DLT DATE 6/3/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

MOBILE LAB RESULTS FOR SOIL
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 10
REV. 0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CNC44-B14
BENZENE < 537
ETHYLBENZENE 185J
TOLUENE < 537
TOTAL XYLENES 64.4J
NAPHTHALENE 1,748J
BENZO(A)ANTHRACENE < 31,500
BENZO(B)FLUORANTHENE < 31,500
BENZO(K)FLUORANTHENE < 31,500
CHRYSENE < 31,500
DIBENZO(A,H)ANTHRACENE < 31,500
CNC44-B01
BENZENE < 5.5
ETHYLBENZENE < 5.5
TOLUENE < 5.5
TOTAL XYLENES < 5.5
NAPHTHALENE < 5.5
BENZO(A)ANTHRACENE 564J
BENZO(B)FLUORANTHENE 872J
BENZO(K)FLUORANTHENE 515J
CHRYSENE 580J
DIBENZO(A,H)ANTHRACENE < 3,320
CNC44-B06
BENZENE < 5.4
ETHYLBENZENE < 5.4
TOLUENE < 5.4
TOTAL XYLENES < 5.4
NAPHTHALENE < 5.4
BENZO(A)ANTHRACENE < 2,080
BENZO(B)FLUORANTHENE < 2,080
BENZO(K)FLUORANTHENE < 2,080
CHRYSENE < 2,080
DIBENZO(A,H)ANTHRACENE < 2,080
CNC44-B02
BENZENE < 5
ETHYLBENZENE < 5
TOLUENE < 5
TOTAL XYLENES < 5
NAPHTHALENE < 5
BENZO(A)ANTHRACENE 38.4J
BENZO(B)FLUORANTHENE 52.1J
BENZO(K)FLUORANTHENE 37.1J
CHRYSENE 46.8J
DIBENZO(A,H)ANTHRACENE < 762
CNC44-B03
BENZENE 9
ETHYLBENZENE 7
TOLUENE 2.6J
TOTAL XYLENES 3.4J
NAPHTHALENE < 5.5
BENZO(A)ANTHRACENE < 7,700
BENZO(B)FLUORANTHENE < 7,700
BENZO(K)FLUORANTHENE < 7,700
CHRYSENE < 7,700
DIBENZO(A,H)ANTHRACENE < 7,700
CNC44-B05
BENZENE < 5.4
ETHYLBENZENE < 5.4
TOLUENE < 5.4
TOTAL XYLENES < 5.4
NAPHTHALENE < 5.4
BENZO(A)ANTHRACENE < 748
BENZO(B)FLUORANTHENE < 748
BENZO(K)FLUORANTHENE < 748
CHRYSENE < 748
DIBENZO(A,H)ANTHRACENE < 748
CNC44-B12
BENZENE < 521
ETHYLBENZENE 89.6J
TOLUENE 1,190
TOTAL XYLENES < 521
NAPHTHALENE 17,040J
BENZO(A)ANTHRACENE < 77,800
BENZO(B)FLUORANTHENE < 77,800
BENZO(K)FLUORANTHENE < 77,800
CHRYSENE < 77,800
DIBENZO(A,H)ANTHRACENE < 77,800
CNC44-B08
BENZENE < 638
ETHYLBENZENE 2,060
TOLUENE 80.3J
TOTAL XYLENES < 638
NAPHTHALENE 88,040J
BENZO(A)ANTHRACENE < 313,000
BENZO(B)FLUORANTHENE < 313,000
BENZO(K)FLUORANTHENE < 313,000
CHRYSENE < 313,000
DIBENZO(A,H)ANTHRACENE < 313,000
CNC44-B17
CNC44-B22
CNC44-B18
CNC44-B23
CNC44-B13
CNC44-B14
SUMP
SS MANHOLE
CNC44-B24
CNC44-B20
LINES CUT & CAPPED
CNC44-B10
99SPORT0261-04
1" SUPPLY LINE
CNC44-B11
NS 69
CNC44-B15
CNC44-B04
AST 601
CNC44-B09
LP GAS TANK
CNC44-B21
VESOLE STREET
99SPORT0261-06
1" RETURN LINE
FIRE HYDRANT
CNC44-B07
99SPORT0261-05
EARTHEN BERM
LEGEND
DPT BORING LOCATIONS
NOTE
CONCENTRATIONS IN ug/kg
0
30
60
SCALE IN FEET
NO.
DATE
REVISIONS
BY
CHKD
APPD
REFERENCES
DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED
FIXED BASE SOIL LABORATORY RESULTS
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA
CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 12
REV. 0

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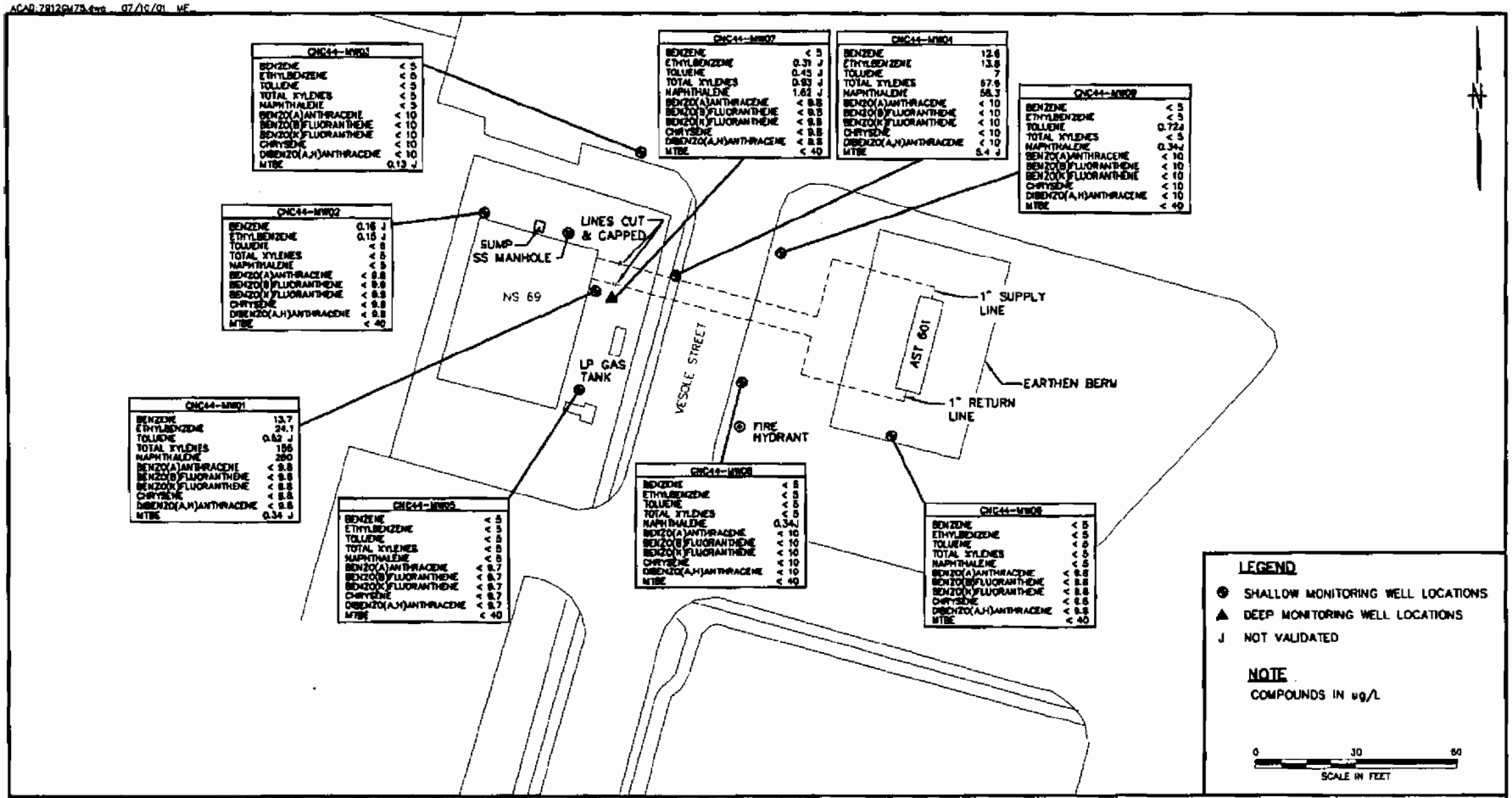


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

FIXED BASE GROUNDWATER LABORATORY RESULTS
SITE 44, AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 13
REV. 0

FORM CADD NO. 122V_3HJNG - REV 0 - 1/20/98

NOTE: Original figure created in color

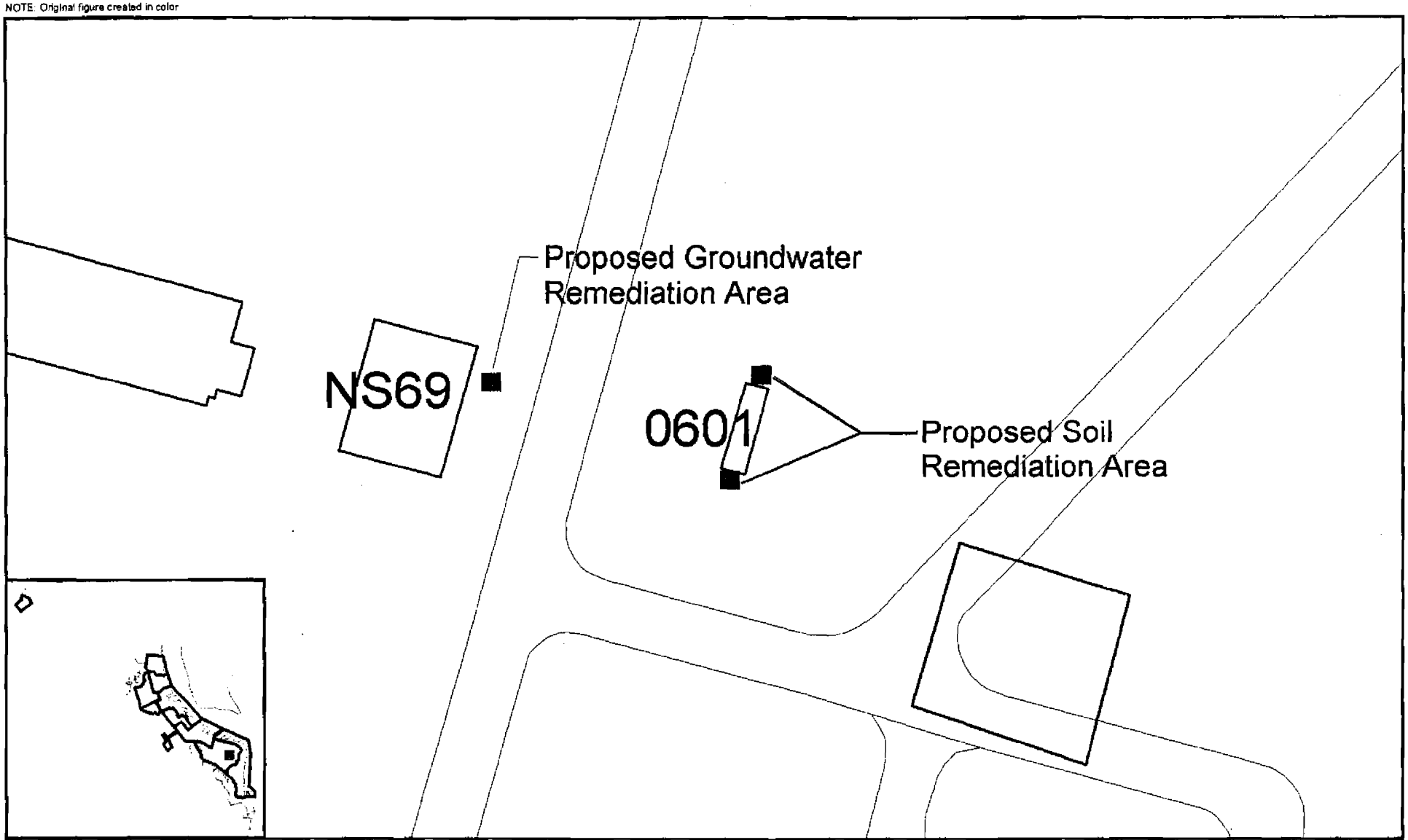


Figure 14
Proposed Remediations
Zone H; AST 601
Charleston Naval Complex

CH2MHILL

File Path: C:\18gis\CNC\cnc-egis.apr, Date: 10 Sep 2001 8:24, Unknown User, EGIS: Charleston Naval Complex - Figure 14 Proposed Remediations

NOTE: Original figure created in color

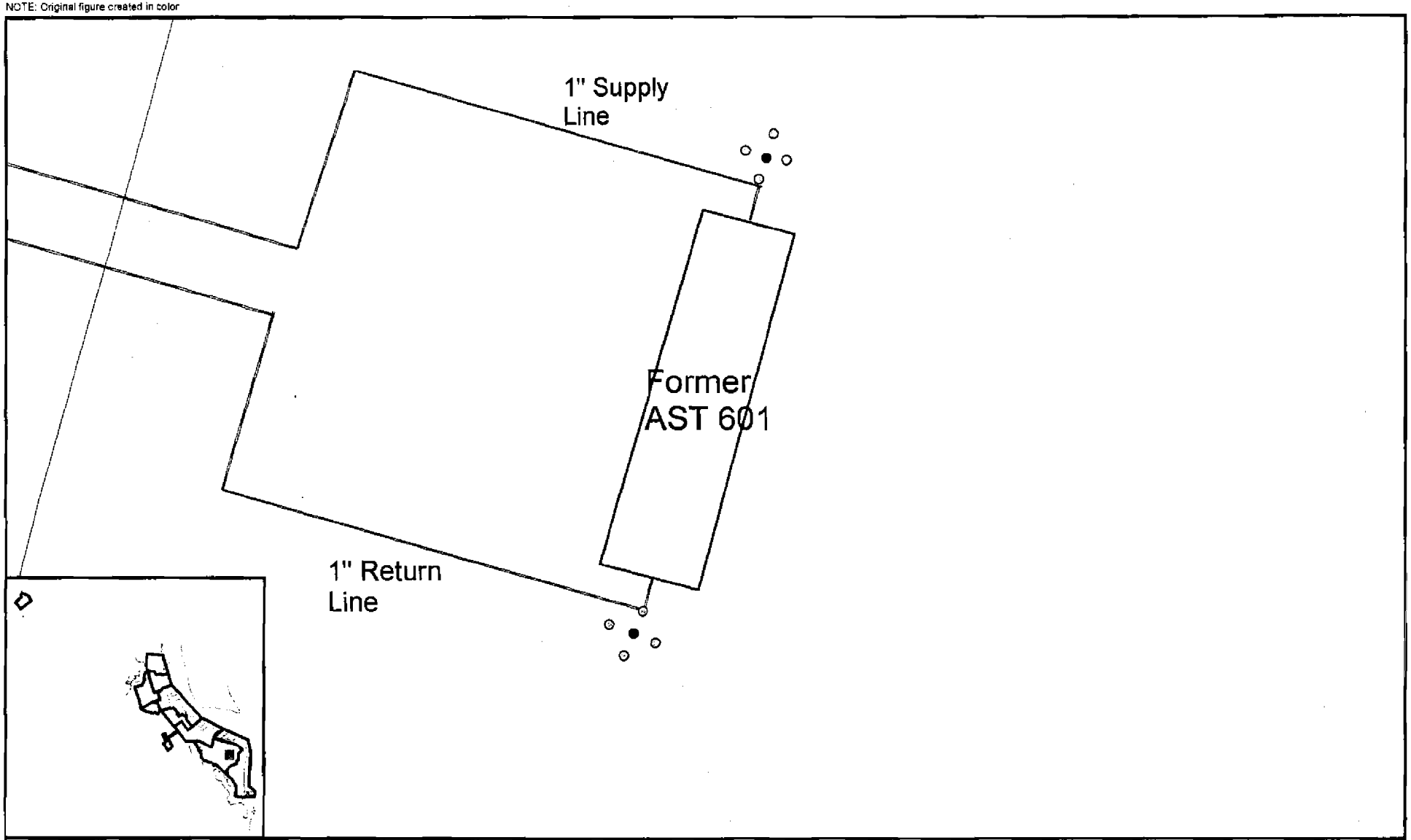


Figure 15
Soil Sampling
Zone H; AST 601
Charleston Naval Complex

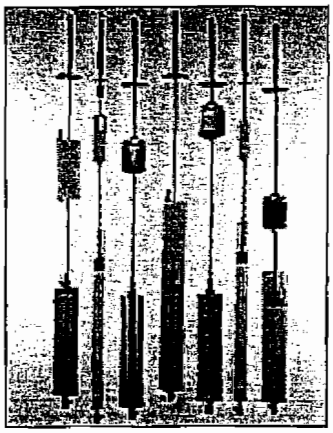
CH2MHILL

File Path: c:\my documents\fig 14 601.apr, Date: 10 Sep 2001 8:46, Unknown User, EGIS: Charleston Naval Complex - *Figure 15 Soil Sampling*

APPENDIX A

REMEDIAL EQUIPMENT – PASSIVE SKIMMER

OIL SKIMMERS



SOS-P
SPG-P

Applications:
Skimming (LNAPL)

Passive Floating-Intake Skimmers
SOS-P Reduce Product Lense to a sheen
SPG-P High Viscosity Hydrocarbons

OVERVIEW

Unlike any other design, these unique Passive Skimmers can be upgraded to fully automatic, active Product Only Recovery Systems. They are designed to recover free-floating hydrocarbon from any depth down to a sheen (? 0.01 inches) without the need for any power source. The floating intake head (which in two configurations: SOS and SPG) follows water table fluctuations. Passive Skimmers include versions for 2-inch (5cm) and 4-inch (10cm) diameter wells, and Tidal Passive Skimmers with extra long strokes are available for sites with high and low tide considerations.

Passive Skimmers consist of four main items: a Floating Intake Head, Guide Rod & Flexible Tube, a Well Centering Disk, and a Clear Product Canister.

PASSIVE OPERATION

The skimmer is lowered into the well until the midpoint of the skimmer's travel is located at the fluid level in the well. The support rope is tied off holding the skimmer at a specific depth and the skimmer is left in the well to collect floating hydrocarbons.

A floating intake head follows any water table fluctuation.

Hydrocarbon first enters the skimmer through the floating intake's outer debris screen and then an inner oileophilic hydrophobic screen, down through a flexible, yellow tube, and into the see-through canister.

To empty the skimmer, it is pulled to the surface and the canister is drained using the valve at its base. The skimmer is returned to the well until next checked at its predetermined maintenance interval.

SKIMMER CAPACITY

18-inch canister : 13.0 oz. (0.38 l)
36-inch canister): 25.5 oz. (0.75 l)
18-inch canister): 47.0 oz. (1.4 l)
36-inch canister : 94.0 oz. (2.8 l)

OPERATIONS AND ACCESSORIES

CEE Passive Skimmers have three upgrade options that are simply undertaken in the field. All conversions require simple tools and do not take longer than thirty minutes. Should it be needed, reverse upgrading back to the standard Passive SOS Skimmer is an easy process that involves the same upgrade steps in reverse order.

CANISTER UPGRADE. CEE Passive Skimmers come in stock canister lengths ranging from 12 - 36 inches with ranging capacities from 8.5 oz. (0.25 L) to 94 oz. (2.8 L) depending on canister diameter. (Other sizes are available dependent on site requirements.) Furthermore, canisters can be removed and replaced as capacity or compatibility demands change.

HAND-PUMP UPGRADE. Most CEE Passive Skimmers, when outfitted with a skimmer-to-surface product tubes, can be serviced without raising the skimmer out of the well. Using a pump at the surface, maintenance personnel can pump product out of the skimmer's product canister and into a portable collection canister at the surface.

FULLY AUTOMATIC PRODUCT RECOVERY UPGRADE. CEE Passive Skimmers can be upgraded to active, fully automatic Product Only Recovery Systems as site needs change. As active systems, product can be recovered at rates over 2000 gpd. Safety and protective features are available such as Tank-Full Shut-Off (TFSO), which turns off the system when the product tank becomes full, and High-Water Shut-Off (HWSO), which turns off the product pump temporarily when water levels rise above the skimmer's effective travel. (Part

Number for upgrade is 300031.)

Click here to download a Site Information Form. Fill it out and fax it to CEE.

This is the shortest path to a solution.

For more information call 800 537-1767 (Toll Free in North America) or (510) 891-0880 ,e-mail CEE directly at sales@cee.com or contact the sales office nearest you.

BACK TO THE MAIN PAGE

OIL SKIMMERS

SOS

Selective Oil Skimmers

SOS Models:

SOS-2 For 2-inch wells; five models for tidal, dual pump, high-water, and shallow wells
SOS-4 For 4-inch wells; six models for tidal, dual pump, high-water, and shallow wells

OVERVIEW

The family of Selective Oil Skimmers (SOS) when coupled with shallow or deep-well product pumps, are designed to recover free-floating hydrocarbon down to a sheen (< 0.01 inches) from depths up to 250 feet (76m). The floating intake head follows water table fluctuations and with optional features, such as High-Water Shut-Off (HWSO), will automatically turn off the product pump temporarily to prevent potential water contamination. Alternate size SOS Skimmers are available for operating in 2-inch (5cm) and 4-inch (10cm) diameter wells. Tidal skimmers with extra long strokes are also available for sites with high and low tide considerations.

The SOS Skimmer consists of three main items: a Floating Intake Head, Guide Rod & Flexible Tube, and 2 Well Centering Disks.

METHOD OF OPERATION

The skimmer is lowered into the well until the midpoint of the skimmer's travel is located at the fluid level in the well and then connected to a surface or down-well mounted product pump.

The skimmer has a floating intake head that follows the fluctuating water table. Hydrocarbon first enters the skimmer through the floating intake's outer debris screen and then an inner oileophilic hydrophobic screen, down through a flexible, yellow tube, through the product pump, and into a product storage tank.

FLOATING INTAKE HEAD

All product which enters the floating intake head passes down through the flexible tube, up into the hollow guide tube, and is drawn out of the well by a product pump.

The Floating Intake Head:

- Consists of an outer debris screen, a floatation collar, and an inner semi-permeable (selective) screen which allows liquid hydrocarbons to pass and repels water.
- Reduces product level to a sheen (< 0.01 in.).
- Floats at the product-water interface in the well and automatically adjusts to any fluctuation of the groundwater within its travel range.
- Slides on a hollow, stainless steel guide tube which passes down through the center of the skimmer head.
- Is connected to the guide tube via a flexible (fuel rated) tube which hangs below the skimmer head and guide tube.

SKIMMER OPTION

SOS Skimmers can be used in conjunction with groundwater depression. When using SOS Skimmers, the groundwater hose must go along side the skimmer itself. The SOS Skimmer is placed inside a slotted PVC tube so the water depression hoses do not interfere with the floating intake skimmer head. CEE can provide either pneumatic or electric water depression pumps, depending upon the water drawdown rate.

Click here to download a Site Information Form. Fill it out and fax it to CEE. This is the shortest path to a solution.

For more information call 800 537-1767 (Toll Free in North America) or (510) 891-0880 ,e-mail CEE directly at sales@cee.com or contact the sales office nearest you.