N61165.AR.005791
CNC CHARLESTON
5090.3a

RAPID ASSESSMENT REPORT FOR SITE 44 ABOVE GROUND STORAGE TANK 601 (AST 601) ZONE H CNC CHARLESTON SC

07/01/2001

TETRA TECH INC

Rev. 1
07/19/01

RAPID ASSESSMENT REPORT
FOR
SITE 44, AST 601

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Water Monitoring, Assessment & Protection Division

ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Naval Facilities Engineering Command
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North Charleston, South Carolina 29406

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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0068

JULY 2001

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EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has completed a Rapid Assessment (RA) for Site 44 which includes a former aboveground storage tank (AST) system 601 for Building NS69 at Charleston Naval Complex (CNC) Zone H, in North Charleston, South Carolina. The AST provided storage for fuel oil to operate boilers in Building NS69. The RA was performed under the direction of the South Carolina Department of Health and Environmental Control (SCDHEC).

TtNUS performed the following actions during the RA:

- Reviewed available Navy documents to identify potential sources and receptors for petroleum hydrocarbons in the vicinity, to evaluate public and private potable wells, to locate utility line areas, to locate nearby surface water bodies, and to determine surface hydrology and drainage;
- Reviewed the previously prepared Aboveground Storage Tank Assessment Report for AST 601 to determine boring locations and monitoring well placements;
- Conducted site survey to identify utilities and to construct a site plan;
- Performed direct push investigation, and collected soil and groundwater samples for field screening of total petroleum hydrocarbons using an organic vapor analyzer;
- Collected groundwater samples from direct push borings for mobile laboratory screening analysis for benzene, toluene, ethylbenzene, and total xylenes (BTEX); and diesel range organics;
- Installed three temporary piezometers during the direct push investigation;
- Installed eight shallow permanent monitoring wells (Type II) to approximately 14 feet below land surface (bls) and a one vertical delineation well (Type III) to approximately 36 feet bls;
- Collected groundwater samples from the permanent monitoring wells for laboratory analysis for BTEX, methyl tert-butyl ether (MTBE), and naphthalene using U.S. Environmental Protection Agency (USEPA) Method 8260 and polynuclear aromatic hydrocarbons (PAHs) using USEPA Method 8270;
- Collected soil samples for laboratory analysis for BTEX and naphthalene using USEPA Method 8260, PAHs using USEPA Method 8270, total organic carbon (TOC) using USEPA Method 415.1, total recoverable petroleum hydrocarbons (TRPH) using USEPA Method 9071, and grain size analysis using sieve and hydrometer methods; and
- Surveyed monitoring well top of casing elevations and collected depth to groundwater measurements to evaluate the groundwater flow direction.

Conclusion

A groundwater sampling event was conducted on November 9-11, 2000. Dissolved naphthalene was detected in wells CNC44-M01 (260 µg/L) and CNC44-M04 (58.3 µg/L) at concentrations exceeding the SCDHEC Risk Based Screening Level (RBSL) of 10 µg/L. Dissolved benzene was detected in wells CNC44-M01 (13.7 µg/L) and CNC44-M04 (12.6 µg/L) at concentrations exceeding the RBSL of 5 µg/L. No CoCs were detected at concentrations exceeding RBSLs in the deep well, CNC44-M07D, adjacent to CNC44-M01. Other groundwater analyte concentrations were below the RBSL or the laboratory reporting detection limit.

During March, 2001, two additional monitoring wells were installed. The new wells were sampled on March 14, 2001 and a round of static water level measurements was made for wells at the site. At this time CNC44-M04 contained 0.25 feet of free product and CNC44-M01 contained 0.01 feet of free product.

Eight environmental soil samples and one duplicate sample were collected August 26, 2000, and analyzed for BTEX and PAHs by a fixed-base laboratory. Soil naphthalene concentrations exceeded the leaching RBSL in three locations (CNC44-B08, CNC44-B12, and CNC44-B16). The ethylbenzene concentration at CNC44-B08 and the benzene concentration at CNC44-B03 also exceeded the leaching RBSL. CNC44-B08 and CNC44-B12 were collected at locations corresponding with the ends of the former AST, adjacent to the locations of samples collected for the tank closure assessment.

Interference due to elevated levels of TRPH in several samples resulted in higher than normal detection limits for many analytes. Benzene concentrations in CNC44-B08, CNC44-B12, and CNC44-B16 are assumed to exceed the leaching RBSL because the laboratory detection limits that were reported for these samples exceeded the leaching RBSL. The reported laboratory detection limits for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h)anthracene from most of the soil samples also exceeded the leaching RBSLs and the concentrations of these PAHs are also assumed to exceed the leaching RBSLs.

Construction worker site-specific target levels (SSTLs) were calculated to evaluate the exposure pathways for soil and groundwater CoCs. The concentrations of benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene in the soil exceed the SSTLs, and the estimated concentrations of benzene and naphthalene in groundwater exceed the calculated SSTLs. These soil and groundwater concentrations may pose a threat to construction workers in nearby utility trenches.

Recommendation

Because concentrations in the groundwater and soil exceed the minimum calculated SSTLs protective of a construction worker in a utility trench, the Author recommends preparing an active Corrective Action Plan.

1.0 INTRODUCTION

Site 44 includes the former location of an aboveground storage tank (AST) system identified as AST 601 that was associated with Building NS 69 at the Charleston Naval Complex (CNC), Zone H in North Charleston, South Carolina. This Rapid Assessment (RA) was performed by the Tetra Tech NUS, Inc. (TtNUS) Tallahassee, Florida, office located at 1401 Oven Park Drive, Suite 102, Tallahassee, Florida, 32308 (telephone number 850-385-9899) on behalf of the U.S. Navy Southern Division (SOUTHDIV) Naval Facilities Engineering Command (NAVFAC), 2155 Eagle Drive, North Charleston, South Carolina 29406 (telephone number 843-820-7307). Authorization to conduct the RA for the Site was issued by NAVFAC under Contract Task Order (CTO) 0068. The RA was performed under the direction of the South Carolina Department of Health and Environmental Control (SCDHEC). TtNUS performed fieldwork necessary to complete the RA during November 2000 through March 2001.

1.1 SITE DESCRIPTION

The CNC is 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 as shown on Figure 2.

The area surrounding CNC is classified as "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 west 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.

Building NS 69 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 Vesole Street approximately 100 feet from Building NS 69. Buried feed and return lines ran from AST 601 to the northeast corner of Building NS 69 (Figure 2).

1.2 SITE HISTORY

In 1901, the U.S. Navy acquired 2,250 acres near Charleston to build a shipyard and the first naval officer was assigned duty in early 1902. Subsequently, buildings and a dry dock were constructed in the Naval Yard. The dry dock was completed in 1909 along with several other brick buildings and the main power plant, which is still in operation today. The first ship was placed in dry dock and work began on fleet vessels in 1910. World War I brought about an expansion of the yards, facilities, land area, and work force. The yard built two gunboats, several submarine chasers, and tugs in addition to performing repairs and other services to the fleet. In 1933, building activity had increased principally in construction of several Coast Guard tugs, a Coast Guard cutter, and a Navy gunboat, creating the need for more facilities and a much larger work force. In 1943 civilian work force peaked with almost 26,000 employees divided among three daily shifts. In 1956, construction began on piers, barracks, and buildings for mine warfare ships and personnel. Later in the decade, the facility became a major homeport for combatant ships and submarines of the U.S. Atlantic Fleet [Ensafe/Allan & Hoshall, Inc. (E/A&H), 1996b].

In 1993, major cuts in defense spending, as a result in part to the end of the Cold War, caused CNC to be added to the list of bases scheduled for closure under the Defense Base Realignment and Closure Act (BRAC). BRAC regulates the closure and transition of property back to the community (E/A&H, 1996b). With the scheduled closure of the base, operations were scaled back and environmental cleanup proceeded to make the property available for redevelopment after closure. As part of the environmental cleanup process, the AST 601 system was removed during July and August 1999.

Between July 16, 1999, and August 30, 1999, AST 601 was removed, cleaned, and recycled as scrap metal (SPORTENDETCHASN, 2000). At the time of removal, corrosion and pitting of AST 601 was observed, but no holes were noted. Piping associated with the AST included steel supply and return lines, which connected the tank to the boilers located in Building NS 69 (Figure 2). The supply and return lines were reportedly disconnected and blanked in 1998, following a petroleum release adjacent to Building NS 69 suspected to have originated from one or both of the lines (SPORTENDETCHASN, 2000). During the AST removal, the aboveground piping was removed and the underground portions of the supply and return lines were capped.

Three soil samples were collected from the vicinity of AST 601, one at each end of the tank and one at the piping connection to the tank. Stained soil and petroleum odors were noted at the time of sampling. The samples were transported to a fixed-base laboratory and analyzed for volatile organics [benzene, toluene, ethylbenzene, and total xylenes (BTEX) plus naphthalene], and polynuclear aromatic hydrocarbons (PAHs). Due to high laboratory dilution factors, the reporting limits for naphthalene and chrysene were at concentrations exceeding the risk based screening levels (RBSLs) established by the SCDHEC. Soil

sampling locations and laboratory data are provided in the Aboveground Storage Tank Assessment Report for AST 601, which is included in Appendix A.

1.3 RECEPTOR SURVEY RESULTS

A survey of the site vicinity was conducted by TtNUS personnel to identify potential receptors for petroleum hydrocarbon contamination. The site plan (Figure 2) depicts the public utilities located within 250 feet of the former AST 601 location. Specific information concerning the depth of utilities below land surface (bls) is currently unavailable. However, according to facility personnel, utility lines are typically located approximately 2 to 6 feet bls (SPORTENVDETCHASN, 1999). The following utility receptors were located:

- Water utility, sanitary sewer utility: A sanitary sewer line originates at the southwest corner of Building NS 69 and extends to a larger sewer line approximately 200 feet to the west of the building. Two potable water lines are located within the target area. One potable water line services Building NS 69 and is parallel to the sanitary sewer line previously described. The second potable water line is a northeast-southwest trending main parallel to Vesole Street and located approximately 50 feet east of Building NS 69 and 30 feet west of the former AST 601 location.

- Storm sewer utility: Three storm sewer lines are located in the target area. One storm sewer line is located approximately 50 feet to the south of Building NS 69 and the former location of AST 601 and is oriented perpendicular to Vesole Street. Storm drain inlets associated with this line are located in the parking area south of Building NS 69 and at the corner of Vesole Street. A second storm sewer line is located approximately 150 feet north of Building NS 69 on the western side of Vesole Street. This line runs perpendicular to the western side of Vesole Street and the inlet is located on Vesole Street. The third line is located approximately 75 feet to the east of the former location of AST 601 and runs to the northeast, parallel to Register Street, with inlets at corner of Vesole Street and on Register Street.

- Electrical utility: Electrical service in this area is provided by overhead power lines.

A survey of groundwater users within a 7-mile radius of CNC was performed for the *Final RCRA Facility Investigation Report for Zone I* (E/A&H, 1996b). According to this report, 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 shallow groundwater usage. Results of the water-use investigation revealed that no drinking water wells that utilize the shallow aquifer are located within a 4-mile radius of CNC. No irrigation wells were identified within 1,000 feet of the site. Numerous monitoring wells are located within

1,000 feet of the site. The nearest surface water bodies to AST 601 are 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 for this area of CNC, as the federal government currently owns the property. Information concerning zoning ordinances was obtained from the SOUTHDIV Remedial Project Manager located at 2155 Eagle Drive, North Charleston, South Carolina 29406 (telephone number 843-820-7307).

1.4 REGIONAL GEOLOGY AND HYDROGEOLOGY

CNC is located in Charleston County, South Carolina on the Cooper River side of the Charleston Peninsula. The peninsula is formed by the confluence of the Cooper and Ashley Rivers. The Charleston area is part of the Lower South Carolina Coastal Plain Physiographic Province. Topography in the area is typical of the South Carolina lower coastal plain and is characterized by low-relief plains broken by meandering streams and rivers, flowing toward the coast past occasional marine terrace escarpments (E/A&H, 1996b).

The geology of the Charleston area is typical of the southern Atlantic Coastal Plain. Cretaceous-age and younger sediments thicken seaward and are underlain by older igneous and metamorphic basement rock. Surface exposures consist of recent or Pleistocene sands, silts, and clays of high organic content referred to as the Wando Formation (E/A&H, 1996b). Underlying the Wando Formation, increasing with age, are the Oligocene-age Cooper Group and the Eocene-age Santee Limestone. The Cooper Group is comprised of the Parkers Ferry, Ashley, and Harleyville Formations. The formation of particular importance in the Cooper Group is the Ashley Formation, which was formerly referred to as the Cooper Marl in most regional geologic literature. In more recent geologic nomenclature, the name "Cooper" has been given to a group of formations which includes the Ashley Formation, a pale green to olive-brown, sandy phosphoric limestone or marl, which is locally muddy and/or sandy. In the Charleston area, the Ashley Formation is encountered at a depth of approximately 30 to 70 feet bls. The top of the Ashley Formation has been reported to be associated with an erosional basin and the entire Cooper Unit, including the Ashley Formation, is indicated to be approximately 300 feet thick (E/A&H, 1996b).

Groundwater occurs under water table or poorly confined conditions within the recent or Pleistocene deposits overlying the Ashley Formation of the Cooper Group. Transmissivity in the Pleistocene aquifer is generally less than 1,000 feet per day and well yields are variable, ranging from 0 to 200 gallons per minute (gpm). This groundwater contains high concentrations of iron and is commonly acidic at shallow

depths (E/A&H, 1996b). The Cooper Group is hydrogeologically significant mainly because of its low permeability. In most locales, its sandy, finely granular limestone produces little or no water, but instead acts as confining material causing artesian conditions in the underlying Santee Limestone. Yields from wells in the Santee are usually less than 300 gpm (E/A&H, 1996b).

2.0 ASSESSMENT INFORMATION

2.1 SITE-SPECIFIC GEOLOGY AND HYDROGEOLOGY

2.1.1 Site Geology

Twenty-four direct-push-technology (DPT) soil borings were advanced at Site 44 under the supervision of a TtNUS geologist between August 22-25, 2000 (see Figure 3). Since groundwater was encountered at shallow depths, soil samples were collected from ground surface to 4 feet bls at most of the sample locations. During November 2000, six shallow monitoring wells and a vertical delineation well were installed at the site. The shallow wells were completed with total depths of approximately 12 feet bls and the vertical delineation well was completed to 35 Feet bls. Based on the sampling results from the first round of well installations, two additional shallow monitoring wells were installed in March 2001. A general view of the subsurface lithology is presented in Figures 4 and 5.

Based on lithologic data collected from the soil sampling and monitoring well borings, the subsurface soil generally consists of fine- to medium-grained sand extending from the ground surface to approximately 4 feet bls. Underlying the sand deposit a dark gray silty, clayey sand was encountered to a depth of about 16 feet bls. Underlying this deposit a dark greenish gray silty clay, which contained thin lenses of sand, was encountered to a depth of 36 feet bls. Boring logs are presented in Appendix B.

2.1.2 Site Hydrogeology

Three temporary small-diameter PVC piezometers, CNC44-P01 through CNC44-P03, were installed during the DPT investigation (Figure 6). Each piezometer was constructed of 1-1/4-inch-diameter Schedule 80 polyvinyl chloride (PVC) threaded casing and 0.01 inch slotted well screen. The piezometers were completed to a total depth of 12 feet bls, utilizing 10-foot PVC screen sections installed to bracket the water table. The top-of-casing (TOC) elevations of the piezometers were surveyed by a TtNUS geologist, using a local reference point as an arbitrary vertical datum. The groundwater elevation data obtained from the piezometers were used in conjunction with the field screening data to aid in the placement of permanent monitoring wells. Figure 6 presents the groundwater isocontour surface for groundwater elevation measurements collected during the preliminary investigation. The temporary piezometers were abandoned in November 2000 by a South Carolina licensed well driller.

Eight shallow water table monitoring wells, CNC4-M01, CNC44-M02, CNC44-M03, CNC44-M04, CNC44-M05, CNC44-M06, CNC44-M08, and CNC36-M09, and one deep vertical delineation monitoring well,

CNC44-M07D, were installed as part of this RA investigation (see Figure 3). The shallow monitoring wells were completed to a depth of 12 feet bls. Each shallow monitoring well was completed using 10 feet of 2-inch diameter, 0.01-inch machine slotted Schedule 40 PVC screen and was designed to bracket the water table. Monitoring well CNC06-M07D was completed as a Type III monitoring well with 6-inch-diameter PVC surface casing grouted to a depth of 20 feet bls. After the grout for the surface casing cured for 24 hours, the borehole was advanced to a depth of 35 feet and a 2-inch-diameter PVC monitoring well was installed with a 5-foot, 0.01-inch machine-slotted PVC screen. Well construction logs for the RA monitoring wells are presented in Appendix B. At the completion of the well installations, a South Carolina registered professional surveyor surveyed each monitoring well location and the top of casing elevation.

Groundwater level measurements collected from the permanent monitoring wells, which were surveyed by professional surveyors, indicates groundwater generally occurs under unconfined conditions at depths of approximately 2 to 5 feet bls in the site area. A complete round of groundwater level measurements was recorded from the available site monitoring wells on November 11, 2000 and on March 13, 2001, and are presented in Table 1. Figure 7 presents the groundwater isocontour surface for groundwater elevation measurements collected during the March 13, 2001, field event. Based on the isocontour map, it appears that groundwater flow is to the northeast, toward the Cooper River.

On March 13, 2001, while collecting a round of water level measurements, free product was detected in CNC44-M04 and CNC44-M01. Free product samples from each of the wells were collected with a clear bailer. The free product thickness was measured from the thickness of product in the bailer. The free product thickness in MO4 was approximately 0.25 feet. Approximately 0.01 feet of product was present in M01. Free product had previously not been detected in either of these monitoring wells. Product thickness measurements are summarized on Table 1 and the estimated areal extent of the free product is depicted on Figure 8.

As part of the Final RFI Report for Zone H (E/A&H, 1996a), a tidal influence investigation was conducted. The objective of the investigation was to provide long-term water level monitoring to determine the effects of the tidal fluctuation on wells and groundwater flow throughout Zone H. During the tidal study water levels were recorded in 19 wells throughout Zone H over 4 days. Measurements were recorded every hour using data loggers. The 4-day period spanned nine high and nine low tide cycles.

Results of the tidal survey identified a maximum fluctuation in shallow monitoring wells of 1.12 feet with monitoring wells located closer to the tidal source being more influenced by tidal changes than wells on the peninsula. The heterogeneity of the aquifer material may limit or accentuate the tidal response in some wells. Tidal influence from Shipyard Creek appears to be greater than that of the Cooper River (possibly because of the quay wall along the Cooper River). The report concluded that the minimal

fluctuations in the groundwater levels were not expected to play a significant role in directing contaminant transport in any direction other than that determined by the natural groundwater gradient (E/A&H, 1996).

2.2 ASSESSMENT RESULTS

Twenty four soil borings were completed as part of the site screening portion of the soil investigation at Site 44. The soil borings for screening evaluation were advanced using a Direct Push Technology (DPT) rig. Screening samples were collected to evaluate subsurface soil vapors, soil contaminant concentration (via a mobile laboratory), and groundwater contaminant concentrations (via a mobile laboratory). The soil and groundwater samples collected for mobile laboratory screening were analyzed for BTEX plus naphthalene and for diesel range organics. The screening soil samples were collected from a maximum depth of 3 feet bls. The groundwater samples were collected using a DPT groundwater sampler with a three-foot long screen deployed near the water table or from temporary piezometers screened from two to twelve feet installed at three of the soil boring locations. Eight hand auger soil borings were completed at selected DPT locations to collect soil samples for analysis at a fixed base laboratory to confirm the presence of chemicals of concern (CoCs).

The eight soil samples collected for fixed base laboratory analysis were analyzed for BTEX and naphthalene using U.S. Environmental Protection Agency (USEPA) Method 8260, PAHs using USEPA Method 8270, and metals using USEPA Method 3050B. Two of the samples, from B08 and B16, were analyzed for total recoverable petroleum hydrocarbons (TRPH) using USEPA Method 9071. One background sample was collected at the B-11 location for total organic carbon (TOC) analysis using USEPA Method 415.1, and grain size analysis using sieve and hydrometer methods. The sample collection was conducted in accordance with the SCDHEC guidance document *Standard Limited Assessment* (June 1997). Lithologic logs for each soil boring are presented in Appendix B. The soil boring locations are shown on Figure 3 and the assessment results are presented in Section 2.4.1.

A groundwater monitoring event was conducted on November 9-11, 2000. Groundwater sampling was conducted using a peristaltic pump and low flow, quiescent techniques. The monitoring wells (CNC44-M01, CNC44-M02, CNC44-M03, CNC44-M04, CNC44-M05, CNC44-M06, AND CNC44-M07D) were sampled in accordance with SCDHEC's guidance document *South Carolina Risk-Based Corrective Action for Petroleum Releases* (January 1998). Each well was purged of three to six well volumes or until water quality parameters of pH, temperature, and conductivity stabilized. The field data sheets are included in Appendix C. A summary of the field parameter measurements is presented in Table 2. Groundwater samples were analyzed for BTEX and naphthalene using USEPA Method 8260, PAHs using USEPA Method 8270, and metals using USEPA Method 6010B.

Additional groundwater samples were collected on March 14, 2001, from two newly installed monitoring wells (CNC44-M08 and CNC44-M09). Sampling procedures and laboratory analytical parameters were the same as the previous sampling event. The field data sheets are included in Appendix C. A summary of the field parameter measurements is presented in Table 2.

2.3 FIELD SCREENING ASSESSMENT

2.3.1 Soil Vapor Assessment

Twenty-three soil borings were completed and evaluated for soil vapor concentrations as part of the soil screening assessment at Site 44. Soil boring B-11 was advanced at the background sample location and was not screened during the soil vapor assessment. Organic vapor analyzer (OVA) headspace measurements were recorded at selected intervals to the top of the water table. Table 3 summarizes the sample depths and soil vapor screening results. Figure 9 presents the results of the soil vapor assessment.

Soil boring vapor concentrations ranged from not detected to 400 parts per million (ppm). Eight soil borings contained vapor concentrations exceeding 20 ppm. Three of these borings had soil vapor concentrations exceeding 100 ppm. The soil vapor assessment was used as a screening method to assist in identifying locations for collection of soil samples and installation of groundwater monitoring wells. Soil sample and monitoring well locations were determined, in part, based on these data.

2.3.2 Soil Mobile Laboratory Results

Soil samples were collected from each soil boring for analysis by a mobile laboratory. The samples were analyzed for BTEX and naphthalene using USEPA Method 8260 and diesel range organics (DRO). The soil samples were selected based on the AST closure analytical results with the additional criteria that the samples originate in the vadose zone above the water table. The majority of the soil samples submitted to the mobile laboratory were collected from the two to three feet bls interval. Where depth to groundwater was less than three feet, samples were collected from the one to two feet interval or the zero to one feet interval for analysis. Table 4 presents a summary of the sample depths and the analytical data from the mobile laboratory. Figure 10 presents the results of the mobile laboratory soil screening.

Petroleum constituents were detected in three of the soil samples analyzed by the mobile laboratory. As indicated in Table 4, analytical results from the field screening reported benzene and toluene below detection limits in all borings. Naphthalene, the most commonly detected analyte, was detected in excess of RBSLs in three locations at concentrations ranging from 400 micrograms per kilogram (μg/kg) to an

estimated 6,900 μg/kg. DRO was detected at the same three sample locations, at concentrations ranging from 120 to 600 micrograms per kilogram (mg/kg). Other analytes detected below RBSLs include ethylbenzene (two locations), xylenes (one location).

The mobile laboratory soil analysis was used as a screening method to assist in identifying locations for collection of soil samples for fixed base laboratory analysis and locations for groundwater monitoring wells.

2.3.3 Groundwater Mobile Laboratory Results

One groundwater sample was collected from each DPT location and analyzed in a mobile laboratory for BTEX and naphthalene using USEPA Method 8260 and for DRO. At the majority of the DPT locations, groundwater samples were collected using a three-foot long groundwater sampler which was advanced to seven feet bls. Three of the groundwater samples were collected from temporary piezometers installed in the DPT boring (B07, B09 and B10). Table 5 presents a summary of the mobile laboratory analytical results. Figure 11 presents the results of the mobile laboratory groundwater screening.

Analyte concentrations exceeding the detection limits were detected in four locations adjacent to Building NS 69. Four analytes, benzene, ethylbenzene, xylene, and naphthalene, were detected at concentrations exceeding the SCDHEC RBSLs. Boring CNC44-B01 contained the maximum concentrations of xylene (32,000 μg/L), ethylbenzene (3,700 μg/L), and naphthalene (28,000 μg/L). Boring CNC44-B15 had the only benzene detection, 16.9 μg/L. DRO was reported in four locations at concentrations ranging from 6 milligrams per liter (mg/L) to 63,000 mg/L.

The mobile laboratory groundwater analysis was used as a screening method to assist in identifying locations for permanent monitoring wells for the collection of groundwater samples for fixed base laboratory analysis.

2.4 CHEMICALS OF CONCERN IN SOIL AND GROUNDWATER

2.4.1 Chemicals of Concern in Soil

Eight subsurface soil samples (plus one duplicate) were collected by hand auger at Site 44 for fixed base laboratory analysis. The soil boring locations are shown on Figure 3 and Table 6 summarizes CoC detection in those samples. Reportable analyte concentrations were detected in samples collected from six locations (CNC44-B01, CNC44-B02, CNC44-B03, CNC44-B08, CNC44-B12, and CNC44-B16). The detected analytes exceeding RBSLs and corresponding maximum concentrations are as follows

- Benzene = 9 μg/kg
- Ethylbenzene = 2,050 μg/kg
- Benzo(a)anthracene = 584 (J) μg/kg
- Benzo(b)fluoranthene = 672 (J) μg/kg
- Benzo(k)fluoranthene = 515 (J) μg/kg
- Chrysene = 590 (J) μg/kg,
- Naphthalene = 89,040 (J) μg/kg

Analytical results from the soil sample analyses were compared to the SCDHEC leaching RBSLs, since the leaching RBSLs are lower than the dermal contact/ingestion RBSLs for the CoC at Site 44. The leaching RBSLs for sand-rich soils were used for this evaluation since the grain size analyses for samples 44SLB0803 and 44SLB1603 indicated sand percentages above 60% (Appendix D). Figure 12 shows the areal distribution of CoCs in soil.

Interference due to elevated levels of TPH in several samples resulted in higher than normal detection limits for many analytes (Table 6). Benzene concentrations in CNC44-B08, CNC44-B12, and CNC44-B16 are assumed to exceed the RBSL because the laboratory detection limits that were reported for these samples exceeded the RBSL. The reported laboratory detection limits for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h)anthracene from most of the soil samples also exceeded the leaching RBSLs and the concentrations of these PAHS are also assumed to exceed the leaching RBSLs.

- Benzene = <638 μg/kg
- Benzo(a)anthracene = <313,000 μg/kg
- Benzo(b)fluoranthene = <313,000 μg/kg
- Benzo(k)fluoranthene = <313,000 μg/kg
- Chrysene = <313,000 μg/kg
- Dibenzo(a,h)anthracene = 313,000 μg/kg

2.4.2 Chemicals of Concern in Groundwater

Nine groundwater samples (plus one duplicate) were collected from monitoring wells at Site 44 for fixed base laboratory analysis. Groundwater analytical reports for the groundwater sampling field events are presented in Appendix D. Table 7 presents the analytical results for CoCs detected in the groundwater samples. Reportable analyte concentrations were detected in samples collected from seven locations (CNC44-M01, CNC44-M02, CNC44-M03, CNC44-M04, CNC44-M07, CNC44-M08, and CNC44-M09). The detected analytes and corresponding maximum concentrations are as follows:

- Benzene = 13.7 μg/l
- Ethylbenzene = 24.1 μg/l
- Toluene = 7 μg/l
- Xylene = 156 μg/l
- Naphthalene = 260 μg/l
- MTBE = 5.4 (J) μg/l

Benzene and naphthalene were the groundwater CoC detected at concentrations above the RBSL. Toluene, ethylbenzene, xylene, and MTBE were identified at concentrations above the laboratory detection limits, but below the RBSL. Figure 13 presents the distribution of organic CoCs reported in the groundwater samples analyzed at the fixed base laboratory.

2.5 ANALYTICAL DATA

The analytical data from the 1999 Aboveground Storage Tank Assessment Report for AST 601 are presented in Appendix A. Fixed base analytical data generated during this RA for soil are summarized in Table 6 and for groundwater in Table 7. The soil and groundwater analytical reports for this RA are included in Appendix D.

2.6 AQUIFER CHARACTERISTICS AND EVALUATION

Groundwater levels were measured from the site monitoring wells on March 13, 2001. The groundwater flow direction at the site is toward the northeast as illustrated on Figure 7. The hydraulic gradient for the site, calculated from the data from monitoring wells CNC44-M05 and CNC44-M09, was 0.0026 feet per foot.

As part of the Final RFI Report for Zone H, rising and falling head slug tests were conducted on 19 shallow monitoring wells throughout Zone H to determine the hydraulic conductivity of the surficial aquifer (E/A&H, 1996). Slug tests were conducted by instantaneously removing (rising head) or adding (falling head) a volume (slug) of water from the well and measuring the recovering water level with a data logger. The data were then used to calculate the hydraulic conductivity for the rising head test and the hydraulic conductivity for the falling head test. The average hydraulic conductivity for each well was determined by calculating the geometric mean of the rising and falling head values.

The well construction details and boring logs for each well tested during the RCRA investigation were reviewed to determine which wells were most representative of the conditions present at Site 44. To make this determination the screened interval, lithology, and proximity to the site were evaluated. Based

on this evaluation, monitoring well NBCH653001 was selected as the most representative well. NBCH653001 is located approximately 500 feet southwest of the site and is completed to a depth of approximately 12.5 feet with a 10-foot screened interval. The boring log indicates that the lithology consists of alternating sand, silty sand, clayey sand, and sandy clay, similar to the lithology observed at Site 44. The geometric mean of the rising and falling head conductivity for NBCH653001 was 0.631 feet per day (Zone H RFI).

The effective porosity for the site was estimated as specific yield based on the grain size analysis results (Fetter, C.W., 1988). Specific yield refers to the percentage of groundwater in the soil pore spaces that will release from an aquifer in response to gravity. The estimated specific yield/effective porosity value was determined from the grain size distribution of sample 44SLB0803. The effective porosity for the site was estimated to be 10 %, or 0.10 cm^3/cm^3.

Potential movement of groundwater at the site may be described in terms of transportation by natural flow system in the saturated zone, assuming groundwater flow follows Darcy's Law. Darcy's Law may be expressed as:

$$V = \left(\frac{K}{n}\right) x\, i$$

where:

V	=	seepage velocity
K	=	hydraulic conductivity = 0.631 ft/day
n	=	effective porosity = 0.10
i	=	most recent hydraulic gradient = 0.0026 ft/ft

therefore:

$$V = \left(\frac{0.631\ ft/day}{0.10}\right) x\, 0.0026\, ft/ft$$

and: $V = 0.016\ ft/day$

In summary, the seepage velocity of the surficial aquifer was calculated to be approximately 5 feet per year based on a hydraulic conductivity of 0.631 feet per day, a hydraulic gradient of 0.0026 feet per foot, and an effective porosity of 0.10 for clayey sand. Aquifer characterization graphs and calculations are provided in Appendix E.

2.7 FATE AND TRANSPORT

The Domenico model was the fate and transport model used to determine groundwater site-specific target levels (SSTLs) in the risk analysis. The Domenico dilution/attenuation model is presented in the SCDHEC guidance document, *South Carolina Risk-Based Corrective Action for Petroleum Releases* (SCDHEC 2001). This model is very conservative in that it assumes an infinite mass, areal source condition through which groundwater flows. The model incorporates biological decay effects through a first-order decay process; however, this mechanism was ignored because SCDHEC guidance specifies that the decay rate must be assumed to be zero if site-specific decay rates have not been determined.

The impacted groundwater source area was modeled based on the March 13, 2001, free product recordings in CNC44-M01 and CNC44-M04 (Figure 8). The estimated source area is 25 feet (7.62 meters) wide and 3 feet (0.91 meters) deep. The maximum source concentrations are assumed to exist throughout the source area, further compounding the conservatism of the estimate. Because of the existence of free product on-site, the maximum solubility in equilibrium with fuel oil calculated using Raoult's Law was used for the maximum constituent concentrations. Fuel oil constituents can vary greatly but were assumed for this investigation to be similar to kerosene, which is typically 44% naphthalene (Conoco, Inc., 1996. *CONCAWE Diesel Fuel / Kerosene*). Calculations are provided in Appendix F.

Site-specific data were used for saturated hydraulic conductivity, hydraulic gradient, effective porosity, and fraction of organic carbon in soil (2.2E-06 m/sec, 0.0026 feet/feet, 0.10 cm^3/cm^3, and 0.00165 g-C/g-soil, respectively). The soil bulk density (1.6 g/cm^3) was determined using Figure C3 given in SCDHEC (1998), based on the grain size test results for sample 44SLB0803. The following estimates of dispersivity were used in the Domenico model as given in SCDHEC (1998):

Parameter	Estimate
Longitudinal Dispersivity, α_x	x/10, where x = distance between the point of exposure and the source or compliance point
Transverse Dispersivity, α_y	$\alpha_x/3$
Vertical Dispersivity, α_z	$\alpha_x/20$

Table 8 summarizes fate and transport parameters used in modeling the SSTLs.

2.8 PREDICTED MIGRATION AND ATTENUATION OF CHEMICALS OF CONCERN

The most recent groundwater-gauging event shows that groundwater flow is primarily toward the northeast. The current extent of impact is limited to wells CNC44-M01 and CNC44-M04, which contained free product on March 14, 2001. Figure 8 shows the areal extent of free product.

The Domenico model was used to predict the distance from the source at which the tip of the plume is attenuated to SCDHEC RBSLs in 10 and 20 years without using degradation due to biological decay. This was done by adjusting the time to 10 years (3.15×10^8 sec) and 20 years (6.31×10^8 sec) and solving by trial and error for a distance (x) at which groundwater CoC concentrations were at or below the SCDHEC RBSLs. The source was assumed to be free product [i.e., the source concentration was assumed to be that of groundwater in equilibrium with fuel oil (see Section 2.6) for the entire 10- and 20- year periods]. Calculated concentrations of benzene, toluene, and naphthalene, at the source (in equilibrium with free product) were greater than their respective RBSLs; therefore, these were the chemicals for which plume distances were calculated. The table below shows the model estimates after 10 and 20 years for migration of benzene, toluene, and naphthalene using their respective RBSLs as the indicator of the downgradient plume edge.

Domenico Model Time Period	**CoC**	**Estimated Distance Traveled (feet)**
10 year	Benzene	41
	Toluene	18
	Ethylbenzene	1
	Xylenes	1
	Naphthalene	6
20 year	Benzene	67
	Toluene	31
	Ethylbenzene	1
	Xylenes	1
	Naphthalene	12

The Cooper River is approximately 1,750 feet from Site 44. Groundwater from site 44 is calculated to require approximately 350 years to migrate the distance from the site to the Cooper River. Therefore, the

Cooper River is unlikely to be at risk from migration of contaminants from Site 44. The Domenico Model calculations are presented in Appendix F.

3.0 TIER 1 and 2 EVALUATION

3.1 COMPARISON OF ANALYTICAL RESULTS WITH RBSLs

3.1.1 Soil Evaluation

Eight soil samples collected on August 26, 2000, were analyzed for BTEX and PAHs including naphthalene by a fixed-base laboratory. Results of the offsite analyses are included in Table 6. Soil naphthalene concentrations exceeded the leaching RBSL in three locations (CNC44-B08, CNC44-B12, and CNC44-B16). The ethylbenzene concentration at CNC44-B08 and the benzene concentration at CNC44-B03 also exceeded the leaching RBSL. CNC44-B08 and CNC44-B12 were collected at locations corresponding with the ends of the former AST, adjacent to the locations of samples collected for the tank closure assessment.

Interference due to elevated levels of TRPH in several samples resulted in higher than normal detection limits for many analytes (Table 6). Benzene concentrations in CNC44-B08, CNC44-B12, and CNC44-B16 are assumed to exceed the leaching RBSL because the laboratory detection limits that were reported for these samples exceeded the leaching RBSL. The reported laboratory detection limits for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and dibenzo(a,h)anthracene from most of the soil samples also exceeded the leaching RBSLs and the concentrations of these PAHs are also assumed to exceed the leaching RBSLs.

3.1.2 Groundwater Evaluation

A groundwater sampling event was conducted on November 9-11, 2000. Dissolved naphthalene was detected in wells CNC44-M01 (260 μg/L) and CNC44-M04 (58.3 μg/L) at concentrations exceeding the RBSL of 10 μg/L. Dissolved benzene was detected in wells CNC44-M01 (13.7 μg/L) and CNC44-M04 (12.6 μg/L) at concentrations exceeding the RBSL of 5 μg/L. No CoCs were detected at concentrations exceeding RBSLs in the deep well, CNC44-M07D, adjacent to CNC44-M01.

During March, 2001, two additional monitoring wells, CNC44-M08 and CNC4-M09, were installed downgradient of CNC44-M01 and CNC44-M04 (Figures 3, 6, and 7). The new wells were sampled on March 14, 2001 and a round of static water level measurements was made for wells at the site. At this time CNC44-M04 contained 0.25 feet of free product and CNC44-M01 contained 0.01 feet of free product (Table 1). To determine the CoC concentrations in the two monitoring wells containing free product, the maximum solubility of fuel oil constituents in equilibrium with water was calculated using Raoult's Law.

Fuel oil constituents can vary greatly but were assumed for this investigation to be similar to kerosene, which is typically 44% naphthalene. Results of the Raoult's Law calculations are located in Appendix F. Calculated concentrations for benzene, toluene, and naphthalene (0.31 mg/L, 4.65 mg/L, and 23.35 mg/L, respectively) in equilibrium with free product exceeded their respective RBSLs (0.005 mg/L, 1.0 mg/L, and 0.010 mg/L, respectively).

3.2 SITE CONCEPTUAL EXPOSURE MODEL

This section focuses on the current and future land use issues concerning the site. Building NS 69 was constructed to house boilers providing steam to adjacent buildings and continues to be used for that purpose. Figure 1 shows that the site is bordered by the CNC to west and south, and by the Cooper River to the north and east. 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. The future use of the property is expected to be industrial or commercial for the foreseeable future when the property is made available for redevelopment as part of the Defense BRAC Act.

Drinking water at the site and surrounding properties is provided by the city of Charleston water treatment plants. A survey of groundwater users within a 7-mile radius of the CNC was provided by the South Carolina Water Resources Commission to ascertain the extent of any shallow groundwater usage. The survey identified no drinking water wells that are screened in the shallow aquifer within a 4-mile radius of the CNC.

Groundwater from the site flows to the north toward the Cooper River, which discharges into Charleston Harbor. Surface water drains into the storm sewer drainage system located to the south and north of the site. The nearest storm drain is located approximately 50 feet south of AST 601's former location. There are no city, county, or state zoning ordinances, as the federal government currently owns the CNC.

3.3 EXPOSURE PATHWAY ANALYSIS

This section presents the receptor characterizations of the potentially exposed populations in the vicinity of the site and identifies the potentially complete exposure pathways for those receptors. SCDHEC requires that those media with CoC concentrations exceeding Tier 1 RBSL concentrations be examined in a Tier 2 Risk-Based Corrective Action Report. Tables 9 and 10 present the exposure pathway assessments for current and future use scenarios.

3.3.1 On-Site Commercial/Industrial Worker

An on-site commercial or industrial worker is defined as a business employee who works in a commercial/ industrial capacity at the site. The future use of the property is expected to be industrial or commercial for the foreseeable future; therefore, an on-site worker was considered as a potential receptor. Incidental ingestion and dermal contact with impacted soil are expected to be negligible for commercial/industrial workers because they are assumed to work inside a building. Groundwater at this site is not a source for drinking water or irrigation; therefore, ingestion or dermal contact with impacted groundwater is expected to be negligible as well. The foundation of Building NS 69 is assumed to be a sufficient barrier to prevent migration of vapors from both soil and groundwater into the building, and there is no history of detection of vapors in Building NS 69. It is unlikely that any additional exposure pathways will exist for future on-site workers; therefore, exposure pathways for either current or future commercial/industrial workers are not complete and this receptor is not quantified for this evaluation.

3.3.2 On-Site Visitor

An on-site visitor is defined as any person other than a worker or resident who might come on site. On-site visitors would have the same exposure pathways as commercial workers, but their exposure duration would be much shorter. Since exposure pathways for commercial workers were not complete, this receptor is not quantified for this evaluation.

3.3.3 On-Site Construction Worker

An on-site construction worker is defined as a laborer who would be involved in intrusive activities on or around the site, particularly in the area of subsurface utilities. On-site construction workers could be exposed to constituents in soil by the following pathways: inhalation of volatiles from soil, dermal contact with soil, and incidental ingestion of soil. On-site construction workers could be exposed to constituents in groundwater by the following pathways: inhalation of volatiles from groundwater, dermal contact with groundwater, and incidental ingestion of groundwater. There is a water line within 50 feet of the area containing free product; therefore, the point of exposure location for the on-site construction worker is considered to be at the source.

3.3.4 On-Site Resident

An on-site resident is defined as any person making his or her home at the site. This site is expected to remain a commercial/industrial facility. Therefore, exposure of on-site residents should not occur and this receptor is not quantified for this evaluation.

3.3.5 Off-Site Resident

An off-site resident is defined as any person making his or her home near the site. This receptor's location is either an actual current residence near the site or is a vacant lot or property near the site on which a residence could be built. The site is located in an area that will likely remain in commercial/industrial use, including all downgradient properties to the Cooper River. Therefore, exposure of off-site residents should not occur and this receptor is not quantified for this evaluation.

3.3.6 Surface Water

The Cooper River is approximately 1,750 feet to the north and northeast of the site. Groundwater at the site appears to flow toward the river at approximately five feet per year. Groundwater from the site would take an estimated 350 years to reach the Cooper River under these conditions. Therefore, exposure of surface water is unlikely to occur and this receptor is not quantified for this evaluation.

3.4 IDENTIFICATION OF DATA REQUIREMENTS

No additional data are required to calculate SSTLs for the site.

3.5 SITE-SPECIFIC TARGET LEVELS

Two future scenarios were considered to calculate SSTLs: on-site construction worker exposure to soil, and on-site construction worker exposure to groundwater. The minimum SSTL for each scenario was selected as the most conservative SSTL for each CoC detected at the site.

3.5.1 Soil SSTLs Protective of the On-Site Construction Worker

3.5.1.1 Dermal and Ingestion SSTLs

The Site Conceptual Model identified a potential receptor as a construction worker ingesting or having dermal contact with soil while working in a utility trench. For ingestion and dermal contact with soil while

working in a utility trench, subsurface soil exposure to a construction worker is similar to surface soil exposure. The RBSLs given by SCDHEC for ingestion and dermal contact with surficial soils by a commercial worker are compared to the maximum site soil concentrations in the table below. (RBSLs for commercial workers are conservative for construction workers. See note below[1]).

CoC	RBSL (mg/kg)	Maximum Onsite Concentrations (mg/kg)	Exceed RBSL
Benzene	100	<0.638	No
Toluene	410,000	<0.0949J	No
Ethylbenzene	200,000	<2.05	No
Xylenes	4,100,000	<0.638	No
Naphthalene	41,000	89.04	No
Benzo(a)anthracene	3.9	<313	Yes
Benzo(b)fluoranthene	3.9	<313	Yes
Benzo(k)fluoranthene	39	<313	Yes
Chrysene	390	<313	No
Dibenzo(a,h)anthracene	0.39	<313	Yes

(1) A commercial worker has a typically assumed exposure duration (ED) of 25 years and an exposure frequency (EF) of 250 days/year. A construction worker would be expected to have both lower ED and EF, based on the nature of utility or construction work. The EF can be assumed to be 90 days/year and the ED can be assumed to be 1 year. These assumptions are based on the nature of utility work. Therefore, the RBSLs for construction workers are expected to be higher than those for commercial workers.

As shown in the above table, the reporting limits reported for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene exceed the commercial RBSLs for ingestion or dermal contact with surficial soil. However, the RBSLs assume that a commercial worker will have an exposure duration for 25 years having an exposure frequency of 250 days per year. A construction worker would be expected to have a much lower exposure duration and exposure frequency based on the nature of utility, construction, or remediation work. The exposure frequency can be assumed to be 90 days/year or less and the exposure duration can be assumed to be 1 year or less. These assumptions are based on the nature of typical utility-type work.

In light of the difference between the exposure assumptions for commercial workers and on site utility construction workers, SSTLs were calculated for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene using the construction worker exposure assumptions.

CoC	SSTL (mg/kg)	Maximum Onsite Concentrations (mg/kg)	Exceed SSTL
Benzo(a)anthracene	21.17	<313	Yes
Benzo(b)fluoranthene	21.17	<313	Yes
Benzo(k)fluoranthene	211.7	<313	Yes
Dibenzo(a,h)anthracene	2.117	<313	Yes

As shown in the above table, the reporting limits for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene exceed the SSTLs for a construction worker exposed to site soil in a utility trench. Appendix F provides the parameters and results of the RBSL and SSTL calculations.

3.5.1.2 Inhalation RBSLs

RBSLs for a construction worker in a trench inhaling volatile vapors from soil were calculated. The calculations are provided in Appendix F. The inhalation RBSLs were calculated using equations given in the American Society for Testing and Materials (ASTM) *Standard Guide for Risk-Based Corrective Action Applied to Petroleum Release Sites, Designation E 1739-95E1* (1997). The following table summarizes the calculated SSTLs for the analyzed pathway:

CoC	Inhalation RBSL (mg/kg)	Maximum Onsite Soil Concentration (mg/kg)	Exceeds RBSL
Benzene	7,853	<0.638	No
Ethylbenzene	227,339	2.05	No
Naphthalenes	3,123	89.04	No

Based on the above table, the construction worker exposed to subsurface soil is not at risk if inhaling benzene, ethylbenzene, or naphthalenes volatilizing from the soil.

3.5.2 Groundwater SSTLs Protective of the On-Site Construction Worker

Groundwater RBSLs provided by SCDHEC are for the chronic ingestion pathway only; therefore, groundwater RBSLs for the construction worker were calculated for three pathways: dermal contact, incidental ingestion, and inhalation of volatiles. A target cancer risk of 1×10^{-6} and a target hazard quotient of 1 were used in the calculations. Where possible, site-specific parameters were used for site conditions. Standard defaults were used when available and applicable to a construction worker. When

no standard parameters were available, conservative assumptions were used. For each pathway, the exposure frequency was assumed to be 90 days/year and the exposure duration was assumed to be 1 year. These assumptions were considered conservative based on the nature of utility work.

The dermal contact RBSLs were calculated using procedures *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Dermal Risk Assessment, Interim Guidance* (USEPA Peer Consultation Workshop Draft, 1998). Based on expected limited contact with groundwater, the event frequency was assumed to be one event/day and the event duration was assumed to be 1 hour/event. The skin surface area available for contact was 4500 cm^2, based on one-fourth the skin surface area given in the risk assessment guidance document for a swimming adult.

The incidental ingestion RBSLs were calculated using the equation given in *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Interim Final)*, (USEPA, 1989). An incidental ingestion rate of 0.01 L/day was assumed based on a fraction (12.5%) of the incidental ingestion rate for a wading adult (0.01 L/hr), considered for an 8-hour work day. The incidental ingestion rate for wading adults is given in *Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment* (USEPA Region 4, 1995).

Utility lines in the area are typically 2 to 6 feet deep. The average depth to groundwater at the point of exposure (CNC44-M04) is 3.00 feet below TOC. It is assumed that a construction worker might be exposed to chemicals volatilizing from standing groundwater. The inhalation RBSLs were calculated using Henry's Law:

$RBSL_{WATER} = RBSL_{AIR}/H$

Where H = Henry's Law constant [mg/L-air/mg/L-water]

The $RBSL_{AIR}$ for each chemical was calculated using the equation given in the ASTM *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (1997). SCDHEC values were used for Henry's Law constants.

A water line is located within 50 feet of the area containing free product. The point of exposure location for the on-site construction worker was considered to be at the source; therefore, no fate and transport calculations were performed to determine the SSTL protective of the construction worker. The minimum RBSL of the three pathways was chosen as the SSTL for the construction worker.

The maximum dissolved hydrocarbon concentrations at the site were assumed to be the concentration of each compound in equilibrium with fuel oil, calculated using Raoult's Law. These concentrations were used in the following table as the maximum on-site groundwater concentration. The Raoult's calculations are shown Appendix F. The following table shows the calculated RBSLs for each pathway and the groundwater SSTL for the construction worker:

CoC	Dermal RBSL (mg/L)	Incidental Ingestion RBSL (mg/L)	Inhalation RBSL (mg/L)	Selected Minimum Groundwater SSTL (mg/L)	Maximum On-site Ground-water Conc. Based on Raoult's Law (mg/L)	Exceeds SSTL
Benzene	0.85	68.52	0.15	0.15	0.31	Yes
Toluene	23.98	5677.78	5.38	5.38	4.65	No
Ethylbenzene	6.05	2838.89	14.50	6.05	0.10	No
Xylenes	102.33	56777.78	NA*	102.33	0.79	No
Naphthalenes	1.63	1135.56	2.63	1.63	23.35	Yes

Note:* No inhalation reference dose is available for xylenes; therefore, no inhalation RBSL can be calculated.

The calculated RBSLs for toluene, ethylbenzene, and xylenes are above the maximum estimated groundwater concentrations; therefore, those CoCs are not considered a risk to the construction worker exposed to groundwater in a utility trench. Benzene and naphthalene maximum estimated groundwater concentrations exceed the RBSL for a construction worker exposed to groundwater. Appendix F provides the parameters and results of the RBSL and SSTL calculations.

3.5.3 Soil Leaching SSTLs Protective of the On-Site Construction Worker

Because separation distance of impacted soil from groundwater at the site is less than eight feet, soil leachability was not modeled for this evaluation.

3.5.4 Selected SSTLs

The selected SSTLs and the source concentrations are:

Media of Concern	Chemical of Concern	Units	Minimum SSTL	Maximum Source Concentration	Exceeds SSTLs
Soil	Benzene	mg/kg	100	<0.638*	No
	Benzo(a)anthracene	mg/kg	3.9	<313*	Yes
	Benzo(b)fluoranthene	mg/kg	3.9	<313*	Yes
	Benzo(k)fluoranthene	mg/kg	39	<313*	Yes
	Dibenzo(a,h)anthracene	mg/kg	0.39	<313*	Yes
	Naphthalene	mg/kg	41,000	89.04	No

Note: * Denotes concentration is below the laboratory reporting limit.

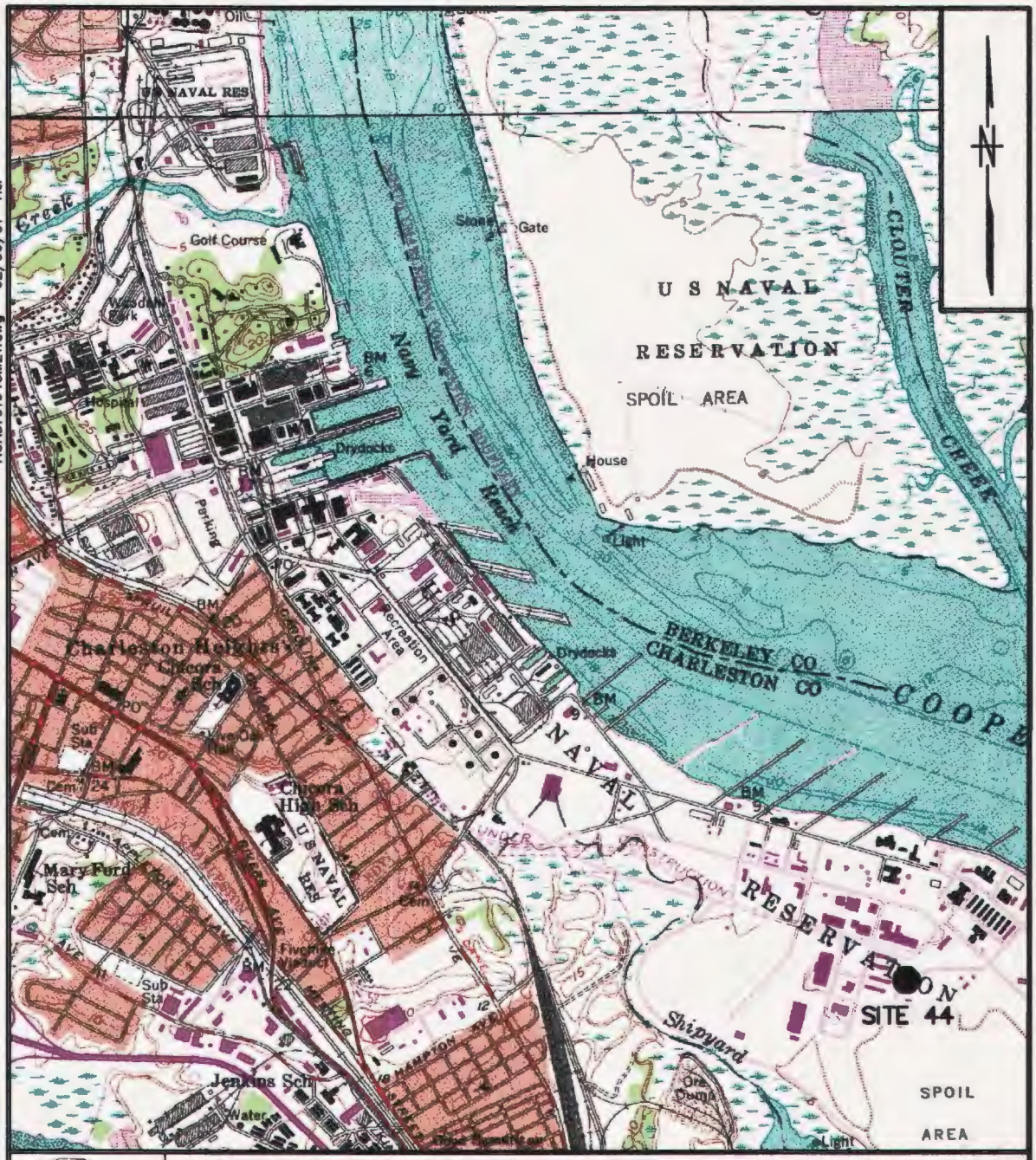
Media of Concern	Chemical of Concern	Units	Minimum SSTL	Maximum Source Concentration	Exceeds SSTLs
Groundwater	Benzene	mg/L	0.15	0.31	Yes
	Toluene	mg/L	5.38	4.65	No
	Ethylbenzene	mg/L	6.05	0.10	No
	Xylenes	mg/L	102.3	0.79	No
	Naphthalenes	mg/L	1.63	23.35	Yes

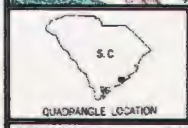
The concentrations of benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene in the soil exceed the SSTLs, and the estimated concentrations of benzene and naphthalene in groundwater exceed the calculated SSTLs. These soil and groundwater concentrations may pose a threat to construction workers in nearby utility trenches.

3.6 RECOMMENDATIONS

Because concentrations in the groundwater and soil exceed the minimum calculated SSTLs protective of a construction worker in a utility trench, the Author recommends preparing an active Corrective Action Plan.

FIGURES





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

0 2000 4000
SCALE IN FEET

DRAWN BY HJP DATE 2/5/01	DEPARTMENT OF THE NAVY SOUTHERN DIV FACILITIES ENGINEERING COMD	SITE LOCATION MAP SITE 44, AST 601 ZONE H, CHARLESTON NAVAL COMPLEX NORTH CHARLESTON, SC	CONTRACT NO. 0164
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1 / REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

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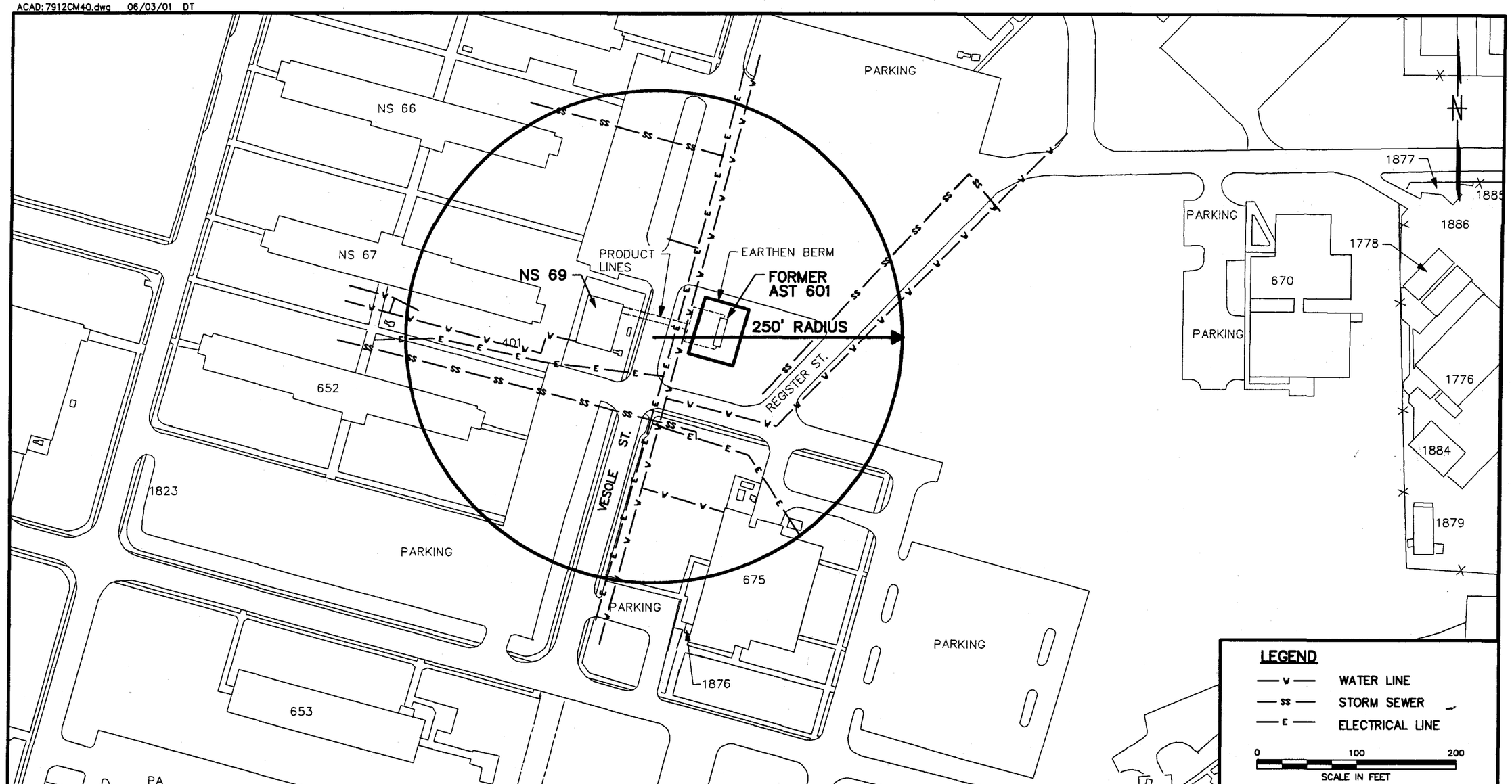
ACAD: 7912CM40.dwg 06/03/01 DT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

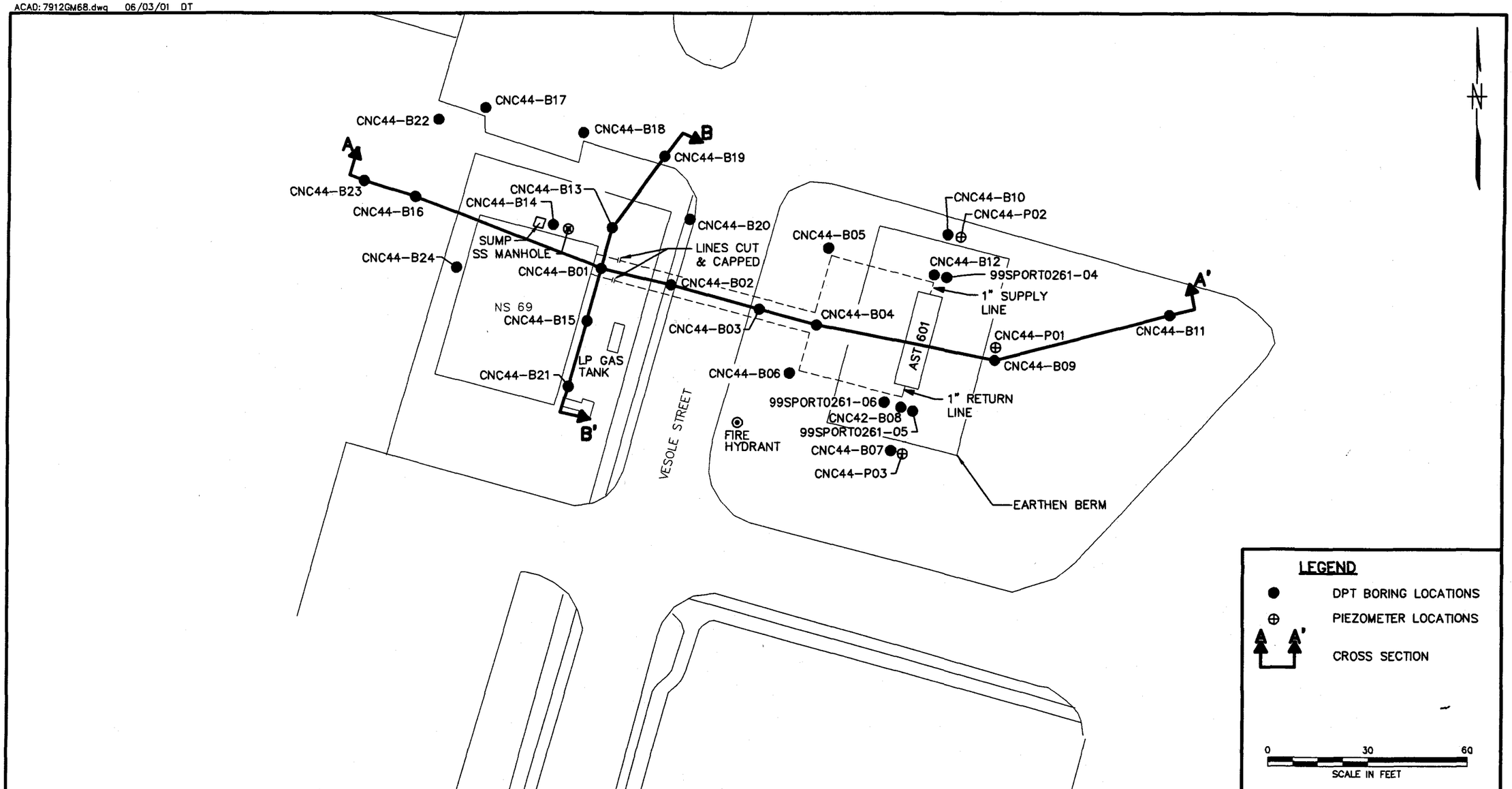
DRAWN BY DLT DATE 6/3/01
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

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

CONTRACT NO. 7912
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

ACAD: 7912GM68.dwg 06/03/01 DT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/3/01
CHECKED BY DATE
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
DRAWING NO. FIGURE 3
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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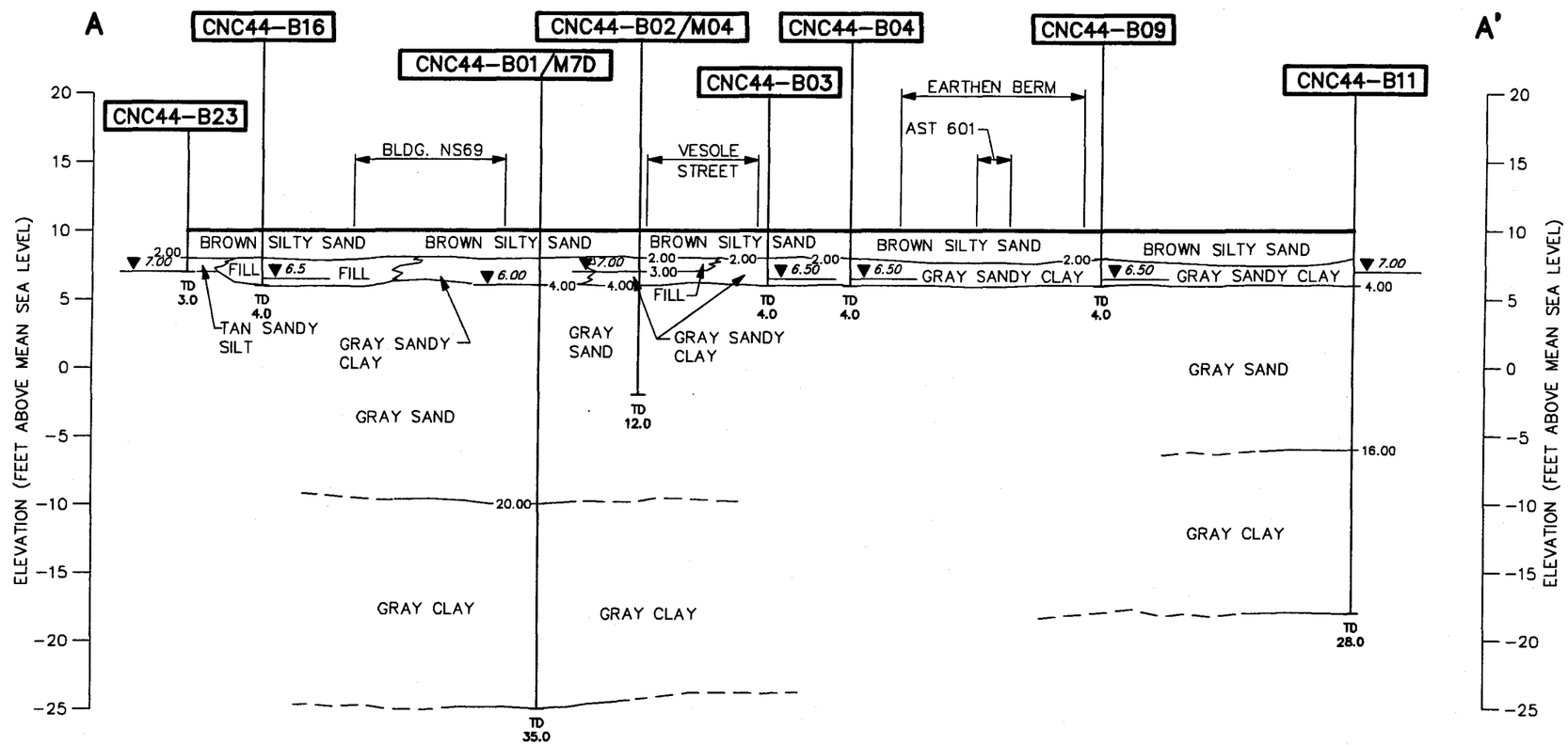

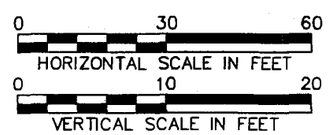

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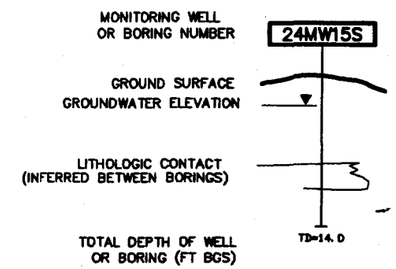

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/7/01
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
DRAWING NO. FIGURE 4
REV. 0

FORM CADD NO. SOUTH-BH.DGN - REV 0 - 9/9/98

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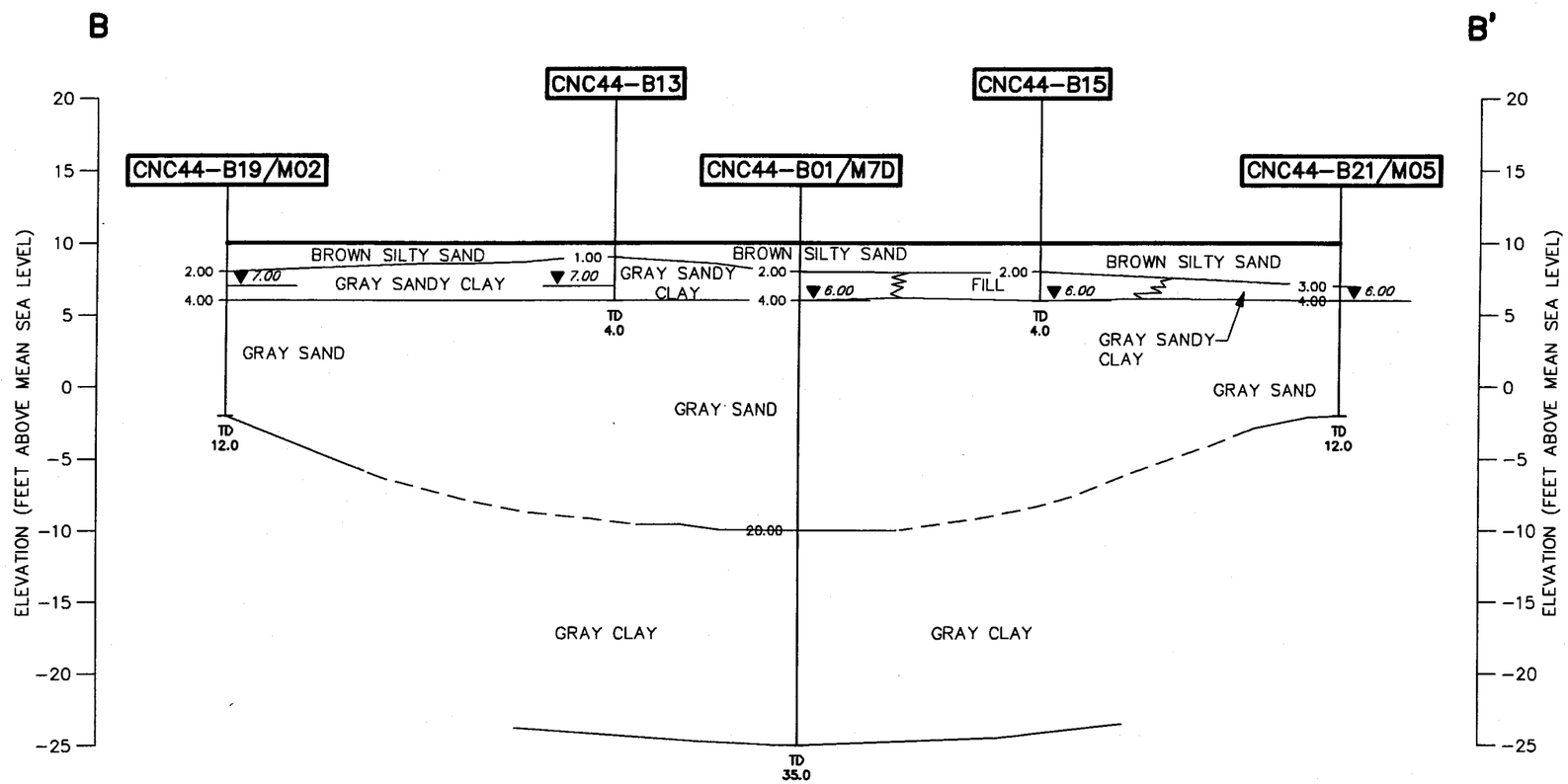

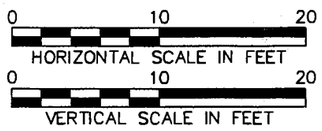

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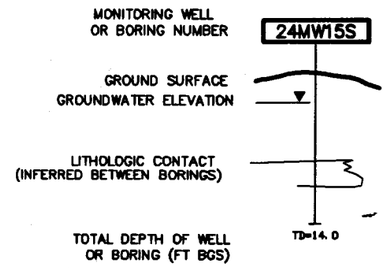

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

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

CROSS SECTION B-B'
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 5
REV. 0

FORM CADD NO. SOUTH-BH.DGN - REV 0 - 9/9/98

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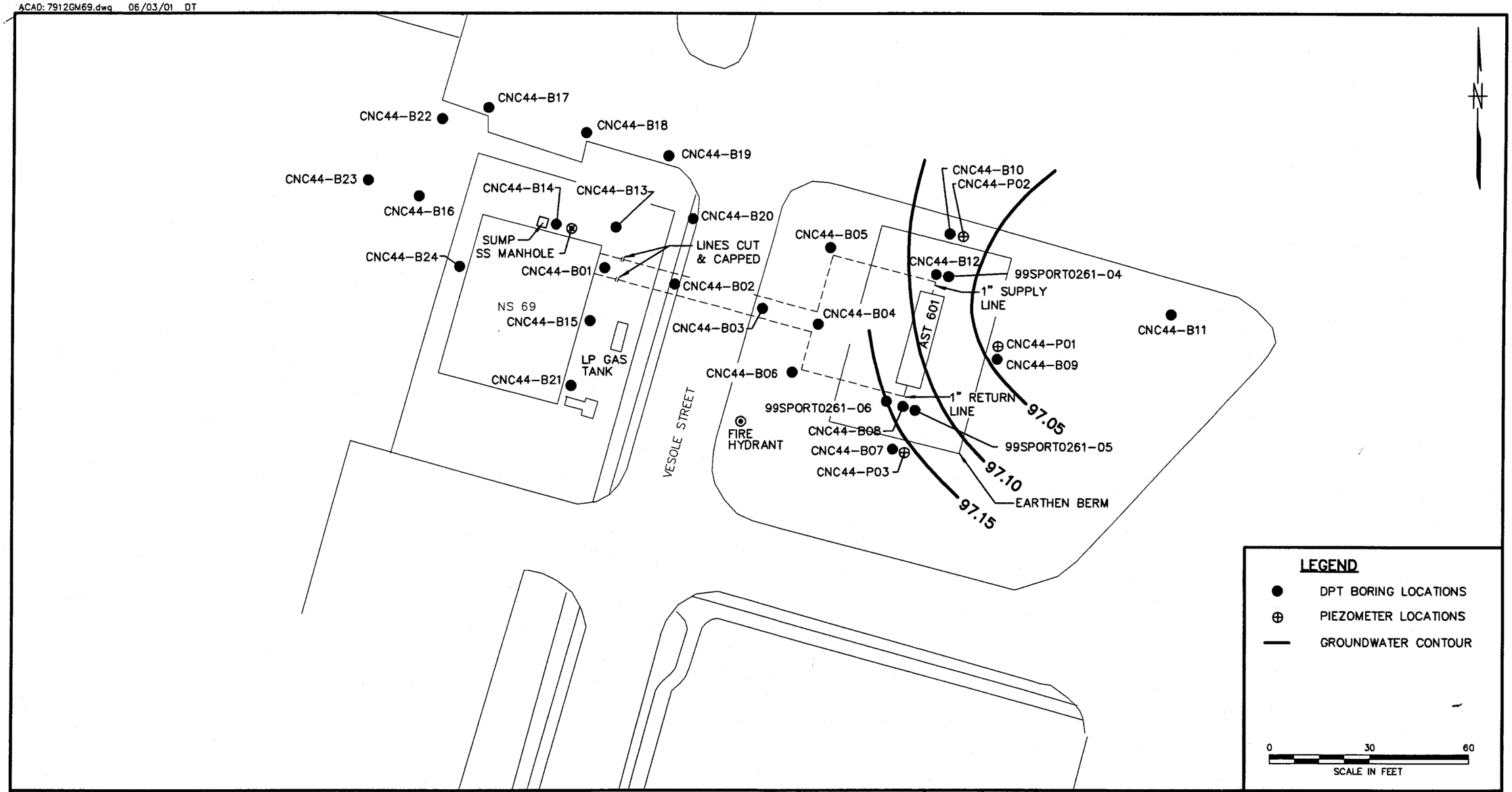

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/3/01
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
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 6
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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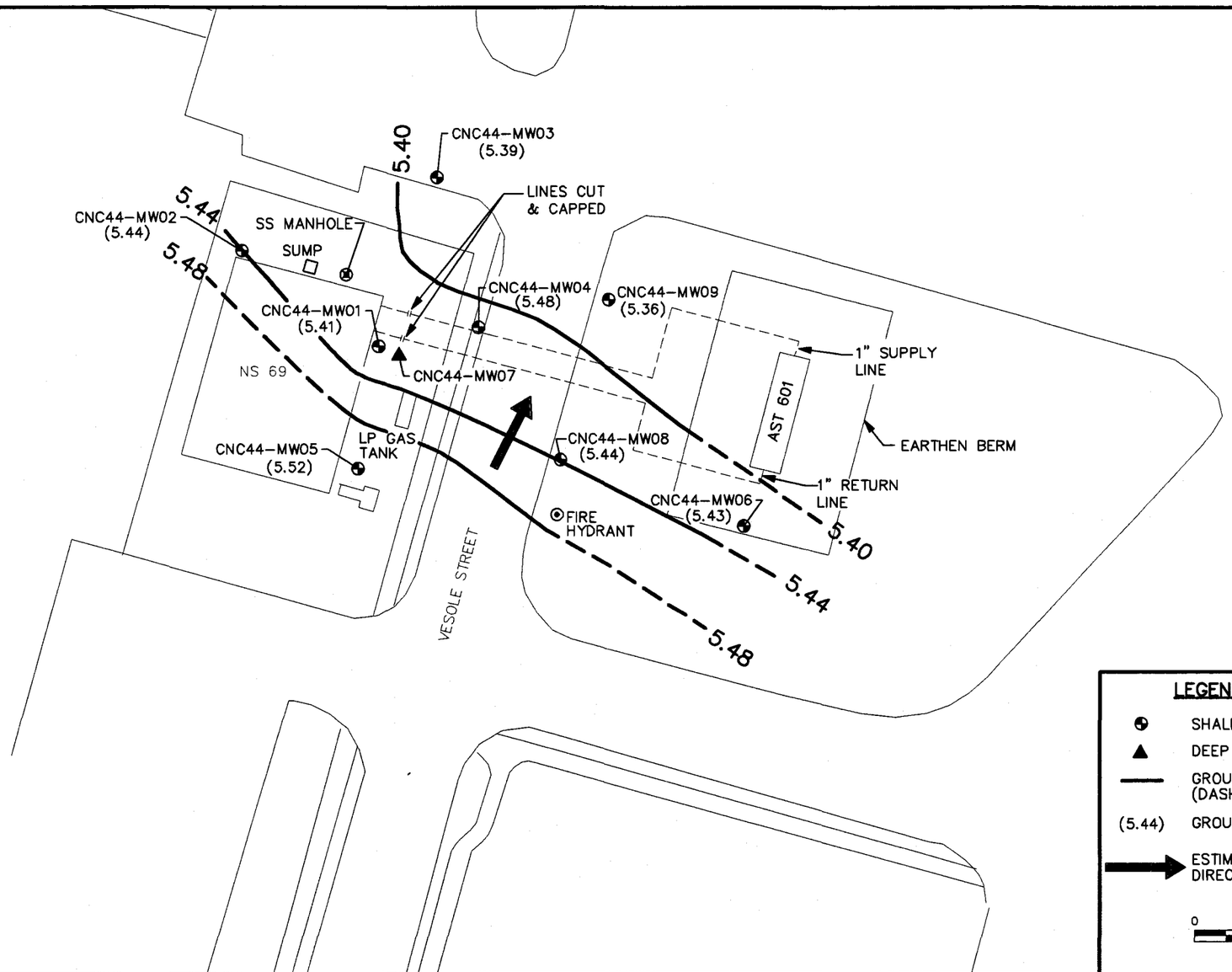

LEGEND

- SHALLOW MONITORING WELL LOCATIONS
- DEEP MONITORING WELL LOCATIONS
- GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
- (5.44) GROUNDWATER ELEVATION
- ESTIMATED GROUNDWATER FLOW DIRECTION

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

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

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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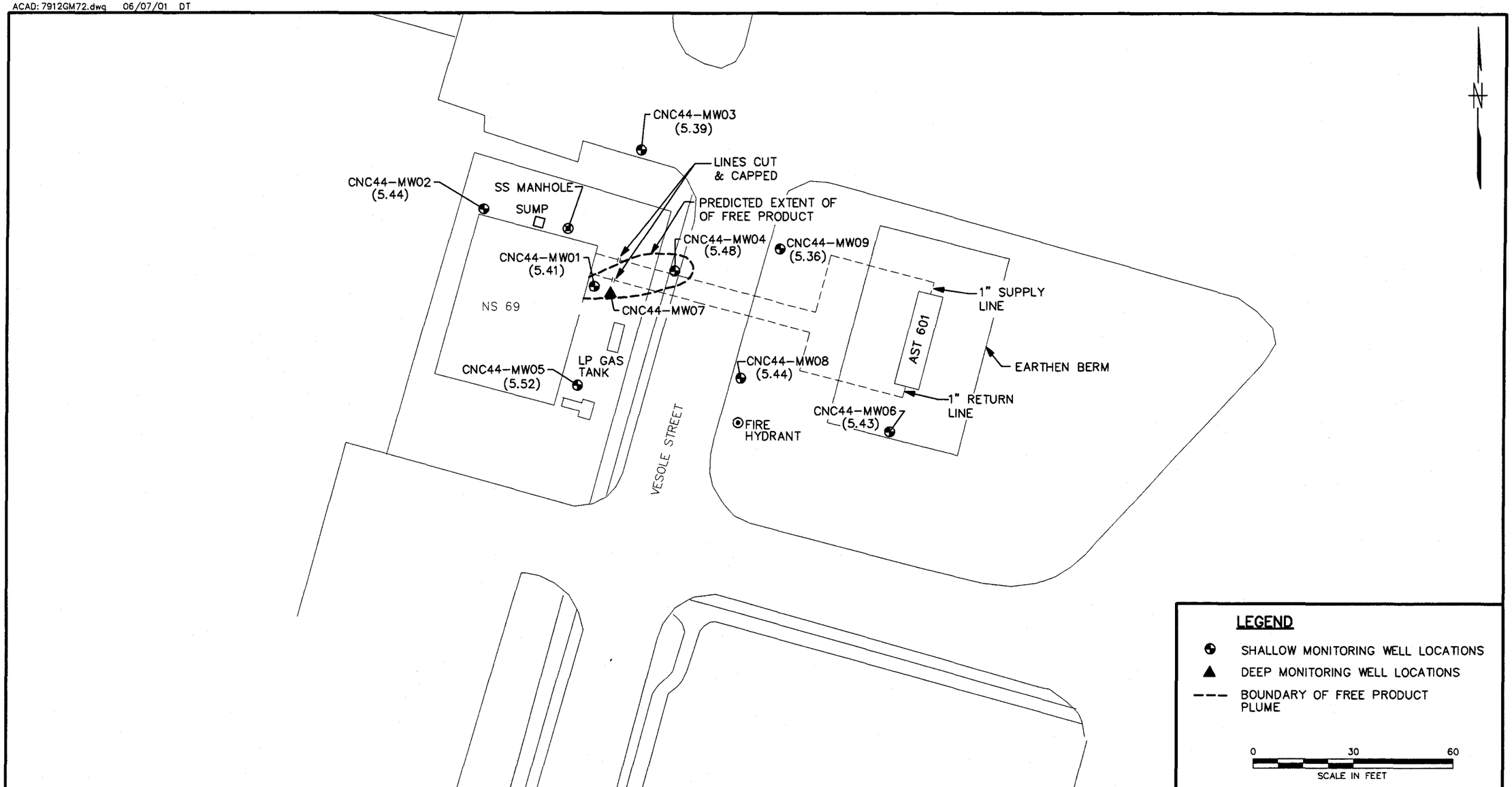

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
CDST/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
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 8
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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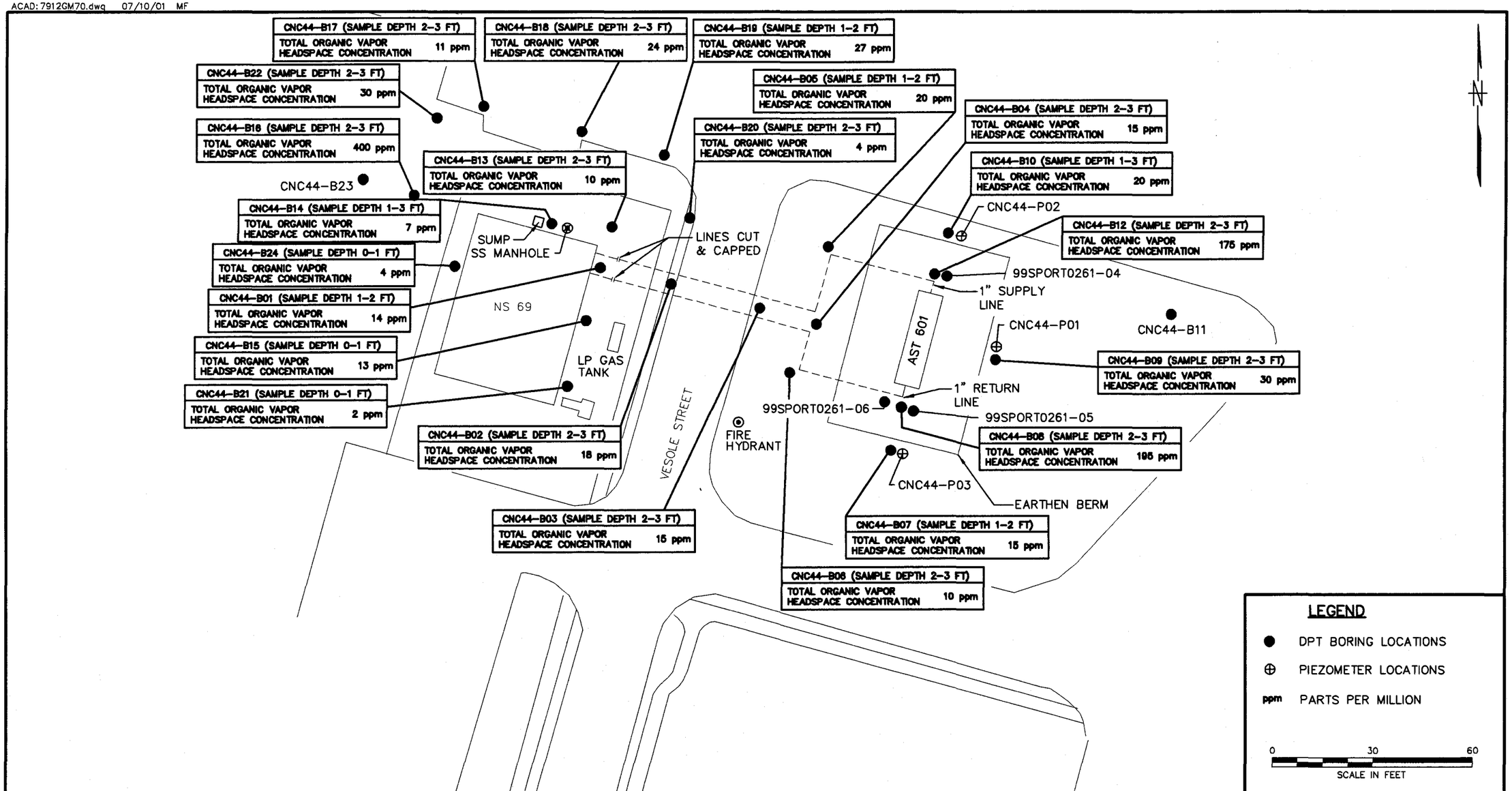

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

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
DRAWING NO. FIGURE 9
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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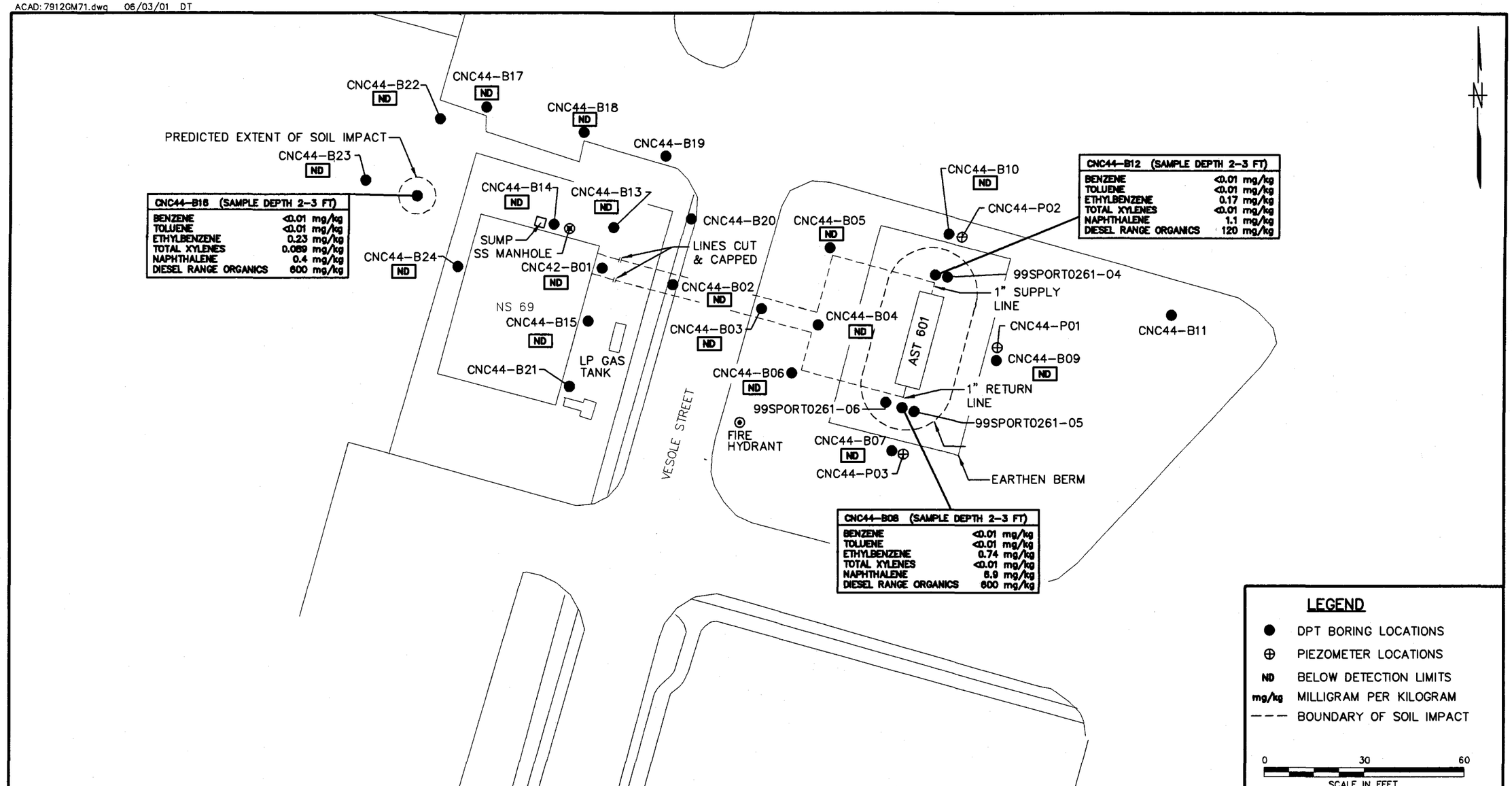

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

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

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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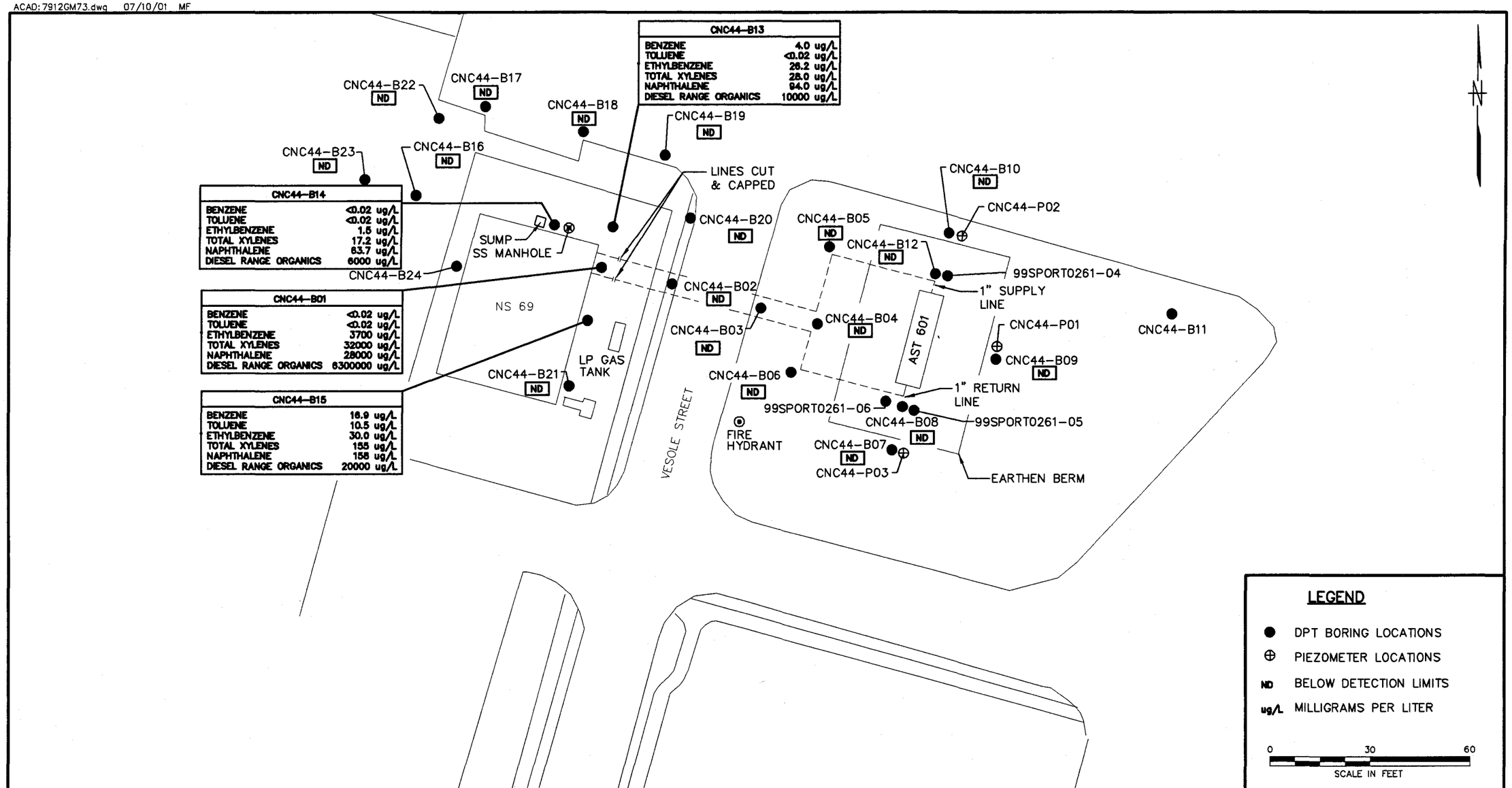

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 9/7/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

MOBILE LAB RESULTS FOR GROUNDWATER
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 11
REV. 0

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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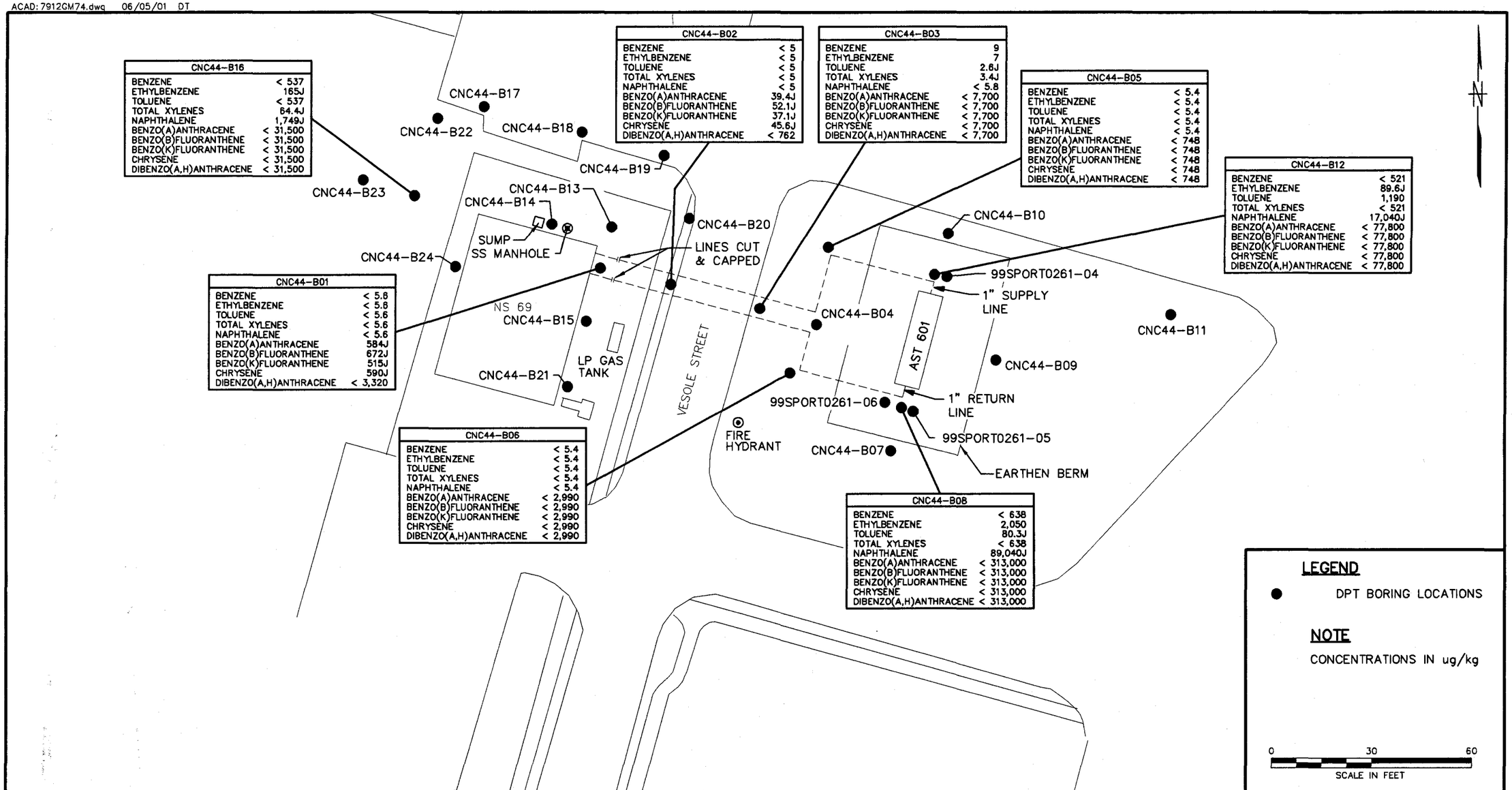

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

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

FIXED BASE 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

FORM CADD NO. SDIV_BH.DWG - REV 0 - 1/20/98

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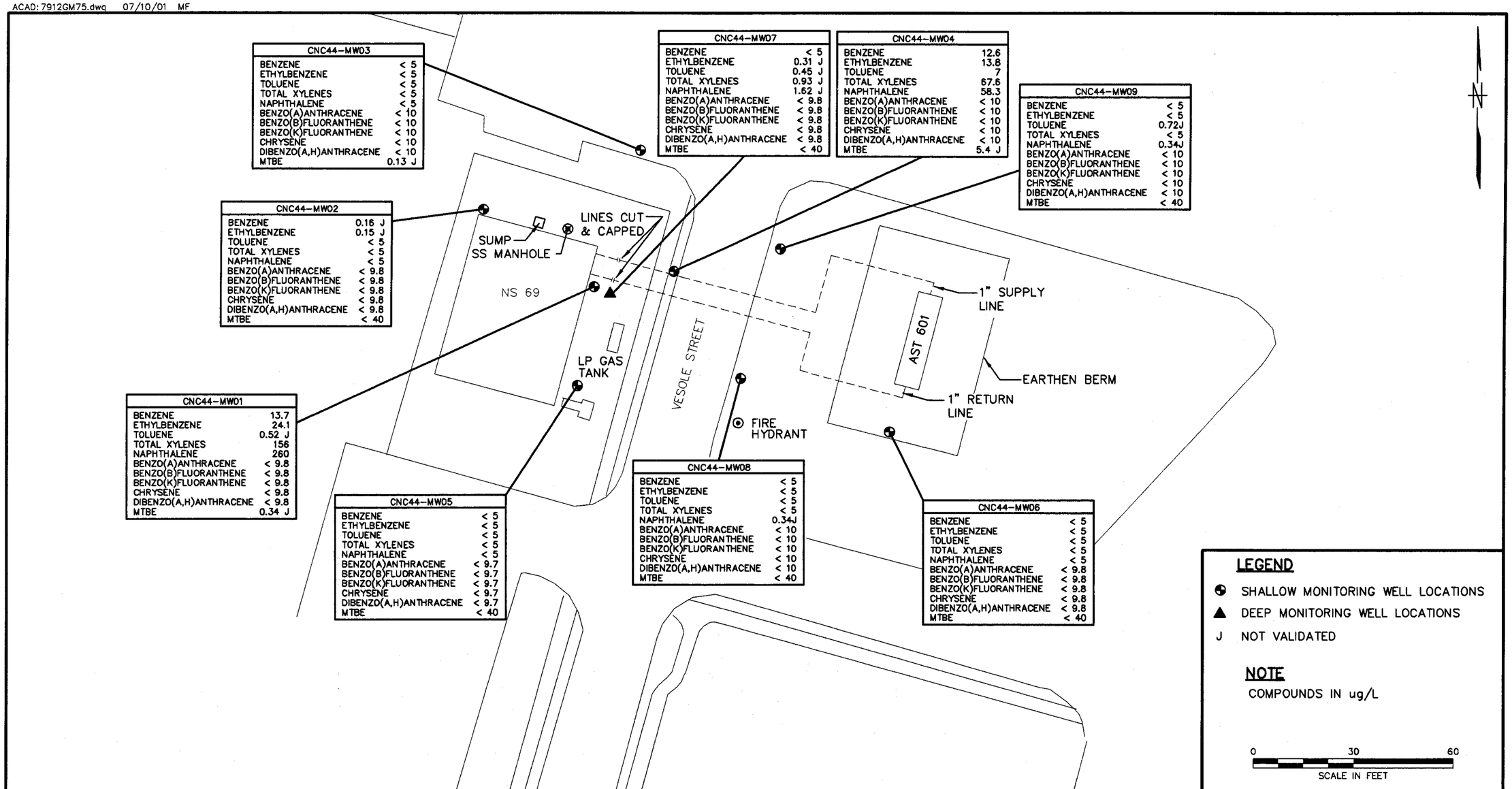


NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DLT DATE 6/5/01
CHECKED BY DATE
CDST/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. SDIV_BH.DWG - REV 0 - 1/20/98

TABLES

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 3

SUMMARY OF OVA SOIL SCREENING RESULTS
SITE 44, BUILDING NS 69/AST 601
ZONE H, FORMER CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Sample Location	Sample Depth (feet)	Corrected Organic Vapor Headspace Concentration
CNC44-B01	1-2	14
CNC44-B02	1-2	6
	2-3	18
CNC44-B03	1-2	6
	2-3	15
CNC44-B04	1-2	14
	2-3	15
CNC44-B05	1-2	20
	2-3	17
CNC44-B06	1-2	8
	2-3	10
CNC44-B07	1-2	15
	2-3	11
CNC44-B08	1-2	27
	2-3	195
CNC44-B09	1-2	20
	2-3	30
CNC44-B10	1-2	20
	2-3	20
CNC44-B11		Not Sampled (background loc.)
CNC44-B12	1-2	20
	2-3	175
CNC44-B13	1-2	6
	2-3	10
CNC44-B14	1-2	7
	2-3	7
CNC44-B15	0-1	13
	1-2	ND
CNC44-B16	1-2	18
	2-3	400
CNC44-B17	1-2	6
	2-3	11
CNC44-B18	1-2	20
	2-3	24
CNC44-B19	1-2	27
CNC44-B20	1-2	3
	2-3	4
CNC44-B21	0-1	2
CNC44-B22	1-2	4
	2-3	30
CNC44-B23	0-1	ND
CNC44-B24	0-1	4
	2-3	ND

Note:
OVA - organic vapor analyzer equipped with a flame ionization detector

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

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

EXPOSURE PATHWAY ASSESSMENT - CURRENT USE
SITE 44, BUILDING NS69/AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Media	Exposure Route	Pathway Selected for Evaluation?	Exposure point or Reason for Non-Selection	Data Requirements (If pathway selected)
Air	Inhalation Explosion Hazard	No No	Free product and groundwater plumes outside building location. No volatilization to enclosed space. No explosion hazard.	
Groundwater	Ingestion Dermal contact Inhalation	No No No	No water supply well downgradient or buildings with basements.	
Surface Water	Ingestion Dermal contact Inhalation	No No No	Cooper River 1,750 feet downgradient. No recreational use of the river in the immediate area. Plume limited to site area.	
Surficial Soil	Ingestion Dermal contact Inhalation	No No No	Former AST area surrounded by berm, access limited.	
Subsurface Soil	Ingestion Dermal contact Inhalation Leaching to Groundwater	No No No No	Groundwater is at a depth of 3 feet.	

TABLE 10

EXPOSURE PATHWAY ASSESSMENT - FUTURE USE
SITE 44, BUILDING NS69/AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

Media	Exposure Route	Pathway Selected for Evaluation?	Exposure point or Reason for Non-Selection	Data Requirements (If pathway selected)
Air	Inhalation Explosion Hazard	No No	Free product and groundwater plumes outside building location. No volatilization to enclosed space. No explosion hazard.	
Groundwater	Ingestion Dermal contact Inhalation	Yes Yes Yes	Future use of property expected to be industrial or commercial. Groundwater level within 3 feet of ground surface; therefore, construction worker exposure possible.	No additional data required.
Surface Water	Ingestion Dermal contact Inhalation	No No No	Cooper River located approx. 1,750 feet downgradient, plume migration to river unlikely.	
Surficial Soil	Ingestion Dermal contact Inhalation	Yes Yes Yes	Future use of property expected to be industrial or commercial. Intrusive construction possible; therefore, construction worker exposure possible.	No additional data required.
Subsurface Soil	Ingestion Dermal contact Inhalation Leaching to Groundwater	Yes Yes Yes No	Future use of property expected to be industrial or commercial. Intrusive construction possible; therefore, construction worker exposure possible.	No additional data required. Groundwater within 5 feet of land surface, therefore leaching to groundwater path not evaluated.

APPENDIX A

UNDERGROUND STORAGE TANK ASSESSMENT REPORT
AST 601

Aboveground Storage Tank (AST) Assessment Report

Date Received State Use Only

Submit Completed Form to:
SCDHEC
2600 Bull Street
Columbia, South Carolina 29201
Telephone (803) 734-5331

I. OWNERSHIP OF AST(S)

Agency/Owner: Southern Division, Naval Facilities Engineering Command, Caretaker Site Office

Mailing Address: P.O. Box 190010

City: N. Charleston State: SC Zip Code: 29419-9010

Area Code: 843 Telephone Number: 743-9985 Contact Person: Henry N. Shepard II, P. E.

II. SITE IDENTIFICATION AND LOCATION

Site I.D. #: AST 601, Unregulated

Facility Name: Charleston Naval Base Complex

Street Address: Vesole Street

City: North Charleston, 29405-2413 County: Charleston

III. CLOSURE INFORMATION

Closure Started: 16 July 99 Closure Completed: 30 August 99

Number of ASTs Closed: 1

N/A	SPORTENVDETCHASN
Consultant	AST Removal Contractor

IV. CERTIFICATION (Read and Sign after completing entire submittal)

I certify that I have personally examined and am familiar with the information submitted in this and all attached documents; and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate and complete.

Henry Shepard II, P. E.
Name (Type or Print)

Henry N. Shepard II 3/10/2000
Signature

V. AST INFORMATION

	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
A. Product.....	Fuel Oil				
B. Capacity.....	12,000 gal.				
C. Age.....	Unk.				
D. Construction Material.....	Steel				
E. Month/Year of Last Use.....	Unk				
F. Spill Prevention Equipment Y/N.....	N				
G. Overfill Prevention Equipment Y/N....	N				
H. Method of Closure Removed/Filled..	R				
I. Visible Corrosion or Pitting Y/N.....	Y				
J. Visible Holes Y/N.....	N				

L. Method of disposal for any ASTs removed.

AST 601 was removed, drained, cut open at both ends, and cleaned with a steam cleaner. It was then cut up for recycling as scrap metal. (See Attachment III.)

M. Method of disposal for any liquid petroleum, sludges, or waste waters removed from the ASTs.

The residual fuel oil, waste water, and sludge were recycled.

N. If any corrosion, pitting, or holes were observed, describe the location and extent for each AST.

The painted AST had several areas of surface rust where paint deterioration had occurred. No corrosion or holes were observed.

VI. PIPING INFORMATION

		Tank 1	Tank 2	Tank 3	Tank 4	Tank 5
A.	Construction Material.....	Steel				
B.	Distance from AST to Dispenser.....	125'				
C.	Number of Dispensers.....	Unk.				
D.	Type of System P/S.....	S				
E.	Was Piping Removed Y/N.....	Y (aboveground only)				
F.	Visible Corrosion or Pitting Y/N.....	N				
G.	Visible Holes Y/N.....	N				
H.	Age.....	Unk.				

I. If any corrosion, pitting, or holes were observed, describe the location and extent for each line.

No corrosion, pitting, or holes were observed.

VII. BRIEF SITE DESCRIPTION AND HISTORY

AST 601 was inside an earthen berm and provided fuel oil for the boiler in Building NS 69. The steel supply and return piping had been previously disconnected and blanked in 1998. This action had been taken as a result of petroleum contamination being found adjacent to Building NS 69 in which one or both of these lines were suspected as being the source of the contamination. The action was taken by the Department of Navy Caretaker Site Office and was reported to the United States Coast Guard Marine Safety Office and SCDHEC.

All aboveground piping was removed. Underground portions of the supply and return were capped.

Excessive dilutions factors for samples taken on the fill/return end of the tank indicate potentially high PAH's.

VIII. SITE CONDITIONS

		Yes	No	Unk
A.	Were any petroleum-stained or contaminated soils found near the AST?	Y		
B.	Were any petroleum odors detected? If yes, indicate location on site map and describe the odor (strong, mild, etc.)	Y		

IX. SAMPLE INFORMATION

A. SCDHEC Lab Certification Number 10120

B.

Sample #	Location	Sample Type (Soil/Water)	Soil Type (Sand/Clay)	Depth*	Date/Time of Collection	Collected By	OVA#
99 SPORT 0261-04	Under the north end of the tank	Soil	Sand	1'	30 August 99 1110	Rusty Cope	Not taken
99 SPORT 0261-05	Under the south end of the tank	Soil	Sand	1'	30 August 99 1120	Rusty Cope	Not taken
99 SPORT 0261-06	Under the AST piping connection on the tank	Soil	Sand	1'	30 August 99 1130	Rusty Cope	Not taken

.* = Depth Below the Surrounding Land Surface

X. SAMPLING METHODOLOGY

Provide a detailed description of the methods used to collect and store (preserve) the samples.

After the removal of AST 601 soil samples were taken. Sampling was performed in accordance with SC DHEC R.61-92 Part 280 and SC DHEC UST Assessment Guidelines.

Sample jars were prepared by the testing laboratory. The grab method was utilized to fill the sample containers leaving as little head space as possible and immediately capped. The soil samples were extracted at the tank ends and under the piping connections at one foot depth. Samples for volatiles were taken using the Encore sampler and T-handle.

The samples were marked, logged, and immediately placed in sample coolers packed with ice to maintain an approximate temperature of 4° C. Tools were thoroughly cleaned and decontaminated with organic-free soap and water after each sample.

The samples remained in the custody of SPORTENVDETCHASN until they were transferred to General Engineering Laboratories for analysis as documented in the attached Chain-of-Custody Record.

XI. RECEPTORS

		Yes	No
A.	Are there any lakes, ponds, streams, or wetlands located within 1000 feet of the AST system? If yes, indicate type of receptor, distance, and direction on site map.		X
B.	Are there any public, private, or irrigation water supply wells within 1000 feet of the AST system? If yes, indicate type of well, distance, and direction on site map.		X
C.	Are there any underground structures (e.g., basements) located within 100 feet of the AST system? If yes, indicate the type of structure, distance, and direction on site map.		X
D.	Are there any underground utilities (e.g., telephone, electricity, gas, water, sewer, storm drain) located within 100 feet of the AST system that could potentially come in contact with the contamination? If yes, indicate the type of utility, distance, and direction on the site map.	X*	

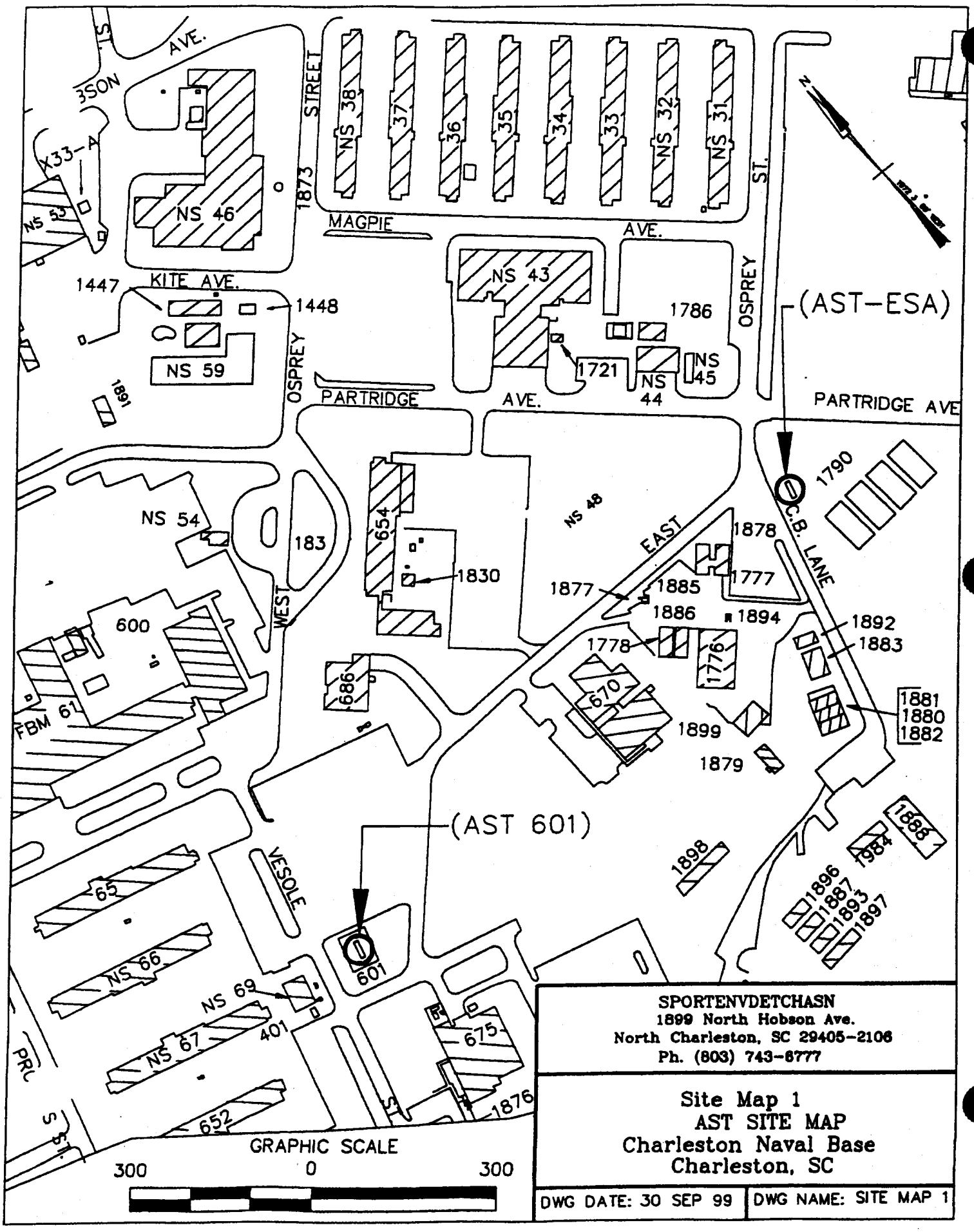
* Water line for the fire hydrant

Attachment I

SITE MAP

You must supply a scaled site map. It should include all buildings, road names, utilities, tank and pump island locations, sample locations, extent of excavation, and any other pertinent information.

Site Maps 1and 2
Photographs A, B, C, D and E



SPORTENVDETCHASN
1899 North Hobson Ave.
North Charleston, SC 29405-2106
Ph. (803) 743-6777

Site Map 1
AST SITE MAP
Charleston Naval Base
Charleston, SC

DWG DATE: 30 SEP 99 | DWG NAME: SITE MAP 1

AST 601

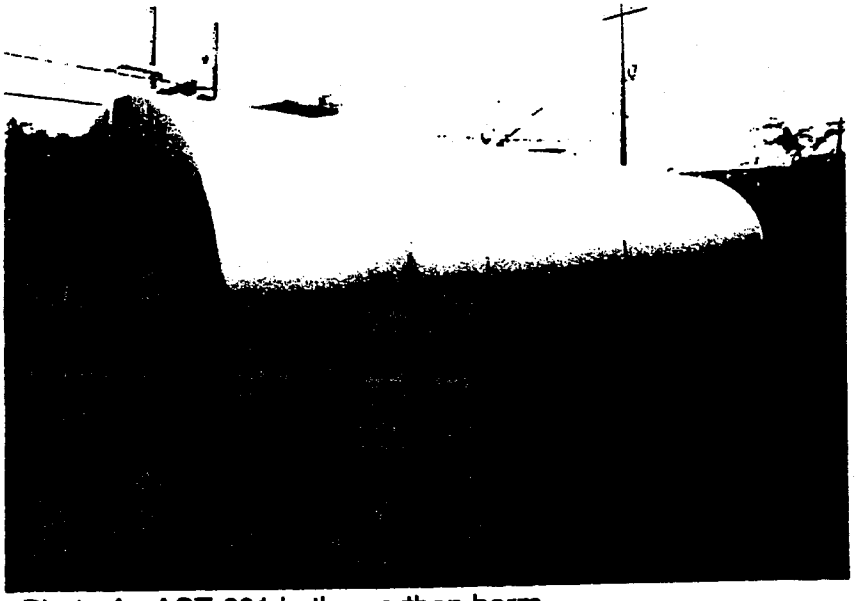


Photo A: AST 601 in the earthen berm

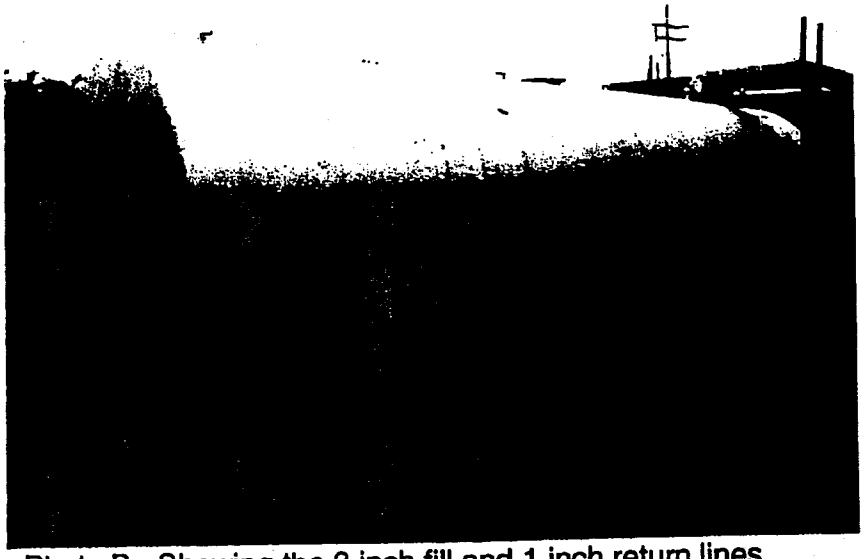


Photo B: Showing the 3 inch fill and 1 inch return lines

Photo C: The one inch supply connection

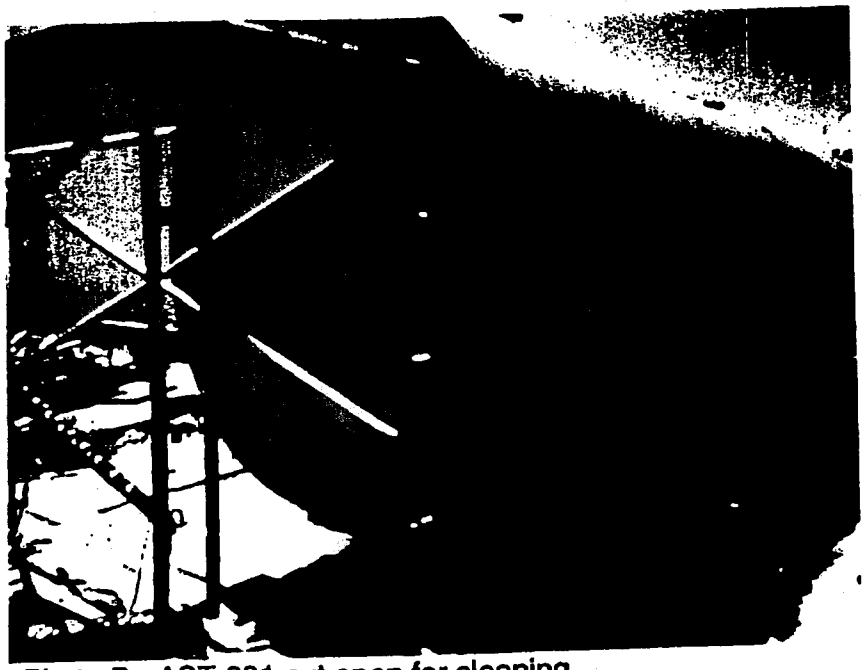


Photo D: AST 601 cut open for cleaning

Attachment II

ANALYTICAL RESULTS

You must submit the laboratory report and chain-of-custody form for the samples. These samples must be analyzed by a South Carolina certified laboratory.

Certified Analytical Results
Chain-of-Custody

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106
Contact: Mr. Bill Hiers
Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID	: 99SPORT0261-04
Lab ID	: 9908E33-04
Matrix	: Soil
Date Collected	: 08/30/99
Date Received	: 08/30/99
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
ile Organics											
_X + NAPTH. - 5 items											
Benzene	U	ND	0.444	1.00	ug/kg	1.0	TCL	08/31/99	1142	157375	1
Ethylbenzene	U	ND	0.266	1.00	ug/kg	1.0					
Naphthalene	U	ND	0.532	1.00	ug/kg	1.0					
Toluene	U	ND	0.798	1.00	ug/kg	1.0					
Xylenes (TOTAL)	U	ND	0.621	2.00	ug/kg	1.0					
Extractable Organics											
Polynuclear Aromatic Hydrocarbons - 16 items											
Acenaphthene	U	ND	66.6	333	ug/kg	10.	JPA	09/01/99	1217	157320	2
Acenaphthylene	U	ND	66.6	333	ug/kg	10.					
Anthracene	U	ND	66.6	333	ug/kg	10.					
Benzo(a)anthracene	U	ND	66.6	333	ug/kg	10.					
Benzo(a)pyrene	U	ND	66.6	333	ug/kg	10.					
Benzo(b)fluoranthene	U	ND	66.6	333	ug/kg	10.					
Benzo(ghi)perylene	U	ND	66.6	333	ug/kg	10.					
Benzo(k)fluoranthene	U	ND	66.6	333	ug/kg	10.					
Chrysene	U	ND	66.6	333	ug/kg	10.					
Dibenzo(a,h)anthracene	U	ND	266	333	ug/kg	10.					
Fluoranthene	U	ND	66.6	333	ug/kg	10.					
Fluorene	U	ND	66.6	333	ug/kg	10.					
Indeno(1,2,3-c,d)pyrene	U	ND	233	333	ug/kg	10.					
Naphthalene	U	ND	66.6	333	ug/kg	10.					
Phenanthrene	U	ND	66.6	333	ug/kg	10.					
[illegible]rene	U	ND	66.6	333	ug/kg	10.					

The following prep procedures were performed:
Volatiles 8260 High Level TCL 08/31/99 0850 157375 3

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(843) 556-8171 • Fax (843) 766-1178

9908E33-04

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106
Contact: Mr. Bill Hiers
Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-04

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
GC/MS Base/Neutral Compounds							HDB	08/31/99	0915	157320	3

Comments:
Surrogate recovery failed due to dilution(s).

Surrogate Recovery	Test	Percent %	Acceptable Limits
2-Fluorobiphenyl	M610-NPWC	0.00*	(44.7 - 110.)
Nitrobenzene-d5	M610-NPWC	0.00*	(42.4 - 107.)
p-Terphenyl-d14	M610-NPWC	0.00*	(45.5 - 104.)
Bromofluorobenzene	BTEX+NAP-8260B	83.8	(73.0 - 129.)
Dibromofluoromethane	BTEX+NAP-8260B	109.	(66.0 - 117.)
Toluene-d8	BTEX+NAP-8260B	107.	(73.0 - 122.)

M = Method	Method-Description
M 1	SW846 8260B
M 2	EPA 8270
M 3	EPA 3550

Notes:
The qualifiers in this report are defined as follows:
ND indicates that the analyte was not detected at a concentration greater than the detection limit.
J indicates presence of analyte at a concentration less than the reporting limit (RL) and greater than the detection limit (DL).
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicates that a quality control analyte recovery is outside of specified acceptance criteria.

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(843) 556-8171 • Fax (843) 766-1178

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client:	Supervisor of Ship Building & Conversion SUPSHIP-Portsmouth Detachment-Env. 1899 North Hobson Ave. North Charleston, South Carolina 29405-2106
Contact:	Mr. Bill Hiers
Project Description:	SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-04

M = Method	Method-Description

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Elise Hanson at 843-556-8171.

E Hanson

wed By

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9908E33-04

Printed on recycled paper

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106

Contact: Mr. Bill Hiers

Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197

Report Date: September 02, 1999

Sample ID	: 99SPORT0261-05
Lab ID	: 9908E33-05
Matrix	: Soil
Date Collected	: 08/30/99
Date Received	: 08/30/99
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
le Organics											
X + NAPTH. - 5 items											
Benzene		1.23	0.585	1.17	ug/kg	1.0	TCL	08/31/99	1509	157375	1
Ethylbenzene	U	ND	0.351	1.17	ug/kg	1.0					
Naphthalene	U	ND	0.702	1.17	ug/kg	1.0					
Toluene		1.33	1.05	1.17	ug/kg	1.0					
Xylenes (TOTAL)	U	ND	0.819	2.34	ug/kg	1.0					
Extractable Organics											
Polynuclear Aromatic Hydrocarbons - 16 items											
Acenaphthene	U	ND	3330	16700	ug/kg	500	JPA	09/01/99	1909	157320	2
Acenaphthylene	U	ND	3330	16700	ug/kg	500					
Anthracene	U	ND	3330	16700	ug/kg	500					
Benzo(a)anthracene	U	ND	3330	16700	ug/kg	500					
Benzo(a)pyrene	U	ND	3330	16700	ug/kg	500					
Benzo(b)fluoranthene	U	ND	3330	16700	ug/kg	500					
Benzo(ghi)perylene	U	ND	3330	16700	ug/kg	500					
Benzo(k)fluoranthene	U	ND	3330	16700	ug/kg	500					
Chrysene	U	ND	3330	16700	ug/kg	500					
Dibenzo(a,h)anthracene	U	ND	13300	16700	ug/kg	500					
Fluoranthene	U	ND	3330	16700	ug/kg	500					
Fluorene	U	ND	3330	16700	ug/kg	500					
Indeno(1,2,3-c,d)pyrene	U	ND	11700	16700	ug/kg	500					
Naphthalene	U	ND	3330	16700	ug/kg	500					
Phenanthrene	U	ND	3330	16700	ug/kg	500					
[illegible]ene	U	ND	3330	16700	ug/kg	500					

e following prep procedures were performed:

Volatiles 8260 High Level

TCL 08/31/99 0856 157375 3

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Meeting today's needs with a vision for tomorrow.

Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106
Contact: Mr. Bill Hiers
Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-05

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
GC/MS Base/Neutral Compounds							HDB	08/31/99	0915	157320	3

Comments:
Surrogate recovery failed due to dilution(s).

Surrogate Recovery	Test	Percent %	Acceptable Limits
2-Fluorobiphenyl	M610-NPWC	0.00*	(44.7 - 110.)
Nitrobenzene-d5	M610-NPWC	0.00*	(42.4 - 107.)
p-Terphenyl-d14	M610-NPWC	0.00*	(45.5 - 104.)
Bromofluorobenzene	BTEX+NAP-8260B	102.	(73.0 - 129.)
Dibromofluoromethane	BTEX+NAP-8260B	108.	(66.0 - 117.)
Toluene-d8	BTEX+NAP-8260B	114.	(73.0 - 122.)

M = Method	Method-Description
M 1	SW846 8260B
M 2	EPA 8270
M 3	EPA 3550

Notes:
The qualifiers in this report are defined as follows:
ND indicates that the analyte was not detected at a concentration greater than the detection limit.
J indicates presence of analyte at a concentration less than the reporting limit (RL) and greater than the detection limit (DL).
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicates that a quality control analyte recovery is outside of specified acceptance criteria.

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9908E33-05

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client:	Supervisor of Ship Building & Conversion SUPSHIP-Portsmouth Detachment-Env. 1899 North Hobson Ave. North Charleston, South Carolina 29405-2106
Contact:	Mr. Bill Hiers
Project Description:	SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-05

M = Method	Method-Description

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Elise Hanson at 843-556-8171.

...wed By

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106

Contact: Mr. Bill Hiers

Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197

Report Date: September 02, 1999

Sample ID	: 99SPORT0261-06
Lab ID	: 9908E33-06
Matrix	: Soil
Date Collected	: 08/30/99
Date Received	: 08/30/99
Priority	: Rush
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Organics											
+ NAPTH. - 5 items											
Benzene		2.45	0.474	1.00	ug/kg	1.0	TCL	08/31/99	1241	157375	1
Ethylbenzene		1.17	0.284	1.00	ug/kg	1.0					
Naphthalene	U	ND	0.568	1.00	ug/kg	1.0					
Toluene		1.91	0.852	1.00	ug/kg	1.0					
Xylenes (TOTAL)		28.9	0.663	2.00	ug/kg	1.0					
Extractable Organics											
Polynuclear Aromatic Hydrocarbons - 16 items											
Acenaphthene	U	ND	3330	16700	ug/kg	500	JPA	09/01/99	1937	157320	2
Acenaphthylene	U	ND	3330	16700	ug/kg	500					
Anthracene	U	ND	3330	16700	ug/kg	500					
Benzo(a)anthracene	U	ND	3330	16700	ug/kg	500					
Benzo(a)pyrene	U	ND	3330	16700	ug/kg	500					
Benzo(b)fluoranthene	U	ND	3330	16700	ug/kg	500					
Benzo(ghi)perylene	U	ND	3330	16700	ug/kg	500					
Benzo(k)fluoranthene	U	ND	3330	16700	ug/kg	500					
Chrysene	U	ND	3330	16700	ug/kg	500					
Dibenzo(a,h)anthracene	U	ND	13300	16700	ug/kg	500					
Fluoranthene	U	ND	3330	16700	ug/kg	500					
Fluorene	U	ND	3330	16700	ug/kg	500					
Indeno(1,2,3-c,d)pyrene	U	ND	11700	16700	ug/kg	500					
Naphthalene	U	ND	3330	16700	ug/kg	500					
Phenanthrene	U	ND	3330	16700	ug/kg	500					
Pyrene	U	ND	3330	16700	ug/kg	500					

The following prep procedures were performed:
Volatiles 8260 High Level

TCL 08/31/99 0900 157375 3

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9908E33-06

GENERAL ENGINEERING LABORATORIES

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Client: Supervisor of Ship Building & Conversion
SUPSHIP-Portsmouth Detachment-Env.
1899 North Hobson Ave.
North Charleston, South Carolina 29405-2106

Contact: Mr. Bill Hiers

Project Description: SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-06

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
GC/MS Base/Neutral Compounds							HDB	08/31/99	0915	157320	3

Comments:
Surrogate recovery failed due to dilution(s).

Surrogate Recovery	Test	Percent %	Acceptable Limits
2-Fluorobiphenyl	M610-NPWC	0.00*	(44.7 - 110.)
Nitrobenzene-d5	M610-NPWC	0.00*	(42.4 - 107.)
p-Terphenyl-d14	M610-NPWC	0.00*	(45.5 - 104.)
Bromofluorobenzene	BTEX+NAP-8260B	85.4	(73.0 - 129.)
Dibromofluoromethane	BTEX+NAP-8260B	116.	(66.0 - 117.)
Toluene-d8	BTEX+NAP-8260B	117.	(73.0 - 122.)

M = Method	Method-Description
M 1	SW846 8260B
M 2	EPA 8270
M 3	EPA 3550

Notes:
The qualifiers in this report are defined as follows:
ND indicates that the analyte was not detected at a concentration greater than the detection limit.
J indicates presence of analyte at a concentration less than the reporting limit (RL) and greater than the detection limit (DL).
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicates that a quality control analyte recovery is outside of specified acceptance criteria.

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Client:	Supervisor of Ship Building & Conversion SUPSHIP-Portsmouth Detachment-Env. 1899 North Hobson Ave. North Charleston, South Carolina 29405-2106
Contact:	Mr. Bill Hiers
Project Description:	SUPSHIP-Portsmouth Detachment

cc: NPWC00197 Report Date: September 02, 1999

Sample ID : 99SPORT0261-06

M = Method	Method-Description

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Elise Hanson at 843-556-8171.

E Hanson

Reviewed By

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9908E33-06

PWC00197 9908E3

CHAIN OF CUSTODY RECORD

RUSH! 3 Day Turn!

General Engineering Laboratories, Inc.
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Charleston, South Carolina 37
P.O. Box 30712
Charleston, South Carolina 29417
(803) 556-8171

Page 1 of 1

Client Name/Facility Name: SPORTEN V DETCHASN

Collected by/Company: SPORTEN DETCHASN

SAMPLE ANALYSIS REQUIRED (s), use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

PRESERVED AT 4°C

42346

	SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	TOC/DOC	TOX	Chloride, Fluoride, Sulfide	Nitrate/Nitrate	VOC - Specify Method required	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type	BTEX/MTBE	PAH	Remarks	
1 99	SPORT0261-01	8-30-99	0900		X		X	3																X		TRIP BLANK	.2
2-	SPORT0261-02	8-30-99	0945		X		X	4																X	X	AST M1143	.1
3-	SPORT0261-03	8-30-99	1025		X		X	4																X	X	AST M142	.1
4-	SPORT0261-04	8-30-99	1110		X		X	4																X	X	AST 601 EAST	.1
5	SPORT0261-05	8-30-99	1120		X		X	4																X	X	AST 601 WEST	.1
6-	SPORT0261-06	8-30-99	1130		X		X	4																X	X	AST 601 PPG	.1
7-	SPORT0261-07	8-30-99	1145		X		X	4																X	X	ESA YARD	.1

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	8-30-99	1350	Vivian Washington	Vivian Washington	8/30/99	1530	[signature]
[signature]	8/30/99	1530	P. Power		8/30/99	15.30	

Remarks:

White = sample collector Yellow = file Pink = with report

Attachment III

Certificate of Disposal (tank)

AST Certificate of Disposal

CONTRACTOR

Supervisor of Shipbuilding, Conversion and Repair, USN
Portsmouth, VA
Environmental Detachment Charleston
1899 North Hobson Avenue
North Charleston 29405-2106

Telephone (843) 743-6482

TANK ID & LOCATION

AST 601; Vesole Street, Charleston Naval Complex, N. Charleston, SC

DISPOSAL LOCATION

Bldg. 1601 Tank Cleaning
& Disposal Area
Charleston Naval Complex

TYPE OF TANK	SIZE (GAL)
Fuel oil	12,000

CLEANING/DISPOSAL METHOD

The tank was cut open on both ends, cleaned with a steam cleaner, cut into sections, and disposed of as recyclable scrap metal.

DISPOSAL CERTIFICATION

I certify that the above tank has been properly cleaned and disposed of as recyclable scrap metal.

Charles C. Wannamaker, II 12/16/99
Charles C. Wannamaker (Date)

APPENDIX B

GEOLOGIC BORING LOGS

BORING ID: CNC42-B01	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-23-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48"	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Br. sandy silt to dark gray		ML	
1	42-SFB01-02	14	0	14			M	YES.	Fine sand, sl. silty clay		CL	
2		—	—	—			M/W	YES.	Witness maybe petrol, not gw?			
3		—	—	—		36"	W	YES.			SC	
4												
-5	42-GFB01-07											
6												
7	EOB								EOB			
8												
-10												
-15												

BORING ID: CNC42-B~~05~~ Ø2	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-23-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0 1		—	—	-			M	No.	Brown sl. sandy silt to		ML to	
2		6	0	6			M	No.	tan, inc. clay w/ depth		CL	
3	42-SFBØ2-Ø3	18	0	18			M	No.	some gravel fill			
4		—	—	—			W	No.	Gray med. coarse sand w/ some clay		SP	
-5 6	42-GFBØ2-Ø7											
7	EDB											
-10												
-15												

BORING ID: CNC42-B~~01~~ Ø3	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE:	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0 ft
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Brown sl-sandy silt		ML	
1		6	0	6			M	No.	Lt. orange to tan sand			
2	42-SFB03-Ø3	15	0	15			M	No.	Gray fine sandy siltyclay		SM	
3		—	—	—		48	M/W	No	Coarse sand, shell fragments quartz gravel		SW	
4												
-5	42-GFBØ3-Ø7											
7	EOB								EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-B~~01~~ 04	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:** 8-23-00	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):** 1 3/4"	**TOTAL DEPTH (ft bls):** 7.0 ft.
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 3.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Brown sandy Silt (fine sand)		ML	
1		14	Ø	14			M	No,	" "			
2	42-SFBØ4-Ø3	15	Ø	15			M	No.	Lt. gray, orange streaked sandy silty clay		CL	
3		—	—	—		48	M/W	YES.	Olive gray to dark gray sand (coarse) clay mix shell fragments	▽	SC	
4												
5	42-GFBØ4-Ø7											
6												
7	EOB								EOB			
10												
15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~0~~05	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE:	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48"	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			Moist	No.	Brown sl. Sandy Silt to Lt. Orange		ML to CL	
1	42-GFB05-02	20	0	20			Moist	No.				
2		20	3	17			Moist	No.	Some clay 2 to 3			
3		–	–	–		48	Wet	–	Coarse sand w/ shell fragments		SP	
4												
6	42-GFB05-04											
7	EOB											
10												
15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~0~~Ø6	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE:	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈3.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Brown sandy silt to		ML	
1	42-SFBØ6-Ø2	8	Ø	8			M	No.	Lt. Brown fine sandy clay		CL	
2		10	Ø	1Ø			M	No.	moisture level higher (will not collect for sample) Tan to Lt. orange silty clay.			
3		—	—	—		44	M/W	No	Dark olive to dark gray sandy silty clay		CH	
4												
-5	42-GFBØ6-Ø7											
6												
7	EOB								EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B07	WELL ID: NA	PIEZOMETER ID: P03 (3¼" 0.2
CONTRACTOR: ESN	COMPLETION DATE: 8-22-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 12.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): 2'-12'	DEPTH TO GW (ft bls): 3.1" bls

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			Moist	No.	Brown to Lt Orange Sl. sandy (fine) silt		ML to CL	Bentonite
1	42-SFB07-02	15	0	15					Sandy, silty clay			Sand
2		15	4	11								.01" slotted screen
3		–	–	–		48"	Wet		Coarse sand, some shell fragments Gray silty clay fine sand) Wet at 3.5 ft.		SC	
4												
6												
7	42-GFB07-12								1 1/4" PVC			
8									Screened 2'-12 ft			
9												
10												
11												
12	EOB								EOB.			
15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-~~##~~ BØ8	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-22-00	LOGGED BY: G. Sisco
METHOD: ~~##~~ H.A.	BORING DIAMETER (in): ≈ 3"	TOTAL DEPTH (ft bls): 6.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 4 ft.

Hand Augered

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		-	-	-			Moist	NO.	Brown sl. sandy silt		ML to CL	
1		30	3	27			Moist	YES.	some gravel fill.			
2	12-SFBØ8-03	200	5	195			Moist	YES.	Hvy. silty clay STRONG PETROL ODOR 1 to 3 ft.		OL	
3		-	-	-								
4	12-GFBØ8-Ø6											
-5												
6	EOB											
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~M~~ Ø9	WELL ID: NA	PIEZOMETER ID: ~~M~~ PØ1 (3¼" ID)
CONTRACTOR: ESN	COMPLETION DATE: 8-22-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1¾" soil	TOTAL DEPTH (ft bls): 12.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): ~~M~~ 2'-12'	DEPTH TO GW (ft bls): 3.4' bls

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			Moist		Brown sandy silty clay, some fill to (low plastic)		ML to	Bentonite
1		20	Ø	20				No.	Lt. Orange, some clay		CL	Sand
2	CNC42-FSBØ9-03	30	Ø	30								SCREEN
3		–	–	–		46"	Wet ≈3.5		Coarse gray clayey sand at 3½ ft.		SC	
4												0.10 Slot screen
6									1¼" PVC			
7									[Screen 2 to 12 ft.]			
8	CNC42-GFBØ9-12								.01" slot			
9												
10												
11												
12	EOB								4" plug at bottom			
15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~01~~ 10	WELL ID: NA	PIEZOMETER ID: ~~P01~~ P02 (3 1/4" O.D. / 1 1/4" PVC)
CONTRACTOR: ESN	COMPLETION DATE: 8-22-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 12.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): ~~0-~~ 2-12'	DEPTH TO GW (ft bls): 4.1' bls

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FILTERED	CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			Moist	NONE	Brown sl. sandy silt, some fill		ML to CL	Bentonite
1	42-SFB10-02	20	0	20					Lt. Orange fine to medium sandy, some clay			Sand
2		20	0	20					Gray med. to high clay		CH	Screen
3		–	–	–		48"	Wet		Wet at 3.75 ft.		SP	
4												
5												
6												
7	CNC42-GFB10-12								1 1/4" PVC .01" screen slot Screened 2-12 ft.			
8												
9												
10												
11												
12	EOB.								4" point plug at bottom			
15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-B~~#~~ 21	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:** 8-22-00	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):** 1 3/4"	**TOTAL DEPTH (ft bls):** 28.0
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 3.0

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48"	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0									Sandy Silt brown to Silty sand, lt. orange		CL	
1							MOIST					
2							Moist	No.	some clay, silty sand			
3						46"	Wet		Gray sandy clay		SC	
4							Sat.					
6								No.	Gray. Med. to coarse well graded sand.		SW	
7						30"						
8												
9							Sat.					
-10						24"		No.			SW	
11									Same			
12							Sat.					
13									No Recovery			
14						0"		N/A				
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~#~~11	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-22-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 13/4 "	TOTAL DEPTH (ft bls): 28.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): 3 to 4 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
5												
6						36"	Wet.	YES.	V. Soft to Soft Dark gray - med. to high plastic clay. Organic odor (hydrogen sulfide)		OH	
10						38"	Wet.	No.	Same		OH	
15						38"	Wet.	No.	Same		OH	
	EOB.											

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B12	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE:	LOGGED BY: G. Sisco
METHOD: H.A.	BORING DIAMETER (in): ≈ 3"	TOTAL DEPTH (ft bls): 6.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 4 ft

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DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			Moist	No.	BROWN · SL · sandy silt		ML to CL	
1		20	0	20			Moist	Yes.	Lt. orange to dark gray fine sandy clay		OL	
2	42-SFB12-03	200	25	175			Moist	Yes.				
3												
4	42-GFB12-06						Wet.					
6	EOB											
-10												
-15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-B~~#~~ 13	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:** 8-23-00	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):**	**TOTAL DEPTH (ft bls):** 7.0 ft.
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 3.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED (in)	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			M	No	Brown sl. sandy silt to dark gray		ML to	
1		6	0	6			M	No	Lt. orange med. sand to Lt. gray		SW	
2	42-SFB13-Ø3	10	0	10			M	No.				
3		–	–	–		46"	W	–	Fine to med. grain sandy clay		CL	
4												
-5	42-GFB13-Ø7											
6												
7	EOB								EOB.			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~01~~ 14	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-23-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48"	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	BROWN sl. sandy silt		ML	
1	42 SFB14-Ø2	7	Ø	7			M	No.	Tan silty clay (med. plastic)		CL	
2		7	Ø	7			M	No.	"			
3		—	—	—		36"	W	—	Fine to med. coarse sand and gravel (fill)		GP	
4												
6	42-GFB14-07											
7	EOB.								EOB			
8												
9												
10												
15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-B~~01~~ 15	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:**	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):** 1 3/4"	**TOTAL DEPTH (ft bls):** 7 ft.
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 2 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED ~~48~~	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0	42-SFB15-01	15	2	13			M	No.	Brown to tan to lt. orange sl. sandy silt		ML to CL	
1							M	No.	some gravel fill			
		—	—	—			W	—	sandy silty clay			
2							W	Yes.	Fine to med. sand, dark gray coarse some clay			
		—	—	—	30							
3							W				SW	
4												
-5	42-GFB15 07											
6												
7	EOB.								EOB.			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-~~B~~ 16	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:** 8-24-00	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):** 1 3/4"	**TOTAL DEPTH (ft bls):** 7.0
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 4 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			M	No.	Brown sl. sandy silt		ML	
1		18	0	18			M	No.				
2	42-SFB16-Ø7	600	200	400			M	YES.	rock fragments			
3		–	–	–		43	M		sand clay mix gravel fill		GC	
4												
6	42-GFB16-Ø7											
7									EOB			
8												
-10												
-15												

BASE: Charleston Naval Complex, Zone H	**SITE ID:** CNC42, Building 601	**PROJECT NO.:** N7912
BORING ID: CNC42-B~~01~~ 17	**WELL ID:** NA	**PIEZOMETER ID:** NA
CONTRACTOR: ESN	**COMPLETION DATE:** 8-24-00	**LOGGED BY:** G. Sisco
METHOD: DPT	**BORING DIAMETER (in):** 1 3/4"	**TOTAL DEPTH (ft bls):** 7.0 ft.
TOC ELEVATION (ft msl): NA	**SCREEN INTERVAL (ft bls):** NA	**DEPTH TO GW (ft bls):** ≈ 3.5 ft

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED ~~48"~~	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Asphalt & fill / Brown sandy silt		ML	
1		18	12	6			M	No.				
2	42-SFB17-Ø3	20	9	11			M	YES.				
3		—	—	—		45	M/W		Stiff Lt. orange to olive gray silty sand, sandy clay		CL	
4												
-5	42-GFB17-Ø7											
6												
7									EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~01~~ 18	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-24-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in):	TOTAL DEPTH (ft bls): 7.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): 3.5

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED ~~1.8~~	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M		Asphalt fill		ML	
1		24	4	20			M		Brown sandy silt dark gray to Lt. orange silty sand			
2	42-SFB18-03	32	8	24			M					
3		—	—	—		42	W		Gray coarse sand, shell frag some clay		SC	
4												
6	42-GFB18-07											
7									EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~4~~19	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8.24-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ~3.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Asphalt & fill (8")			
1									brown sandy silt		ML	
		30	3	27			M	No.				
2												
		—	—	—			M to W	No.	(Moisture increasing 2-3 ft)			
3									Lt. gray to gray			
		—	—	—		38	W	No.	sand (med. to coarse) with tr. clay		SC	
4												
-5	42-GFB19											
6	-07											
7									EOB			
-10												
-15												

SITE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~01~~20	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-24-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ~3 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No.	Brown silty sand		ML	
1	No.	3	Ø	3			M		Lt. orange			
2	No.	4	Ø	4			M			▽		
3		—	—	—		48	W		dive gray fine sandy clay		CL to SC	
4	42-GFB2Ø											
5												
6	Ø7											
7									EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~02~~ 21	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-24-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 7 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 1.5 ft.

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		2	Ø	2			M dist	No,				
1		–	–	–			Wet	No.				
2		–	–	–		30	SAT.	No,				
3												
4												
-5	42-GFB21											
6	Ø7											
7									EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~#~~ 22	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-25-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 4.0
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): ≈ 3.7

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		–	–	–			DRY	No.	some concrete fill material	ML		
1		24	20	4			M	No.				
2	42-SFB22-Ø3	70	40	30			M	slight ?				
3	42-GFB22-Ø4	–	–	–		48	M/W	No.	Lt. orange silty clay (w fine sand)	SC	▽	
4									EOB			
-10												
-15												

BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~04~~ 23	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-25-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): ≈ 3.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): s1. > 3.0 ft.

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DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION
0		—	—	—			M	No,	BROWN Sandy silt to		ML	
1							M	No.	Tan Sandy silt		SM	
2	42-SF823-Ø3						M	slight ?				
3							W		EOB			
5												
10												

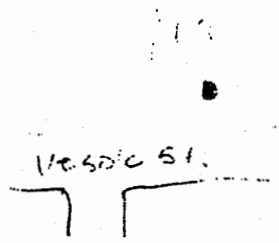
BASE: Charleston Naval Complex, Zone H	SITE ID: CNC42, Building 601	PROJECT NO.: N7912
BORING ID: CNC42-B~~01~~ 24	WELL ID: NA	PIEZOMETER ID: NA
CONTRACTOR: ESN	COMPLETION DATE: 8-25-00	LOGGED BY: G. Sisco
METHOD: DPT	BORING DIAMETER (in): 1 3/4"	TOTAL DEPTH (ft bls): 4.0 ft.
TOC ELEVATION (ft msl): NA	SCREEN INTERVAL (ft bls): NA	DEPTH TO GW (ft bls): 1.7 ft. bls

DEPTH (FT)	SAMPLE INTERVAL/ SAMPLE ID	FID (PPM) UNFILTERED	FID (PPM) FILTERED	FID (PPM) CORRECTED	SPT BLOWS PER FT	FT RECOVERED 48	MOISTURE	ODOR	LITHOLOGIC DESCRIPTION	LITHOLOGIC SYMBOLS	USCS	WELL CONSTRUCTION w/ WATER LEVEL DOWN OPEN BOREHOLE
0	42-SFB24-01	4	0	4			M	No	Brown to Lt. orange sandy silt		ML	
1		W	E	T			Wet	No.				
2		W 30	E 30	T 0				slight ? (organic?)	Dark gray sandy-clayey mix		SC	
3	42-GFB24-04					32						
4									EOB			
-10												
-15												

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32° 51' 46" Longitude: 79° 58' 13"
Distance and Direction from Road Intersections: 30' from Vesole St.
Street Address & City of Well Location:
Sketch Map:



2. CUTTING SAMPLES: ☐ Yes ☒ No
Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
brown fine sand fs: 1/4	1'	1'
gravelly brown sand	1'	2'
green clayey sand	2'	5'
green sandy clay & clay	5'	35'
*Indicate Water Bearing Zones (Use a 2nd sheet if needed)		

3. REMARKS: CNC4HM07D

4. OWNER OF WELL:
Address: U.S. Navy South Div
Telephone No.:
Engineer: Tetra Tech NUS
Address: 1401 Oven Park Pl. Tallahassee FL 32311
Telephone No.: (850) 385-9899

5. WELL DEPTH (completed) 35 ft. Date Started: 11-7/00 Date Completed: 11-9/00

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 30 ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface FM ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☒ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 5'
Set Between: 30 ft. and 35 ft.
____ ft. and ____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☐ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
____ ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ____

12. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 28' ft. to 35' ft.
Effective size ____ Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From 0 ft. to 26' ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
____ Type well disinfected upon completion ☐ Yes ☒ No Type: ____ Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

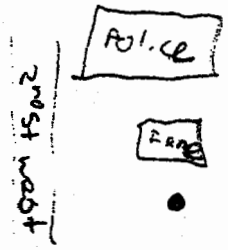
17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: Geotek Drilling Date: 11/11/00
Address: Oak Ridge Hwy Kingstree SC 29537
Signed: ____ Cert. No.: 299
Authorized Representative

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32° 51' 46" Longitude: 79° 58' 13"
Distance and Direction from Road Intersections:
600' W int. of 2nd St west & Ave. D.
Street Address & City of Well Location:

Sketch Map:



2. CUTTING SAMPLES: ☐ Yes ☒ No
Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
Brown Fine Sand Silt	2'	2'
Tan Fine Sand and silt	3'	5'
Lt. Tan Fine Sand	5'	10'
Light Brown Fine Sand	9'	19'

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

3. REMARKS: CWC 43mod

4. OWNER OF WELL: U.S. Navy South Div
Address:
Telephone No.:
Engineer: Tetra Tech NUS
Address: 1401 Oven Park Dr. Tallahassee FL 32311
Telephone No.: (850) 385-9999

5. WELL DEPTH (completed) 19 ft. Date Started: 11-10/00 Date Completed: 11-10/00

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
0 in. to 9' ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface 0 ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☒ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 10'
Set Between: 9 ft. and 19 ft.
____ ft. and ____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
____ ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ____

12. WATER QUALITY
Chemical Analysis ☐ Yes ☒ No Bacterial Analysis ☐ Yes ☒ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 7 ft. to 19 ft.
Effective size ____ Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From 0 ft. to 5 ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
NA Type well disinfected upon completion ☐ Yes Type: ____ ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

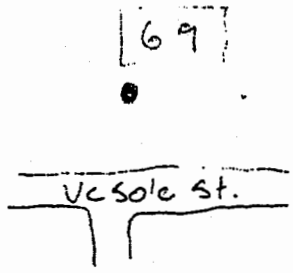
17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: Geotek Drilling Date: 11/10/00
Address: 2444 Ridge Hwy, Knoxville TN 37931
Signed: ____ Cert. No. 274
Authorized Representative

COPY 1 - MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32° 51' 46" Longitude: 79° 58' 13"
Distance and Direction from Road Intersections:
30' from Vesole St.
Street Address & City of Well Location:
Sketch Map:



2. CUTTING SAMPLES: ☐ Yes ☒ No
Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
Tan fine sand and clay w/gravel	3'	3'
Green sandy clay	9'	12'

*Indicate Water Bearing Zones.
(Use a 2nd sheet if needed)

3. REMARKS: CWC 44 mg 5

4. OWNER OF WELL: U.S. Navy South Div.
Address:
Telephone No.:
Engineer: Tetra tech NUS
Address: 1401 Oven Park Dr. Tallahassee FL 32317
Telephone No.: (850) 385-9899

5. WELL DEPTH (completed) 12 ft. Date Started: 11-8/00 Date Completed: 11-8/00

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
Ø in. to 2 ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface Ø ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☒ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 10'
Set Between: 2 ft. and 12 ft.
____ ft. and ____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
____ ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ____

12. WATER QUALITY
Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☒ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 2' ft. to 12' ft.
Effective size ____ Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From Ø ft. to 1½ ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
____ Type well disinfected ☐ Yes Type: ____
upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: Gatek Drilling Date: 11/1/00
Address: Oak Ridge Hwy. Knoxville TN 37931
Signed: ____ Authorized Representative Cert. No.: 194

HES 1000 (10/00) COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)

DHEC

PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

LOCATION OF WELL:

County: Charleston System Name: Surficial

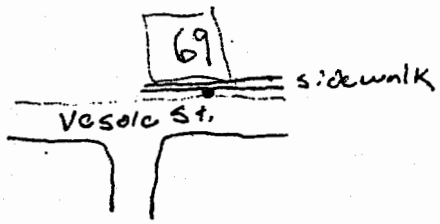
Latitude: 32° 51' 46" Longitude: 79° 58' 13"

Distance and Direction from Road Intersections:

Adj. to Vesole St.

Street Address & City of Well Location:

Sketch Map:



2. CUTTING SAMPLES: ☐ Yes ☒ No

Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
a brown silty Fine Sand	2'	2'
Tan clayey fine sand pyrite	1½'	3½'
green sand w/clay	8½'	12'

*Indicate Water Bearing Zones

(use a 2nd sheet if needed)

3. REMARKS: CWC 44 m04

4. OWNER OF WELL: U.S. Navy South Div

Address:

Telephone No.:

Engineer: Tetra tech NUS

Address: 1401 Oven Park Pl. Tallahassee FL 32311

Telephone No.: (850) 385-9899

5. WELL DEPTH (completed) 12' ft. Date Started: Date Completed:

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded

Diam.: 2"

Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other

Ø in. to 2 ft. depth

____ in. to ____ ft. depth

Height: Above/Below Surface Ø ft.

Weight ____ lb./ft.

Drive Shoe? ☐ Yes ☐ No

9. SCREEN

Type: PVC Diam.: 2"

Slot/Gauge: 0.010 Length: 10'

Set Between: 2 ft. and 12 ft. NOTE: MULTIPLE SCREENS

____ ft. and ____ ft. USE SECOND SHEET

Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL

____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.

____ ft. after ____ hrs. Pumping ____ G.P.M.

Pumping Test: ☐ Yes (please enclose) ☐ No

Yield: ____

12. WATER QUALITY

Chemical Analysis ☐ Yes ☐ No Bacterial Analysis ☐ Yes ☒ No

Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No

Installed from 2 ft. to 12 ft.

Effective size ____ Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No

☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____

Depth: From Ø ft. to 1½ ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction

____ Type well disinfected ☐ Yes Type: ____

upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒

Mfr. Name: ____ Model No.: ____

H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm

TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Registered Business Name: Gator Drilling Date: 11/1/00

Address: Oak Ridge Hwy. Knoxville TN 37931

Signed: ____ Cert. No.: 294

Authorized Representative

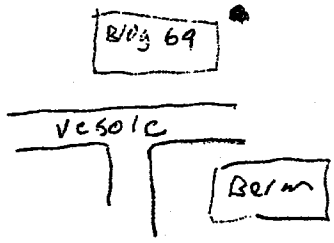
DHEC 1903 (1096) COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32°51' 46" Longitude: 79° 58' 13"
Distance and Direction from Road Intersections:
70' W of Versole ST.
Street Address & City of Well Location:

Sketch Map:



2. CUTTING SAMPLES: ☒ Yes ☐ No

Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
brown clayey fs w/gravel	2'	2'
green sandy clay & clay	1'	3'
black angular sand	1'	4'
green sand and clay	8'	12'

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

3. REMARKS: CNC 44 mØ2

4. OWNER OF WELL: U.S. Navy South Div
Address:
Telephone No.:
Engineer: Tetra Tech NUS
Address: 1401 Oven Park Pl. Tallahassee FL
Telephone No.: (850) 385-9899

5. WELL DEPTH (completed) 12' ft. Date Started: 11-8/00
Date Completed:

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug
☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE:
☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry
☐ Irrigation ☐ Air Conditioning ☐ Commercial
☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
Ø in. to 2 ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface FM ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☒ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010" Length: 10'
Set Between: 2 ft. and 12 ft.
____ ft. and ____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
____ ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield: ____

12. WATER QUALITY
Chemical Analysis ☒ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 2' ft. to 12' ft.
Effective size #2 Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From Ø ft. to 1½ ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
NA Type well disinfected ☐ Yes Type: ____
upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine
☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: Geotex Drilling Date: 11/14/00
Address: Oak Ridge Hwy Knoxville TN 37931
Signed: ____ Cert. No. 279
Authorized Representative

HEC 1903 (10/98) COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water

2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:

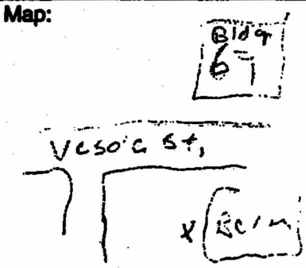
County: Charleston System Name: Surficial

Latitude: 32° 51' 46" Longitude: 79° 58' 13"

Distance and Direction from Road Intersections:
50' S of Vesoia St.

Street Address & City of Well Location:

Sketch Map:



4. OWNER OF WELL: U.S. NAVY - South Div
Address:

Telephone No.:

Engineer: Tetra tech NUS
Address: 1401 oven park Dr
Tallahassee FL
Telephone No.: (850) 385-9899

5. WELL DEPTH (completed) 12 ft. Date Started: 11-7/00 Date Completed: 11-7/00

6. ☐ Mud Rotary ☐ Jetted ☐ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☒ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
____ in. to 2' ft. depth
____ in. to ____ ft. depth

Height: Above/Below Surface Ø ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☒ No

2. CUTTING SAMPLES: ☒ Yes ☐ No

Geophysical Logs: ☐ Yes (please enclose) ☐ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
Gray brown fine sand/silt	2'	2'
Green sandy clay	3'	5'
Green clayey sand / shells	7'	12'

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

3. REMARKS: CNC 42 MW6
44

9. SCREEN
Type: Sched 40 PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 10'
Set Between: 10 ft. and 12 ft. NOTE: MULTIPLE SCREENS
____ ft. and ____ ft. USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
____ ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☐ No
Yield:

12. WATER QUALITY
Chemical Analysis ☒ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 2 ft. to 12 ft.
Effective size #2 Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☐ Neat Cement ☐ Sand Cement ☒ Concrete ☐ Other ____
Depth: From ____ ft. to ____ ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: 30 ft. E direction
____ Type well disinfected ☐ Yes Type: ____
upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

Registered Business Name: GeoTek Drilling Date: 11/4/00
Address: Oak Ridge Hwy Knoxville TN 37931
Signed: [signature] Cert. No.: 974
Authorized Representative

DHEC
PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32° 51' 46" Longitude: 79° 58' 13"
Distance and Direction from Road Intersections: 20' N of Vesole St
Street Address & City of Well Location:
Sketch Map: Bldg 69, N, NTS, Vesole, Bldg

2. CUTTING SAMPLES: ☒ Yes ☐ No
Geophysical Logs: ☐ Yes (please enclose) ☒ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
Gray fine Sand and Silt	1'	1'
tan Silty fine Sand & gray	1'	2'
dark brown FS then	10'	12'
Green Clayey Sand		

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

3. REMARKS: CNC44M01

4. OWNER OF WELL: U.S. Navy South Div
Address:
Telephone No.:
Engineer: Tetra Tech NUS
Address: 1401 Oven Park Dr, Tallahassee FL 32311
Telephone No: (850) 385-9899

5. WELL DEPTH (completed) 12' ft. Date Started: 11-7/00 Date Completed: 11-7/00

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☒ ~~Other~~

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
____ in. to ____ ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface FM ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 10'
Set Between: 2 ft. and 12 ft. NOTE: MULTIPLE SCREENS
____ ft. and ____ ft. USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
NA ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☒ No
Yield:

12. WATER QUALITY
Chemical Analysis ☒ Yes ☐ No Bacterial Analysis ☐ Yes ☐ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 2 ft. to 12 ft.
Effective size #2 Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From surface ft. to 1½ ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
____ Type well disinfected ☐ Yes Type: ____
upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

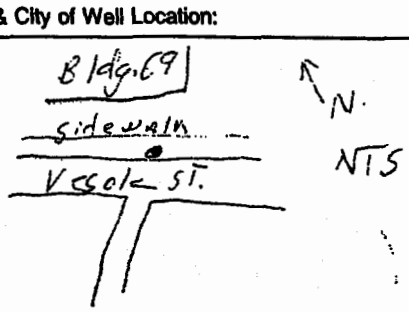
17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: GeoTek Drilling Date: 11/4/00
Address: Oak Ridge Hwy, Knoxville TN 37931
Signed: [signature] Cert. No.: 794
Authorized Representative

DHEC

PROMOTE PROTECT PROSPER

Water Well Record
Bureau of Water
2600 Bull Street, Columbia, SC 29201-1708; (803) 734-5300

1. LOCATION OF WELL:
County: Charleston System Name: Surficial
Latitude: 32° 51' Longitude: 79° 58'
Distance and Direction from Road Intersections:
2' N of Vesole ST
Street Address & City of Well Location:
Sketch Map:



2. CUTTING SAMPLES: ☐ Yes ☐ No

Geophysical Logs: ☐ Yes (please enclose) ☐ No

Formation Description	*Thickness of Stratum	Depth to Bottom of Stratum
gray fine Sand + SILT	1'	1'
Tan silty Fine Sand + Gravel	1'	2'
dark brown + Thin		
green clays, Sand	10'	12'

*Indicate Water Bearing Zones
(Use a 2nd sheet if needed)

3. REMARKS:
CNC 4403

4. OWNER OF WELL: U.S. Navy South Div
Address:
Telephone No.:
Engineer: Tetra Tech NUS
Address: 1401 Oven Park Dr. Tallahassee FL 32311
Telephone No.: (850) 385-9599

5. WELL DEPTH (completed) 12 ft. Date Started: 11/7/00 Date Completed: 11/7/00

6. ☐ Mud Rotary ☐ Jetted ☒ Bored ☐ Dug ☐ Air Rotary ☐ Driven ☐ Cable tool ☐ Other

7. USE: ☐ Domestic ☐ Public Supply–Permit No. ____ ☐ Industry ☐ Irrigation ☐ Air Conditioning ☐ Commercial ☐ Test Well ☒ Monitor Well ☐ ____

8. CASING: ☒ Threaded ☐ Welded
Diam.: 2"
Type: ☒ PVC ☐ Galvanized ☐ Steel ☐ Other
____ in. to ____ ft. depth
____ in. to ____ ft. depth
Height: Above/Below Surface FM ft.
Weight ____ lb./ft.
Drive Shoe? ☐ Yes ☐ No

9. SCREEN
Type: PVC Diam.: 2"
Slot/Gauge: 0.010 Length: 10'
Set Between: 2 ft. and 12 ft.
____ ft. and ____ ft.
NOTE: MULTIPLE SCREENS USE SECOND SHEET
Sieve Analysis ☐ Yes (please enclose) ☒ No

10. STATIC WATER LEVEL
____ ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface.
NA ft. after ____ hrs. Pumping ____ G.P.M.
Pumping Test: ☐ Yes (please enclose) ☒ No
Yield: ____

12. WATER QUALITY
Chemical Analysis ☒ Yes ☐ No Bacterial Analysis ☐ Yes ☒ No
Please enclose lab results.

13. ARTIFICIAL FILTER (gravel pack) ☒ Yes ☐ No
Installed from 2 ft. to 12 ft.
Effective size #2 Uniformity Coefficient ____

14. WELL GROUTED? ☒ Yes ☐ No
☒ Neat Cement ☐ Sand Cement ☐ Concrete ☐ Other ____
Depth: From Surface ft. to 1.5 ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: ____ ft. ____ direction
____ Type well disinfected ☐ Yes Type: ____
upon completion ☒ No Amount: ____

16. PUMP: Date installed: ____ Not installed ☒
Mfr. Name: ____ Model No.: ____
H.P. ____ Volts ____ Length of drop pipe ____ ft. Capacity ____ gpm
TYPE: ☐ Submersible ☐ Jet (shallow) ☐ Turbine ☐ Jet (deep) ☐ Reciprocating ☐ Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.
Registered Business Name: Geotek Drilling Date: 11/11/00
Address: Oak Ridge Hwy, Knoxville TN 37931
Signed: ____ Cert. No.: 794
Authorized Representative

DHEC 1903 (10/96) COPY 1 MAIL TO: S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (ADDRESS ABOVE)

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: CWC Zone 4
PROJECT NUMBER: 7912
DRILLING COMPANY: F/W
DRILLING RIG: CME

BORING No.: M08
DATE: 3-13-01
GEOLOGIST: W.A. Olson
DRILLER: Arnold Chapel

	Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Drillers BZ**
1								Brw FS/S,Mt						
2														
3								Tan clayey sand						
4														
5								green sandy clay						
6								Some shells						
7														
8														
9														
10										H2S odor				
11														
12														

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: TWC Zone H
PROJECT NUMBER: 7512
DRILLING COMPANY: PW
DRILLING RIG: CME 75

BORING No.: M09
DATE: 3-13/01
GEOLOGIST: W.D Olson
DRILLER: Arnold Chapal

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
1							Brown FS-Silt						
2							Tan FS + Silt						
3							Gray FS + Silt						
4							↓						
5							green gray clayey						
6							sand some shells						
7													
8													
9													
10													
11													
12													

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No ____ Well I.D. #: ____

Tetra Tech NUS, Inc.

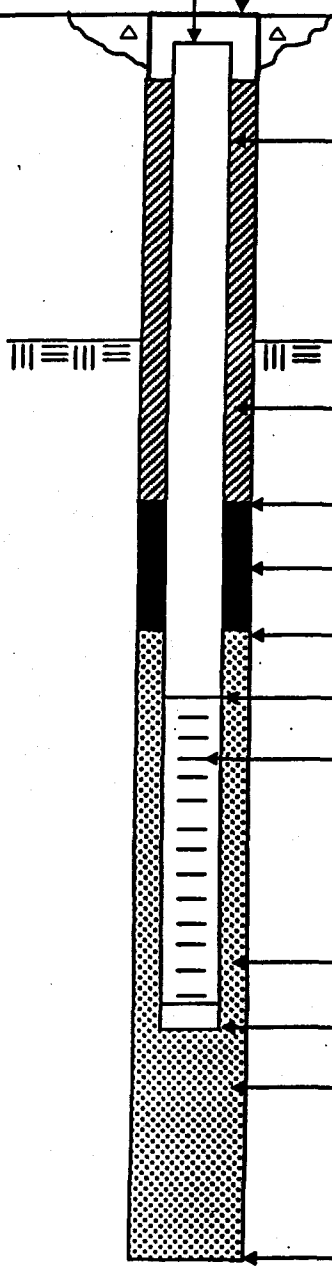
WELL No.: CWC 44 MØL

MONITORING WELL SHEET

PROJECT:	CWC	DRILLING Co.:	Geotek	BORING No.:	CWC44MØL
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-7/00
SITE:	44	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.A. Olson	DEV. METHOD:	Sub. Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: 1

Elevation / Height of Top of Surface Casing: 1

I.D. of Surface Casing: 8"

Type of Surface Casing: bolt down

Type of Surface Seal: PAD

I.D. of Riser: 2"

Type of Riser: Sch 40 PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: NA 1

Type of Backfill: grout

Elevation / Depth of Seal: 1 1½'

Type of Seal: bentonite pellets

Elevation / Depth of Top of Filter Pack: 1 2'

Elevation / Depth of Top of Screen: 1 2'

Type of Screen: Sch 40 PVC

Slot Size x Length: 0.010 X 10'

I.D. of Screen: 2"

Type of Filter Pack: #2 well gravel pack

Elevation / Depth of Bottom of Screen: 1 12'

Elevation / Depth of Bottom of Filter Pack: 1 12'

Type of Backfill Below Well: NA

Elevation / Total Depth of Borehole: 1 12'

Tetra Tech NUS, Inc.

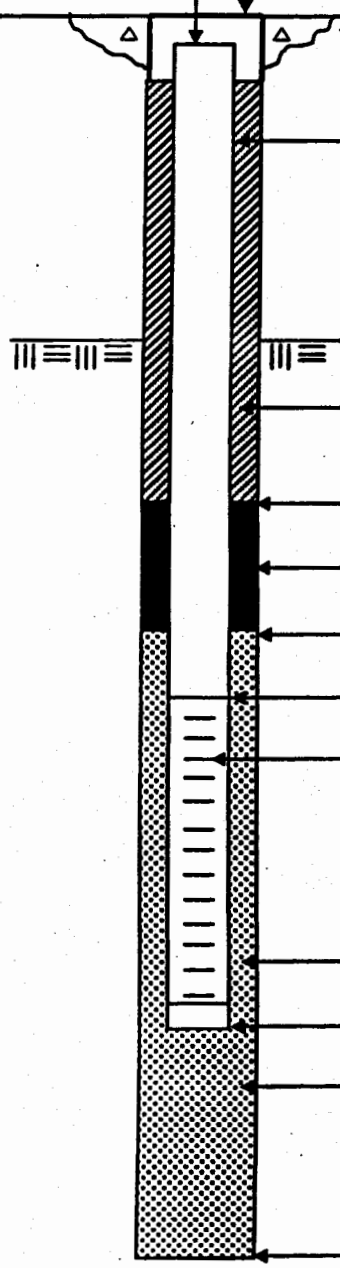
WELL No.: CNC 44 MØ2

MONITORING WELL SHEET

PROJECT:	CNC	DRILLING Co.:	Geotek	BORING No.:	CNC44M02
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-8/00
SITE:	44	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.D. Olson	DEV. METHOD:	Sub. Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: 1

Elevation / Height of Top of Surface Casing: 1

I.D. of Surface Casing: NA

Type of Surface Casing: NA

Type of Surface Seal: NA

I.D. of Riser: 2"

Type of Riser: Sched 40 PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: 1

Type of Backfill: grout

Elevation / Depth of Seal: 1 1½'

Type of Seal: bentonite Pellets

Elevation / Depth of Top of Filter Pack: 12'

Elevation / Depth of Top of Screen: 12'

Type of Screen: Sched 40 PVC

Slot Size x Length: 10' x 0.010"

I.D. of Screen: 2"

Type of Filter Pack: #2 well graded Pack

Elevation / Depth of Bottom of Screen: 12'

Elevation / Depth of Bottom of Filter Pack: 12'

Type of Backfill Below Well: NA

Elevation / Total Depth of Borehole: 12'

Tetra Tech NUS, Inc.

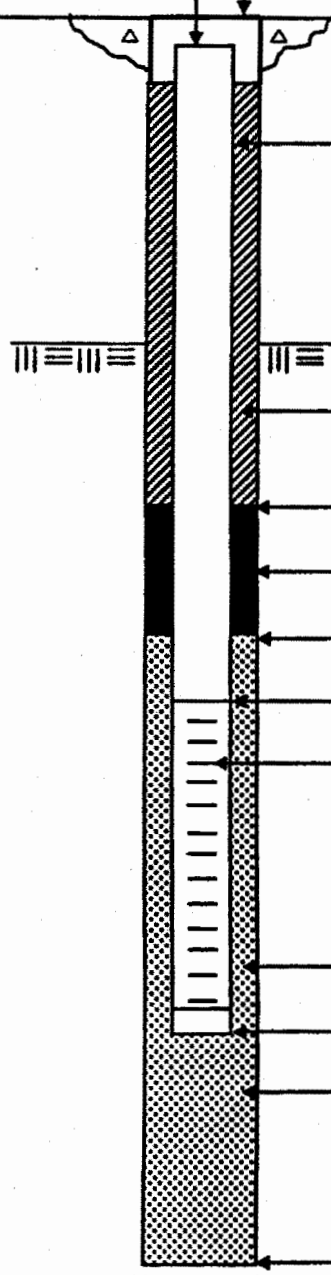
WELL No.: ~~44~~ CWC 44mØ3

MONITORING WELL SHEET

PROJECT:	CNC	DRILLING Co.:	Geotek	BORING No.:	CWC44mØ3
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-9-00
SITE:	44	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.D. Olson	DEV. METHOD:	Sub. Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser:	1
Elevation / Height of Top of Surface Casing:	1Ø
I.D. of Surface Casing:	8"
Type of Surface Casing:	Boltdown
Type of Surface Seal:	PAD
I.D. of Riser:	2"
Type of Riser:	PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	1 NA
Type of Backfill:	Neat cement grout
Elevation / Depth of Seal:	1 1½'
Type of Seal:	Bentonite Pellets
Elevation / Depth of Top of Filter Pack:	1 2'
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	PVC
Slot Size x Length:	0.010 x 10'
I.D. of Screen:	2"
Type of Filter Pack:	#2 well gravel pack
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	
Elevation / Total Depth of Borehole:	1 12'

Tetra Tech NUS, Inc.

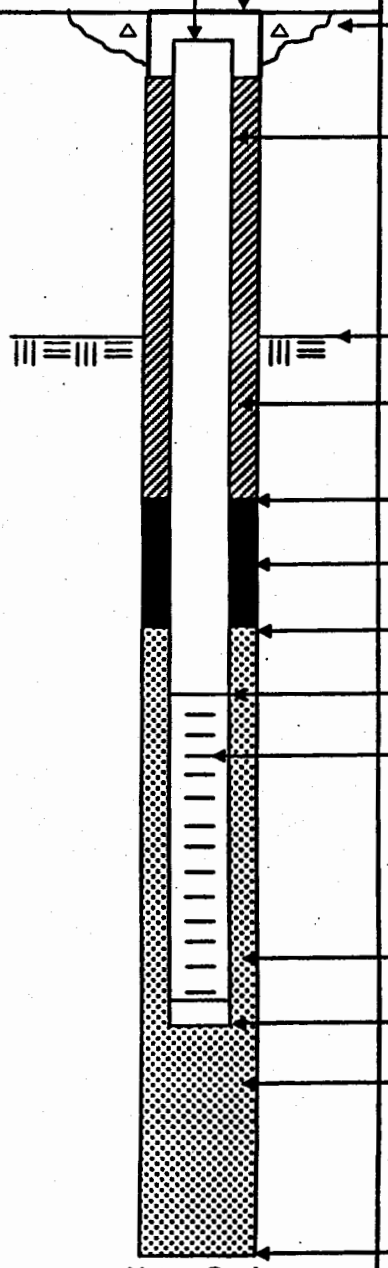
WELL No.: CWC 44 MW4

MONITORING WELL SHEET

PROJECT:	CWC	DRILLING Co.:	Geotek	BORING No.:	CWC 44 MW4
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-8-00
SITE:	44	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.D. Olson	DEV. METHOD:	Sub Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: 1

Elevation / Height of Top of Surface Casing: 1 FM

I.D. of Surface Casing: 8"

Type of Surface Casing: Bolt down

Type of Surface Seal: 2x2 Concrete Pad

I.D. of Riser: 2"

Type of Riser: Schd 40 PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: NA

Type of Backfill: Neat Cement grout

Elevation / Depth of Seal: 1 1/2

Type of Seal: Bentonite Pellets

Elevation / Depth of Top of Filter Pack: 12'

Elevation / Depth of Top of Screen: 12'

Type of Screen: Schd 40 PVC

Slot Size x Length: 0.010" X 10'

I.D. of Screen: 2"

Type of Filter Pack: #2 well graded Pack

Elevation / Depth of Bottom of Screen: 112'

Elevation / Depth of Bottom of Filter Pack: 12'

Type of Backfill Below Well: NA

Elevation / Total Depth of Borehole: 112'

Tetra Tech NUS, Inc.

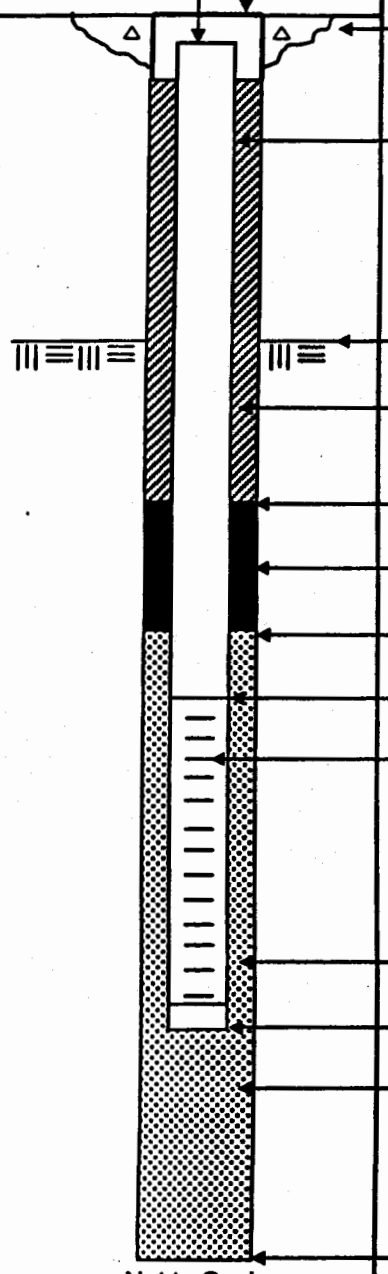
WELL No.: CWC 44 MØ5

MONITORING WELL SHEET

PROJECT:	CWC	DRILLING Co.:	Geotek	BORING No.:	CWC 44 MØ5
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-8/00
SITE:	44	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.D. Olson	DEV. METHOD:	Sub. Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: 1

Elevation / Height of Top of Surface Casing: 1 FM

I.D. of Surface Casing: 8"

Type of Surface Casing: Boltdown

Type of Surface Seal: 2x2 Concrete PAD

I.D. of Riser: 2"

Type of Riser: Sch 40 PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: 1 NA

Type of Backfill: Neat cement grout

Elevation / Depth of Seal: 1 1½'

Type of Seal: bentonite Pellets

Elevation / Depth of Top of Filter Pack: 1 2'

Elevation / Depth of Top of Screen: 1 2'

Type of Screen: Sch 40 PVC

Slot Size x Length: 0.010" x 10'

I.D. of Screen: 2"

Type of Filter Pack: #2 well graded Sand

Elevation / Depth of Bottom of Screen: 1 12'

Elevation / Depth of Bottom of Filter Pack: 1 12'

Type of Backfill Below Well: NA

Elevation / Total Depth of Borehole: 1 12'

Tetra Tech NUS, Inc.

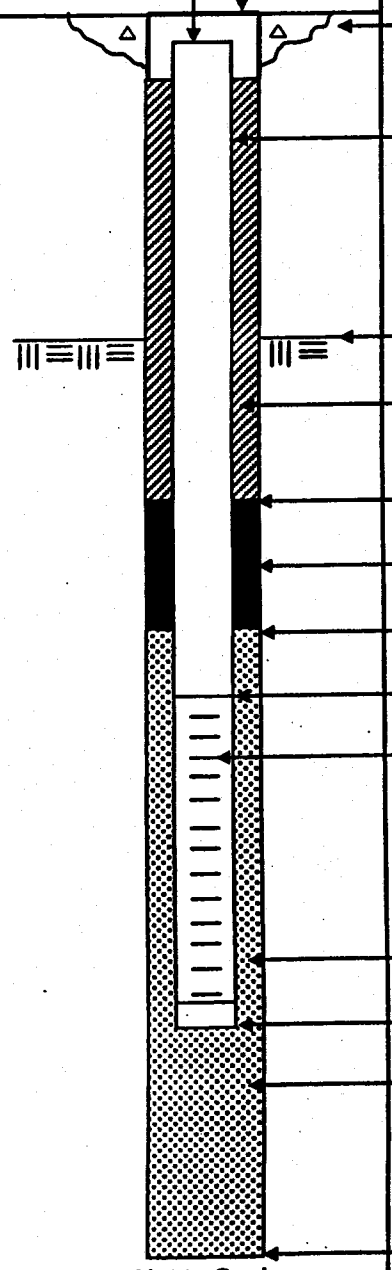
WELL No.: CNC 42mw06

MONITORING WELL SHEET

PROJECT:	CNC UST	DRILLING Co.:	Geotek	BORING No.:	CNC 42mw06
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	11-7-00
SITE:	Bldg 601	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.B. Olson	DEV. METHOD:	Surge/Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser:	1
Elevation / Height of Top of Surface Casing:	1
I.D. of Surface Casing:	NA
Type of Surface Casing:	
Type of Surface Seal:	PAN Grout
I.D. of Riser:	2"
Type of Riser:	Sched. 40 PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	NA /
Type of Backfill:	grout
Elevation / Depth of Seal:	1 6'
Type of Seal:	bentonite pellets
Elevation / Depth of Top of Filter Pack:	1 1½'
Elevation / Depth of Top of Screen:	1 2'
Type of Screen:	Sched 40 PVC mill slot
Slot Size x Length:	0.010 X 10'
I.D. of Screen:	2"
Type of Filter Pack:	#2 Gravel Pack
Elevation / Depth of Bottom of Screen:	1 12'
Elevation / Depth of Bottom of Filter Pack:	1 12'
Type of Backfill Below Well:	
Elevation / Total Depth of Borehole:	1 12'

Tetra Tech NUS, Inc.

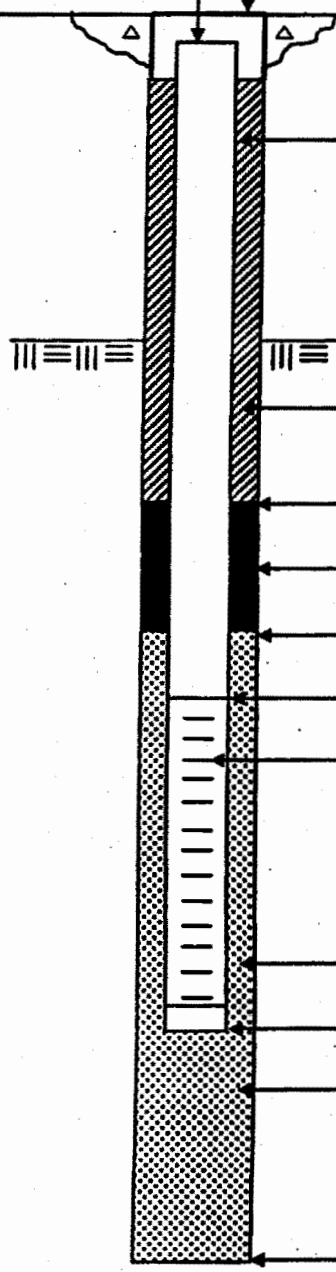
WELL No.: CNC H4 m07D

MONITORING WELL SHEET

PROJECT:	CNC	DRILLING Co.:	Geotek	BORING No.:	CNC H4m07D
PROJECT No.:		DRILLER:	Paul Gibson	DATE COMPLETED:	1/9/00
SITE:	H4	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W. D. Olson	DEV. METHOD:	Sub. Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser: /

Elevation / Height of Top of Surface Casing: /

I.D. of Surface Casing: 8"

Type of Surface Casing: Bolt down

Type of Surface Seal: 2x2 PAD

I.D. of Riser: 2"

Type of Riser: PVC

Borehole Diameter: 8"

Elevation / Depth Top of Rock: / NA

Type of Backfill: Neat cement grout

Elevation / Depth of Seal: / 26'

Type of Seal: bentonite Pellets

Elevation / Depth of Top of Filter Pack: / 28'

Elevation / Depth of Top of Screen: / 30'

Type of Screen: PVC

Slot Size x Length: 0.010 x 10'

I.D. of Screen: 2"

Type of Filter Pack: #2 well gravel Pack

Elevation / Depth of Bottom of Screen: / 35'

Elevation / Depth of Bottom of Filter Pack: / 35'

Type of Backfill Below Well:

Elevation / Total Depth of Borehole: / 35'

Tetra Tech NUS, Inc.

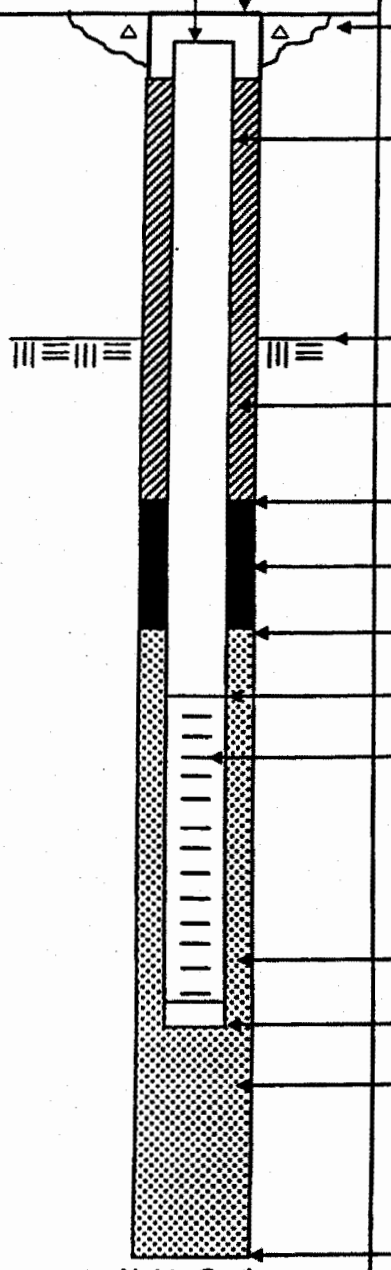
WELL No.: _____

MONITORING WELL SHEET

PROJECT:	CWC Zone 4	DRILLING Co.:	PW	BORING No.:	M08
PROJECT No.:	7912	DRILLER:	Arnold Chapa	DATE COMPLETED:	8-13/01
SITE:	601	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.A. Olson	DEV. METHOD:	Surge/Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser:	1
Elevation / Height of Top of Surface Casing:	1
I.D. of Surface Casing:	
Type of Surface Casing:	8" bolt down
Type of Surface Seal:	2X2 Pad
I.D. of Riser:	
Type of Riser:	
Borehole Diameter:	
Elevation / Depth Top of Rock:	1 NA
Type of Backfill:	PAD
Elevation / Depth of Seal:	1 6"
Type of Seal:	bentonite
Elevation / Depth of Top of Filter Pack:	1 1'
Elevation / Depth of Top of Screen:	1 2
Type of Screen:	Sched 40 PVC
Slot Size x Length:	0.010 X10'
I.D. of Screen:	2"
Type of Filter Pack:	DSI #1 Filter Pack
Elevation / Depth of Bottom of Screen:	112'
Elevation / Depth of Bottom of Filter Pack:	112'
Type of Backfill Below Well:	
Elevation / Total Depth of Borehole:	112'

Tetra Tech NUS, Inc.

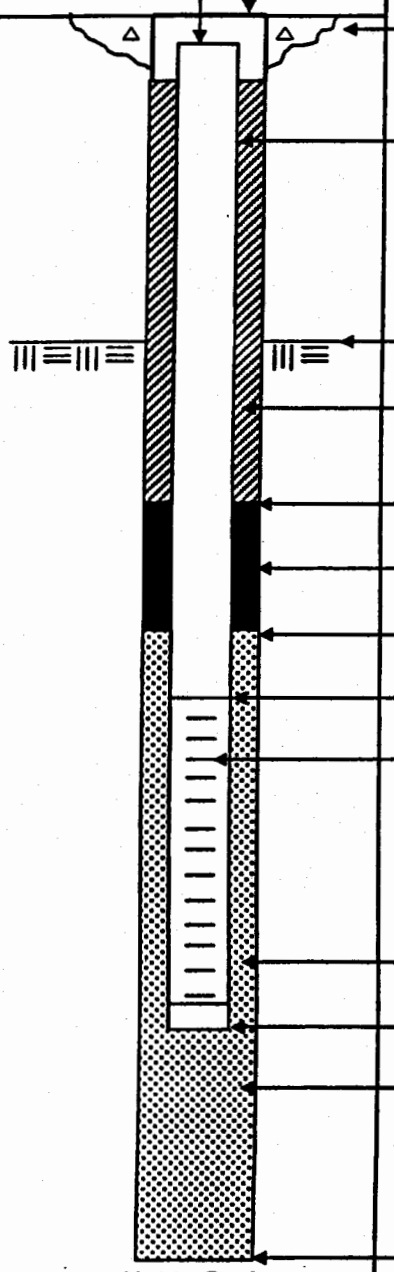
WELL No.: M Ø9

MONITORING WELL SHEET

PROJECT:	CNC Rome H	DRILLING Co.:	PNJ	BORING No.:	
PROJECT No.:	7512	DRILLER:	Arnold Chapel	DATE COMPLETED:	3-13/01
SITE:	601	DRILLING METHOD:	HSA	NORTHING:	
GEOLOGIST:	W.B. Olson	DEV. METHOD:	Surge/Pump	EASTING:	

Ground Elevation =

Datum:



Not to Scale

Elevation / Depth of Top of Riser:	/
Elevation / Height of Top of Surface Casing:	/
I.D. of Surface Casing:	8"
Type of Surface Casing:	
Type of Surface Seal:	2x2 PAD
I.D. of Riser:	2"
Type of Riser:	2" Sched 40 PVC
Borehole Diameter:	8"
Elevation / Depth Top of Rock:	/
Type of Backfill:	NA
Elevation / Depth of Seal:	/ 6"
Type of Seal:	bentonite
Elevation / Depth of Top of Filter Pack:	/ 1
Elevation / Depth of Top of Screen:	/
Type of Screen:	2" Sched 40 PVC
Slot Size x Length:	0.010 x 10'
I.D. of Screen:	2"
Type of Filter Pack:	DSI #1
Elevation / Depth of Bottom of Screen:	/ 12'
Elevation / Depth of Bottom of Filter Pack:	/ 12'
Type of Backfill Below Well:	
Elevation / Total Depth of Borehole:	/ 12'

APPENDIX C

FIELD SAMPLING DATA SHEETS

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Charleston Naval Shipyard
Project No.: 7912

[X] Domestic Well Data
[ ] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: 44GLM0101
Sample Location: CNX44M01
Sampled By: JA
C.O.C. No.:
Type of Sample:
[ ] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date: 11 10 00								
Time: 1415								
Method: pump/straw	clear	6.99	3.66	25.7	3	0.44	0.18	

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 11 10 00								
Method: pump		7.24	1.65	25.3	29	1.10	0.07	
Monitor Reading (ppm): —	1.1	6.99	1.44	23.1	17	0.80	0.01	
Well Casing Diameter & Material	2.2	6.96	2.14	25.4	15	1.32	0.11	
Type: 2" PVC	3.3	6.95	3.04	25.5	9	0.46	0.09	
Total Well Depth (TD): 11.86	4.4	6.99	3.66	26.7	3	0.44	0.18	
Static Water Level (WL): 5.03								
One Casing Volume(gal/L): 1.19								
Start Purge (hrs): 0850								
End Purge (hrs): 0951								
Total Purge Time (min): 61								
Total Vol. Purged (gal/L): ~5g								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOAs 8260B			
BTEX/Naphth/EDB/MTBE	HCl	3 x 40ml glass	✓
PAHs 8270C	none	2 x 1l amber	✓
Anions			
dissolved methane	HCl	3 x 40ml glass	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD

Duplicate ID No.: 44GLM0101D

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Charleston Naval Complex
Project No.: 7912

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: EN44GLM0201
Sample Location: CNC44 - M02
Sampled By: JA
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 11.10.00	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1355								
Method: pump/straw		7.17	1.54	23.1	48	1.20	0.07	

PURGE DATA:

Date: 11.10.00	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: peristaltic		7.58	.775	21.6	248	1.18	0.03	
Monitor Reading (ppm): —	1	7.53	0.98	23.3	167	0.97	0.04	
Well Casing Diameter & Material	2	7.57	.945	23.3	80	0.41	0.04	
Type: 2" PVC	3	7.69	1.13	23.4	30	0.43	0.05	
Total Well Depth (TD): 11.75	4	7.04	1.38	22.6	47	0.68	0.06	
Static Water Level (WL): 5.39	5	7.17	1.54	23.1	48	1.20	0.07	
One Casing Volume(gal/L): 1 g								
Start Purge (hrs): 0855								
End Purge (hrs): 0950 10/6								
Total Purge Time (min): 80								
Total Vol. Purged (gal/L): ~6								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOAs 8260B	HCl	3 x 40ml glass	
BTEX/Naphth/			
EDB/MTBE			
PAHs 8270C	none	2 x 1L amber	
Anions	none	1 x 500ml plastic	
dissolved methane	HCl	3 x 40ml glass	

OBSERVATIONS / NOTES:

11.75
5.39
6.36
.16
3826

3826
6360
9186

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CNC
Project No.:

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: 44 MØ 3
Sample Location: 44M03
Sampled By: WKW/ JMA
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 11-11-00	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time:								
Method: LOW FLOW	yellow							

PURGE DATA:

Date: 11-11-00	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: LOW FLOW	INIT	6.52	1.44	23.9	60	1.26	0.61	
Monitor Reading (ppm): —	1 g	6.82	2.39	24.5	11	0.53	0.11	
Well Casing Diameter & Material	2 g	6.75	3.86	24.7	3	0.83	0.19	
Type: 2" PVC	3 g	6.71	3.61	25.0	1	0.60	0.23	
Total Well Depth (TD): 11.55	5 g	6.84	4.93	25.3	-3	0.97	0.25	
Static Water Level (WL): 4.18								
One Casing Volume(gal/L): 1.2 g								
Start Purge (hrs): 08:35								
End Purge (hrs): 09:35								
Total Purge Time (min): 60								
Total Vol. Purged (gal/L): 5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

11.55
4.18
7.37

.737
.074
.37
1.181

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Charleston Naval Complex
Project No.: 7912

[X] Domestic Well Data
[ ] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: 44GL M05 M04 01
Sample Location: CNC44M05
Sampled By: JA
C.O.C. No.:
Type of Sample:
[ ] Low Concentration
[ ] High Concentration

SAMPLING DATA:

Date: 11 10 00	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1435								
Method: pump/straw	clear	6.64	5.74	26.0	8	0.24		

PURGE DATA:

Date: 11 10 00	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: peristaltic		7.35	3.22	24.8	35	0.88	0.05	
Monitor Reading (ppm): —	1.1	7.29	3.28	24.8	21	1.28	0.03	
Well Casing Diameter & Material	2.2	7.25	3.59	25.5	9	1.32	0.04	
Type: 2" PVC	3.3	7.23	4.95	25.5	4	0.11	~~0.11~~	
Total Well Depth (TD): 11.75	4.4	6.64	5.74	26.0	8	0.24		
Static Water Level (WL): 4.35								
One Casing Volume(gal/L): 1.14								
Start Purge (hrs): 0852								
End Purge (hrs): 0955								
Total Purge Time (min): 63								
Total Vol. Purged (gal/L): ~5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOAs 8260B	HCl	3 x 40ml glass	
PAHs 8270C	none	2 x 1l amber	
Anions	none	1 x 500ml plastic	
dissolved methane	HCl	3 x 40ml glass	

OBSERVATIONS / NOTES:

.7
.16
1.3

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CWC 44
Project No.:

[] Domestic Well Data
[x] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.:
Sample Location: CWC 44 MW5
Sampled By:
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: / Time:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Method:								

PURGE DATA:

Date: 11.10.00	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: Low Flow	INIT	7.28	1.25	24.1	4	1.22	0.05	
Monitor Reading (ppm): —	1/2 g	6.73	1.77	24.5	3	0.46	0.08	
Well Casing Diameter & Material	2.5 g	6.65	4.60	24.5	1	-0.04	0.23	
Type: 2" PVC	3.5 g	6.87	4.79	24.3	1	0.01	0.25	
Total Well Depth (TD): 11.92	5 g	6.99	5.02	23.8	Ø	0.16	0.26	
Static Water Level (WL): 5.15	5.5	7.03	5.15	24.1	Ø	0.01	0.27	
One Casing Volume(gal/L): 1.12								
Start Purge (hrs): 16:35								
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

11.92
5.15
6.97 = WC
.7 ~~.697~~
.35 .0
.07

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: Charleston Naval Shipyard
Project No.: 7912

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 44GLM0601
Sample Location: CNC44 M06
Sampled By: JA
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 11/9/00	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1410								
Method: pump/straw	clear	6.68	6.71	24.2	-4	0.58	6.36	

PURGE DATA:

Date: 11/9/00	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: peristaltic		6.72	4.38	24.7	7	1.49		
Monitor Reading (ppm): —	1.3	6.41	6.32	24.2	Ø	0.85		
Well Casing Diameter & Material	2.6	6.60	6.72	24.2	Ø	0.57	0.36	
Type: 2" PVC	3.9	6.66	6.75	24.2	-2	0.52	0.36	
Total Well Depth (TD): 11.59' ~~12.5~~	4.5	6.68	6.71	24.2	-4	0.58	0.36	
Static Water Level (WL): 3.9'								
One Casing Volume(gal/L): 1.528								
Start Purge (hrs): 1337								
End Purge (hrs): 1420								
Total Purge Time (min): 43								
Total Vol. Purged (gal/L): ~4.54								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX/Naph.	HCl	3 x 40ml glass	
PAH	none	2 x 1 l amber	
~~Lead~~	~~HNO3~~	~~1 x 250ml plastic~~	

OBSERVATIONS / NOTES:

~~5.9~~ 5
~~1.16~~ 1.16
~~5.4~~ 4
~~8.0~~ 8
~~1.54~~ 1.78

MS MSD taken.

Circle if Applicable:
MS/MSD: yes
Duplicate ID No.:

Signature(s): [signature]

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: CNC bldg 601
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials): —

Sample ID No.: 44GFM~~0301~~ 0401
Sample Location: CNC44 M04
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

	Color (Visual)	ORP (Eh) (+/- mv)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	Sal. (%)	pH (SU)
Date: 11/10/00								
Time: 1435								
Method: pump/straw	clear	—	5.74	26.0	8	0.24	—	6.64

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: 0-1 mg/L) Analysis Time: 1055

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
_____	x 0.01	=
_____	x 0.02	=

CHEMetrics: 0.4 mg/L

Notes:

Alkalinity:

Analysis Time: 1105

Equipment: HACH Digital Titrator AL-DT (circled) CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	=
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & 375	x 2.0	= 750
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	Ø	Ø	750

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____mg/L) Analysis Time: 1125

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☒	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
_____	x 0.1	=
_____	x 0.2	=
310	x 1.0	= 310
_____	x 2.0	=

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

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Project Site Name: CNC 44
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials): ✓

Sample ID No.: 44GEM ~~0501~~ 0401
Sample Location: CNC44 M04
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 90 HS-C Color Chart HS-WR Color Wheel Analysis Time: 1142
Program/Module: 610nm 93 Other: _____

Concentration: 0.80 mg/L Filtered: ☐
Notes: >LIMIT

Sulfate (SO_4^{2-}):

Equipment: ~~DR-700~~ DR-8 __ Other: _____ Analysis Time: _____
Program/Module: 91
Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results: _____
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Nitrite (NO_2^--N):

Analysis Time: 1226
Equipment: DR-700 DR-8 90 Other: _____ Filtered: ☐
Program/Module: 60
Concentration: 0.255 mg/L Reagent Blank Correction: ☐
Standard Solution: ☐ Results: ☐
Notes:

Nitrate (NO_3^--N):

Analysis Time: _____
Equipment: ~~DR-700~~ DR-8 __ Other: _____ Filtered: ☐
Program/Module: 55
Concentration: _____ mg/L
Nitrite Interference Treatment: ☐
Reagent Blank Correction: ☐
Standard Solution: ☐ Results: _____
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

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Project Site Name: CNC 44

Project No.: 7912

Sampled By: JA

Field Analyst: JA

Field Form Checked (initials): —

Sample ID No.: 44GFM04~~5~~01

Sample Location: CNC44M04

Duplicate: ☐

Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 __ HACH MN-5 Other: _____ Analysis Time: 1148

Program/Module: 525nm 41

Concentration: 0.0 mg/L

Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____

Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 90 IR-18C Color Wheel Other: _____ Analysis Time: 1156

Program/Module: 500nm 33

Concentration: 0.06 mg/L

Filtered: ☐

Notes:

Hydrogen Sulfide

Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: HS-C

Filtered: ☐

Program/Module:

Concentration: 0.1 mg/L

Notes:

Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____

Filtered: ☐

Program/Module:

Concentration: _____ mg/L

Notes:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: Charleston Naval Shipyard
Project No.: 7912
Sampled By: Jeff Alexander
Field Analyst: " "
Field Form Checked (initials): —

Sample ID No.: 44GFM02Ø1
Sample Location: CNC44M02
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

	Color (Visual)	ORP (Eh) (+/- mv)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	Sal. (%)	pH (SU)
Date: 11 10 00								
Time: 1355								
Method: Pump/straw		—	~~7.17~~ 1.54	23.1	48	1.24	0.07	7.17

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range 0-1 mg/L) Analysis Time: ~~1055~~ 2

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
	x 0.01	=
	x 0.02	=

CHEMetrics: 0.5 mg/L

Notes:

Alkalinity:

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____ mg/L) Analysis Time: 1055 Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	&	x 0.1	=
☐	40-160 mg/L	25 ml	0.1600 N	0.4	&	x 0.4	=
☒	100-400 mg/L	100 ml	1.600 N	1.0	Ø & 195	x 1.0	= 195
☐	200-800 mg/L	50 ml	1.600 N	2.0	&	x 2.0	=
☐	500-2000 mg/L	20 ml	1.600 N	5.0	&	x 5.0	=
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	&	x 10.0	=

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	Ø	Ø	195

CHEMetrics: _____ mg/L

Notes:

Standard Additions: ☐ Titrant Molarity: _____ Digits Required: 1st.: _____ 2nd.: _____ 3rd.: _____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____ mg/L) Analysis Time: 1120

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☒	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
	x 0.1	=
430	x 0.2	= 86
	x 1.0	=
	x 2.0	=

CHEMetrics: _____ mg/L

Notes:

Standard Additions: ☐ Titrant Molarity: Digits Required: 1st.:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: Charleston Naval Complex
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials): —

Sample ID No.: 44GFM02 01
Sample Location: CNC44M02
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 90 HS-C Color Chart HS-WR Color Wheel Analysis Time: 1141
Program/Module: 610nm 93 Other: _____

Concentration: 0.06 mg/L Filtered: ☐
Notes:

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____
Program/Module: 91
Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results: _____
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Nitrite (NO_2^--N):

Analysis Time: _____
Equipment: DR-700 DR-8 90 Other: _____ Filtered: ☐
Program/Module: 60
Concentration: 0.041 mg/L Reagent Blank Correction: ☐
Standard Solution: ☐ Results: ☐
Notes:

Nitrate (NO_3^--N):

Analysis Time: _____
Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐
Program/Module: 55
Concentration: _____ mg/L
Nitrite Interference Treatment: ☐
Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Tetra Tech NUS, Inc.

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Project Site Name: Charleston Naval Complex
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials):

Sample ID No.: 44GFM02001
Sample Location: CNC44 M02
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 90 HACH MN-5 Other: _____ Analysis Time: ~~1154~~ 02

Program/Module: 525nm 41

Concentration: ~~0.06~~ 0 mg/L 0.0 mg/L

Filtered: ☐
Digestion: ☐
Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-8 90 IR-18C Color Wheel Other: _____ Analysis Time: 1154

Program/Module: 500nm 33

Concentration: 0.06 mg/L

Filtered: ☐

Notes:

Hydrogen Sulfide

Analysis Time: 1217

Equipment: DR-700 DR-8 __ Other: HS-C

Filtered: ☐

Program/Module:

Concentration: 0.0 mg/L

Notes:

Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____

Filtered: ☐

Program/Module:

Concentration: _____ mg/L

Notes:

(B)

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

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Project Site Name: CNC 44
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials):

Sample ID No.: 44GFMØ1Ø1
Sample Location: CNC44MØ1
Duplicate: ☐
Blank: ☐

SAMPLING DATA:

	Color (Visual)	ORP (Eh) (+/- mv)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (Meter, mg/l)	Sal. (%)	pH (SU)
Date: 11 10 00								
Time: 1415								
Method: pump/straw	clear	—	3.66	25.7	3	0.44	0.18	6.95

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: 0-1 / 1-12 mg/L) Analysis Time: 1100

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0.200 N	0.02

Titration Count	Multiplier	Concentration
_____	x 0.01	=
_____	x 0.02	=

CHEMetrics: 1.0 mg/L

Notes: tried both ranges 1.0 on both.

Alkalinity:

Analysis Time: 11ØØ

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) Filtered: ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	=
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=
☒	200-800 mg/L	50 ml	1.600 N	2.0	Ø & 270	x 2.0	= 54Ø
☐	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	=
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:	Ø	Ø	54Ø

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____mg/L) Analysis Time: 112Ø

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☒	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count		Concentration
_____	x 0.1	=
_____	x 0.2	=
180	x 1.0	= 180
_____	x 2.0	=

CHEMetrics: _____mg/L

Notes:

Standard Additions: ☐ Titrant Molarity:_____ Digits Required: 1st.:_____ 2nd.:_____ 3rd.:_____

B

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

Project Site Name: CNC 44
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials): [illegible]

Sample ID No.: 44GEMD1Ø1
Sample Location: CNC 44MØ1
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-890 HS-C Color Chart HS-WR Color Wheel Analysis Time: _____
Program/Module: 610nm 93 Other: _____

Concentration: 0.01 mg/L Filtered: ☐
Notes:

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____
Program/Module: 91
Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results: _____
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

Nitrite (NO_2^--N): Analysis Time: 1225

Equipment: DR-700 DR-890 Other: _____ Filtered: ☐
Program/Module: 60
Concentration: 0.022 mg/L Reagent Blank Correction: ☐
Standard Solution: ☐ Results: ☐
Notes:

Nitrate (NO_3^--N): Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐
Program/Module: 55
Concentration: _____ mg/L
Nitrite Interference Treatment: ☐
Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐
Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____
Notes:

(B)

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

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Project Site Name: CNC 44
Project No.: 7912
Sampled By: JA
Field Analyst: JA
Field Form Checked (initials): [illegible]

Sample ID No.: 44GFM01001
Sample Location: CNC44 M01
Duplicate: ☐
Blank: ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-890 HACH MN-5 Other: _____ Analysis Time: ~~1155~~ 1155

Program/Module: 525nm 41

Concentration: 0.8 mg/L

Filtered: ☐

Digestion: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes:

Ferrous Iron (Fe^{2+}):

Equipment: DR-700 DR-890 IR-18C Color Wheel Other: _____ Analysis Time: 1155

Program/Module: 500nm 33

Concentration: 0.48 mg/L

Filtered: ☐

Notes:

Hydrogen Sulfide

Equipment: DR-700 DR-8 __ Other: HS-C

Analysis Time: _____

Filtered: ☐

Program/Module:

Concentration: 0.0 mg/L

Notes:

_____

Equipment: DR-700 DR-8 __ Other: _____

Analysis Time: _____

Filtered: ☐

Program/Module:

Concentration: _____ mg/L

Notes:

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CNC site 44
Project No.: 7912

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 44GLM0901
Sample Location: CNC44 M09
Sampled By: JA/BO
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 3 14 01	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 1045								
Method: pump/straw	sl. yellow	6.90	4.85	17.9	9	1.92	0.25	

PURGE DATA:

Date: 3 14 01	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: peristaltic	initial	6.72	2.30	17.0	14	1.70	0.10	
Monitor Reading (ppm): —	1st	6.91	2.42	17.6	25	1.92	0.11	
Well Casing Diameter & Material	3.0	7.04	3.51	17.7	27	1.71	0.11	
Type: 2" PVC	4.5	6.83	4.52	18.3	8	1.38	0.23	
Total Well Depth (TD): ~12	5.0	6.92	4.78	17.8	4	1.45	0.24	
Static Water Level (WL): 2.89	6.0	6.90	4.85	17.9	9	1.92	0.25	
One Casing Volume(gal/L): ~1.5								
Start Purge (hrs): 0938								
End Purge (hrs): 1040								
Total Purge Time (min): ~62								
Total Vol. Purged (gal/L): ~6 g								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOCs	HCl	3 x 40ml	y
PAH	—	2 x 1 l	y

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: CNC site 44
Project No.: 7912

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 44GLM0801
Sample Location: 44 MW8
Sampled By: JA/BO
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 3-14-01	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Time: 0925								
Method: pump/straw	yellowish	6.92	6.70	17.6	6	2.05	0.35	

PURGE DATA:

Date: 3-14-01	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method: pump	initial	5.47	2.37	16.7	14	2.62	0.11	~450 ml/min
Monitor Reading (ppm): —	1.5	7.02	4.39	17.2	8	1.28	0.22	
Well Casing Diameter & Material	3.0	6.62	1.17	17.2	3	1.57	0.33	
Type: 2" pvc	4.5	6.88	6.61	17.6	6	1.69	0.35	
Total Well Depth (TD): ~12	5.2	6.92	6.70	17.6	6	2.05	0.35	
Static Water Level (WL): 2.95								
One Casing Volume(gal/L): 1.4								
Start Purge (hrs): 0830								
End Purge (hrs): 0920								
Total Purge Time (min): 50								
Total Vol. Purged (gal/L) ~5.5								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
VOCs	HCl	3 x 40 ml	yes
PAHs	—	2 x 1 l amber	yes

OBSERVATIONS / NOTES:

5.16
5
14.4

* yellowish tint to water and sulfur odor.

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

APPENDIX D

SOIL AND GROUNDWATER LABORATORY ANALYTICAL DATA

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

CASE NARRATIVE
for
Tetra Tech NUS, Inc.
Charleston Naval Complex
Charleson, SC
SDG# 39153

April 11, 2001

Laboratory Identification:

General Engineering Laboratories, Inc. (GEL)

Mailing Address:

PO Box 30712
Charleston, SC 29417

Express Mail Delivery and Shipping Address:

2040 Savage Rd
Charleston, SC 29414

Telephone Number:

(843) 556-8171

Summary:

Sample receipt

The samples arrived at General Engineering Laboratories, Inc. Charleston, SC on March 14, 2001 for environmental analyses. All sample containers arrived without any visible signs of tampering or breakage. All samples were delivered with chain of custody documentation and signatures.

The following samples were received by the laboratory:

Laboratory Identification	Sample Description
39153001	44T031401
39153002	44R031401
39153003	44GLM0801
39153004	44GLM0901

Case Narrative:

Sample analyses were conducted using methodology as outlined in General Engineering Laboratories Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are listed below by analytical parameter.

Internal Chain of Custody:

Custody was maintained for all samples.

Data Package:

The enclosed data package contains the following sections: Case Narrative, Qualifier Flag Definitions, Chain of Custody, Cooler Receipt Checklist, Volatile Analysis and Semivolatile Analysis.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Valerie Davis
Project Manager

General Engineering Laboratories, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

CHAIN OF CUSTODY RECORD

39153%

*Page 1 of 1

Client Name/Facility Name: Tetra Tech, Charleston Naval Complex

Collected by/Company: J. Edwards/G.O.Con

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	PAH	VOC	Remarks
44UT-S1401	3/13/01	1120					3		3	*PAHs by EPA method 8270
44RO3M01	3/14/01	0900				Y	5	2	3	
44GLM0801	3/14/01	0925	Y				5	2	3	*VOCs by EPA method 8260
44GLM0901	3/14/01	1045	X				5	2	3	

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[illegible]	3/14/01	1147					

Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:
			[illegible]	3/16/01	11:47	

00013137549

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR INORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
E	The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentrations exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP (6010B/ILMO 3.0) or 100 times the absolute value of the preparation blank's concentration (6020). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.	Form 1, and EDD
*	The qualifier that is used to indicate that the duplicate sample analysis for an analyte is out of control.	Form 1, and EDD
÷	Correlation coefficient the Method of Standard Addition (MSA) is less than 0.095.	Form 2, and EDD
B	The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.	Form 1, and EDD
M	The qualifier is used to indicate that the replicate injection readings of the GFAA sample analysis do not agree within 20% relative standard deviation (RSD) or coefficient of variation (CV).	Form 1, and EDD
N	This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.	Form 1, and EDD
S	The reported value was determined by the Method of Standard Addition (MSA).	Form 1, and EDD
U	The analyte's result was less than the IDL/MDL.	C of A, Form 1, and EDD
W	Post-digestion spike for GFAA analysis is out of control limits (85%-115%), while sample results are less than 50% of the spike absorbance.	EDD, and Form 5, part 2
X	Other reporting flag as defined in report narrative.	Form 1, and EDD
**	This qualifier is used to indicate that the Laboratory Control Sample (LCS) recovery for an analyte is outside of the specified limits.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.
All flags do not apply to QC Summary and Certificate of Analysis packages.

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR ORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
A	The TIC is suspected aldol-condensation product.	C of A, Form 1, and EDD
B	Analyte was detected in the associated method blank as well as in the sample.	C of A; Form 1, and EDD
C	Pesticide analyte has been confirmed by GC/MS.	C of A, Form 1, and EDD
D	Analyte(s) quantified in an analysis performed at a secondary dilution factor.	C of A, Form 1, and EDD
E	Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.	C of A, Form 1, and EDD
J	This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.	C of A, Form 1, and EDD
N	Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.	C of A, Form 1, and EDD
NJ	Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.	C of A, Form 1, and EDD
P	Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.	C of A, EDD, Form 1,
U	Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture)..	C of A, Form 1, and EDD
X	Other reporting flag as defined in report narrative.	C of A, Form 1, and EDD
**	Laboratory Control Sample recovery outside of acceptance limit.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.

SAMPLE RECEIPT REVIEW SHEET

Date 3-14-01

Client

Received by Patricia Dover

	SAMPLE REVIEW CRITERIA	YES	NO	N/A	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓			
3	Shipping container temperature(s) checked:	✓			4°
4	Is temperature documented on Chain of Custody		✓		
5	Was shipping container temperature within specifications (4 +/- 2 C) If no, notify Project Manager	✓			
6	Are any of the samples identified by the client as radioactive?		✓		
	Were the samples screened for radioactivity?			✓	
	Were the screening results <= background? If results are > background inform RSO			✓	
7	Were chain of custody documents completed correctly? (ink, signed, match containers)	✓			
8	Were sample containers received intact and sealed? If no, notify the Project Manager	✓			
9	Were all sample containers properly labeled?	✓			
10	Were correct sample containers received?	✓			
11	Preserved samples checked for pH?	✓			
12	Were samples preserved correctly? If no, notify Project Manager	✓			
13	Were samples received within holding time? If No, notify Project Manager	✓			
14	Were VOA vials free of headspace?	✓			
15	ARCOC#			✓	
16	SDG#	✓			

PM(A) Review:

Date Reviewed:

Additional Comments:

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0801

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 39153

Matrix: (soil/water) WATER Lab Sample ID: 39153003

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 1B312

Level: (low/med) LOW Date Received: 03/14/01

% Moisture: not dec. _____ Date Analyzed: 03/21/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
75-69-4	Xylenes (total)	5.0	U
91-20-3	Naphthalene	0.34	JB

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0901

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 39153

Matrix: (soil/water) WATER Lab Sample ID: 39153004

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 1B313

Level: (low/med) LOW Date Received: 03/14/01

% Moisture: not dec. _____ Date Analyzed: 03/21/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	0.72	J
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
75-69-4	Xylenes (total)	5.0	U
91-20-3	Naphthalene	0.44	JB

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44R031401

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 39153

Matrix: (soil/water) WATER Lab Sample ID: 39153002

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 1B311

Level: (low/med) LOW Date Received: 03/14/01

% Moisture: not dec. _____ Date Analyzed: 03/21/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____ (uL) Soil Aliquot Volume: _____ (uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	2.1	J
71-43-2	Benzene	5.0	U
108-88-3	Toluene	0.95	J
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
75-69-4	Xylenes (total)	0.50	J
91-20-3	Naphthalene	0.84	JB

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44T031401

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 39153

Matrix: (soil/water) WATER Lab Sample ID: 39153001

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 1B310

Level: (low/med) LOW Date Received: 03/14/01

% Moisture: not dec. _____ Date Analyzed: 03/21/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
75-69-4	Xylenes (total)	5.0	U
91-20-3	Naphthalene	0.30	JB

CASE NARRATIVE
for
Tetra Tech NUS, Inc.
Charleston Naval Complex
Charleson, SC
SDG# 34005

December 8, 2000

Laboratory Identification:

General Engineering Laboratories, Inc. (GEL)

Mailing Address:

PO Box 30712
Charleston, SC 29417

Express Mail Delivery and Shipping Address:

2040 Savage Rd
Charleston, SC 29414

Telephone Number:

(843) 556-8171

Summary:

Sample receipt

The samples arrived at General Engineering Laboratories, Inc. Charleston, SC on November 11, 2000, for environmental analyses. All sample containers arrived without any visible signs of tampering or breakage. All samples were delivered with chain of custody documentation and signatures.

The following samples were received by the laboratory:

Laboratory Identification	Sample Description
34005001	44GLM0501
34005002	44GLM0301
34005003	44GLM0701
34005004	43GLM0101
34005005	44EL00201
34005006	44XL00102

34005007 44TB00301

Case Narrative:

Sample analyses were conducted using methodology as outlined in General Engineering Laboratories Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are listed below by analytical parameter.

Internal Chain of Custody:

Custody was maintained for all samples.

Data Package:

The enclosed data package contains the following sections: Case Narrative, Qualifier Flag Definitions, Chain of Custody, Cooler Receipt Checklist, GC/MS Volatile and GC/MS Semivolatile Analysis.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Valerie Davis
Project Manager

fc:tetr34005%

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR ORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
A	The TIC is suspected aldol-condensation product.	C of A, Form 1, and EDD
B	Analyte was detected in the associated method blank as well as in the sample.	C of A, Form 1, and EDD
C	Pesticide analyte has been confirmed by GC/MS.	C of A, Form 1, and EDD
D	Analyte(s) quantified in an analysis performed at a secondary dilution factor.	C of A, Form 1, and EDD
E	Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.	C of A, Form 1, and EDD
J	This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.	C of A, Form 1, and EDD
N	Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.	C of A, Form 1, and EDD
NJ	Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.	C of A, Form 1, and EDD
P	Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.	C of A, EDD, Form 1,
U	Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture).	C of A, Form 1, and EDD
X	Other reporting flag as defined in report narrative.	C of A, Form 1, and EDD
**	Laboratory Control Sample recovery outside of acceptance limit.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR INORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C 0f A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
E	The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentrations exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP (6010B/ILMO 3.0) or 100 times the absolute value of the preparation blank's concentration (6020). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.	Form 1, and EDD
*	The qualifier that is used to indicate that the duplicate sample analysis for an analyte is out of control.	Form 1, and EDD
÷	Correlation coefficient the Method of Standard Addition (MSA) is less than 0.095.	Form 2, and EDD
B	The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.	Form 1, and EDD
M	The qualifier is used to indicate that the replicate injection readings of the GFAA sample analysis do not agree within 20% relative standard deviation (RSD) or coefficient of variation (CV).	Form 1, and EDD
N	This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.	Form 1, and EDD
S	The reported value was determined by the Method of Standard Addition (MSA).	Form 1, and EDD
U	The analyte's result was less than the IDL/MDL.	C of A, Form 1, and EDD
W	Post-digestion spike for GFAA analysis is out of control limits (85%-115%), while sample results are less than 50% of the spike absorbance.	EDD, and Form 5, part 2
X	Other reporting flag as defined in report narrative.	Form 1, and EDD
**	This qualifier is used to indicate that the Laboratory Control Sample (LCS) recovery for an analyte is outside of the specified limits.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.
All flags do not apply to QC Summary and Certificate of Analysis packages.

General Engineering Laboratory, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

CHAIN OF CUSTODY RECORD

Page_____ of _____

34005% / 34006%

Client Name/Facility Name: CNC Charleston 7912

Collected by/Company: Tetra Tech NUS Inc.

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	TOC/DOC	TOX/TPH	Chloride, Fluoride, Sulfide	Nitrite/Nitrate	VOCs - Specify Method required	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Californ - specify type			Remarks
44GLMØ5Ø1	11/10/00	1815	X				5			2			3												
44GLMØ3Ø1	11/11/00	0930	X				5			2			3												x PAHs - 8270C
44GLMØ7Ø1	11/11/00	1215	X				5			2			3												x VOAs 826ØB BTEX/EDB/MTBE/Naph
43GLMØ1Ø1	11/11/00	1200	X				5			2			3												~~x Anions - nitrate, sulfate~~
44ELØØ2Ø1	11/11/00	0820					5			2			3												
44XLØØ1Ø2	11/11/00	1020					5			2			3												
44XLØØ1Ø1	11/11/11	1000		X			5			1													3	1	encores
44TBØØ3Ø1							2																		TRIP BLANK

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	11/11/00	1250					

Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:
			[signature]	11/11/00	1050	

White = sample collector Yellow = file Pink = with report

8

SAMPLE RECEIPT REVIEW

Date 11-11-00

Client TETRA TECH

Received by Gustavo Sanda

	SAMPLE REVIEW CRITERIA	YES	NO	N/A	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓			
3	Shipping container temperature(s) checked:	✓			
4	Is temperature documented on Chain of Custody		✓		
5	Was shipping container temperature within specifications (4 +/- 2 C) If no, notify Project Manager	✓			4.9
6	Are any of the samples identified by the client as radioactive?		✓		
	Were the samples screened for radioactivity?	✓			
	Were the screening results <= background? If results are > background inform RSO			✓	
7	Were chain of custody documents completed correctly? (ink, signed, match containers)	✓			
8	Were sample containers received intact and sealed? If no, notify the Project Manager	✓			
9	Were all sample containers properly labeled?	✓			
10	Were correct sample containers received?	✓			
11	Preserved samples checked for pH?			✓	PAH / vial/ok?
12	Were samples preserved correctly? If no, notify Project Manager			✓	
13	Were samples received within holding time? If No, notify Project Manager	✓			
14	Were VOA vials free of headspace?	✓			
15	AFCOC#				
16	SDG#				

PM(A) Review: _____

Date Reviewed: _____

Additional Comments:

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

43GLM0101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005004

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K135

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44EL00201

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005005

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K136

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0301

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005002

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K139

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	0.13	J
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0501

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005001

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K211

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0701

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005003

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K140

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	0.45	J
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	0.31	J
1330-20-7	Xylenes (total)	0.93	J
91-20-3	Naphthalene	1.0	J

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44TB00301

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005007

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K128

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44XL00102

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 34005

Matrix: (soil/water) WATER Lab Sample ID: 34005006

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 2K137

Level: (low/med) LOW Date Received: 11/11/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

CASE NARRATIVE
for
Tetra Tech NUS, Inc.
Charleston Naval Complex
Charleson, SC
SDG# 33906

December 8, 2000

Laboratory Identification:

General Engineering Laboratories, Inc. (GEL)

Mailing Address:

PO Box 30712
Charleston, SC 29417

Express Mail Delivery and Shipping Address:

2040 Savage Rd
Charleston, SC 29414

Telephone Number:

(843) 556-8171

Summary:

Sample receipt

The samples arrived at General Engineering Laboratories, Inc. Charleston, SC on November 09, 2000 for environmental analyses. All sample containers arrived without any visible signs of tampering or breakage. All samples were delivered with chain of custody documentation and signatures.

The following samples were received by the laboratory:

Laboratory Identification	Sample Description
33906001	44GLM0601
33906002	44TB00101

Case Narrative:

Sample analyses were conducted using methodology as outlined in General Engineering Laboratories Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are listed below by analytical parameter.

Internal Chain of Custody:

Custody was maintained for all samples.

Data Package:

The enclosed data package contains the following sections: Case Narrative, Qualifier Flag Definitions, Chain of Custody, Cooler Receipt Checklist, GC/MS Volatile, GC/MS Semivolatile and Inorganic Analysis.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Valerie Davis
Project Manager

fc:tetr33906%

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR ORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
A	The TIC is suspected aldol-condensation product.	C of A, Form 1, and EDD
B	Analyte was detected in the associated method blank as well as in the sample.	C of A, Form 1, and EDD
C	Pesticide analyte has been confirmed by GC/MS.	C of A, Form 1, and EDD
D	Analyte(s) quantified in an analysis performed at a secondary dilution factor.	C of A, Form 1, and EDD
E	Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.	C of A, Form 1, and EDD
J	This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.	C of A, Form 1, and EDD
N	Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.	C of A, Form 1, and EDD
NJ	Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.	C of A, Form 1, and EDD
P	Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.	C of A, EDD, Form 1,
U	Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture).	C of A, Form 1, and EDD
X	Other reporting flag as defined in report narrative.	C of A, Form 1, and EDD
**	Laboratory Control Sample recovery outside of acceptance limit.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR INORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C 0f A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
E	The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentrations exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP (6010B/ILMO 3.0) or 100 times the absolute value of the preparation blank's concentration (6020). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.	Form 1, and EDD
*	The qualifier that is used to indicate that the duplicate sample analysis for an analyte is out of control.	Form 1, and EDD
÷	Correlation coefficient the Method of Standard Addition (MSA) is less than 0.095.	Form 2, and EDD
B	The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.	Form 1, and EDD
M	The qualifier is used to indicate that the replicate injection readings of the GFAA sample analysis do not agree within 20% relative standard deviation (RSD) or coefficient of variation (CV).	Form 1, and EDD
N	This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.	Form 1, and EDD
S	The reported value was determined by the Method of Standard Addition (MSA).	Form 1, and EDD
U	The analyte's result was less than the IDL/MDL.	C of A, Form 1, and EDD
W	Post-digestion spike for GFAA analysis is out of control limits (85%-115%), while sample results are less than 50% of the spike absorbance.	EDD, and Form 5, part 2
X	Other reporting flag as defined in report narrative.	Form 1, and EDD
**	This qualifier is used to indicate that the Laboratory Control Sample (LCS) recovery for an analyte is outside of the specified limits.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.
All flags do not apply to QC Summary and Certificate of Analysis packages.

General Engineering Laboratories, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

CHAIN OF CUSTODY RECORD

Page_____ of _____

33906 1.

Client Name/Facility Name: Tetra Tech NUS Inc.

Collected by/Company: For Charleston Naval Shipyard

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	~~TOC~~ BTEX Meth.	8270 PAH	Chloride, Fluoride, Sulfide	Nitrate/Nitrate	VOC - Specify Method required	LEAD METALS specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type			Remarks
44GLM0601	11900	1410	X				6		3	2				1											
44GLM0601MS	11900	1410	X				6		3	2				1											matrix spike
44GLM06MD	11900	1410	X				6		3	2				1											matrix spike dupl.
44TB00101	11800	1150																							TRIP BLANK

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:

Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:
[signature]	11/9/00	1540	Patricia [signature]	11/9/00	15:40	

White = sample collector Yellow = file Pink = with report

8

SAMPLE RECEIPT REVIEW

Date Nov. 9, 00

Client TETRA

Received by Patricia Doner

	SAMPLE REVIEW CRITERIA	YES	NO	N/A	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓			
3	Shipping container temperature(s) checked:	✓			3.0°C
4	Is temperature documented on Chain of Custody			✓	
5	Was shipping container temperature within specifications (4 +/- 2 C) If no, notify Project Manager	P.D.			
6	Are any of the samples identified by the client as radioactive?	✓		✓	
	Were the samples screened for radioactivity?	✓			
	Were the screening results <= background? If results are > background inform RSO.	✓			
7	Were chain of custody documents completed correctly? (ink, signed, match containers)	✓			
8	Were sample containers received intact and sealed? If no, notify the Project Manager	✓			
9	Were all sample containers properly labeled?	✓			
10	Were correct sample containers received?	✓			
11	Preserved samples checked for pH?	✓			
12	Were samples preserved correctly? If no, notify Project Manager	✓			
13	Were samples received within holding time? If No, notify Project Manager	✓		!	
14	Were VOA vials free of headspace?	✓			
15	ARCOC#	✓			
16	SDG#	✓			

PM(A) Review: _____

Date Reviewed: _____

Additional Comments:

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0601

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33906

Matrix: (soil/water) WATER Lab Sample ID: 33906001

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K130

Level: (low/med) LOW Date Received: 11/09/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44TB00101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33906

Matrix: (soil/water) WATER Lab Sample ID: 33906002

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K121

Level: (low/med) LOW Date Received: 11/09/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

CASE NARRATIVE
for
Tetra Tech NUS, Inc.
Charleston Naval Complex
Charleson, SC
SDG# 33955

December 8, 2000

Laboratory Identification:

General Engineering Laboratories, Inc. (GEL)

Mailing Address:

PO Box 30712
Charleston, SC 29417

Express Mail Delivery and Shipping Address:

2040 Savage Rd
Charleston, SC 29414

Telephone Number:

(843) 556-8171

Summary:

Sample receipt

The samples arrived at General Engineering Laboratories, Inc. Charleston, SC on November 10, 2000 for environmental analyses. All sample containers arrived without any visible signs of tampering or breakage. All samples were delivered with chain of custody documentation and signatures.

The following samples were received by the laboratory:

Laboratory Identification	Sample Description
33995001	44TB00201
33995002	44GLM0201
33995003	44GLM0101
33995004	44GLM0401
33995005	44GLM0101D

Case Narrative:

Sample analyses were conducted using methodology as outlined in General Engineering Laboratories Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are listed below by analytical parameter.

Internal Chain of Custody:

Custody was maintained for all samples.

Data Package:

The enclosed data package contains the following sections: Case Narrative, Qualifier Flag Definitions, Chain of Custody, Cooler Receipt Checklist, GC/MS Volatile, GC/MS Semivolatile and General Chemistry Analysis.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Valerie Davis
Project Manager

fc:tetr33995%

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR ORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
A	The TIC is suspected aldol-condensation product.	C of A, Form 1, and EDD
B	Analyte was detected in the associated method blank as well as in the sample.	C of A, Form 1, and EDD
C	Pesticide analyte has been confirmed by GC/MS.	C of A, Form 1, and EDD
D	Analyte(s) quantified in an analysis performed at a secondary dilution factor.	C of A, Form 1, and EDD
E	Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.	C of A, Form 1, and EDD
J	This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.	C of A, Form 1, and EDD
N	Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.	C of A, Form 1, and EDD
NJ	Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.	C of A, Form 1, and EDD
P	Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.	C of A, EDD, Form 1,
U	Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture).	C of A, Form 1, and EDD
X	Other reporting flag as defined in report narrative.	C of A, Form 1, and EDD
**	Laboratory Control Sample recovery outside of acceptance limit.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR INORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C 0f A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
E	The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentrations exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP (6010B/ILMO 3.0) or 100 times the absolute value of the preparation blank's concentration (6020). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.	Form 1. and EDD
*	The qualifier that is used to indicate that the duplicate sample analysis for an analyte is out of control.	Form 1, and EDD
÷	Correlation coefficient the Method of Standard Addition (MSA) is less than 0.095.	Form 2, and EDD
B	The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.	Form 1, and EDD
M	The qualifier is used to indicate that the replicate injection readings of the GFAA sample analysis do not agree within 20% relative standard deviation (RSD) or coefficient of variation (CV).	Form 1, and EDD
N	This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.	Form 1, and EDD
S	The reported value was determined by the Method of Standard Addition (MSA).	Form 1, and EDD
U	The analyte's result was less than the IDL/MDL.	C of A, Form 1, and EDD
W	Post-digestion spike for GFAA analysis is out of control limits (85%-115%), while sample results are less than 50% of the spike absorbance.	EDD, and Form 5. part 2
X	Other reporting flag as defined in report narrative.	Form 1, and EDD
**	This qualifier is used to indicate that the Laboratory Control Sample (LCS) recovery for an analyte is outside of the specified limits.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a *.
All flags do not apply to QC Summary and Certificate of Analysis packages.

General Engineering Laboratories, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

Page 1 of 1

CHAIN OF CUSTODY RECORD

Client Name/Facility Name: Charleston Naval Complex — job # 7912

Collected by/Company: Tetra Tech NUS, Inc.

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved: 339953

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	pH, conductivity	TOC/DOC	PAH +	Chloride, Fluoride, Sulfide	Nitrite/Nitrate	VOC - Specify Method required	METALS - specify	Pesticide Anions +	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type	Dissolved Methane X		Remarks
44TB0201	11/8/00	1150	X				2						2												TRIP BLANK
44GLM0201	11/10/00	1355	X				9			2			3		1								3		
44GLM0101	11/10/00	1415	X				9			2			3		1								3		* 8260B BTEX/EDB/Naph/MTBE
44GLM0101D	11/10/00	1415	X				5			2			3												x PAHs-8270C
44GLM0401 (4 MSD)	11/10/00	1435	X				9			2			3		1								3		+ Anions - nitrate, sulfate
																									x dissolved methane by RSKOP 147/145

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	11/10/00	1645					

Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:
			[signature]	11/10/00	16:45	

White = sample collector Yellow = file Pink = with report

8

SAMPLE RECEIPT REVIEW

Date Nov. 10, 00

Client T&TB

Received by Patricia Dover

	SAMPLE REVIEW CRITERIA	YES	NO	NA	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓			
3	Shipping container temperature(s) checked:	✓			3.0°c
4	Is temperature documented on Chain of Custody		✓		
5	Was shipping container temperature within specifications (4 +/- 2 C) If no, notify Project Manager	✓			
6	Are any of the samples identified by the client as radioactive?		✓		
	Were the samples screened for radioactivity?	✓			
	Were the screening results <= background? If results are > background inform RSO	✓			
7	Were chain of custody documents completed correctly? (ink, signed, match containers)	✓			
8	Were sample containers received intact and sealed? If no, notify the Project Manager	✓			
9	Were all sample containers properly labeled?	✓			
10	Were correct sample containers received?	✓			
11	Preserved samples checked for pH?			✓	
12	Were samples preserved correctly? If no, notify Project Manager			✓	
13	Were samples received within holding time? If No, notify Project Manager	✓			
14	Were VOA vials free of headspace?	✓			
15	AHCOC#			✓	
16	SDG#		✓		

PM(A) Review:_____

Date Reviewed:_____

Additional Comments:

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995003

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K132

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	0.34	J
71-43-2	Benzene	13.7	
108-88-3	Toluene	0.52	J
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	24.1	
1330-20-7	Xylenes (total)	156	
91-20-3	Naphthalene	116	E

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0101D

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995005

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K207

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	0.14	J
71-43-2	Benzene	7.0	
108-88-3	Toluene	0.30	J
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	12.2	
1330-20-7	Xylenes (total)	89.3	
91-20-3	Naphthalene	66.9	

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0101DL

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995003

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K205

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 2.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	80.0	U
71-43-2	Benzene	11.9	D
108-88-3	Toluene	10.0	U
106-93-4	1,2-Dibromoethane	10.0	U
100-41-4	Ethylbenzene	20.8	D
1330-20-7	Xylenes (total)	147	D
91-20-3	Naphthalene	97.7	D

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0201

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995002

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K131

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	0.16	J
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	0.15	J
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44GLM0401

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995004

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K206

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/21/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	5.4	J
71-43-2	Benzene	12.6	
108-88-3	Toluene	7.0	
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	13.8	
1330-20-7	Xylenes (total)	67.6	
91-20-3	Naphthalene	53.9	

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

44TB00201

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 33995

Matrix: (soil/water) WATER Lab Sample ID: 33995001

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 5K122

Level: (low/med) LOW Date Received: 11/10/00

% Moisture: not dec. _____ Date Analyzed: 11/20/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
1634-04-4	tert-Butyl methyl ether	40.0	U
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
106-93-4	1,2-Dibromoethane	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

CASE NARRATIVE
for
Tetra Tech NUS, Inc.
Naval Weapons Station (NWS)
Charleson, SC
SDG# 30170

September 22, 2000

Laboratory Identification:

General Engineering Laboratories, Inc. (GEL)

Mailing Address:

PO Box 30712
Charleston, SC 29417

Express Mail Delivery and Shipping Address:

2040 Savage Rd
Charleston, SC 29414

Telephone Number:

(843) 556-8171

Summary:

Sample receipt

The samples arrived at General Engineering Laboratories, Inc. Charleston, SC on June 22, 2000, for environmental analyses. All sample containers arrived without any visible signs of tampering or breakage. All samples were delivered with chain of custody documentation and signatures.

The following samples were received by the laboratory:

Laboratory Identification	Sample Description
30170001	43SLB0510
30170002	42SLB1103
30170003	43SLB0110
30170004	43SLB0310
30170005	43SLB0310D
30170006	43SLB0210

30170007	42SLB0203
30170008	42SLB0303
30170009	42SLB0502
30170010	42SLB0602
30170011	42SLB0102
30170012	42SLB1203
30170013	42SLB1203D
30170014	43SLB0402
30170015	43SLB0410
30170016	42IDW00101
30170017	42SLB1603
30170018	42SLB0803
30170019	42SLB0502M

Case Narrative:

Sample analyses were conducted using methodology as outlined in General Engineering Laboratories Standard Operating Procedures. Any technical or administrative problems during analysis, data review, and reduction are listed below by analytical parameter.

Internal Chain of Custody:

Custody was maintained for all samples.

Data Package:

The enclosed data package contains the following sections: Case Narrative, Qualifier Flag Definitions, Chain of Custody, Cooler Receipt Checklist, and GC/MS Volatiles and GC/MS Semivolatile Analysis, DRO, Inorganic Analysis and Geotechnical Analysis.

This data package, to the best of my knowledge, is in compliance with technical and administrative requirements.

Valerie Davis
Project Manager

fc:tetr30170%

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR ORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
A	The TIC is suspected aldol-condensation product.	C of A. Form 1, and EDD
B	Analyte was detected in the associated method blank as well as in the sample.	C of A, Form 1, and EDD
C	Pesticide analyte has been confirmed by GC/MS.	C of A, Form 1, and EDD
D	Analyte(s) quantified in an analysis performed at a secondary dilution factor.	C of A, Form 1, and EDD
E	Identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.	C of A, Form 1, and EDD
J	This flag indicates an estimated value concerning either, (1) estimating a concentration for tentatively identified compounds (TICs), or (2) analyte detected at a level less than the RDL or PQL and greater than or equal to the MDL.	C of A, Form 1, and EDD
N	Presumptive evidence based upon a mass spectral library search to make a tentative identification of the analyte.	C of A, Form 1, and EDD
NJ	Analyte has been tentatively identified and the associated numerical value is estimated based upon 1:1 response factor to the nearest eluting internal standard.	C of A, Form 1, and EDD
P	Pesticide/PCB target analyte that is greater than 25% difference for the detected concentrations between the two GC columns.	C of A, EDD, Form 1,
U	Compound analyzed for but not detected (sample quantitation limit has been adjusted to reflect dilutions and percent moisture).	C of A, Form 1, and EDD
X	Other reporting flag as defined in report narrative.	C of A, Form 1, and EDD
**	Laboratory Control Sample recovery outside of acceptance limit.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.

General Engineering Laboratories, Inc.

DATA QUALIFIERS FOR INORGANIC ANALYSES

Data Qualifiers used on Form 1s or Certificates of Analysis (C Of A) follow the specifications set forth in the technical specifications of the most current CLP Statement of Work and are defined as follows.

Section	Explanation	Location
E	The qualifier that is used when the percent difference between the parent sample and its serial dilution's concentrations exceeds 10%. The sample's concentration must be greater than 50 times the IDL/MDL for ICP (6010B/ILMO 3.0) or 100 times the absolute value of the preparation blank's concentration (6020). However, if analyzing ILMO 4.0 (ICP-MS), the parent sample's concentration must be 20 times the CRDL before the "E" flag is applied.	Form 1, and EDD
*	The qualifier that is used to indicate that the duplicate sample analysis for an analyte is out of control.	Form 1, and EDD
÷	Correlation coefficient the Method of Standard Addition (MSA) is less than 0.095.	Form 2, and EDD
B	The qualifier is used to indicate that the reported result fell above the IDL/MDL but below the CRDL.	Form 1, and EDD
M	The qualifier is used to indicate that the replicate injection readings of the GFAA sample analysis do not agree within 20% relative standard deviation (RSD) or coefficient of variation (CV).	Form 1, and EDD
N	This qualifier is used to indicate that the matrix or pre-digested spike sample recovery for an analyte is not within the specified control limit.	Form 1, and EDD
S	The reported value was determined by the Method of Standard Addition (MSA).	Form 1, and EDD
U	The analyte's result was less than the IDL/MDL.	C of A, Form 1, and EDD
W	Post-digestion spike for GFAA analysis is out of control limits (85%-115%), while sample results are less than 50% of the spike absorbance.	EDD, and Form 5, part 2
X	Other reporting flag as defined in report narrative.	Form 1, and EDD
**	This qualifier is used to indicate that the Laboratory Control Sample (LCS) recovery for an analyte is outside of the specified limits.	QC Summary Report

All surrogate recoveries and acceptance ranges are reported at the bottom of Form 2 or C of A.
Any recoveries falling outside the acceptance range will be flagged with a **.
All flags do not apply to QC Summary and Certificate of Analysis packages.

General Engineering Laboratories, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

Page 1 of 1

CHAIN OF CUSTODY RECORD

Client Name/Facility Name: Charleston Naval Complex

Collected by/Company: Tetra Tech NUS

SAMPLE ANALYSIS REQUIRED (x) - use remarks area to specify specific compounds or methods

Use P or F in the boxes to indicate whether sample was filtered and/or preserved

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	PAH 8310	TOC/BOC	TOX	Chloride, Fluoride, Sulfide	Nitrite/Nitrate	VOC - Specify Method required	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type	TRPH	Grain Size	Remarks
425LB11Ø3	8260Ø	ØØ8Ø		X			1		1																
425LBØ2Ø3		Ø82Ø		X			4	1					3												* Benzene, 8260B BTEX + Naphth.
425LBØ3Ø3		Ø845		X			4	1					3												* PAH 8310 plus 1-methylnaphth. + 2-met
425LBØ5Ø2		Ø9ØØ		X			4	1					3												
425LBØ6Ø2		Ø92Ø		X			4	1					3												
425LBØ1Ø2		Ø935		X			4	1					3												
425LB12Ø3		Ø955		X			4	1					3												
425LB12Ø3D		Ø955		X			4	1					3												very hot!
425LB16Ø3		1Ø2Ø		X			6	1					3										1	1	very hot!
425LBØ8Ø3		1Ø4Ø		X			6	1					3										1	1	very hot!
425LBØ5Ø2M		Ø9ØØ		X			8	2					6												MS MSD
42FLØØ1Ø1		11ØØ		H2O			5	1					3										+	VSO 8/28/00	
42TLØØ1Ø1	8220	Ø855		H2O			3						3												

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:

Relinquished by:	Date:	Time:	Received for lab by:	Date:	Time:	Remarks:
[signature]	8/26/00	1130	[signature]	8/26/00	1130	

White = sample collector Yellow = file Pink = with report

General Engineering Laboratories, Inc.
2040 Savage Road
Charleston, South Carolina 29407
P.O. Box 30712
Charleston, South Carolina 29417
(843) 556-8171

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client Name/Facility Name: Tetra Tech NUS (CNC)

Collected by/Company: Jeff Alexander/Greg Sisco Tetra

SAMPLE ANALYSIS REQUIRED (x): use remarks area to specify specific compounds or methods

Use F or P in the boxes to indicate whether sample was filtered and/or preserved

SAMPLE ID	DATE	TIME	WELL	SOIL	COMP	GRAB	# OF CONTAINERS	Phenol/Acidity PAH	TOC/DOC	TRPH 8015	Chloride, Fluoride, Sulfide	Nitrate/Nitrite	VOC - Specify Method required *	METALS - specify	Pesticide	Herbicide	Total Phenol	Acid Extractables	B/N Extractables	PCB's	Cyanide	Coliform - specify type		Grain size	Remarks
435LB051Ø	82500	123Ø		X			1		1																
435LB011Ø	"	124Ø		X			4	1					3												* envirocs 8260B (methane BTEX + Naphthalene addition
435LB04Ø2	"	1255		X			5	1		1			3												
435LBØ41Ø	"	1255		X			1																	1	
435LBØ31Ø	"	1315		X			4	1					3												
435LBØ31ØD	"	1315		X			4	1					3												
43ELØØ1Ø1	"	143Ø		X			5	1					3												TRPH unpreserved!
43TLØØ1Ø1	82200	0855		X			3						3												ip blanks
421DWØØ1Ø1	82500	145Ø		X			5	1		1			3	1											* Lead 6010B RCRA metals + Hg
435LBØ21Ø	"	1345		X			4	1					3												

Relinquished by:	Date:	Time:	Received by:	Relinquished by:	Date:	Time:	Received by:
[signature]	82500	1600	[signature]				

Relinquished by:	Date:	Time:	Received by lab by:	Date:	Time:	Remarks:
			[signature]	8/25/00	1600	

White = sample collector Yellow = file Pink = with report

9

SAMPLE RECEIPT REVIEW

Client T&NA Received by [illegible] Date 8/26/00

GEL COOLER___ GEL POLY COOLER ✓ CLIENT COOLER___ OTHER___

SAMPLE REVIEW CRITERIA	YES	NO	COMMENTS/QUALIFIERS
1. Were shipping containers received intact and sealed? If no, notify Project Manager	✓		
2. Was the Shipment screened following the radiochemistry survey procedure (EPI SOP S-007)?	✓		
Were the survey results negative? If no, notify Project Manager	✓		
Are any of the samples identified by the client as radioactive? If yes, did client provide RAD activity?		✓	
3. Were chain of custody documents included?	✓		
4. Were chain of custody documents completed correctly? (Ink, signed, match containers)	✓		
5. Were all sample containers properly labeled?	✓		
6. Were correct sample containers received?	✓		
7. Preserved samples checked for pH?	✓		
8. Were samples preserved correctly? If no, list samples & tests	✓		
9. Shipping container temperature checked?	✓		
10. Was shipping container temperature within specifications (4+2 C) If no, notify Project Manager	✓		4.2°
11. Is temperature documented on the Chain of Custody?		✓	
12. Were samples received within holding time? If No, notify Project Manager	✓		
13. Were VOA vials free of headspace?	✓		
14. ARCOC# IF REQUIRED			
15. SDG# IF REQUIRED			

REVIEW [illegible] DATE 8/26/00 (SA - SEALS ATTACHED) NSA - NO SEALS ATTACHED

General Engineering
Soils Testing Laboratory

GRAIN-SIZE ANALYSIS

Sample No. 42SLB1603 Project No. tetr 00400
Boring No. 30170017 Location
Depth
Description of Sample
Tested By C. Sandel Date / /00

(7) (1) Weight of air dried sample 95.73 g, Can no. 48

Hygroscopic Moisture Determination

(2) Can no. 96
(3) Can weight 7.15 g
(4) Weight of can & air-dried soil 27.90 g
(5) Weight of can & oven dried soil 27.35 g

Sieve Analysis of Fine Aggregate

Sieve Size	Weight Retained (g)
No. 10	3.22
No. 20	1.72
No. 40	2.23
No. 60	4.40
No. 100	30.92
No. 200	25.87

Sieve Analysis of Coarse Aggregate

Sieve Size	Weight Retained (g)
3 in.	
2 in.	
1 1/2 in.	
1 in.	
3/4 in.	
3/8 in.	
No. 4	

Date	Time	Elapsed Time, T, min.	Actual Hydrometer Reading	Temperature, °C
8/30/00	1100	0	--	--
	1102	2	1.017	24
	1105	5	1.016	24
	1115	15	1.015	24
	1130	30	1.015	24
	1200	60	1.015	24
	1510	250	1.014	24
8/31/00	1100	1440	1.013	24

General Engineering
Soils Testing Laboratory

GRAIN-SIZE ANALYSIS

Sample No. 42SLB0803 Project No. tetr00400
Boring No. 30170018 Location
Depth
Description of Sample
Tested By C. Sandel Date 8/31/00

(16) (1) Weight of air dried sample 114.99 g, Can no. 36

Hygroscopic Moisture Determination

(2) Can no. 49
(3) Can weight 7.19 g
(4) Weight of can & air-dried soil 36.04 g
(5) Weight of can & oven dried soil 35.11 g

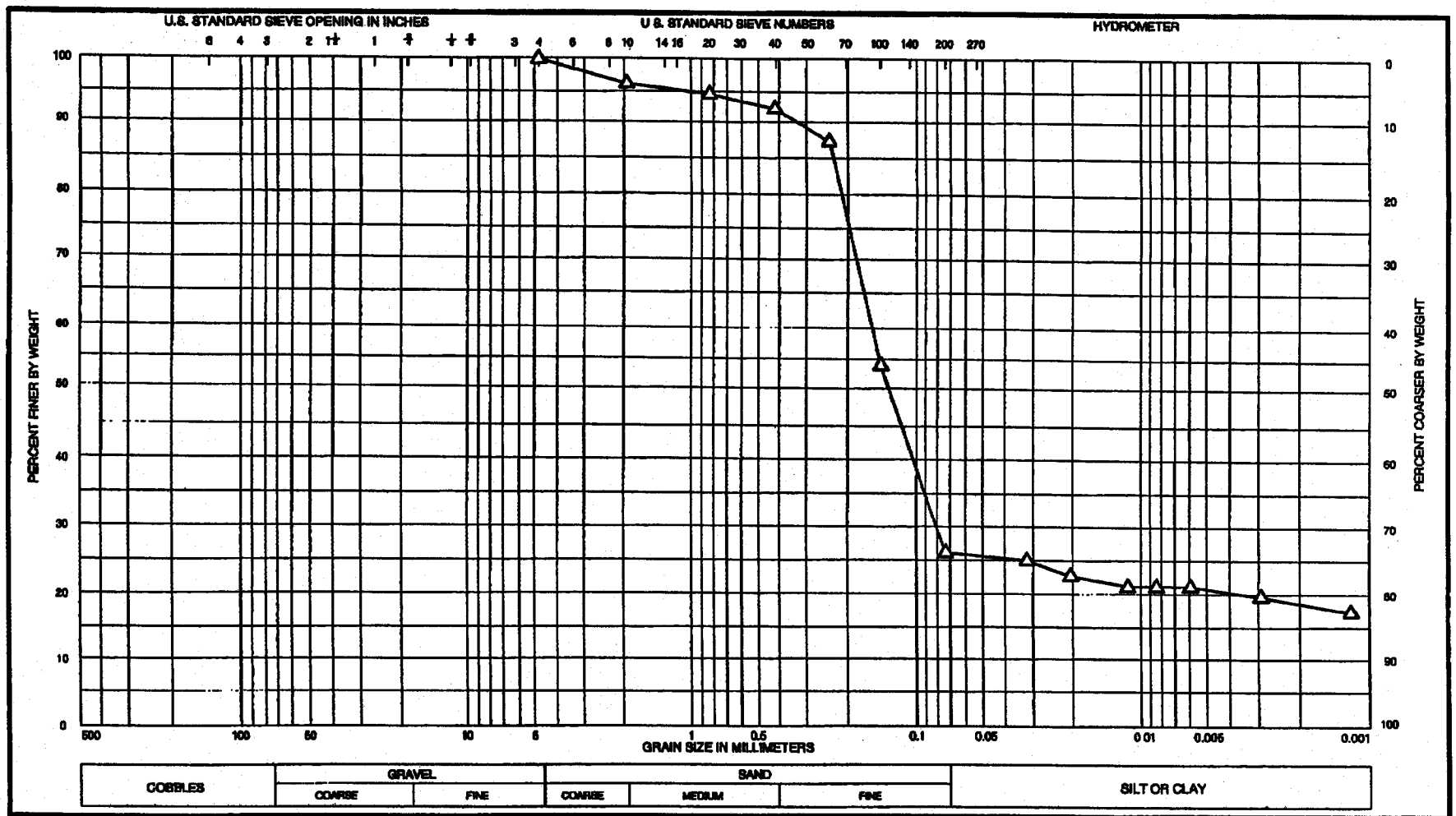
Sieve Analysis of Fine Aggregate

Sieve Size	Weight Retained (g)
No. 10	0.55
No. 20	2.72
No. 40	4.50
No. 60	11.44
No. 100	35.76
No. 200	13.51

Sieve Analysis of Coarse Aggregate

Sieve Size	Weight Retained (g)
3 in.	
2 in.	
1 1/2 in.	
1 in.	
3/4 in.	
3/8 in.	
No. 4	

Date	Time	Elapsed Time, T, min.	Actual Hydrometer Reading	Temperature, °C
8/30/00	1053	0	--	--
	1055	2	1.027	24
	1058	5	1.026	24
	1108	15	1.025	24
	1123	30	1.024	24
	1153	60	1.022	24
	1503	250	1.021	24
8/31/00	1053	1440	1.020	24

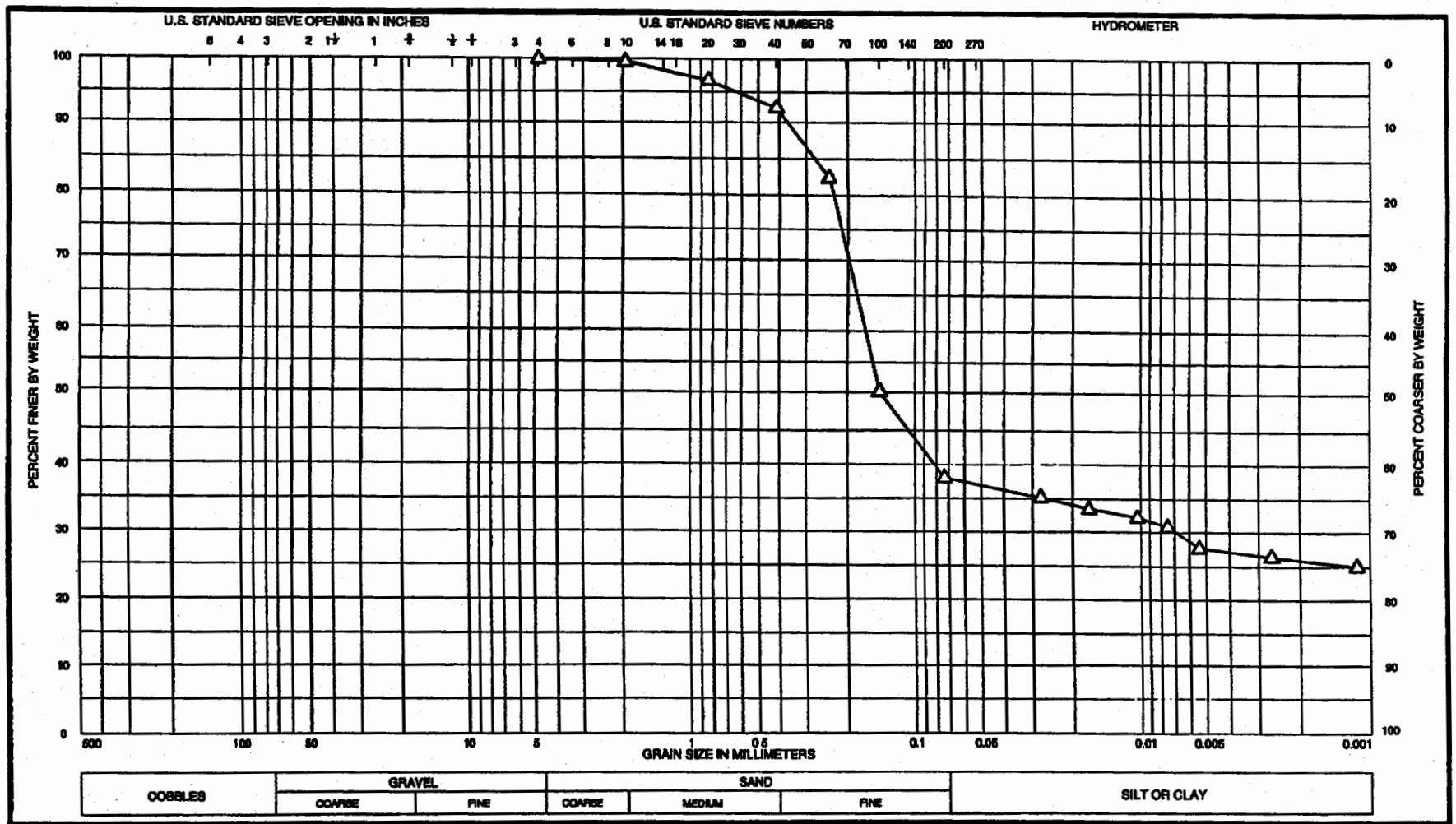


Sample No.	Specific Gravity	Classification	Nat w %	LL %	PL %	PI %
42SLB1603	--	SC	--	--	--	--
		% SAND = 73.6				
		% SILT = 5.4				
		% CLAY = 21.0				

GRADATION CURVES

GENERAL ENGINEERING
A Division of General Engineering Laboratories, Inc.

Project Code: tetr00400
Project Name: Tetratech
CNC Zone C&H UST
Boring No.
Date: September 11, 2000



Sample No.	Specific Gravity	Classification	Nat w %	LL %	PL %	PI %
42SLB0803	--	SC	--	--	--	--
		% SAND = 61.4				
		% SILT = 11.1				
		% CLAY = 27.5				

GRADATION CURVES

GENERAL ENGINEERING
A Division of General Engineering Laboratories, Inc.

Project Code: tetr00400
Project Name: Tetratech
CNC Zone C&H UST
Boring No
Date: September 11, 2000

GEOTECHNICAL SPREADSHEET

Project Number: TETR00400C
Sample Number: 42SLB1603
Boring Number: NA
Location:

Depth:
Tested By: C. Sandel
Date: 9/11/00

HYGROSCOPIC MOISTURE CONTENT DETERMINATION

weight of total air dried sample=	95.73
weight of container + air-dried soil=	27.9
weight of container + oven-dried soil=	27.35
weight of container=	7.15
weight of water=	0.55
weight of oven-dried soil=	20.2
weight of air-dried soil=	20.75
hygroscopic moisture correction factor=	0.97
weight of oven-dried sample for hydro. anal.=	92.86

GRAIN SIZE ANALYSIS

weight of oven-dried sample= 92.86

Sieve #	Weight Ret.	Weight Passed	% Passing
4	0	92.86	100.0
10	3.22	89.64	96.5
20	1.72	87.92	94.7
40	2.23	85.69	92.3
60	4.4	81.29	87.5
100	30.92	50.37	54.2
200	25.87	24.50	26.4
pan	24.5	0.00	0.0

HYDROMETER ANALYSIS

weight	92.86
SG	2.60

TIME	ACTUAL READING	TEMP.	COMPOSITE CORRECTION	R	LENGTH	K	DIAMETER	P		
2	1.017	24	0.00275	1.01425	11.8	0.01321	.03208	24.9		
5	1.016	24	0.00275	1.01325	12.1	0.01321	.02052	23.2	2.60	0.01337
15	1.015	24	0.00275	1.01225	12.3	0.01321	.01198	21.4	2.62	0.01329
30	1.015	24	0.00275	1.01225	12.3	0.01321	.00847	21.4	2.65	0.01317
60	1.015	24	0.00275	1.01225	12.3	0.01321	.00599	21.4		
250	1.014	24	0.00275	1.01125	12.6	0.01321	.00296	19.7		
1440	1.013	24	0.00275	1.01025	12.9	0.01321	.00125	17.9		

GEOTECHNICAL SPREADSHEET

Project Number: TETR00400C
Sample Number: 42SLB0803
Boring Number: NA
Location:

Depth:
Tested By: C. Sandal
Date: 9/11/00

HYGROSCOPIC MOISTURE CONTENT DETERMINATION

weight of total air dried sample=	114.99
weight of container + air-dried soil=	36.04
weight of container + oven-dried soil=	35.11
weight of container=	7.19
weight of water=	0.93
weight of oven-dried soil=	27.92
weight of air-dried soil=	28.85
hygroscopic moisture correction factor=	0.97
weight of oven-dried sample for hydro. anal.=	111.54

GRAIN SIZE ANALYSIS

weight of oven-dried sample= 111.54

Sieve #	Weight Ret.	Weight Passed	% Passing
4	0	111.54	100.0
10	0.55	110.99	99.5
20	2.72	108.27	97.1
40	4.5	103.77	93.0
60	11.44	92.33	82.8
100	35.76	56.57	50.7
200	13.51	43.06	38.6
pan	43.06	0.00	0.0

HYDROMETER ANALYSIS

weight	111.54
SG	2.60

TIME	ACTUAL READING	TEMP.	COMPOSITE CORRECTION	R	LENGTH	K	DIAMETER	P
2	1.027	24	0.00275	1.02425	9.1	0.01321	.02825	35.3
5	1.026	24	0.00275	1.02325	9.4	0.01321	.01812	33.9
15	1.025	24	0.00275	1.02225	9.7	0.01321	.01061	32.4
30	1.024	24	0.00275	1.02125	9.9	0.01321	.00760	31.0
60	1.022	24	0.00275	1.01925	10.5	0.01321	.00552	28.0
250	1.021	24	0.00275	1.01825	10.7	0.01321	.00274	26.6
1440	1.02	24	0.00275	1.01725	11.0	0.01321	.00115	25.1

2.60	0.01337
2.62	0.01329
2.65	0.01317

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42IDW00101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170016

Sample wt/vol: 4.9 (g/mL) G Lab File ID: 1Y522

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 15 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	6.0	U
108-88-3	Toluene	0.37	J
100-41-4	Ethylbenzene	0.30	J
1330-20-7	Xylenes (total)	6.0	U
91-20-3	Naphthalene	3.6	JB

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0102

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170011

Sample wt/vol: 5.6 (g/mL) G Lab File ID: 1Y519

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 20 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	5.6	U
108-88-3	Toluene	5.6	U
100-41-4	Ethylbenzene	5.6	U
1330-20-7	Xylenes (total)	5.6	U
91-20-3	Naphthalene	5.6	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0203

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170007

Sample wt/vol: 5.7 (g/mL) G Lab File ID: 1Y515

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 12 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	5.0	U
108-88-3	Toluene	5.0	U
100-41-4	Ethylbenzene	5.0	U
1330-20-7	Xylenes (total)	5.0	U
91-20-3	Naphthalene	5.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0303

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170008

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Y516

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 13 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	9.1	
108-88-3	Toluene	7.2	
100-41-4	Ethylbenzene	2.6	J
1330-20-7	Xylenes (total)	3.4	J
91-20-3	Naphthalene	5.8	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0502

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170009

Sample wt/vol: 5.2 (g/mL) G Lab File ID: 1Y517

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 11 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	5.4	U
108-88-3	Toluene	5.4	U
100-41-4	Ethylbenzene	5.4	U
1330-20-7	Xylenes (total)	5.4	U
91-20-3	Naphthalene	5.4	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0502M

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170019

Sample wt/vol: 5.1 (g/mL) G Lab File ID: 1Z209

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 10 Date Analyzed: 09/05/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	5.5	U
108-88-3	Toluene	5.5	U
100-41-4	Ethylbenzene	5.5	U
1330-20-7	Xylenes (total)	5.5	U
91-20-3	Naphthalene	5.5	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0602

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170010

Sample wt/vol: 5.2 (g/mL) G Lab File ID: 1Y518

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: not dec. 11 Date Analyzed: 09/01/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	5.4	U
108-88-3	Toluene	5.4	U
100-41-4	Ethylbenzene	5.4	U
1330-20-7	Xylenes (total)	5.4	U
91-20-3	Naphthalene	5.4	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0803

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170018

Sample wt/vol: 4.6 (g/mL) G Lab File ID: 1Z211

Level: (low/med) MED Date Received: 08/25/00

% Moisture: not dec. 15 Date Analyzed: 09/05/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000(uL) Soil Aliquot Volume: 100(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	638	U
108-88-3	Toluene	80.3	J
100-41-4	Ethylbenzene	2050	
1330-20-7	Xylenes (total)	638	U
91-20-3	Naphthalene	4940	

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1203

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170012

Sample wt/vol: 4.7 (g/mL) G Lab File ID: 1Z212

Level: (low/med) MED Date Received: 08/25/00

% Moisture: not dec. 14 Date Analyzed: 09/05/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000(uL) Soil Aliquot Volume: 100(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	615	U
108-88-3	Toluene	94.9	J
100-41-4	Ethylbenzene	730	
1330-20-7	Xylenes (total)	75.3	J
91-20-3	Naphthalene	1880	

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1203D

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170013

Sample wt/vol: 5.6 (g/mL) G Lab File ID: 1Z213

Level: (low/med) MED Date Received: 08/25/00

% Moisture: not dec. 14 Date Analyzed: 09/05/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000(uL) Soil Aliquot Volume: 100(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	521	U
108-88-3	Toluene	89.6	J
100-41-4	Ethylbenzene	1190	
1330-20-7	Xylenes (total)	521	U
91-20-3	Naphthalene	3340	

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1603

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170017

Sample wt/vol: 5.5 (g/mL) G Lab File ID: 1Z214

Level: (low/med) MED Date Received: 08/25/00

% Moisture: not dec. 15 Date Analyzed: 09/05/00

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000(uL) Soil Aliquot Volume: 100(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
71-43-2	Benzene	537	U
108-88-3	Toluene	537	U
100-41-4	Ethylbenzene	165	J
1330-20-7	Xylenes (total)	64.4	J
91-20-3	Naphthalene	863	

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42IDW00101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170016

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L710

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	7860	U
91-57-6	2-Methylnaphthalene	7860	U
90-12-0	1-Methylnaphthalene	7860	U
56-55-3	Benzo(a)anthracene	459	J
218-01-9	Chrysene	627	J
205-99-2	Benzo(b)fluoranthene	478	J
207-08-9	Benzo(k)fluoranthene	474	J
53-70-3	Dibenz(a,h)anthracene	7860	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0102

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170011

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L706

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 20 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 4.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	3320	U
91-57-6	2-Methylnaphthalene	3320	U
90-12-0	1-Methylnaphthalene	3320	U
56-55-3	Benzo(a)anthracene	584	J
218-01-9	Chrysene	590	J
205-99-2	Benzo(b)fluoranthene	672	J
207-08-9	Benzo(k)fluoranthene	515	J
53-70-3	Dibenz(a,h)anthracene	3320	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0203

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170007

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L513

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 12 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/15/00

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	762	U
91-57-6	2-Methylnaphthalene	762	U
90-12-0	1-Methylnaphthalene	762	U
56-55-3	Benzo(a)anthracene	39.4	J
218-01-9	Chrysene	45.6	J
205-99-2	Benzo(b)fluoranthene	52.1	J
207-08-9	Benzo(k)fluoranthene	37.1	J
53-70-3	Dibenz(a,h)anthracene	762	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0303

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170008

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 5M113

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 13 decanted: (Y/N) N Date Extracted:08/30/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/18/00

Injection Volume: 1.0(uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	7700	U
91-57-6	2-Methylnaphthalene	7700	U
90-12-0	1-Methylnaphthalene	7700	U
56-55-3	Benzo(a)anthracene	7700	U
218-01-9	Chrysene	7700	U
205-99-2	Benzo(b)fluoranthene	7700	U
207-08-9	Benzo(k)fluoranthene	7700	U
53-70-3	Dibenz(a,h)anthracene	7700	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0502

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170009

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L713

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 11 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	748	U
91-57-6	2-Methylnaphthalene	748	U
90-12-0	1-Methylnaphthalene	748	U
56-55-3	Benzo(a)anthracene	748	U
218-01-9	Chrysene	748	U
205-99-2	Benzo(b)fluoranthene	748	U
207-08-9	Benzo(k)fluoranthene	748	U
53-70-3	Dibenz(a,h)anthracene	748	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0502RE

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170009

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 5M518

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 11 decanted: (Y/N) N Date Extracted: 09/21/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/22/00

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	748	U
91-57-6	2-Methylnaphthalene	748	U
90-12-0	1-Methylnaphthalene	748	U
56-55-3	Benzo(a)anthracene	748	U
218-01-9	Chrysene	748	U
205-99-2	Benzo(b)fluoranthene	748	U
207-08-9	Benzo(k)fluoranthene	748	U
53-70-3	Dibenz(a,h)anthracene	748	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0502M

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170019

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L508

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 10 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/15/00

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	744	U
91-57-6	2-Methylnaphthalene	744	U
90-12-0	1-Methylnaphthalene	744	U
56-55-3	Benzo(a)anthracene	744	U
218-01-9	Chrysene	744	U
205-99-2	Benzo(b)fluoranthene	744	U
207-08-9	Benzo(k)fluoranthene	744	U
53-70-3	Dibenz(a,h)anthracene	744	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0602

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170010

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L705

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 11 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 4.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	2990	U
91-57-6	2-Methylnaphthalene	2990	U
90-12-0	1-Methylnaphthalene	2990	U
56-55-3	Benzo(a)anthracene	2990	U
218-01-9	Chrysene	2990	U
205-99-2	Benzo(b)fluoranthene	2990	U
207-08-9	Benzo(k)fluoranthene	2990	U
53-70-3	Dibenz(a,h)anthracene	2990	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB0803

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170018

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L712

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 400.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	27000	J
91-57-6	2-Methylnaphthalene	132000	J
90-12-0	1-Methylnaphthalene	84100	J
56-55-3	Benzo(a)anthracene	313000	U
218-01-9	Chrysene	313000	U
205-99-2	Benzo(b)fluoranthene	313000	U
207-08-9	Benzo(k)fluoranthene	313000	U
53-70-3	Dibenz(a,h)anthracene	313000	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1203

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170012

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L707

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 14 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	5730	J
91-57-6	2-Methylnaphthalene	28200	J
90-12-0	1-Methylnaphthalene	22600	J
56-55-3	Benzo(a)anthracene	77100	U
218-01-9	Chrysene	77100	U
205-99-2	Benzo(b)fluoranthene	77100	U
207-08-9	Benzo(k)fluoranthene	77100	U
53-70-3	Dibenz(a,h)anthracene	77100	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1203D

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170013

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L708

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 14 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	3110	J
91-57-6	2-Methylnaphthalene	15500	J
90-12-0	1-Methylnaphthalene	13700	J
56-55-3	Benzo(a)anthracene	77800	U
218-01-9	Chrysene	77800	U
205-99-2	Benzo(b)fluoranthene	77800	U
207-08-9	Benzo(k)fluoranthene	77800	U
53-70-3	Dibenz(a,h)anthracene	77800	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

42SLB1603

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170017

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 2L711

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted: 08/30/00

Concentrated Extract Volume: 1.00 (mL) Date Analyzed: 09/17/00

Injection Volume: 1.0 (uL) Dilution Factor: 40.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
91-20-3	Naphthalene	1020	J
91-57-6	2-Methylnaphthalene	875	J
90-12-0	1-Methylnaphthalene	886	J
56-55-3	Benzo(a)anthracene	31500	U
218-01-9	Chrysene	31500	U
205-99-2	Benzo(b)fluoranthene	31500	U
207-08-9	Benzo(k)fluoranthene	31500	U
53-70-3	Dibenz(a,h)anthracene	31500	U

FORM 1 Tetra Tech NUS, Inc.25-AUG-2000 00

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

42IDW00101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170016

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 007F0701

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted:09/07/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/11/00

Injection Volume: 1.0(uL) Dilution Factor: 100.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) MG/KG	Q
	----------Diesel Range Organics_____	299	B

FORM I SV

FORM 1 Tetra Tech NUS, Inc.25-AUG-2000 00

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

42SLB1603

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170017

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 008F0801

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted:09/07/00

Concentrated Extract Volume: 1.00(mL) Date Analyzed: 09/11/00

Injection Volume: 1.0(uL) Dilution Factor: 50.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) MG/KG	Q
	----------Diesel Range Organics_____	168	B

FORM I SV

FORM 1 Tetra Tech NUS, Inc.25-AUG-2000 00
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

42SLB0803

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 30170

Matrix: (soil/water) SOIL Lab Sample ID: 30170018

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 009F0901

Level: (low/med) LOW Date Received: 08/25/00

% Moisture: 15 decanted: (Y/N) N Date Extracted:09/07/00

Concentrated Extract Volume: 3.00(mL) Date Analyzed: 09/11/00

Injection Volume: 1.0(uL) Dilution Factor: 1000.0

GPC Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) MG/KG	Q
	----------Diesel Range Organics_____	8180	B

FORM I SV

TOTAL METALS
-1-
INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 30170 Method Type: SW-846

Sample ID: 30170016 Client ID: 42IDW00101

Contract: TETR00400 Lab Code: GEL Case No.: GEL SAS No.:

Matrix: SOIL Date Received: 8/25/2000 Level: LOW % Solids: 84.80

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-38-2	Arsenic	4.26	mg/kg			P	0.25	TJA61 Trace ICP1	90400
7440-39-3	Barium	21.9	mg/kg			P	0.05	TJA61 Trace ICP1	90400
7440-43-9	Cadmium	0.08	mg/kg	U		P	0.08	TJA61 Trace ICP1	90400
7440-47-3	Chromium	12.6	mg/kg			P	0.10	TJA61 Trace ICP1	90400
7439-92-1	Lead	24.4	mg/kg		N*	P	0.16	TJA61 Trace ICP1	90400
7439-97-6	Mercury	0.043	mg/kg			AV	0.002	PE CVAA	83100spHg
7782-49-2	Selenium	0.43	mg/kg	U		P	0.43	TJA61 Trace ICP1	90400
7440-22-4	Silver	0.11	mg/kg	U		P	0.11	TJA61 Trace ICP1	90400

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts:

Comments:

Certificate of Analysis

Company : Tetra Tech NUS, Inc.
Address : 661 Andersen Dr.
Pittsburgh, PA 15220

Report Date: September 20, 2000

Contact: Lee Leck
Project: CTO 68 & 93 - CNC Zone C and H UST

Client Sample ID: 42SLB1103
Sample ID: 30170002
Matrix: Soil
Collect Date: 26-AUG-00
Receive Date: 25-AUG-00
Collector: Client

Project: TETR00400
Client ID: TETR006

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
TOC Analysis Federal											
SW 9060 Total Organic Carbon											
Total Organic Carbon		1650	47.2	100	mg/kg	1	LS	08/30/00	1401	42242	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
SW846 9060 Mod	SW846-9060 Modified Total Organic Carbon	MS1	08/29/00	1645	42137

The following Analytical Methods were performed

Method	Description
1	SW846-9060 Modified

Notes:
The Qualifiers in this report are defined as follows :

* Indicates that a quality control analyte recovery is outside of specified acceptance criteria.
** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Valerie Davis at 843-556-8171 Ext. 4485.

Reviewed by

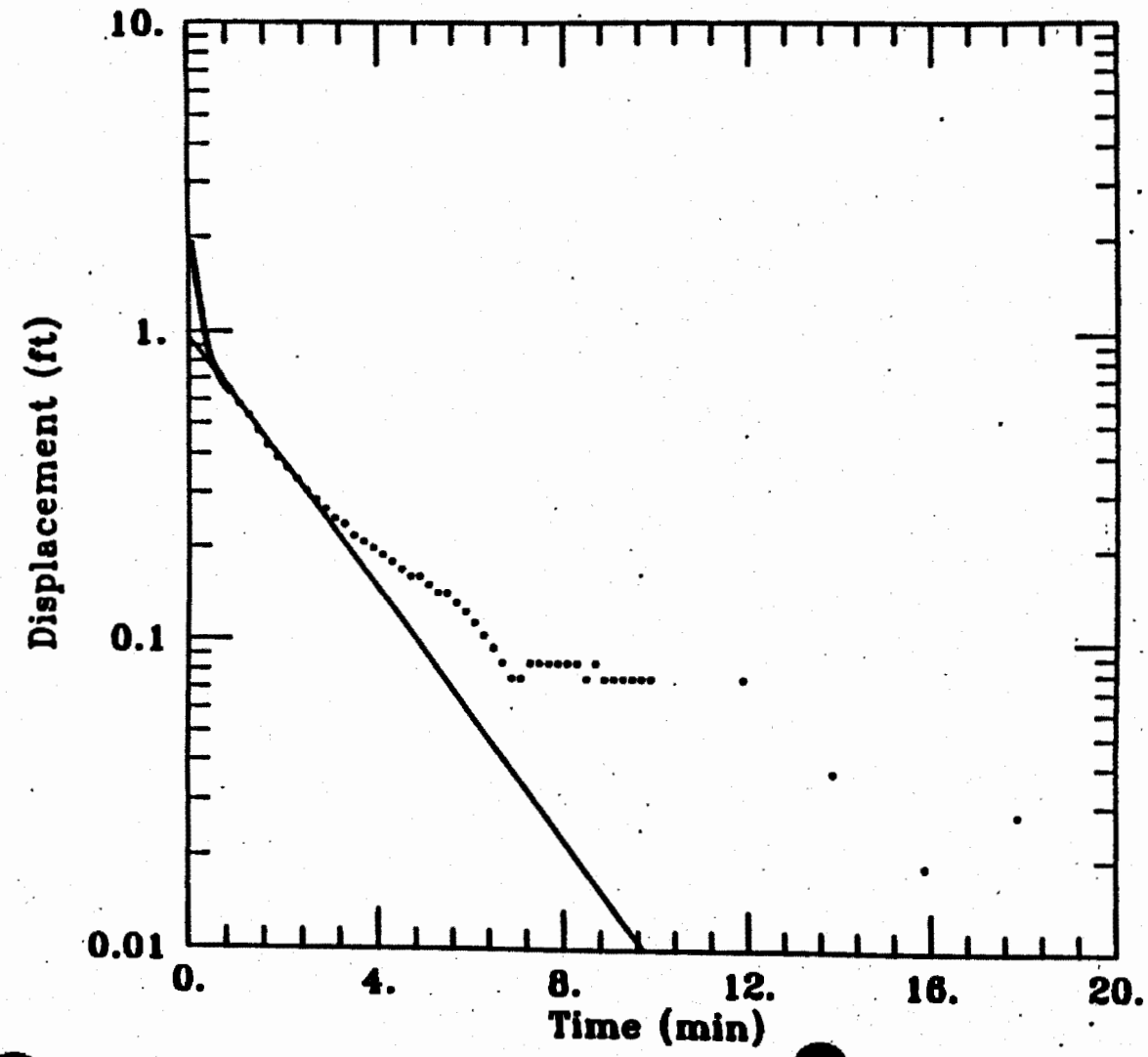
APPENDIX E

AQUIFER CHARACTERIZATION GRAPHS

Client: CLEAN | Company: E/A&H

Location: NAS CHARLESTON | Project: 2908-08450

NBCH653001 Rising Head Slug Test



DATA SET:
65301RIS.AQT
01/16/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATA:
H0 = 3. ft
rc = 0.08333 ft
rw = 0.333 ft
L = 10. ft
b = 12. ft
H = 10.5 ft

PARAMETER ESTIMATES:
K = 0.0003881 ft/min
y0 = 0.9621 ft

AQTESOLV

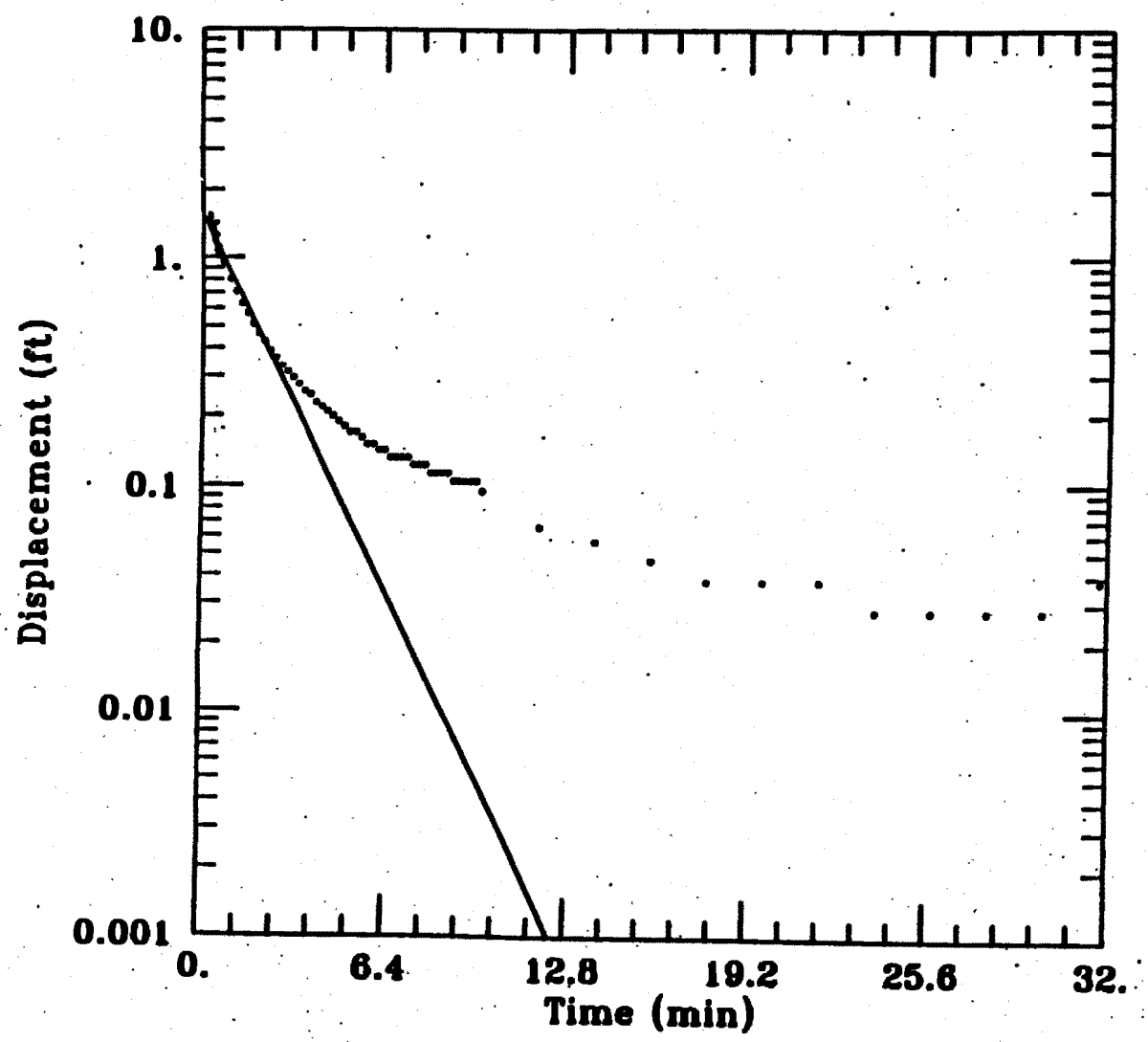
Client: CLEAN

Company: E/A&H

Location: NAS CHARLESTON

Project: 2908-08450

NBCH653001 Falling Head Slug Test



DATA SET:
65301FAL.AQT
01/12/95

AQUIFER MODEL:
Unconfined

SOLUTION METHOD:
Bouwer-Rice

TEST DATA:
H0 = 3. ft
rc = 0.08333 ft
rw = 0.333 ft
L = 10. ft
b = 12. ft
H = 10.5 ft

PARAMETER ESTIMATES:
K = 0.0004942 ft/min
y0 = 1.547 ft

AQTESOLV

APPENDIX F

RBCA CALCULATIONS

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

HYDROCARBON CONSTITUENT CONCENTRATIONS IN WATER BASED ON RAOULT'S LAW

Parameter Descriptions:	Units
C_W = Aqueous Solubility of Organic Constituents Dissolved from Product	mg/L
C_F = Concentration of the Constituent in the Fuel Oil	mg/L
K_{FW} = Fuel/Water Partition Coefficient	
P_F = Density of Fuel Oil	g/mL
MW_F = Molecular Weight of Fuel Oil	g/mol
C_{SAT} = Aqueous Solubility of the Pure Phase Constituent	mol/L
MW_C = Molecular Weight of the Constituent	g/mol
$K_{FW} = (10^3(mL/L)\ p_F)/(MW_F{*}C_{SAT}/(1000{*}MW_C))$	
$C_W = C_F/K_{FW}$	mg/L

Source: "Solubility, Sorption, and Transport of Hydrophobic Organic Chemicals in Complex Mixtures," EPA Environmental Research Brief, EPA/600/M-91/009, Robert S. Kerr Environmental Research Laboratory, ADA, Oklahoma.
Source: "CONCAWE 1996 Diesel Fuel/Kerosene" Conoco, Inc., Houston Texas

Key Assumptions:	
MW_F: Molecular Weight of Kerosene, Source: "CONCAWE 1996 Diesel Fuel/Kerosene" Conoco Inc., Houston Texas.	170 g/mol
P_F: Density of the Product, Source: Conoco Material Safety Data Sheet for Diesel fuel/ Kerosene	0.88 g/mL

Concentration of Chemical Constituents in Water Based on Molar Solubility

Constituent	MW_F g/mol	C_{SAT} mg/L	MW_C g/mol	P_F g/mL	K_{FW}	C_F mg/L	C_W mg/L
Benzene	170.00	1,750	78	0.88	230.72	72.16	0.313
Toluene	170.00	535	92	0.88	890.16	4,136.00	4.646
Ethylbenzene	170.00	152	106	0.88	3609.91	378.40	0.105
Xylene	170.00	198	106	0.88	2771.24	2,200.00	0.794
Napthalene	170.00	40	128.16	0.88	16585.41	387,200.00	23.346

Prepared By: _____ Reviewed By: _____

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

DOMENICO'S DILUTION/ATTENUATION EQUATION FOR GROUNDWATER TRANSPORT

Predicted 10-year Migration of Constituents in Groundwater

Parameter Descriptions:	Units
POE = Point of Exposure	
SSTL = Site-Specific Target Level	mg/L
$SSTL_{SOURCE}$ = Hydrocarbon Concentration in Plume Source Area protective of RBSLs at POE	mg/L
$SSTL_{COMP}$ = Hydrocarbon Concentration at Compliance Point protective of RBSLs at POE	mg/L
X_{POE} = x = Distance from Plume Source to POE (along Centerline)	m
X_{COMP} = x = Distance from POE to Compliance Point (along Centerline)	m
Y = Source Width (Perpendicular to Flow Direction)	m
Z = Source Depth (Perpendicular to Flow Direction in Vertical Plane)	m
K_s = Saturated Hydraulic Conductivity	m/sec
I = Groundwater Gradient	cm/cm
θ = Porosity in Saturated Zone	cm^3/cm^3

Parameter Descriptions:	Units
ρ_s = Soil Bulk Density	g/cm^3
f_{OC} = Fraction Organic Carbon in Soil	g-C/g-soil
α_X = Longitudinal Dispersivity = x/10	m
α_Y = Transverse Dispersivity = $\alpha_X/3$	m
α_Z = Vertical Dispersivity = $\alpha_X/20$	m
k_{OC} = Organic Carbon Partition Coefficient	cm^3-H_2O/g-C
k_D = Soil-Water Sorption Coefficient	cm^3-H_2O/g-soil
V = Pore Water Velocity	m/sec
R_C = Constituent Retardation Factor	
V/R_C = Maximum Transport Rate of Dissolved Constituent = $(K_sI)/(\theta R_C)$	m/sec
RBSL = Risk-Based Screening Level in Water Provided by SCDHEC (1998)	mg/L

Dilution & Attenuation without Biological Decay

Constituent	X_{POE} ft	X_{POE} m	Y m	Z m	t sec	K_s m/sec	I m/m	θ cm^3/cm^3	ρ_s g/cm^3	α_X m	α_Y m	α_Z m	f_{OC} g-C/g-soil	k_{OC} cm^3-H_2O/g-C	k_D cm^3-H_2O/g-soil	V m/sec	R_C	C_{POE}/C_{SOURCE}
Benzene	41	12.49695	7.62	0.91	3.15E+08	2.20E-06	0.0026	0.1	1.6	1.25	0.42	0.06	1.65E-03	81	0.13365	5.72E-08	3.138	1.524E-02
Toluene	18	5.486467	7.62	0.91	3.15E+08	2.20E-06	0.0026	0.1	1.6	0.55	0.18	0.03	1.65E-03	133	0.21945	5.72E-08	4.511	2.140E-01
Ethylbenzene	1	0.304804	7.62	0.91	3.15E+08	2.20E-06	0.0026	0.1	1.6	0.03	0.01	0.00	1.65E-03	176	0.2904	5.72E-08	5.646	1.000E+00
Xylenes	1	0.304804	7.62	0.91	3.15E+08	2.20E-06	0.0026	0.1	1.6	0.03	0.01	0.00	1.65E-03	639	1.05435	5.72E-08	17.870	9.977E-01
Naphthalene	6	1.828822	7.62	0.91	3.15E+08	2.20E-06	0.0026	0.1	1.6	0.18	0.06	0.01	1.65E-03	1543	2.54595	5.72E-08	41.735	2.219E-04

Source: South Carolina Department of Health and Environmental Control (SCDHEC) 1998. *Risk-Based Corrective Action for Petroleum Releases*, Bureau of Underground Storage Tank Management.

DOMENICO DILUTION/ATTENUATION MODEL WITHOUT BIOLOGICAL DECAY

$$\frac{C_X}{C_{SOURCE}} = \frac{1}{2} erfc\left[\frac{\left(x - \frac{vt}{R_c}\right)}{2\sqrt{\alpha_X \frac{vt}{R_c}}}\right] \times erf\left[\frac{Y}{4\sqrt{\alpha_Y x}}\right] \times erf\left[\frac{Z}{2\sqrt{\alpha_Z x}}\right]$$

Constituent	C_{SOURCE} mg/L	C_X mg/L	C_{RBSL} mg/L
Benzene	0.313	0.005	0.005
Toluene	4.646	0.994	1.000
Ethylbenzene	0.105	0.105	0.700
Xylenes	0.794	0.792	10.000
Naphthalene	23.346	0.005	0.010

Prepared By: _____ Reviewed By: _____

SITE 44, BUILDNG NS69/ AST 601
ZONE H, CHARLESTON NAVAL COMPLEX
NORTH CHARLESTON, SOUTH CAROLINA

DOMENICO'S DILUTION/ATTENUATION EQUATION FOR GROUNDWATER TRANSPORT

Predicted 20-year Migration of Constituents in Groundwater

Parameter Descriptions:	Units
POE = Point of Exposure	
SSTL = Site-Specific Target Level	mg/L
$SSTL_{SOURCE}$ = Hydrocarbon Concentration in Plume Source Area protective of RBSLs at POE	mg/L
$SSTL_{COMP}$ = Hydrocarbon Concentration at Compliance Point protective of RBSLs at POE	mg/L
X_{POE} = X = Distance from Plume Source to POE (along Centerline)	m
X_{COMP} = X = Distance from POE to Compliance Point (along Centerline)	m
Y = Source Width (Perpendicular to Flow Direction)	m
Z = Source Depth (Perpendicular to Flow Direction in Vertical Plane)	m
K_s = Saturated Hydraulic Conductivity	m/sec
I = Groundwater Gradient	cm/cm
θ = Porosity in Saturated Zone	cm^3/cm^3

Parameter Descriptions:	Units
ρ_s = Soil Bulk Density	g/cm^3
f_{OC} = Fraction Organic Carbon in Soil	g-C/g-soil
α_X = Longitudinal Dispersivity = x/10	m
α_Y = Transverse Dispersivity = $\alpha_X/3$	m
α_Z = Vertical Dispersivity = $\alpha_X/20$	m
k_{OC} = Organic Carbon Partition Coefficient	cm^3-H_2O/g-C
k_D = Soil-Water Sorption Coefficient	cm^3-H_2O/g-soil
V = Pore Water Velocity	m/sec
R_C = Constituent Retardation Factor	
V/R_C = Maximum Transport Rate of Dissolved Constituent = $(K_sI)/(\theta R_C)$	m/sec
RBSL = Risk-Based Screening Level in Water Provided by SCDHEC (1998)	mg/L

Dilution & Attenuation without Biological Decay

Constituent	X_{POE} ft	X_{POE} m	Y m	Z m	t sec	K_s m/sec	I m/m	θ $:m^3/cm^3$	ρ_s g/cm^3	α_X m	α_Y m	α_Z m	f_{OC} g-C/g-soil	k_{OC} cm^3-H_2O/g-C	k_D cm^3-H_2O/g-soil	V m/sec	R_C	C_{POE}/C_{SOURCE}
Benzene	67	20.42185	7.62	0.91	6.31E+08	2.20E-06	0.0026	0.1	1.6	2.04	0.68	0.10	1.65E-03	81	0.13365	5.72E-08	3.138	1.757E-02
Toluene	31	9.448915	7.62	0.91	6.31E+08	2.20E-06	0.0026	0.1	1.6	0.94	0.31	0.05	1.65E-03	133	0.21945	5.72E-08	4.511	2.076E-01
Ethylbenzene	1	0.304804	7.62	0.91	6.31E+08	2.20E-06	0.0026	0.1	1.6	0.03	0.01	0.00	1.65E-03	176	0.2904	5.72E-08	5.646	1.000E+00
Xylenes	1	0.304804	7.62	0.91	6.31E+08	2.20E-06	0.0026	0.1	1.6	0.03	0.01	0.00	1.65E-03	639	1.05435	5.72E-08	17.870	1.000E+00
Naphthalene	12	3.657644	7.62	0.91	6.31E+08	2.20E-06	0.0026	0.1	1.6	0.37	0.12	0.02	1.65E-03	1543	2.54595	5.72E-08	41.735	2.190E-04

Source: South Carolina Department of Health and Environmental Control (SCDHEC) 1998. *Risk-Based Corrective Action for Petroleum Releases*, Bureau of Underground Storage Tank Management.

DOMENICO DILUTION/ATTENUATION MODEL WITHOUT BIOLOGICAL DECAY

$$\frac{C_X}{C_{SOURCE}} = \frac{1}{2} erfc\left[\frac{\left(x - \frac{vt}{R_c}\right)}{2\sqrt{\alpha_X \frac{vt}{R_c}}}\right] \times erf\left[\frac{Y}{4\sqrt{\alpha_Y x}}\right] \times erf\left[\frac{Z}{2\sqrt{\alpha_Z x}}\right]$$

Constituent	C_{SOURCE} mg/L	C_X mg/L	C_{RBSL} mg/L
Benzene	0.313	0.005	0.005
Toluene	4.646	0.965	1.000
Ethylbenzene	0.105	0.105	0.700
Xylenes	0.794	0.794	10.000
Naphthalene	23.346	0.005	0.010

Prepared By: _____

Reviewed By: _____

APPENDIX F

Soil Volatilization Calculation for Construction Worker:

Parameter Descriptions:	Units
d, Lower depth of surficial soil zone	cm
D^{air}, Diffusion coefficient in air	cm2/s
D^{wat}, Diffusion coefficient in water	cm2/s
f_{OC}, Fraction organic carbon in soil	g/g
H, Henry's law constant	L/L
K_{OC}, Carbon-water sorption coefficient	L/kg
K_s, Soil-water sorption coefficient	L/kg
U_{air}, Wind speed in ambient mixing zone	cm/s
W, Width of source area parallel to flow direction	cm
δ_{air}, Ambient air mixing zone height	cm
θ_{as}, Volumetric air content in vadose zone soils	
θ_T, Total soil porosity	
θ_{ws}, Volumetric water content in vadose zone soils	
ρ_s, Soil bulk density	g/cm3
τ, Averaging time for vapor flux	s
D^{eff}_s, Effective diffusion coefficient in soil	
Vfss Volatilization factor from surficial soils to ambient air (vapors)	(mg/m³-air)/(mg/kg-soil)

Equations:

$$VF_{ss} = \frac{2W\rho_s}{U_{air}\delta_{air}}\sqrt{\frac{D^{eff}{}_s H}{P\left[\theta_{ws} + k_s\rho_s + H\,\theta_{as}\right]}} \bullet 10^3 \frac{cm^3\,kg}{m^3\,g}$$

$$VF_{ss} = \frac{W\rho_s d}{U_{air}\delta_{air}\tau} \bullet 10^3 \frac{cm^3\,kg}{m^3\,g}$$

$D_{EFF-S} = D_{AIR}{}^{eff}(\Phi_{AS}{}^{eff}/\Phi_T{}^2) + D_{WAT}/H^*(\Phi_{WS}{}^{eff}/\Phi_T{}^2)$

Constituent	H	k_{OC}	D^{air}	D^{wat}	f_{OC}	d	k_s	U_{air}	W	δ_{air}	θ_{as}	θ_T	θ_{ws}	ρ_s	τ	D^{eff}_s	VFss
Benzene	0.22	81	0.093	1.1E-05	1.91E-04	213.4	0.015471	225	1500	200	0.26	0.38	0.12	1.45	7.88E+08	7.26E-03	1.31E-05
Toluene	0.26	135	0.085	9.40E-06	1.91E-04	213.4	0.025785	225	1500	200	0.26	0.38	0.12	1.45	7.88E+08	6.63E-03	1.31E-05
Ethylbenzene	0.32	95.5	0.076	8.50E-06	1.91E-04	213.4	0.0182405	225	1500	200	0.26	0.38	0.12	1.45	7.88E+08	5.93E-03	1.31E-05
Xylenes	0.29	240	0.072	8.50E-06	1.91E-04	213.4	0.04584	225	1500	200	0.26	0.38	0.12	1.45	7.88E+08	5.62E-03	1.31E-05
Naphthalene	0.049	1288	0.072	9.40E-06	1.91E-04	213.4	0.246008	225	1500	200	0.26	0.38	0.12	1.45	7.88E+08	5.62E-03	1.31E-05

Source: ASTM (American Society for Testing and Materials), 1996. *Standard Guide for Risk-Based Corrective Action applied at Petroleum Release Sites: E 1739 - 95*[ε1], Annual Book of ASTM Standards, West Conshohocken, PA

Site Specific Target Level Calculations for Soil: Construction Worker Inhalation of Volatiles from Soil

Parameter Descriptions:	Units	Parameter Descriptions:	Units
ABS = Absorption Fraction		ET = Exposure Time	hours/day
AF = Adherence Factor of Soil to Skin	mg/cm^2	FI = Fraction Ingested	
AT = Averaging Time	days	HQ = Hazard Quotient	
BW = Body Weight	kg	IR = Inhalation or Ingestion Rate	m^3/hour or mg/day
CF = Conversion Factor		RBSL = Risk Based Sceening Level	
CSF_D = Dermal Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	RfD_D = Dermal Reference Dose	mg/kg-day
CSF_I = Inhalation Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	RfD_I = Inhalation Reference Dose	mg/kg-day
CSF_O = Oral Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	RfD_O = Oral Reference Dose	mg/kg-day
ED = Exposure Duration	year	SA =Skin Surface Area Available for Contact	cm^2
EF = Exposure Frequency	days/year	VF_{SS} = Volatilization Factor	
ELCR = Excess Lifetime Cancer Risk			

Construction Worker Inhalation of Vapor from Soil (Outdoor)

Constituent	IR	ET	EF	ED	AT	BW
	m^3/hour	hours/day	days/year	years	days	kg
Benzene	0.83	8	90	1	25550	70
Ethylbenzene	0.83	8	90	1	87.6	70
Napthalene	0.83	8	90	1	87.6	70

Constituent	CSF_I	RfD_I	Target ELCR	Target HQ	$RBSL_{AIR}$	VF_{SS}	$RBSL_{SOIL}$
	$(mg/kg\text{-}day)^{-1}$	mg/kg-day			mg/m^3	mg/m^3 / mg/kg	mg/kg
Benzene	0.029	NA	1.0E-06	NA	0.1027874	1.31E-05	7,853
Ethylbenzene	NA	0.29	NA	1.0E+00	2.9757028	1.31E-05	227,339
Napthalene	NA	0.004	NA	1.0E+00	0.04088	1.31E-05	3,123

Source: ASTM (American Society for Testing and Materials), 1997. *Standard Guide for Risk-Based Corrective Action applied at Petroleum Release Sites: E 1739 - 95E1*, Annual Book of ASTM Standards, West Conshohocken, PA

Appendix F

Site Specific Target Level Calculations for Soil: Construction Worker

Parameter Descriptions:	Units
Target ELCR = Target Excess Individual Lifetime Cancer Risk	unitless
Target HQ = Target Hazard Quotient for Individual Constituents	unitless
CSF_O = Oral Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$
RfD_O = Oral Reference Dose	mg/kg-day
CSF_I = Inhalation Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$
RfD_I = Inhalation Reference Dose	mg/kg-day
CSF_D = Dermal Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$
RfD_D = Dermal Reference Dose	mg/kg-day
IR = Inhalation or Ingestion Rate	m^3/day or mg/day
BW = Body Weight	kg
AT = Averaging Time	days
M = Soil to Skin Adherence Factor	mg/cm^2
RAF_O = Oral Relative Absorption Factor	unitless
RAF_d = Dermal Relative Absorption Factor	unitless
EF = Exposure Frequency	days/year
ED = Exposure Duration	years
SA = Skin Surface Area	cm^2/day
Vfss = Volatilization Factor from Surficial Soils to Ambient Air	$(mg/m^3\text{-air})/(mg/kg\text{-soil})$
$RBSL_{SOIL}$ = Risk Based Screening Level (Site Specific Target Level) for Soil	mg/kg

Constituent	Target ELCR	Target HQ	BW	AT	EF	ED	CSFo	CSFI	RfDo	RfDI	IR_{SOIL}	RAF_O	SA	M	RAF_d	IR_{AIR}	VF_{SS}	$SSTL_{SOIL}$
			kg	days	days/year	years	$(mg/kg\text{-}day)^{-1}$	$(mg/kg\text{-}day)^{-1}$	mg/kg-day	mg/kg-day	mg/day		cm^2/day	mg/cm^2		m^3/day	mg/m^3 / mg/kg	mg/kg
Benzo(a)anthracene	1.00E-06	NA	70	25550	90	1	0.73	0.31	NA	NA	100	0.5	4500	0.5	0.5	20	1.31E-05	2.117E+01
Benzo(b)fluoranthene	1.00E-06	NA	70	25550	90	1	0.73	0.31	NA	NA	100	0.5	4500	0.5	0.5	20	1.31E-05	2.117E+01
Benzo(k)fluoranthene	1.00E-06	NA	70	25550	90	1	0.073	0.031	NA	NA	100	0.5	4500	0.5	0.5	20	1.31E-05	2.117E+02
Dibenzo(a,h)anthracene	1.00E-06	NA	70	25550	90	1	7.3	3.1	NA	NA	100	0.5	4500	0.5	0.5	20	1.31E-05	2.117E+00

Source: ASTM (American Society for Testing and Materials), 1996, *Standard Guide for Risk-Based Corrective Action applied at Petroleum Release Sites: E 1739 - 95[ε1]*, Annual Book of ASTM Standards, West Conshohocken, PA

APPENDIX I

Site-Specific Target Levels (SSTLs) Summary

SOIL:

Constituent	RBSL [mg/kg]	Surficial Soil SSTL Construction Worker [mg/kg]	Soil SSTL Soil Leachability [mg/kg]	Overall Soil SSTL [mg/kg]
Benzene	0.006	2.117E+01	5.137E-01	5.137E-01
Toluene	1.722	2.117E+01	7.350E+08	2.117E+01
Ethylbenzene	1.410	2.117E+02	4.574E+04	2.117E+02
Xylene	44.833	2.117E+00	4.052E+05	2.117E+00
Naphthalene	0.218	#REF!	4.080E+07	#REF!