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FINAL
SITE ASSESSMENT REPORT
FOR SITES 6, 48 AND 69

CHARACTERIZATION STUDY TO DETERMINE EXISTENCE AND POSSIBLE MIGRATION OF SPECIFIC CHEMICALS IN SITU

MARINE CORPS BASE
Camp Lejeune, North Carolina

Contract No. N62470-83-C-6106

Prepared for:

NAVAL FACILITIES ENGINEERING COMMAND
Atlantic Division

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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
DPDO	Defense Property Disposal Office
DRMO	Defense Reutilization and Marketing Office
EPA	U.S. Environmental Protection Agency
ESE	Environmental Science and Engineering, Inc.
ft	feet
ft/day	feet per day
ft^2/day	square feet per day
ft BLS	feet below land surface
ft/ft	feet per foot
gal	gallons
GC	gas chromatograph
GC/MS	gas chromatography/mass spectrometry
gpd/ft	gallons per day per foot
gpm	gallons per minute
gpm/ft	gallons per minute per foot
HPIA	Hadnot Point Industrial Area
IAS	Initial Assessment Study
ID	inside diameter
LANTDIV	Naval Facilities Engineering Command, Atlantic Division
MCL	Maximum Contaminant Level

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

MDL	method detection limit
MEK	methylethylketone
mmHg	millimeters of mercury
NCWQS	North Carolina Water Quality Standards
NEESA	Naval Energy and Environmental Support Activity
O&G	oil and grease
OD	outside diameter
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,2-DCE	1,2-dichloroethene
PCB	polychlorinated biphenyl
POL	petroleum, oil, and lubricant
ppb	parts per billion
PVC	polyvinyl chloride
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
TCE	trichloroethene
TCL	Toxic Contaminant List (volatile and semi-volatile compounds, pesticides and metals)
ug/L	microgram per liter
UIC	unquantifiable identified compound
USGS	U.S. Geological Survey
VOC	volatile organic compound

1.0 INTRODUCTION

Marine Corps Base (MCB) Camp Lejeune was listed on the National Priorities List (NPL) of Superfund Sites effective November 4, 1989. On February 13, 1991, the United States Department of the Navy (DON), the United States Environmental Protection Agency (EPA) Region IV, and the North Carolina Department of Environment, Health, and Natural Resources (DEHNR), entered into a Federal Facilities Agreement (FFA). Based on results of an Initial Assessment Study (IAS) (Water and Air Research, 1983), the FFA targeted Storage Lots 201 and 203 (Site 6), the Marine Corps Air Station (MCAS) New River Mercury Dump (Site 48), and the Rifle Range Chemical Dump (Site 69) for further investigation (Site Assessment Studies).

Site Assessment Studies were performed at Sites 6, 48, and 69 by Environmental Science & Engineering, Inc. (ESE) under A&E Contract No. N62470-83-C-6106 with the Naval Facilities Engineering Command - Atlantic Division (LANTDIV). A description of the Site Assessment Studies and their findings are presented in this document.

1.1 PURPOSE OF REPORT

The purpose of this Site Assessment (SA) Report is to present a description of the site assessment investigations performed at Sites 6, 48, and 69, the findings of those investigations, and a preliminary assessment of those findings to identify potential risks to public health and the environment. The Site Assessment Studies are preliminary in nature and are not intended to represent complete remedial investigations.

1.2 SITE BACKGROUNDS LOCATIONS AND DESCRIPTIONS

MCB Camp Lejeune is a training base for the Marine Corps, located in Onslow County, North Carolina (**Figure 1-1**). It covers approximately 170 square miles, and is bounded to the southeast by the Atlantic Ocean, to the west by U.S. 17, and to the northeast by State Road 24. The base is bisected by the New River estuary, which occupies approximately 30 square miles of the total area of the facility.

As a result of Marine operations and activities, wastes that contain hazardous and toxic organic compounds are generated at the base. This has resulted in the storage, disposal, and/or spillage of these wastes around the base. Several of the base's water supply wells have been shut down as a result of the presence of organic compounds, thus suggesting that some of the wastes may have entered the groundwater. **Figure 1-1** shows the locations of Sites 6, 48, and 69 within MCB Camp Lejeune.

Sites 6, 48, and 69 are described in detail below. Information on site histories was obtained from the Initial Assessment Studies performed in 1983 by Water and Air Research.

1.2.1 Site 6 - Storage Lots 201 and 203

Site 6, located just north of the Hadnot Point Industrial Area (HPIA), is comprised of Storage Lots 201 and 203. These lots are situated just east of Holcomb Boulevard, along the Camp Lejeune Railroad, north of Bearhead Creek and south of Wallace Creek.

Figure 1-2 shows Site 6. Lots 201 and 203 are estimated to be approximately 25 and 46 acres in size, respectively. The lot surfaces are relatively flat and unpaved. Surface soils have reportedly been moved around as a result of equipment movement and regrading (Water and Air Research, 1983).

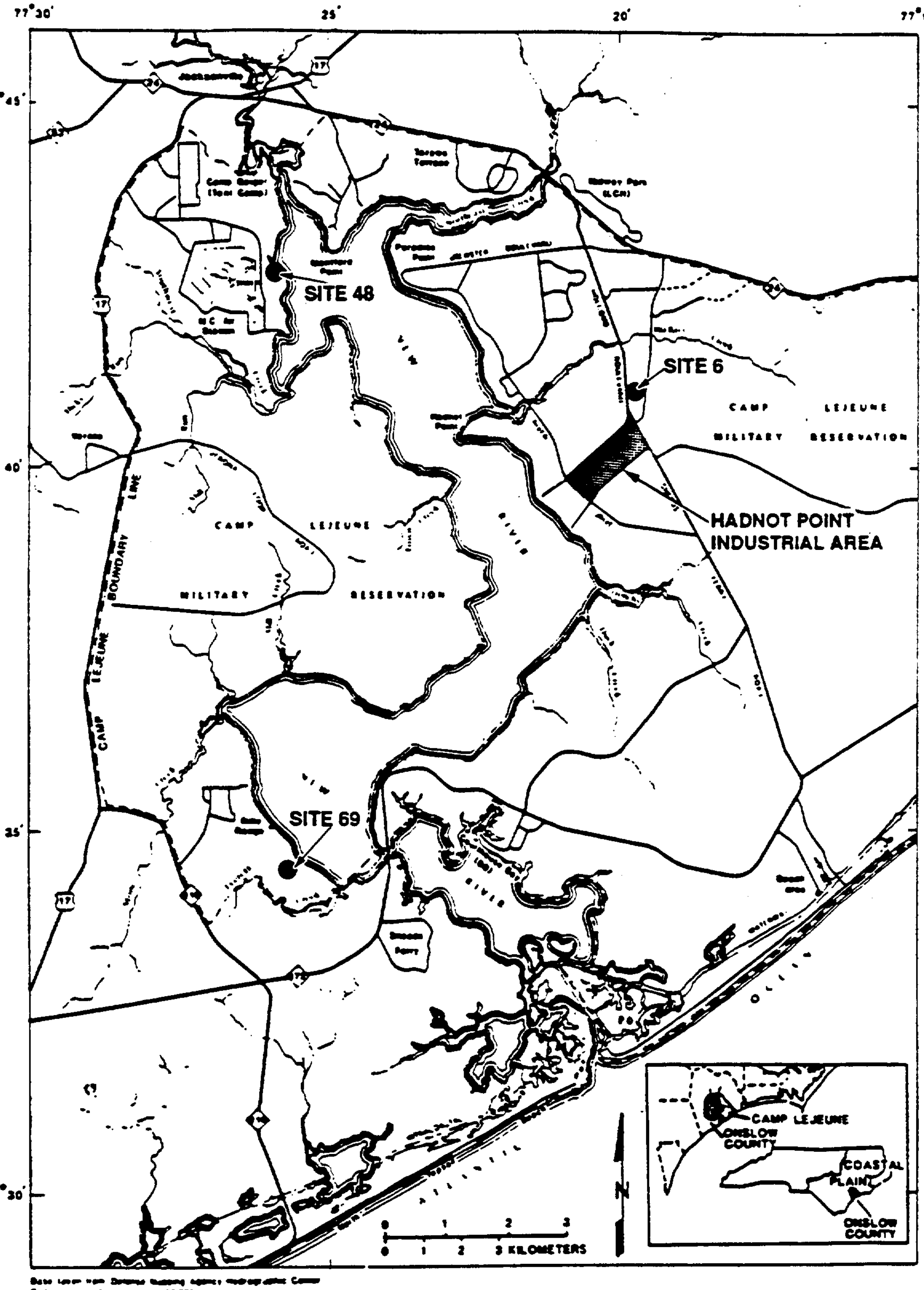

FIGURE 1-1
CAMP LEJEUNE LOCATION
WITH STUDY AREAS 6, 48, AND 69

SOURCE: HARNED *et al.*, 1989.

MARINE CORPS BASE
CAMP LEJEUNE

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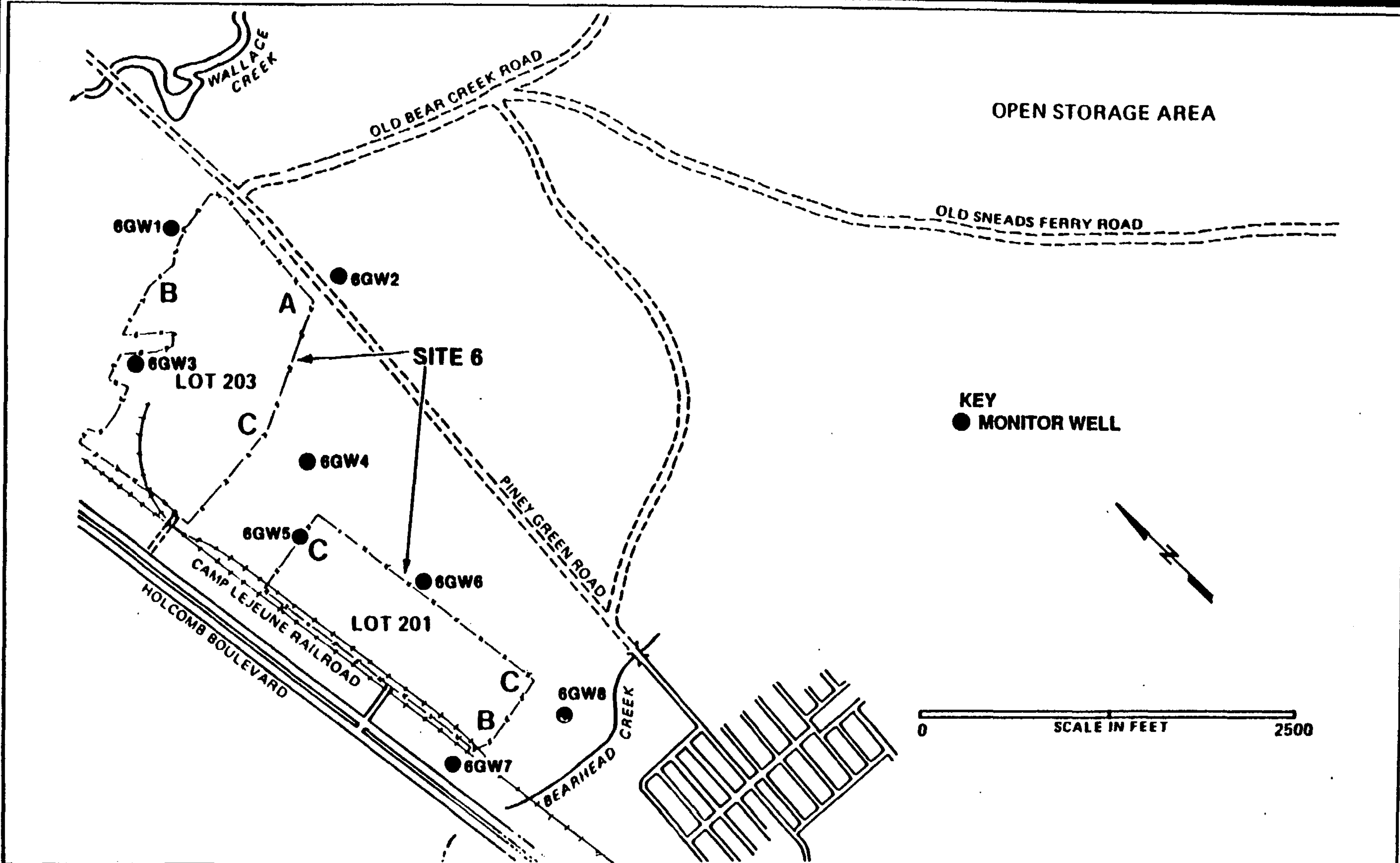

FIGURE 1-2
SITE 6,
STORAGE LOTS 201 AND 203

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

MARINE CORPS BASE
CAMP LEJEUNE

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Lots 201 and 203 have long histories of various uses, including disposal and storage of hazardous materials. Reports from 1983 indicate that hazardous materials were being stored on these lots at that time. DDT was reportedly disposed of in Lot 203 when it served as a waste disposal area in the 1940s. Transformers containing polychlorinated biphenyls (PCBs) were also stored at this site. There have been no reports of spills or leaks pertaining to the transformers, however reports of white powder (suspected DDT) have been noted. Available background information does not give an accurate estimate of the amount of DDT spilled on the site. However, the Initial Assessment Study (Water and Air Research, Inc., 1983) suggests that accumulation of 100 to 200 pounds of DDT may be involved. Likewise, the amount and extent of DDT disposal is not known, but the report suggests quantities of several hundred pounds within an area of an 80 to 100 foot radius (Water and Air Research, Inc. 1983).

1.2.2 Site 48 - MCAS New River Mercury Dump Site

Site 48 is located at the Marine Corps Air Station (MCAS) New River west of the New River estuary on Longstaff Road next to Building 804 (photo lab). **Figure 1-3** shows Site 48.

Available background information indicates that metallic mercury was periodically drained from the delay lines of radar units and disposed of in woods near Building 804. The disposal area is a 100 by 200 foot corridor extending from the rear of Building 804 to the banks of the New River. The quantity of mercury disposed of at the site has been estimated at 1 gallon per year over a 10 year period, totaling more than 1000 pounds. The background information indicates that the mercury was probably hand carried and dumped or buried in small quantities at randomly selected locations (Water and Air Research, Inc., 1983)

RI 6, 48, 69 6/91 LB

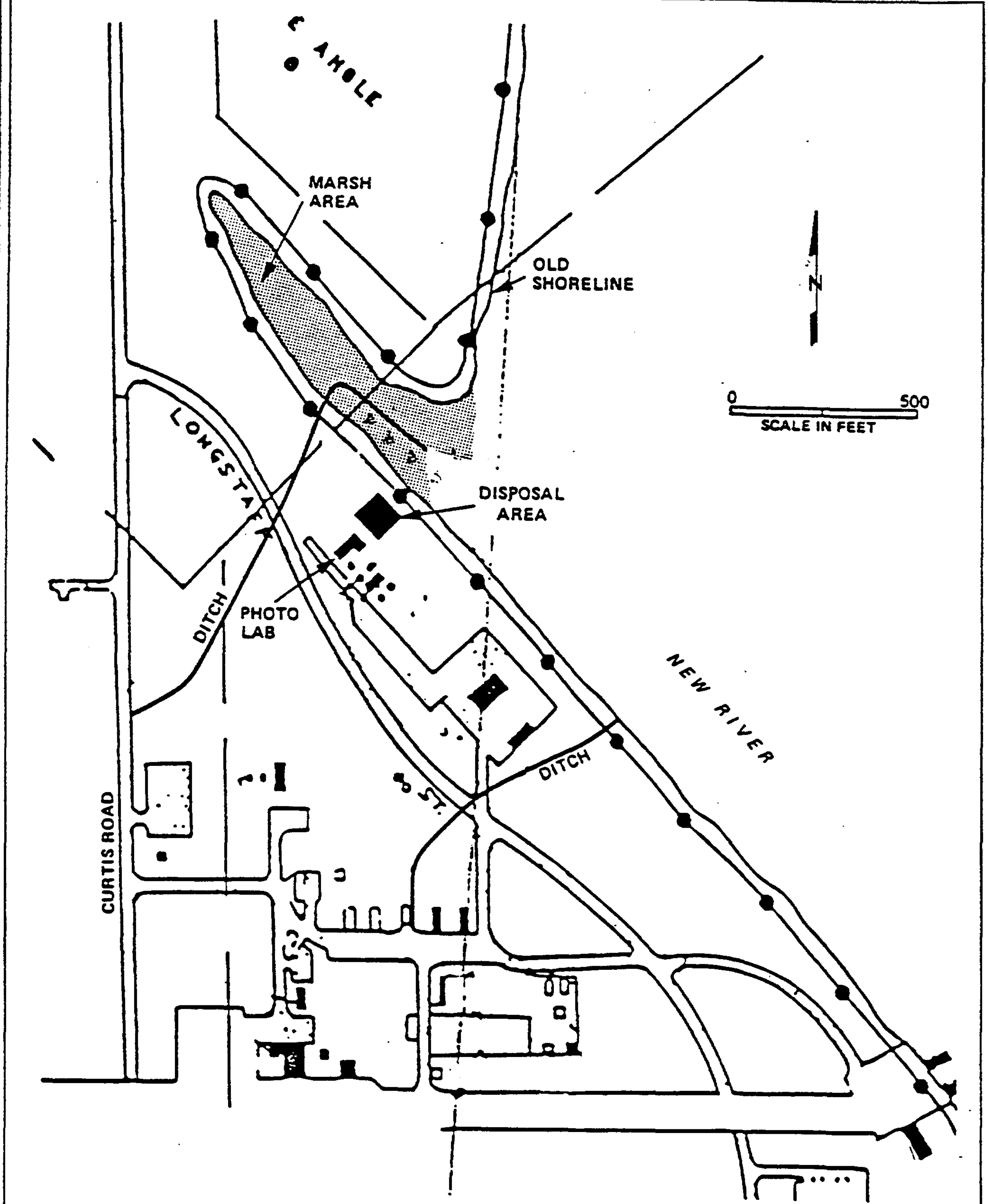

FIGURE 1-3
SITE 48,
MCAS MERCURY DUMP

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

MARINE CORPS BASE
CAMP LEJEUNE

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1.2.3 Site 69 - Rifle Range Chemical Dump

Site 69 is located west of the New River estuary, approximately 9000 feet east of the intersection of Range Road and Sneads Ferry Road, north of Everett Creek. **Figure 1-4** shows Site 69. The site is approximately 6 acres in size and was used as a dump for chemical wastes, including various pesticides, PCBs, and fire retardants from approximately 1950 to 1976. It has been estimated that approximately 93,000 cubic yards of hazardous material may have been disposed of at the site. Reportedly, material was disposed of in pits or trenches from 6 to 20 feet deep. At least 12 dumping incidents have been documented (Water and Air Research, 1983)

Hazardous materials disposed of at Site 69 include pentachlorophenol, DDT, TCE, malathion, diazinon, lindane, gas cylinders, Calcium Hypochlorite (HTH), PCBs, drums of "gas" (probably a training agent containing chloroacetophenone (CN)), chemical agent test kits for chemical warfare, which contain no agent substances, and all other hazardous materials generated or used on base (Water and Air Research,1983).

Two reports of atmospheric emissions at Site 69 were noted in the Initial Assessment Study report. One incident most likely occurred as a result of meteorological conditions. The second incident most likely occurred due to accidental disturbance of the ground surface by grading/disking machinery (Water and Air Research, 1983).

Reportedly, PCBs sealed in cement septic tanks have been buried at Site 69. In addition, both fired and unfired blank rifle cartridges have been found on the site, indicating that troop training exercises may have occurred in this area at one time (Water and Air Research, 1983).

Two disposal incidents at Site 69 have been documented. The first incident occurred in 1953 or 1954. Approximately 50 drums of, what is believed to be, a training agent were, reportedly, delivered to the site on rubber-padded trucks and disposed of in two

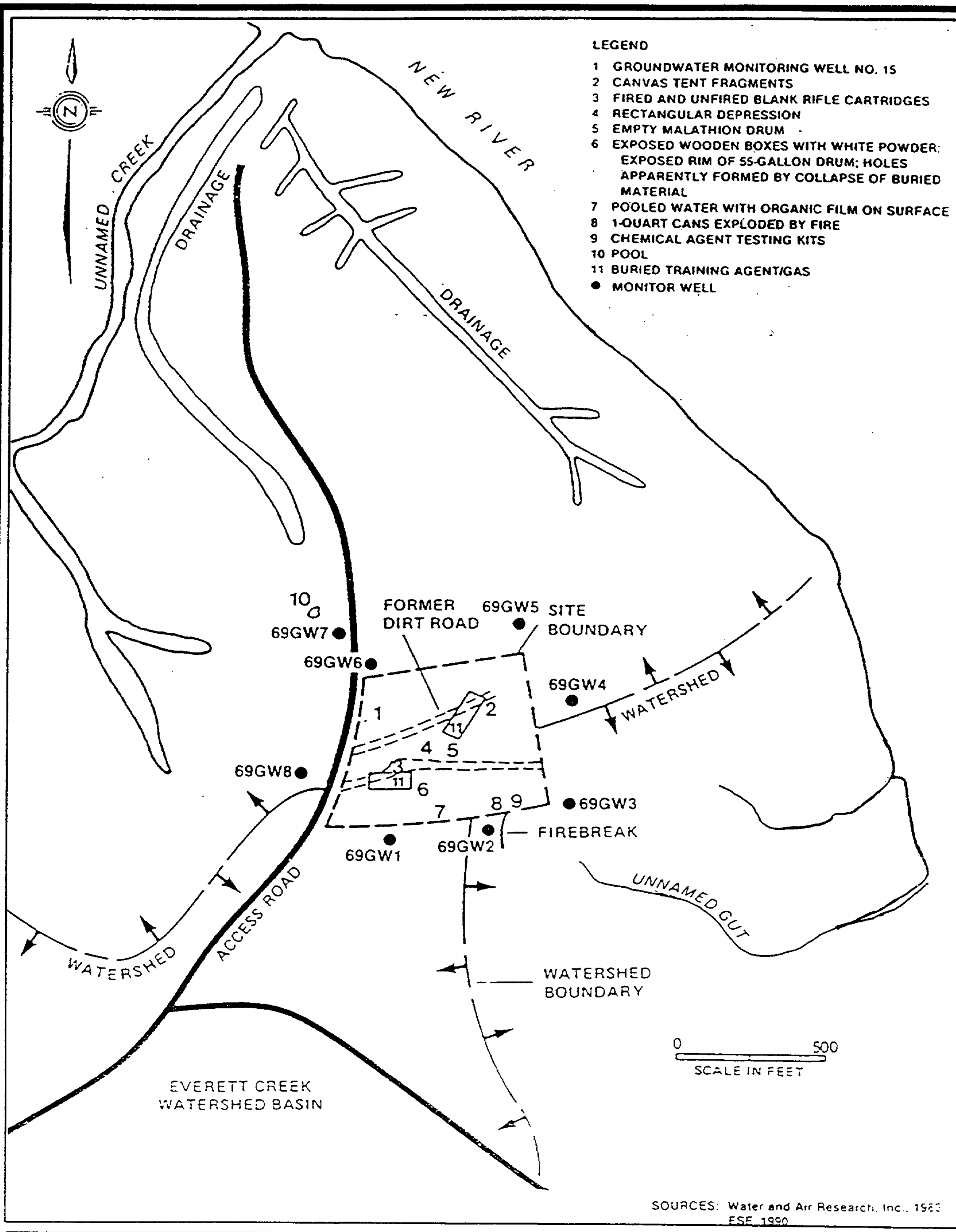

FIGURE 1-4
SITE 69
RIFLE RANGE CHEMICAL DUMP

MARINE CORPS BASE
CAMP LEJEUNE

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trenches. The trenches were approximately 20 feet deep. Drums were placed in the pit one at a time, side by side, and stacked so that the top layer of drums was approximately 5 or 6 feet below ground surface. The drums were light-blue or blue-green in color and unmarked. Workers disposing of the drums reportedly wore canister gas masks and protective clothing. One worker reported itching after working at the site. The second incident, in 1970, involved the burial of 5-gallon cans and 55-gallon drums of DDT, trichloroethylene (TCE), and calcium hypochlorite in a common pit. While covering the containers with earthen material an explosion and fire occurred, blowing drums approximately 40 yards from the pit and starting a forest fire. Some of the base safety personnel responding to the incident wore gas masks (Water and Air Research, 1983).

1.3 RI APPROACH AND SCOPE

The IAS identified the potential for contamination within the shallow groundwater, surface waters and sediments at the 3 sites.

The purpose of this investigation was to verify the nature and extent of contamination within the affected media and to determine if potential risks to human health or the environment may result from this contamination. Data collected during this investigation and previous investigations has been compiled within this SA report. Specific investigative tasks and data collected during these investigations included:

1. Installation of shallow groundwater monitoring wells at sites 6 and 69;

2. Determination of groundwater flow direction and groundwater gradients in the shallow water bearing zones at sites 6 and 69;

3. Collection of groundwater analytical data to characterize the nature and extent of the contamination at sites 6 and 69;

4. Collection of sediment and surface water analytical data to characterize the nature and extent of contamination within the surface drainages at the three sites (sites 6, 48, and 69); and

5. Collection of tissue samples from near sites 48 and 69.

All data collected and compiled within this SA report will be used to determine if additional studies will be required at the 3 sites.

1.4 REPORT ORGANIZATION

This SA report is structured in general accordance with EPA format guidelines (EPA, 1988) for Remedial Investigation Reports. This introduction (**Section 1.0**) presents a brief overview of the scope and structure of the RI Investigation. **Section 2.0** contain a summary of investigations. **Section 3.0** presents the methods and procedures used for conducting the field investigation. Hydrogeologic analysis and physical characteristics of the site are presented in **Section 4.0**. The nature and extent of contamination within the soils and groundwater at HPIA are summarized in **Section 5.0**. A preliminary assessment of risks associated with contamination detected in the latest round of sampling is presented in **Section 6.0**.

2.0 INVESTIGATIONS TO DATE

In response to the passage of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) in 1980, the DON initiated the Navy Assessment and Control of Installation Pollutants (NACIP) program to identify, investigate, and clean up past hazardous waste disposal sites at Navy installations. The NACIP investigations were conducted by the Naval Energy and Environmental Support Activity (NEESA) and consisted of Initial Assessment Studies (IAS), similar to the U.S. EPA's Preliminary Assessments/Site Investigations (PA/SI), and Confirmation Studies, similar to EPA's RI/FS. When the Superfund Amendment's and Reauthorization Act (SARA) was passed in 1986, the DON aborted the NACIP program in favor of the Installation Restoration Program (IRP), which adopted EPA Superfund terminology and procedures.

An IAS was conducted under the NACIP program at MCB Camp Lejeune in 1983. The IAS report (Water and Air Research, 1983) identified a number of areas within MCB Camp Lejeune as potential sources of contamination, including the sites presented in this report. As a result of this study, ESE was contracted by LANTDIV to investigate these potential source areas as per NACIP program protocol.

The initial ESE investigation, referred to as a Confirmation Study, focused on those areas identified in the IAS. The Confirmation Study is divided into two investigation steps: the Verification Step and the Characterization Step. The final investigation completed was a Supplemental Characterization to collect additional data to complete the SA. These investigations are briefly described below.

2.1 VERIFICATION STEP

Site 6 - Lots 201 and 203

During the Verification Step (August 1984), four locations within Storage Lots 201 and 203 were identified as most likely areas of contamination. Five borings were drilled at each of the four locations and composite soil samples were collected from the 0-to-3-foot depth range. The soil samples were analyzed for o,p - and p,p- isomers of DDD, DDE, and DDT.

Site 48 - MCAS New River Mercury Dump Site

In August 1984, five soil samples were collected at the soil-groundwater interface from four soil borings at Site 48. During this same investigation, four sediment samples were collected from the marshy area to the north of Building 804 (photo lab). The soil and sediment samples were analyzed for mercury only.

Site 69 - Rifle Range Chemical Dump

During the period of July-August, 1984, 8 groundwater monitoring wells (69GW1 through 69GW8) were installed and sampled at Site 69. Additionally, 3 surface water samples were collected from 2 locations on the site. The groundwater and surface water samples were analyzed for organochlorine pesticides, PCBs, pentachlorophenol, VOCs, mercury, and residual chlorine.

2.2 CHARACTERIZATION STEP

Site 6 - Lots 201 and 203

In November 1986, 8 shallow monitoring wells were installed at Site 6. Two rounds of groundwater sampling were performed at the site, the first round in November

1986, and the second round in January 1987. The samples collected during both rounds of sampling were analyzed for VOCs and the o,p - and p,p - isomers of DDD, DDE, and DDT.

The investigation also included four surface water and four sediment samples which were collected from upstream and downstream locations in Wallace and Bearhead Creeks. Wallace and Bearhead Creeks border Site 6 to the north and south, respectively. The samples were analyzed for the o,p - and p,p-isomers of DDD, DDE, and DDT, and VOCs. A forested section of land between Wallace Creek and Lot 203 showed apparent signs of past disposal activities as evidenced by small debris piles and depressions on the ground surface. This area was thought to be a potential source of contamination impacting Wallace Creek.

Site 48 - MCAS New River Mercury Dump Site

No activities were conducted at this site during the Characterization Step.

Site 69 - Rifle Range Chemical Dump

During December, 1986 a second round of groundwater samples was collected from 69GW1 through 69GW8. Three surface water samples were collected from three locations on site. Additionally, two sediment samples were collected from two unnamed creeks that drain from the site into the New River estuary. All samples were analyzed for the same target compounds as in the 1984 sampling event, plus tetrachlorodioxin, xylene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and ethylene dibromide.

2.3 SUPPLEMENTAL CHARACTERIZATION INVESTIGATION

Additional field investigations for the site assessments were performed at Sites 6, 48, and 69 from January through February, 1991. These investigations consisted of the following tasks:

Site 6 - Lots 201 and 203

Eight existing shallow monitoring wells (6GW1 through 6GW8) and two water supply wells (WS651, WS653) were scheduled to be sampled at Site 6 during the field investigation to obtain current information on groundwater quality at the site. Monitoring wells 6GW2 through 6GW8 were sampled during the period January 18 through January 19, 1991. Water supply wells WS651 and WS653 were sampled on January 22, 1991. 6GW1 was not sampled during the field investigation because the well was dry. All samples were analyzed for full TCL parameters.

Two surface water and two sediment samples were collected from Wallace Creek during the field investigation. Surface water sample 6SW1 and sediment sample 6SE1, the designated upstream samples, were collected from Wallace Creek at Piney Green Road. Surface water sample 6SW2 and sediment sample 6SE2, the designated downstream samples, were collected from Wallace Creek at Holcomb Boulevard. These samples were collected on January 23, 1991. All samples were analyzed for full TCL parameters.

Site 48 - MCAS New River Mercury Dump

Ten surface water and ten sediment samples were collected from the marsh area and inlet northeast of Building 804 (Photo Lab) at Site 48. One surface water and one sediment sample were also collected in the New River at a background location upstream and outside of the Site 48 marsh area.

The Site 48 sampling area provides limited fisheries habitat due to the shallow depths and lack of internal structure for cover. At the time of sampling, the area was devoid of any submerged aquatic vegetation, however, species of emergent vegetation and algae were present along the shoreline. This vegetation and algae could be used by small fish.

The background sampling location, situated outside and upstream of the channel adjacent to Site 48, was similar to the fisheries habitat of the main sampling area. This area was therefore expected to support similar species that had not had the potential exposure to Site 48 contamination.

Fish tissue sampling was attempted on two separate days (January 14 and 17, 1991), at periods of high and low tide. Two seine hauls were pulled through a small area of the sample site, however, no fish or shellfish were caught.

Site 69 - Rifle Range Chemical Dump

Eight existing shallow monitoring wells (69GW1 through 69GW8) were sampled at Site 69 during this investigation. The monitoring wells were sampled during the period January 14 to January 16, 1991. Monitoring well 69GW1 was resampled on January 24, 1991 because the original sample containers arrived at the laboratory broken. All groundwater samples were analyzed for full TCL parameters.

Seven surface water and seven sediment samples were scheduled to be collected at Site 69 during the field investigation. One sample of each media was scheduled to be collected at each of three locations previously sampled during the Characterization Step (69SW1, 69SW2, and 69SW3). Two samples of each media were to be collected at each of two locations previously sampled during the Characterization Step (69SW4 and 69SW5).

The Characterization Step sample locations 69SW1, 69SW2, and 69SW3 can be described as small-scale depressions in the vicinity of Site 69 which accumulated water during the previous investigations. These "wet areas" are intermittent in nature, and as a result, locations 69SW2 and 69SW3 were not present during the 1991 field investigation. Location 69SW1 was identified during the investigation. One surface water (69SW1) and one sediment sample (69SE1) was collected from this location on January 16, 1991. 69SE1 was resampled for cyanide only on February 21, 1991 due to a missed holding time by the lab.

Characterization Step samples, 69SW4/69SE4 and 69SW5/69SE5 were collected from gullies in the vicinities of Site 69 which contained water during the previous sampling. These gullies were dry during the 1991 investigation and, therefore, could not be sampled. As a means of investigating the impact of drainage through these gullies to the New River estuary, two surface water and sediment samples were collected at the confluences of each gully with the New River Estuary, or just downgradient of these confluences. The average depth is approximately 2 feet in these areas. These samples were collected on January 14, 1991. All surface water and sediment samples were analyzed for full TCL parameters.

Fish tissue sampling at Site 69 was performed in the New River estuary at the confluence of the dry gullies and the estuary. The area was shallow with an average depth of two feet. The bottom substrate was comprised of a silty coarse sand and lacked any submerged vegetation. The near shore area had an abundance of emergent grasses which would provide adequate habitat for juvenile fish. This area probably provides a source of food for fish in the spring and summer months. However, due to the depth, this area probably has limited usefulness as a fisheries habitat.

At the time of sampling, there was no observed fish activity in the sampling area. It was determined that sampling for fish further into the river channel would not provide information useful to determine contaminant uptake in organisms from the study area. The population of shellfish was scattered and concentrated in the near shore area.

Shell fish (oysters and mussels) were collected at each sampling location. Approximately 10 oysters (Clostridius virginica) plus two to three mussels (Geukensia demissa) were composited for each of the four samples (69TI1 through 69TI4). Fish tissue sampling at Site 69 was performed on January 14, 1991.

3.0 SITE INVESTIGATIVE PROCEDURES

Three field investigations have been completed in conjunction with this SA. Sampling activities associated with these investigations have included the collection and analysis of soil samples, shallow groundwater samples, and fish tissue samples. Not all of these activities were conducted at each of the three study areas, nor were all of these activities conducted during each investigation. A description of the investigative procedures is presented in this section.

3.1 SOIL SAMPLING

Soil samples were collected from Sites 6 and 48 during the Verification Step. Samples at Site 6 were composited of soil collected from the surface to a depth of approximately 3-feet at each of the sample locations. Samples at Site 48 were collected at the soil-groundwater interface at each sampling location.

Surface soil samples were collected using a stainless steel scoop. Soil sampling at depth was conducted using a stainless steel, 2-inch diameter bucket auger. Samples were placed into a clean stainless steel bowl and fully homogenized using a stainless steel mixing spoon. Soil samples were placed in pre-labeled laboratory containers which were then placed in ice-filled coolers for shipment to the laboratory.

Soil samples collected from Site 6 were analyzed for the o,p- and p,p-isomers of DDD, DDE, and DDT. Samples collected from Site 48 were analyzed for mercury only.

3.2 GROUNDWATER INVESTIGATION

Groundwater monitoring wells were installed and samples were collected from Sites 6 and 69 to determine if activities at the sites had impacted the groundwater quality in the shallow water bearing zones. This section describes the well installation and sampling techniques associated with these investigations.

3.2.1 Monitor Wells

Groundwater monitor wells were installed at Site 69 during the Verification Step and at Site 6 during the Characterization Step. The locations, depths, and screened intervals of monitor wells were selected to delineate contaminant distribution and the geohydrological environment within the shallow groundwater aquifer. The selection was based on information gathered during previous studies and subsurface conditions observed during drilling. The locations of the groundwater monitoring wells at the two sites is presented in **Figures 1-2** and **1-4**.

Monitoring wells at each site were given a site specific prefix (6GW or 69GW) and were then numbered sequentially within the site.

During all drilling activities at the sites, an ESE site geologist was present at each active drill rig. The geologist was responsible for supervision of borehole drilling, well installation, and supervision of subcontractor personnel. The geologist was familiar with the specific objectives of the investigation as outlined in the Work Plan, and was furnished with a copy of the approved Safety Plan for the investigation, a 10x hand lens, and a weighted tape.

Prior to the commencement of drilling, the following requirements were completed:

1. Personnel scheduled to be involved with the drilling program, including ESE personnel and subcontractors, were safety trained in

accordance with OSHA regulations and informed about onsite safety protocols by the ESE Safety Officer.

2. Permits were obtained for the installation of the wells from the State of North Carolina Department of Natural Resources and Community Development.

3. All drilling equipment, including water tanks, were steam cleaned prior to arrival at each site.

4. All drilling equipment and supplies were stored in a secure area onsite.

Drilling was performed under contract by Soil Testing Services and ATEC and Associates, Inc., and proceeded under the following guidelines:

1. Unchlorinated water for drilling and well installation was obtained from the installation's fire supply lines.

2. Drilling was conducted under the direct supervision of the ESE geologist.

3. Between borings, all downhole drilling equipment, including the weighted steel tape used by the geologist, was cleaned using unchlorinated water from the approved source using a high pressure spray.

4. All safety matters were the responsibility of the site geologist who acted as the on-site safety officer.

5. During drilling of monitor wells, continuous soil samples were collected using split spoon sampler.

6. All drilling sites were arranged to minimize the possibility of material, sediment, or fluids produced during drilling entering the borehole.

7. Drill rigs were carefully leveled at each site prior to drilling and were inspected by the site geologist.

All wells were drilled, logged, and constructed as described in the following sections. Boring logs are presented in **Appendices B** and **C**.

Drilling Techniques

The shallow monitor wells were installed using hollow stem augers. Continuous samples were taken in each well borehole for geological characterization using a split spoon sampler. The wells were completed to a depth of 25 feet.

Borehole Logs and Documentation

Each well was fully described on a boring log as it was being drilled by the site geologist. Data collected in the borehole logs are identified in this section of the report. The following procedures were followed during borehole logging:

1. Depths were recorded in feet and tenths of feet.

2. Soil descriptions were prepared in the field by the ESE geologist following the USCS.

3. Individual soil samples were fully described on the log. The descriptions included:
   a. Classification
   b. USCS symbol
   c. Secondary components and estimated percentages of each
   d. Color
   e. Plasticity
   f. Consistency (for cohesive soils) or density (for noncohesive soils)
   g. Moisture content

4. Numerical, visual estimates were made of secondary soil constituents. Estimates only were used during borehole logging; qualitative terms were not used.

5. The length of sample recovered or the percentage of sample recovered for each core sample was recorded.

6. The interval for each sample was specified and noted on the borehole log.

7. Depth to first water was indicated along with the method of determination. Any distinct increases or decreases of water occurrence below the first zone were also recorded.

8. The dates for start and completion of all borings were recorded.

9. Lithologic boundaries were noted on the boring log.

Well Construction

Plumbness of the completed boring was ensured by the careful leveling of the drill rig prior to initiation of the drilling process. Additionally, a drilling rate compatible with both the drilling equipment and the downhole materials was maintained so as not to force the drilling tools to diverge from a vertical direction. Well construction began immediately after completion of the boring, if possible.

The following materials were used in monitor well construction:

1. Casing used in the well was 4-inch-diameter polyvinyl chloride (PVC) Schedule 40 with flush-threaded joints. The well screen was factory slotted with a slot width of 0.010 inch.

2. A 20- to 30- mesh silica sand was used in the filter envelope around the well screen to ensure compatibility with the screen slot size and natural subsurface materials. The sand extended approximately 2 feet above the screen.

3. Bentonite pellets used in the seal were a commercially available product designed for well-sealing purposes. A minimum one foot seal was installed over the sand.

4. Grout was composed of a mixture of Portland Type I/II cement and approximately 5-10 percent powdered bentonite to prevent shrinkage. The bentonite-cement grout seal extended from the top of the bentonite seal to the land surface. The grout was pumped into the annular space under low pressure using a PVC tremie pipe placed at the top of the bentonite seal to ensure that a continuous grout seal was emplaced.

5. After grouting, a locking steel casing was placed around the well casing for security. A concrete pad was constructed around the steel casing, and protective guard posts were placed at the edge of the pad. The concrete pad was contoured to slope away from the flush-mount cover/steel casing.

6. A sketch of the well installation was included on the boring log and showed, by depth, the bottom of the boring, screen location, granular backfill, seals, grout, and height of riser above ground surface.

7. The grout seal was checked after approximately 24 hour (hr) for settlement, and additional grout (of approved composition) was added to fill any depressions.

Monitor well construction details for each well are presented with the boring logs in **Appendices B** and **C**.

3.2.2 Monitoring Well Development

All monitoring wells were developed with a centrifugal pump. The primary purpose of well development is to maximize the production of low turbidity water by removing fines from the filter pack and surrounding aquifer. The development of the wells was performed immediately after completion of each well, after the grout had been given sufficient time to cure.

During development, a steam-cleaned 1-inch O.D. flexible PVC pipe was inserted to the bottom of each well and attached to the pump to be used. Development continued until the water was visibly free of fines. Samples were taken before and after the development of each well and measured for pH and specific conductivity with a portable Hydrolab unit.

3.2.3 Groundwater Sampling

The monitor wells installed at Site 69 were sampled during the Verification Phase, the Characterization Phase and during the Supplemental Characterization. The monitor wells installed at Site 6 were sampled during the Characterization and Supplemental Characterization Phases.

The samples collected from Site 69 in July and August 1984 (Verification Step) were analyzed for organochlorine pesticides, PCB's, pentachlorophenol, VOC's, mercury, and residual chlorine. Samples collected in December, 1986 were analyzed for the same compounds and additionally tetrachlorodioxin, xylene, MEK, MIK, and EDB. Samples collected during the Supplemental Characterization were analyzed for full TCL parameters.

Two sets of samples were collected from Site 6 during the Characterization Phase (November 1986 and January 1987). These samples were analyzed for VOC's and the o,p- and p.p-isomers of DDE, DDD, and DDT. Samples were also collected during the Supplemental Characterization and analyzed for the full TCL parameters.

Field measurements of pH, specific conductivity and temperature measured during the Supplemental Characterization sampling event are presented in **Table 3-1**.

Sampling Procedures

Wells were not sampled until a minimum of 14 days had elapsed following development.

The following procedures were used when sampling groundwater monitor wells:

1. The depth to water was measured from the top of casing to within 0.01 foot.

Table 3-1. SITE 6 SAMPLE WATER QUALITY (Page 1 of 3)

Sample I.D.	pH	Conductivity (uS/cm)	Temp. (Celsius)	Sample Date	Time (Military)
6GW1	*	WELL	IS	DRY	*
6GW2	4.55	54	16.88	1/19/91	08:40
6GW3	5.52	380	18.58	1/19/91	10:55
6GW4	4.63	83	17.32	1/18/91	10:10
6GW5	6.14	179	17.40	1/18/91	10:55
6GW6	4.31	214	16.69	1/18/91	12:08
6GW7	6.75	206	15.87	1/18/91	13:00
6GW8	6.21	131	16.01	1/18/91	15:15
6SW1	5.35	109.1	12.67	1/23/91	11:40
6SW2	6.33	1425	18.11	1/23/91	10:43

Marine Corps Base Camp Lejeune, NC \48WATQUAL.WR1

Site 48 Sample Water Quality

Sample I.D.	pH	Conductivity (uS/cm)	Temp. (Celsius)	Sample Date	Time (Military)
48SW1	6.63	>11000	8.50	1/15/91	09:45
48SW2	6.80	>11000	9.00	1/15/91	10:13
48SW3	3.57	>11000	2.11	1/15/91	11:33
48SW4	3.65	>11000	2.17	1/15/91	11:50
48SW5	6.52	>11000	18.28	1/15/91	14:10
48SW6	6.97	7900	17.89	1/15/91	14:22
48SW7	7.60	14370	17.17	1/15/91	15:05
48SW8	7.65	13040	16.50	1/15/91	15:10
48SW9	5.89	>11000	12.17	1/17/91	08:55
48SW10	7.76	>11000	17.33	1/17/91	09:15
48SW11	6.31	15.7	12.22	1/17/91	09:30

Table 3-1. (Continued, Page 3 of 3)

Marine Corps Base Camp Lejeune, NC \69WATQUAL.WR1

Site 69 Sample Water Quality

Sample I.D.	pH	Conductivity (uS/cm)	Temp. (Celsius)	Sample Date	Time (Military)
69GW1	5.64	610	18.40	1/16/91	11:05
69GW2	3.81	240	17.10	1/15/91	15:45
69GW3	5.02	128.6	14.89	1/14/91	16:05
69GW4	4.34	125.5	15.67	1/14/91	13:20
69GW5	5.05	81.2	15.17	1/14/91	09:48
69GW6	4.65	126	14.78	1/14/91	10:55
69GW7	5.04	61	14.39	1/14/91	12:00
69GW8	5.12	30	16.30	1/15/91	11:50
69SW1	4.01	90	14.10	1/16/91	11:30
69SW4-1	9.95	>1000	9.80	1/14/91	13:10
69SW4-2	10.42	>1000	10.20	1/14/91	13:15
69SW5-1	8.81	>1000	8.20	1/14/91	10:10
69SW5-2	8.86	>1000	8.30	1/14/91	10:20

2. The volume of water in the well casing and saturated annulus was calculated.

3. Standing water in the well casing and saturated annulus was evacuated prior to sampling. Sample protocol required purging five times the amount of standing water. The amount of water purged was measured and recorded.

4. To protect the wells from contamination during sampling procedures, the following guidelines were followed:

   a. Groundwater samples were collected using decontaminated PVC bailers for the monitoring wells and from bypass pipes in the water supply wells. A separate bailer, constructed prior to the start of the field effort, was provided for each monitor well. Each bailer was suspended from a Teflon-coated stainless steel leader attached to a polypropylene monofilament rope. The leader was 8 feet in length to ensure that the rope did not come in contact with the groundwater being sampled.

   b. When a pump was used to purge the standing water from the well, the pump and the hoses were thoroughly cleaned between samples.

   c. All sampling and well purging equipment were protected from ground contact by placing the equipment on disposable polyethylene plastic sheeting.

   d. Samples were collected from background wells and wells suspected of being free from contamination before wells that were suspected or known to contain contaminants were sampled.

e. Field parameters were measured and recorded in the bound field book.

f. The sample containers were filled directly from the sample tap, labeled, and placed on ice.

Onsite measurements of water quality obtained during the groundwater sampling consisted of conductivity, temperature, and pH. Measurements were made using a Hydrolab® 4000. These measurements were made at the start, at least once during, and at the end of the fluid purging procedure for groundwater monitor wells and prior to sampling only when at public supply wells. Calibration standards were run and recorded prior to, during, and after each sampling day. Three saline [potassium chloride (KCl)] solutions of known conductivity [(141, 718, and 1,413 micromhos per centimeter (μmho/cm)] were measured at each calibration check. If calibration indicated that the instrument was not responding correctly, a backup unit was used. The pH calibration consisted of testing pH buffer standards (pH 4.0, 7.0, and 10) and adjustment of the Hydrolab® function to read specified pH units. A backup pH meter was used if the calibration procedure indicated improper meter response.

During the sampling of each monitor well, the following data were recorded in a bound field notebook:

1. Well number
2. Date
3. Time
4. Static water level
5. Depth of well
6. Number of bailer volumes removed, if applicable

7. Pumping rate and type of pump, if applicable
8. Time of pumping, if applicable
9. Deepest water level during purging
10. In situ water quality measurements of pH, specific conductance, and temperature
11. Other pertinent observations of water samples (color, turbidity, odor, particulates)
12. Fractions sampled and preservatives used
13. Weather conditions and miscellaneous observations and
14. Signature of sampler and date and time of sample collection.

Samples were collected in a manner that minimized aeration and prevented oxidation of reduced compounds. Each sample container was carefully labeled, including the project number, sample number, time and date, pH and conductivity measurements, and sampler's initials. Samples were shipped in insulated coolers by overnight courier and were kept on ice from time of sample collection until analysis. Chain of custody documentation was prepared at the time of collection for each sample collected. This documentation remained with the sample until it reached the laboratory. Copies of this documentation is provided in **Appendix I**.

3.2.4 Water Level Measurements

Two rounds of water level measurements were taken at HPIA during the supplemental characterization investigation to determine horizontal and vertical groundwater flow gradients at the site. The first water level measurements were taken on January 25, 1991, and the second round of measurements were taken on February 20, 1991. Both rounds of water level measurements were taken to the nearest 0.01 feet using an electronic water level indicator. Water level measurements are presented in **Section 4.3**.

3.2.5 Well Location and Elevation Survey

Elevations of well inner and outer casings, and ground surface were established to the nearest 0.01 foot relative to an arbitrary data point at each site. Survey data was obtained to determine direction and gradients of groundwater flow.

3.3 QUALITY ASSURANCE/QUALITY CONTROL

The Verification and Characterization Steps were conducted under Navy and ESE QA/QC protocols. In compliance with the FFA, the Supplemental Characterization assessments at Sites 6, 48, and 69 were conducted under the regulations, guidelines, and criteria established by EPA Region IV for Superfund sites.

QA/QC protocol during the latest sampling event included the collection of trip blanks, equipment rinsate blanks, potable water blanks, and deionized water blanks. Trip blanks were collected at a frequency of 1/day of aqueous volatile organic sampling. Aqueous volatile sampling was performed on 8 days resulting in the collection of 8 trip blanks. Trip blanks were analyzed for TCL Volatile Organic Compounds (VOCs).

All sampling equipment used during this investigation was decontaminated as per EPA Guidelines. Decontamination procedures are described in detail in **Appendix A**.

Equipment rinsate blanks were required and collected at a frequency of 1/day/sampling procedure, if decontamination was performed in the field, and 1/day of decontamination effort if decontamination was performed in the laboratory. Bailers for groundwater sampling were decontaminated at the ESE Gainesville Laboratory. All other sampling equipment was decontaminated in the field. Equipment rinsate blanks were analyzed for the same parameters as associated environmental samples.

One deionized water (DI) blank was collected for each lot (batch) of deionized water used for decontamination and blanks in the field. Three lots of DI were used during the field investigation. The 3 blanks were analyzed for full TCL compounds. DI water was furnished by the ESE Gainesville Laboratory.

In order to evaluate the quality of potable water used during the field investigation, one potable water blank (FB) was collected during the investigation. The potable water blank was analyzed for full TCL compounds.

Duplicate samples were collected for each matrix sampled (groundwater, surface water, and sediment) at a frequency of 10%. As per Navy protocol, an additional sample was collected for matrix spike and matrix spike duplicate (MS/MSD) analyses at each duplicate sample location. For the aqueous matrix, a total of 35 samples were collected, resulting in the collection of 4 duplicate and MS/MSD samples. For the sediment matrix, a total of 19 samples were collected. Two duplicate and MS/MSD samples were collected to meet the 10% frequency requirement for the sediment matrix.

Duplicate and MS/MSD samples for fish/shellfish tissue sampling were not collected due to the low number and amount of tissue samples that could be collected at Site 69.

As part of the QA/QC program during the field investigation, a representative from the U.S. EPA split one surface water and one sediment sample from Site 48, and one surface water, one sediment, and one groundwater sample from Site 69. The EPA representative also furnished spike and blank samples which were sent to the site assessment laboratories to serve as an indicator of the laboratories' performance. ESE has not received the EPA data for these samples. A comparison of ESE's results will be presented at a later date.

All analytical data obtained during the site assessments is the result of analyses under Data Quality Objective (DQO) Level D. DQO Level D correlates to EPA Level 4, and is required for sites that are on or about to be on the NPL. Level D QC includes review and approval of the laboratory QA plan, the site work plan, and the field QA plan.

The laboratories must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports (MPRs) on QA. These activities are administered and evaluated by the NEESA Contract Representative (NCR). The audit and the analysis performance sample are in addition to those related to the EPA Superfund Program. The laboratory that performs Level D QC must have passed the performance sample furnished through the Superfund Contract Laboratory Protocol (CLP) and must be able to generate the CLP deliverables. For a Level D site, the CLP methods are used and the CLP data package generated.

The ESE Denver laboratory performed all aqueous and fish tissue sample analyses. Ceimic Laboratory performed the analyses of all sediment samples. Both laboratories are Navy-approved to perform Level D analysis.

A summary table of QA/QC samples collected is presented as **Table 3-2**. QA/QC analytical results are presented in **Appendix D** and a discussion of the QA/QC results is presented in **Appendix E**.

Table 3-2. CAMP LEJEUNE SITES 6, 48, AND 69 SAMPLE QA/QC (Page 1 of 2)

* = EB001 or EB002
** = not applicable
*** = TCL VOA, Pest/PCB, TCLP Metals

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Sample I.D.	Analysis	Associated QA/QC Sample: Duplicates MS/MSD	Equipment Blank	Trip Blank
GROUNDWATER:				
6GW2	Full TCL	**	EB001	TB012
6GW3	Full TCL	**	EB001	TB012
6GW4	Full TCL	**	EB001	TB011
6GW5	Full TCL	**	EB001	TB011
6GW6	Full TCL	**	EB001	TB011
6GW7	Full TCL	**	EB001	TB011
6GW8	Full TCL	GWDUP7	EB001	TB011
69GW1	Full TCL	**	EB001	TB015
69GW2	Full TCL	**	EB002	TB008
69GW3	Full TCL	**	EB001	TB007
69GW4	Full TCL	**	EB002	TB007
69GW5	Full TCL	**	EB002	TB007
69GW6	Full TCL	**	EB001	TB007
69GW7	Full TCL	**	EB001	TB007
69GW8	Full TCL	GWDUP6	EB001	TB008
WATER SUPPLY:				
WS651	Full TCL	**	**	TB013
WS653	Full TCL	**	**	TB013
SURFACE WATER:				
6SW1	Full TCL	SWDUP2	**	TB014
6SW2	Full TCL	**	**	TB014
48SW1	TCL Metals	SWDUP1	**	**
48SW2	TCL Metals	**	**	**
48SW3	TCL Metals	**	**	**
48SW4	TCL Metals	**	**	**
48SW5	TCL Metals	**	**	**
48SW6	TCL Metals	**	**	**
48SW7	TCL Metals	**	**	**
48SW8	TCL Metals	**	**	**
48SW9	TCL Metals	**	**	**
48SW10	TCL Metals	**	**	**
48SW11	TCL Metals	**	**	**
69SW1	Full TCL	**	**	TB009
69SW4-1	Full TCL	**	**	TB007
69SW4-2	Full TCL	**	**	TB007
69SW5-1	Full TCL	**	**	TB007
69SW5-2	Full TCL	**	**	TB007

Table 3-2. CAMP LEJEUNE SITES 6, 48, AND 69 SAMPLE QA/QC (Continued, Page 2 of 2)

Sample I.D.	Analysis	------ Associated QA/QC Sample ------ Duplicates MS/MSD	Equipment Blank	Trip Blank
SEDIMENT:				
6SE1	Full TCL	**	EB015	**
6SE2	Full TCL	SEDUP2	EB015	**
48SE1	TCL Metals	SEDUP1	EB009	**
48SE2	TCL Metals	**	EB009	**
48SE3	TCL Metals	**	EB009	**
48SE4	TCL Metals	**	EB009	**
48SE5	TCL Metals	**	EB009	**
48SE6	TCL Metals	**	EB009	**
48SE7	TCL Metals	**	EB009	**
48SE8	TCL Metals	**	EB009	**
48SE9	TCL Metals	**	EB012	**
48SE10	TCL Metals	**	EB012	**
48SE11	TCL Metals	**	EB012	**
69SE1	Full TCL	**	EB011	**
69SE4-1	Full TCL	**	EB008	**
69SE4-2	Full TCL	**	EB008	**
69SE5-1	Full TCL	**	EB008	**
69SE5-2	Full TCL	**	EB008	**
SEDIMENT (resampling 2/21/91):				
69SE1	Cyanide Only	**	EB016	**
FISH TISSUE:				
69TI4-1	Full TCL	**	EB008	TB007
69TI4-2	Full TCL	**	EB008	TB007
69TI5-1	Full TCL	**	EB008	TB007
69TI5-2	Full TCL	**	EB008	TB007

4.0 PHYSICAL CHARACTERIZATION OF STUDY AREAS

4.1 SURFACE FEATURES

4.1.1 Topography and Surface Water Drainage

Site 6 - Storage Lots 201 and 203

Site 6 is relatively flat and unpaved. The surface soils have reportedly been moved about as a result of regrading and equipment movement (Water and Air Research, 1983). Elevations across the site in a north to south direction decrease from approximately 120 feet above mean sea level (msl) to 105 feet above msl. Wallace Creek and Bearhead Creek, tributaries of the New River, border the site to the north and south, respectively. Surface runoff from the site most likely drains to these two tributaries.

Site 48 - MCAS Mercury Dump Site

Site 48 is grass-covered and relatively flat in the vicinity of Building 804. Elevations across the site are less than 10 feet above msl. The New River Estuary lies to the east of the site. A shallow, forked inlet, which empties into the estuary, borders the site to the northeast. The average depth of the inlet is 2 to 2.5 feet. Small trees, thick underbrush and marsh areas are associated with the inlet.

Surface runoff from the site most likely drains into the inlet and the marshy area. A drainage ditch, located approximately 250 feet northwest of the site directs surface runoff from the site into the inlet.

Site 69 - Rifle Range Chemical Landfill

Three watershed boundaries that affect surface runoff are present at Site 69. One watershed boundary extends east of the site and directs surface runoff to the north and south. A second watershed boundary extends south of the site and directs surface runoff to the east and west. The third watershed boundary extends southwest of the site and directs surface water runoff to the northwest and southeast. As a result of these watershed boundaries, surface runoff from the northern portion of the site drains into unnamed ditches and creeks which drain into the New River estuary. Surface runoff from the southeastern portion of the site drains into unnamed ditches which also drain into the New River estuary. Surface runoff from the southwestern portion of the site drains into the Everett Creek watershed basin, eventually draining into Everett Creek and the New River estuary.

4.2 GEOLOGY

4.2.1 Regional Geology

MCB Camp Lejeune is located in the Atlantic Coastal Plan physiographic province. The sediments of the Atlantic Coastal Plain consist of interbedded sands, clays, calcareous clays, shell beds, sandstone, and limestone. These sediments are layered in interfingering beds and lenses that gently dip and thicken to the southeast (Todd, 1983). Regionally, they comprise 10 aquifers and 9 confining units which overlie igneous and metamorphic basement rocks of pre-Cretaceous age.

These sediments were deposited in marine or near-marine environments (Brown et. al., 1972) and range in age from early Cretaceous to Quaternary time. **Figure 4-1** presents a generalized stratigraphic column for this area (Harned et. al., 1989).

RI 6, 48, 69 6/91 LB

GEOLOGIC UNITS			HYDROGEOLOGIC UNITS
SYSTEM	SERIES	FORMATION	AQUIFER AND CONFINING UNIT
Quaternary	Holocene Pleistocene	Undifferentiated	Surficial aquifer
Tertiary	Pliocene	Yorktown Formation[1]	Yorktown confining unit
	Miocene	Eastover Formation[1]	Yorktown aquifer
		Pungo River Formation[1]	Pungo River confining unit
			Pungo River aquifer
		Belgrade Formation[2]	Castle Hayne confining unit
	Oligocene	River Bend Formation	Castle Hayne aquifer
	Eocene	Castle Hayne Formation	Beaufort confining unit[3]
	Paleocene	Beaufort Formation	Beaufort aquifer
			Peedee confining unit
Cretaceous	Upper Cretaceous	Peedee Formation	Peedee aquifer
			Black Creek confining unit
		Black Creek and Middendorf Formations	Black Creek aquifer
			Upper Cape Fear confining unit
		Cape Fear Formation	Upper Cape Fear aquifer
			Lower Cape Fear confining unit
			Lower Cape Fear aquifer
	Lower Cretaceous[1]	Unnamed deposits[1]	Lower Cretaceous confining unit
			Lower Cretaceous aquifer[1]
Pre-Cretaceous basement rocks		--	--

[1]Geologic and hydrologic units probably not present beneath Camp Lejeune.
[2]Constitutes part of the surficial aquifer and Castle Hayne confining unit in the study area.
[3]Estimated to be confined to deposits of Paleocene age in the study area.

FIGURE 4-1
GEOLOGIC AND HYDROGEOLOGIC UNITS IN THE COASTAL PLAIN OF NORTH CAROLINA

SOURCE: HARNED *et al.*, 1989.

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CAMP LEJEUNE

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4.2.2 <u>Geology - MCB Camp Lejeune</u>

USGS studies (Harned et. al., 1989) at MCB Camp Lejeune indicate that the base is underlain by 7 sand and limestone aquifers separated by confining units of silt and clay. These include the surficial, Castle Hayne, Beaufort, Peedee, Black Creek, and upper and lower Cape Fear aquifers. The combined thickness of these sediments is approximately 1500 feet. Less permeable clay and silt beds function as confining or semi-confining units which separate the aquifers and impede the flow of groundwater between aquifers. A hydrogeologic cross-section of this area, taken from Harned et. al., 1989, is presented in **Figure 4-2**. This cross-section illustrates the relationship between the aquifers in this area.

Fresh water is present in the surficial and Castle Hayne aquifers at MCB Camp Lejeune and are, therefore, the hydrogeologic units of concern with respect to these assessments. Fresh water extends to a depth of approximately 300 feet (Harned et. al., 1989). Aquifers below this depth have been affected by saltwater intrusion.

The surficial aquifer at MCB Camp Lejeune is composed of Quaternary and Miocene sand, silt, and clay. This aquifer ranges in thickness from 0 feet in the channels of the New River and its tributaries to 75 feet in the southeastern portion of Camp Lejeune (Harned et. al., 1989).

The Castle Hayne aquifer is composed of sand and limestone of Oligocene and Middle Eocene age (Harned et. al., 1989). The upper portion of the aquifer is primarily unconsolidated sand. The lower portion is partially consolidated sand and limestone. Thin clay layers are found throughout the unit. The Castle Hayne aquifer thickens toward the southeast, from 175 feet in the northern portion of the base to 375 feet at the coast. The Castle Hayne aquifer is approximately 340 feet thick in the Hadnot Point Area (Harned et. al., 1989).

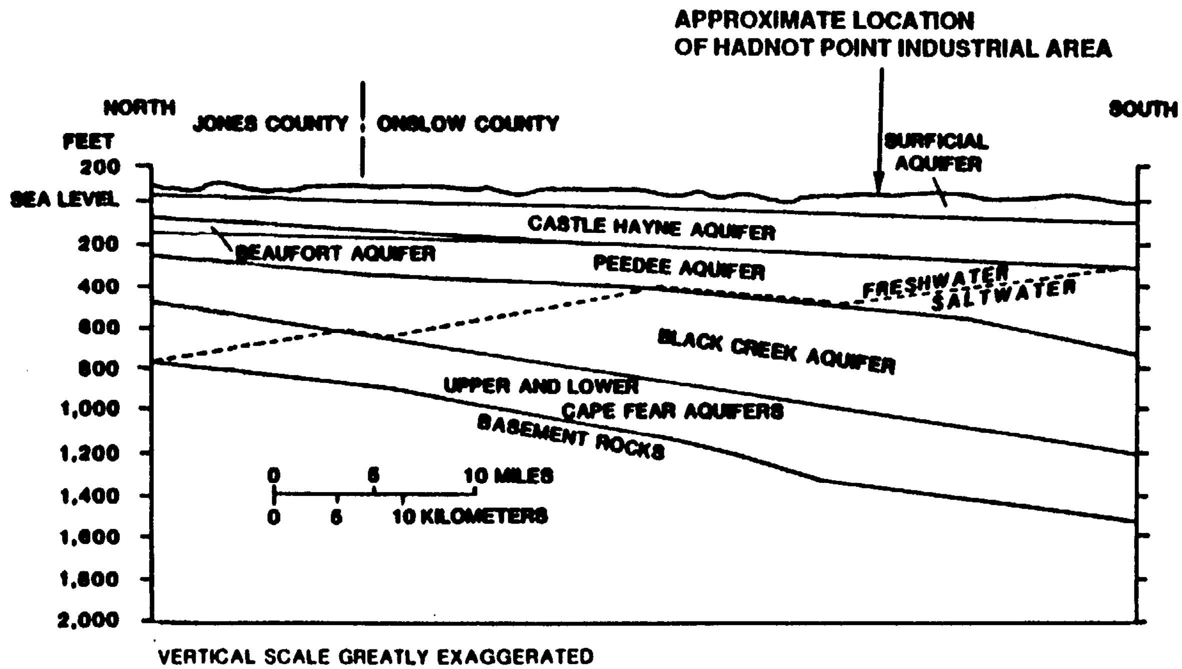

FIGURE 4-2
GENERALIZED HYDROGEOLOGIC CROSS SECTION, JONES AND ONSLOW COUNTIES, NORTH CAROLINA

SOURCE: HARNED *et al.*, 1989.

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4.2.3 Site Geology

The Site Assessment Studies performed at Sites 6, 48, and 69 did not include geologic investigations within their scopes of work. Site specific geologic information for Sites 6, 48, and 69 is limited to information obtained during monitoring well installation and soil boring tasks performed during previous investigations.

Site 6 - Storage Lots 201 and 203

Monitoring well installation and soil boring tasks at Site 6 indicate that the site is underlain by silty sand, sand, and coarse sand. **Figure 4-3** presents a geologic cross-section of Site 6. The cross-section is drawn on a north-south line. The geologic cross-section location is presented in **Figure 4-4**.

Site 48 - MCAS Mercury Dump

Previous and past field efforts at Site 48 were limited and did not include an investigation of site-specific geology.

Site 69 - Rifle Range Chemical Dump

Monitoring well installation efforts at Site 69 indicate that this area is primarily underlain by silty sand and sandy clay with discontinuous layers of clayey sand, sand, sandy silt, and clayey silt. **Figures 4-5** and **4-6** are geologic cross-sections of Site 69. **Figure 4-7** presents the cross-section locations.

RI 6, 48, 69 6/91 LB

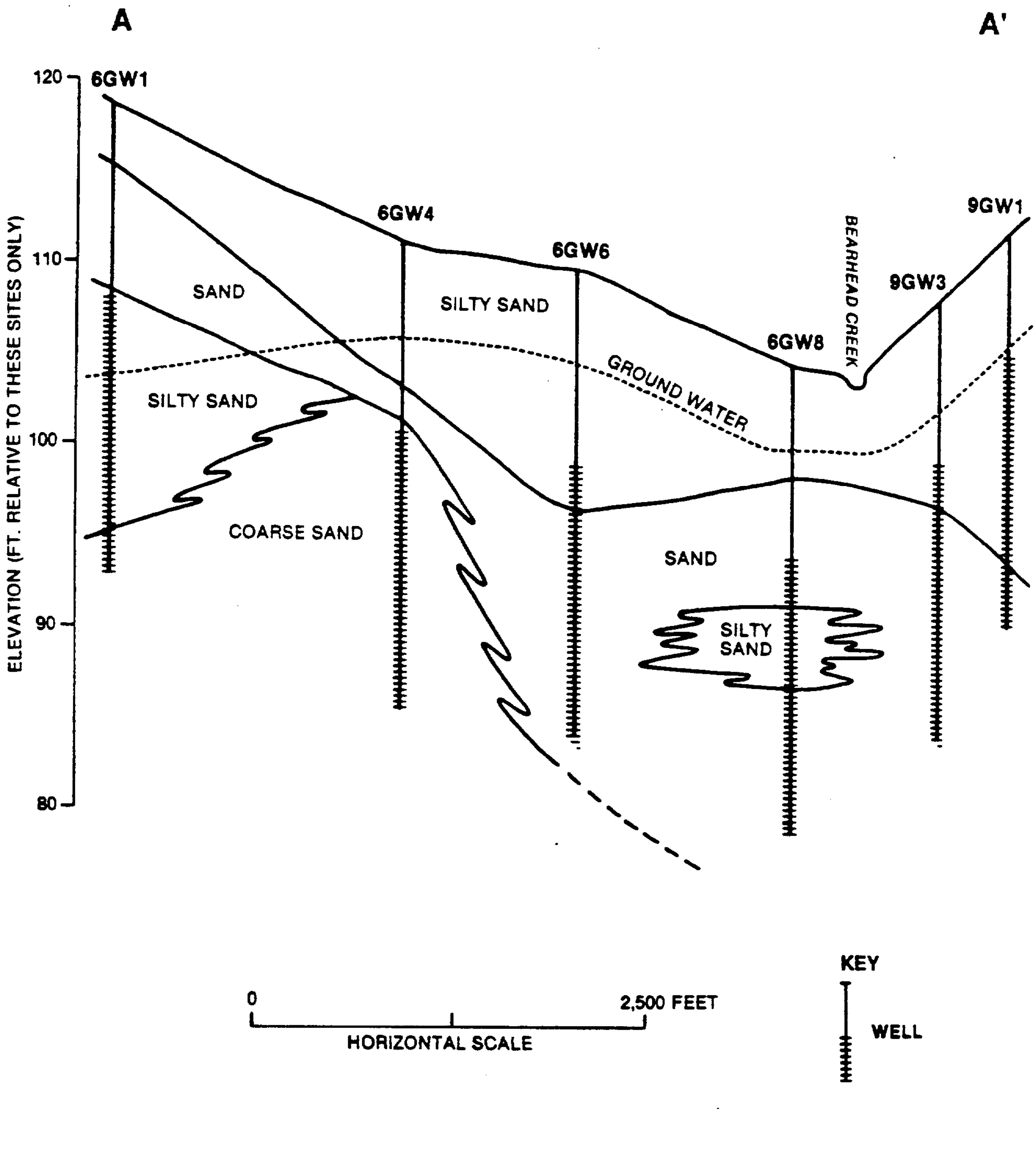

FIGURE 4-3
GEOLOGIC CROSS SECTION, SITES 6 AND 9– STORAGE LOTS 201 AND 203 AND FIRE FIGHTING TRAINING PIT

SOURCE: ESE.

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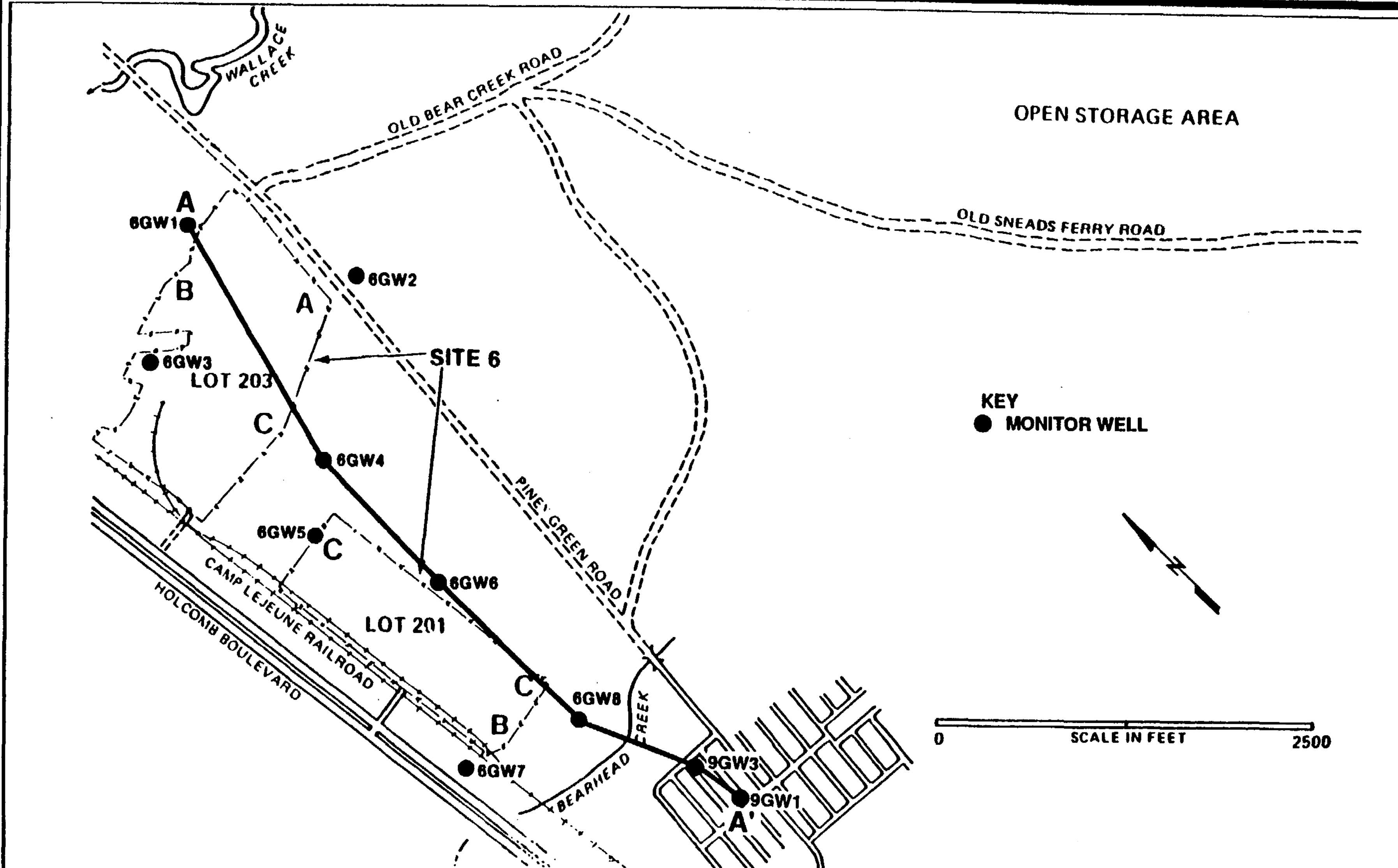

FIGURE 4-4
SITE 6,
STORAGE LOTS 201 AND 203,
GEOLOGIC CROSS SECTION LOCATIONS

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

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CAMP LEJEUNE

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RI 6, 48, 69 6/91 LB

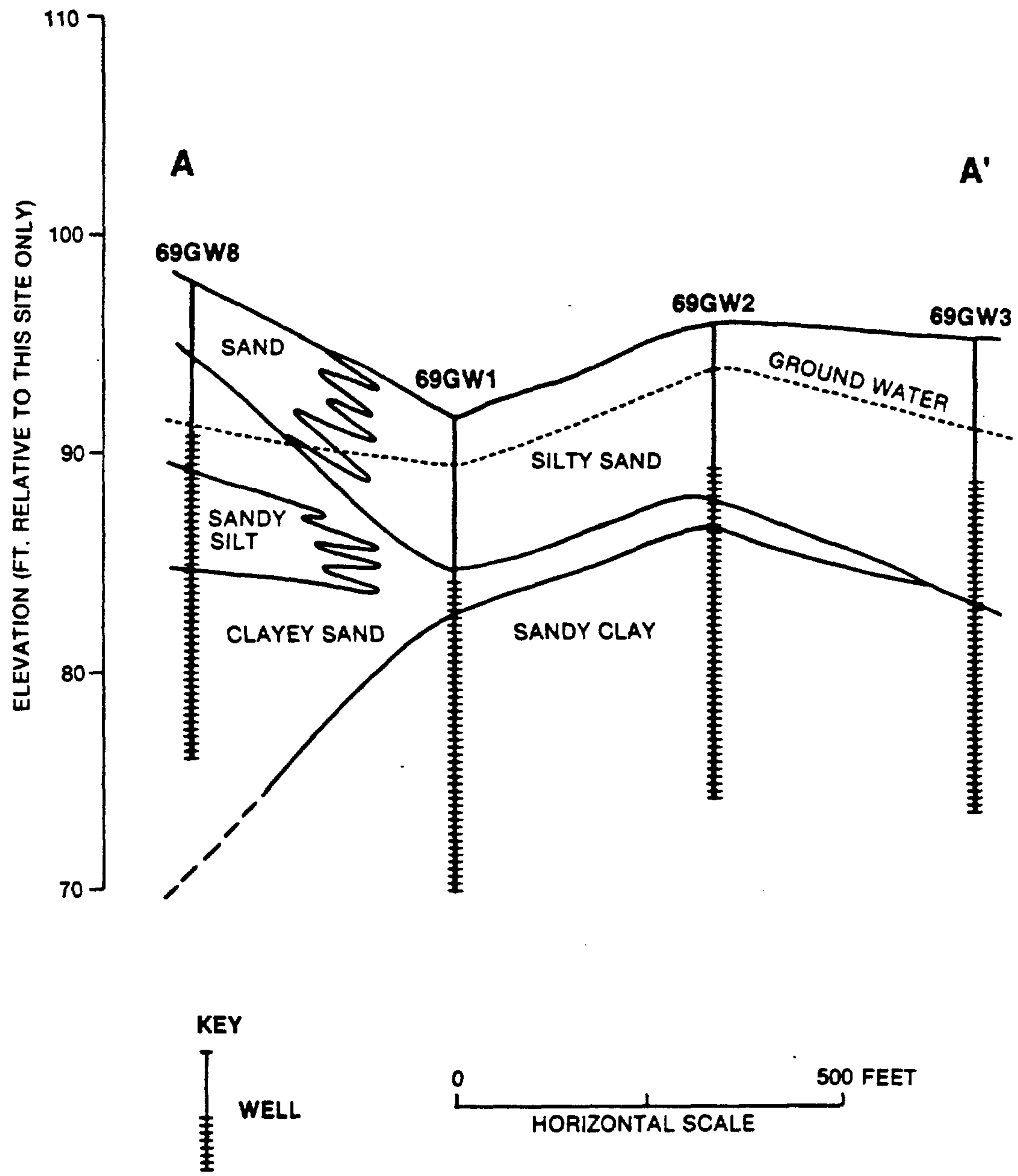

FIGURE 4-5
GEOLOGIC CROSS SECTION A - A', SITE 69-RIFLE RANGE CHEMICAL DUMP

SOURCE: ESE.

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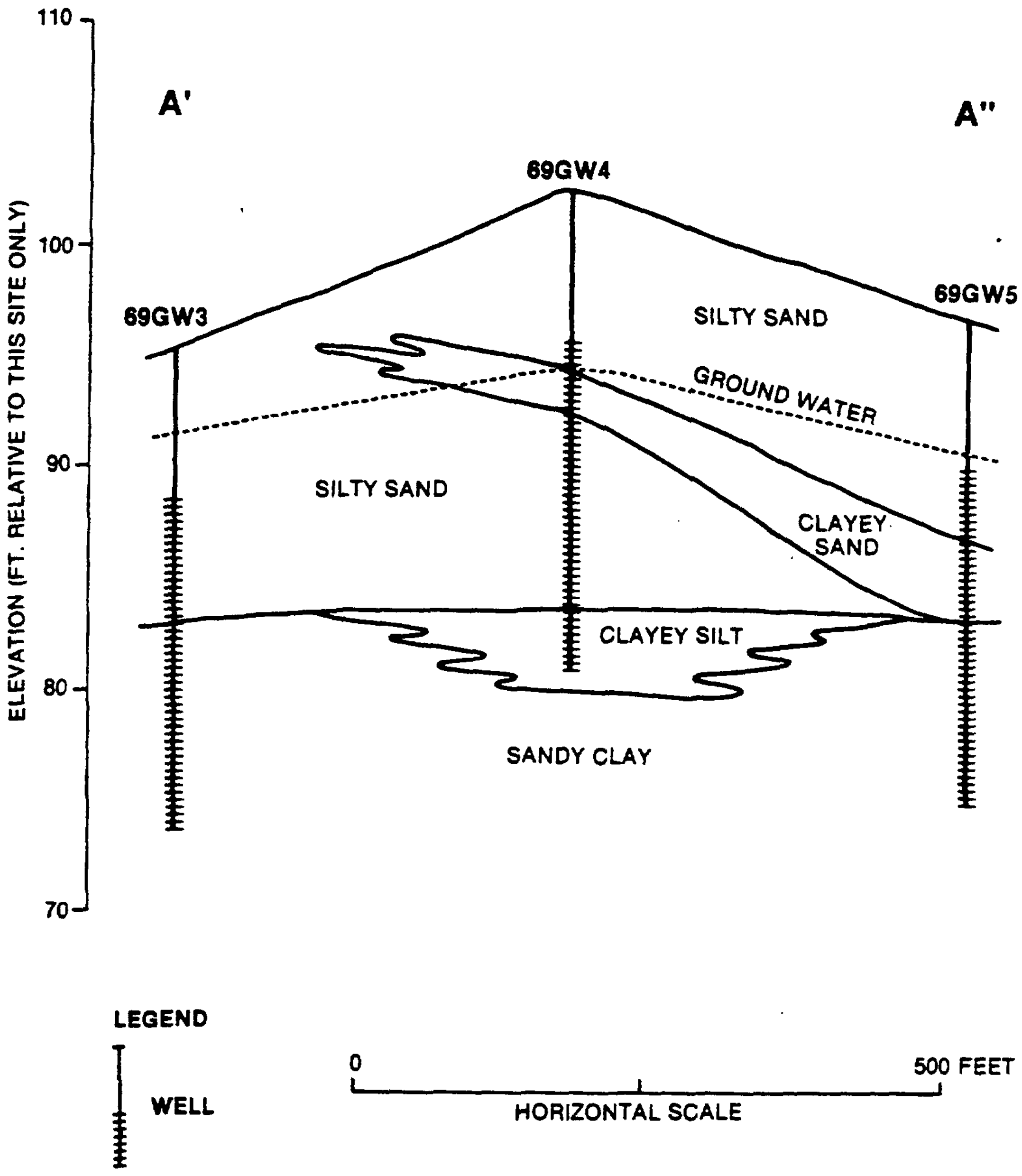

FIGURE 4-6
GEOLOGIC CROSS SECTION A' - A", SITE 69-RIFLE RANGE CHEMICAL DUMP

SOURCE: ESE.

MARINE CORPS BASE CAMP LEJEUNE

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RI 6, 48, 69 6/91 LB

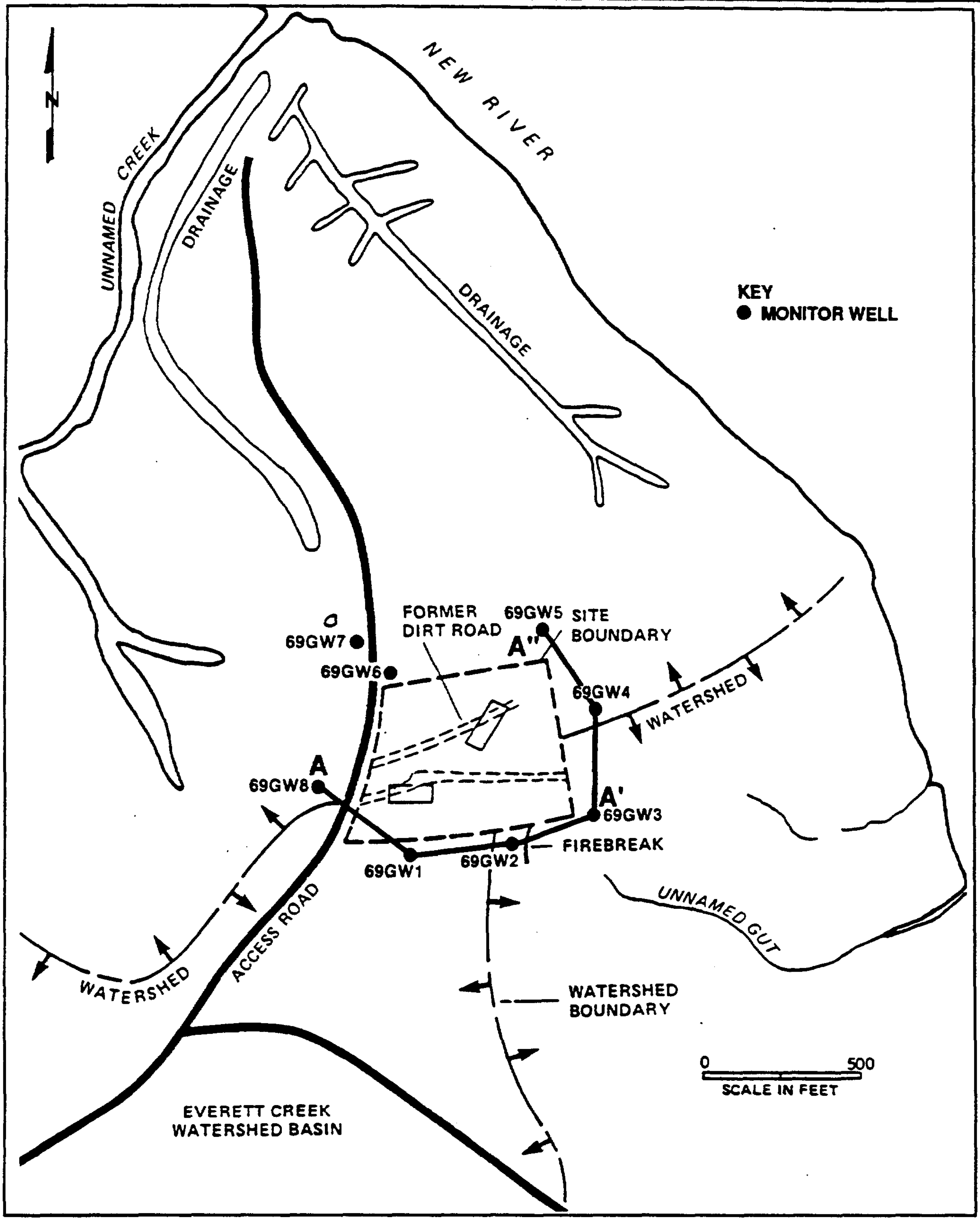

FIGURE 4-7
SITE 69,
RIFLE RANGE CHEMICAL DUMP,
GEOLOGIC CROSS SECTION LOCATIONS

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

MARINE CORPS BASE
CAMP LEJEUNE

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4.3 HYDROLOGY

4.3.1 Site 6

The water table at Site 6 was encountered in silty sand at depths ranging from 2 to 15 feet in April, 1987 (ESE, January 1990), and in silty sand and sand at depths ranging from 7 to greater than 22 feet in January 1991. **Table 4-1** presents water levels measured at Site 6 in April 1987 and January 1991.

Figure 4-8 presents a groundwater contour map of Site 6 generated from April 1987 water levels. The contours indicate that groundwater flows radially toward Wallace and Bearhead Creeks. Water levels measured in January 1991 indicate a similar orientation of groundwater contours and flow directions. Groundwater flow gradients based on April 1987 data are estimated to be approximately 0.009 feet per foot (ESE, January 1990). Groundwater gradients based on January 1991 data are not as steep (0.003 ft/ft) due to a lower water table at this time.

4.3.2 Site 48

Site specific groundwater information based on monitoring well data is not available for Site 48. However, the close proximity of the New River, the forked inlet, and associated marshy area north and east of the site indicates a high water table in the area and probable northeast groundwater flow direction.

4.3.3 Site 69

The water table at Site 69 was encountered in silty sand and clayey sand at depths ranging from approximately 5 to 22 feet bls in April 1987 and in silty sand, clayey sand, and sandy clay at depths ranging from approximately 7 to 27 feet bls in January 1991. **Table 4-2** presents water levels measured at Site 69 in April 1987 and January 1991.

Table 4-1. SITE 6 GROUNDWATER ELEVATION

(Elev. Relative to site only)

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WELL #	Elev. TOC (ft)	Elev. LS. (ft)	Stick-up (ft)	4/15/87 DTW - TOC (ft)	4/15/87 ELEV - GW (ft)	1/18 - 1/19/91 DTW - TOC (ft)	1/18 - 1/19/91 ELEV - GW (ft)
6GW1	120.83	118.41	2.42	17.08	103.75	>22'	<98
6GW2	124.02	121.86	2.16	12.17	111.85	18.05	105.97
6GW3	116.99	114.74	2.25	14.92	102.07	17.96	99.03
6GW4	113.45	111.00	2.45	7.42	106.03	11.02	102.43
6GW5	111.06	108.73	2.33	6.42	104.64	9.80	101.26
6GW6	112.09	109.77	2.32	7.58	104.51	11.20	100.89
6GW7	101.48	99.21	2.27	5.21	96.27	7.05	94.43
6GW8	105.98	104.91	1.07	6.13	99.85	8.52	97.46

NOTES: TOC = Top of Casing
LS = Land Surface
DTW = Depth to Water

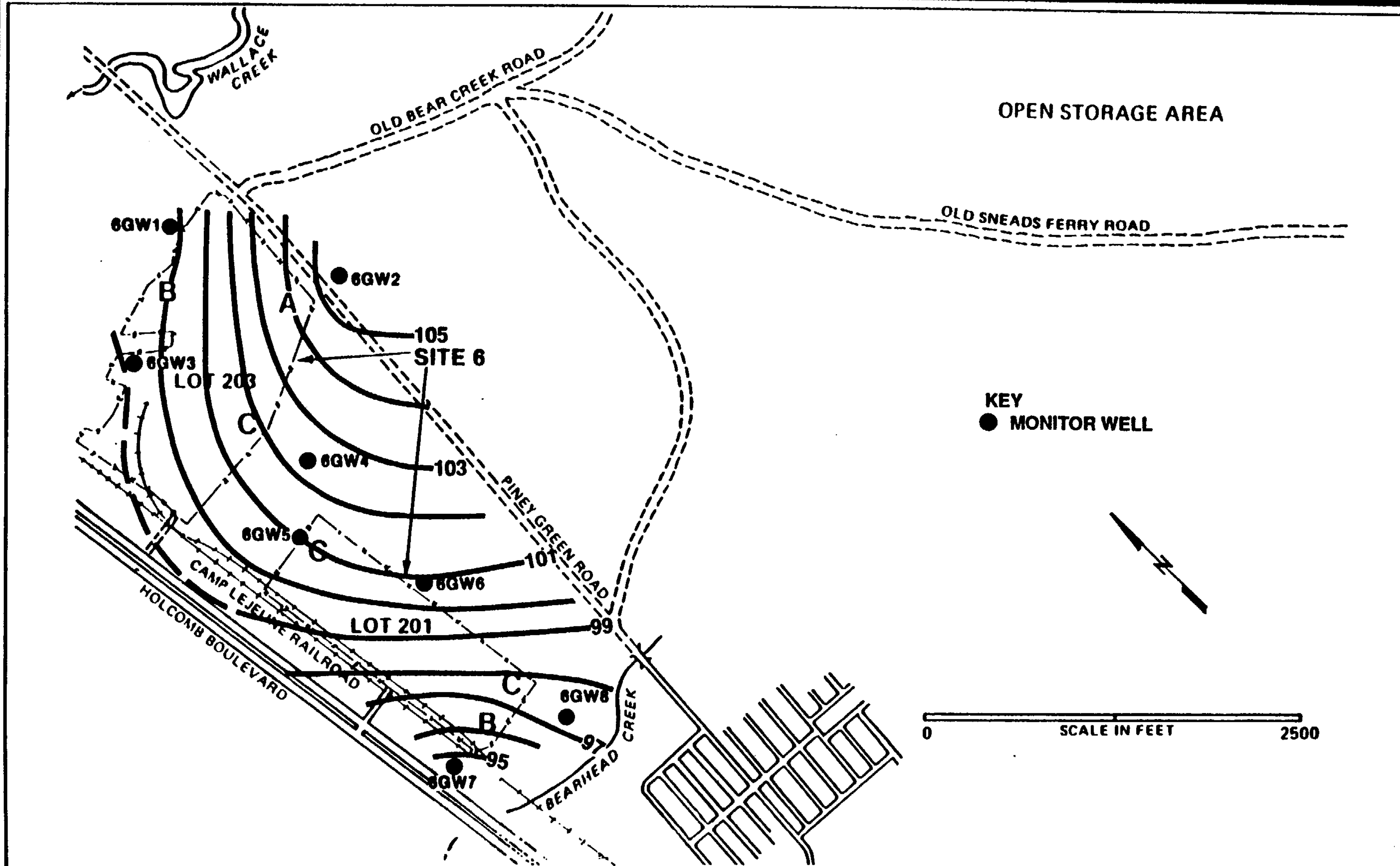

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FIGURE 4-8
SITE 6,
STORAGE LOTS 201 AND 203
POTENTIOMETRIC MAP (1/18/91)

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

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Table 4-2. SITE 69 GROUNDWATER ELEVATION

(Elev. Relative to site only)

wp8a\gwelev.wr1

WELL #	Elev. TOC (ft)	Elev. LS. (ft)	Stick-up (ft)	4/15/87 DTW - TOC (ft)	4/15/87 ELEV - GW (ft)	1/18 - 1/19/91 DTW - TOC (ft)	1/18 - 1/19/91 ELEV - GW (ft)
69GW1	94.11	91.64	2.47	4.92	89.19	12.54	81.57
69GW2	98.99	95.93	3.06	5.17	93.82	9.60	89.39
69GW3	97.01	95.21	1.80	5.63	91.38	7.21	89.80
69GW4	101.78	102.39	-0.61	6.92	94.86	9.25	92.53
69GW5	99.09	96.74	2.35	8.40	90.69	13.95	85.14
69GW6	92.54	90.70	1.84	22.08	70.46	26.80	65.74
69GW7	81.73	79.48	2.25	12.23	69.50	15.29	66.44
69GW8	100.00	97.70	2.30	8.50	91.50	8.32	91.68

NOTES: TOC = Top of Casing
LS = Land Surface
DTW = Depth to Water

Figure 4-9 presents a groundwater contour map of the site generated using January 1991 water levels. The contour map indicates that groundwater flow beneath Site 69 may be minimally impacted by watershed boundaries based on the measuring points available. Groundwater generally flows across the site towards the north and northwest. Some mounding is evident in the vicinity of well 69GW1, however this is very localized. Typical groundwater gradients beneath this site average 0.032 ft/ft. Water levels measured in January 1991generate a similar groundwater contour pattern with slightly shallower gradients (0.028 ft/ft).

4.4 METEOROLOGY

The MCB Camp Lejeune, which is located in the North Carolina coastal plain area, is influenced by mild winters and humid summers with typically elevated temperatures. Rainfall typically averages more than 50 inches a year, and potential evapotranspiration varies from 34 to 36 inches of rainfall equivalent per year (Narkunas, 1980; Water and Air Research, 1983). The wet seasons typically occur during the winter and summer months. During January, typical temperature ranges are reported to be from 33°F to 53°F; and during July the typical temperature ranges are reported to be from 71°F to 88°F (Odell, 1970; Water and Air Research, 1983). During the warm seasons, winds are generally from the south-southwest; while during the cooler seasons they are generally from the north-northwest. The area has a relatively long growing season of 230 days. **Figure 4-10** is a summary of regional climatic conditions (Water and Air Research, 1983; NAVFACENGCOM, 1975).

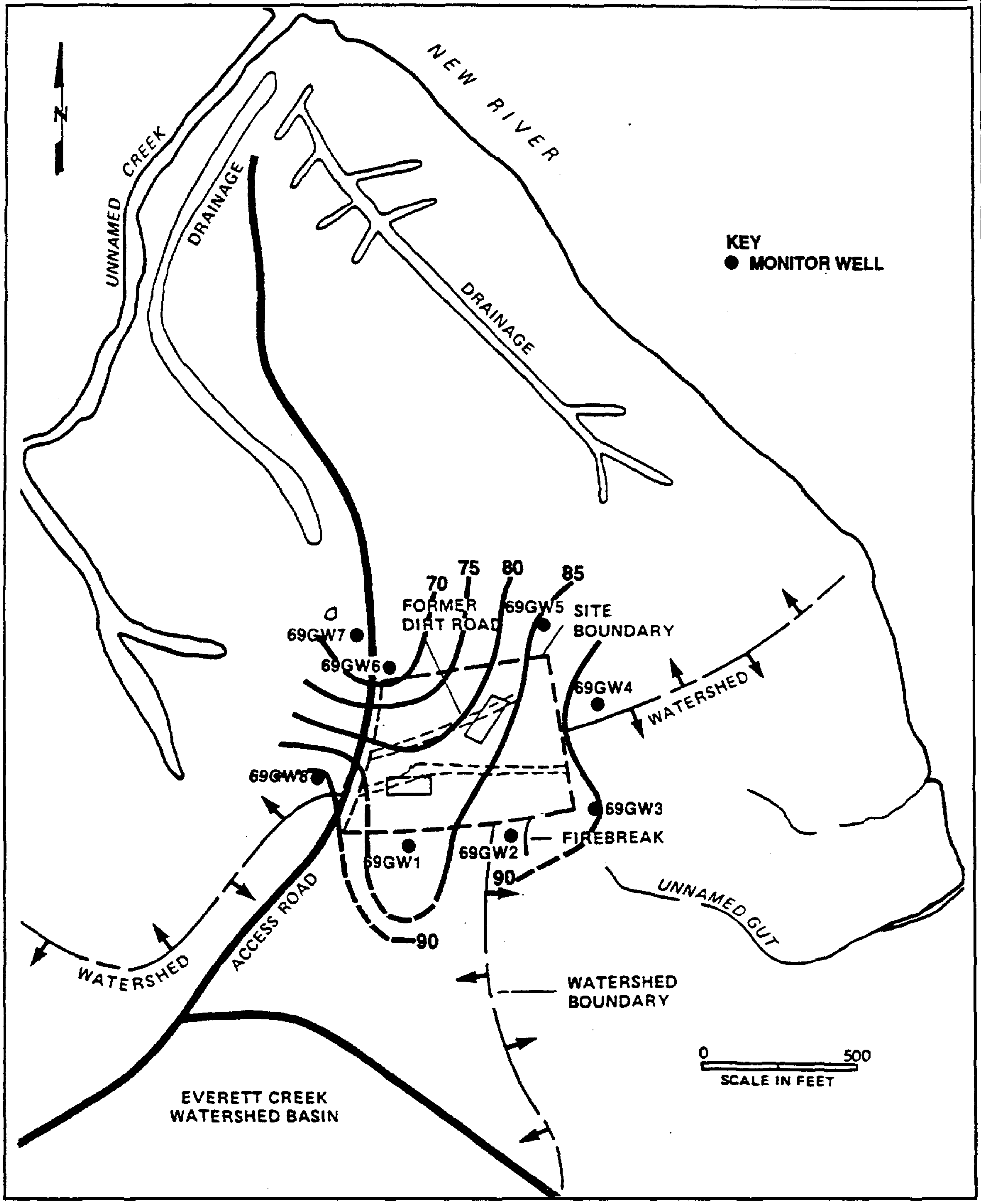

FIGURE 4-9
SITE 69,
RIFLE RANGE CHEMICAL DUMP,
POTENTIOMETRIC MAP (1/18/91)

SOURCES: WATER AND AIR RESEARCH, INC., 1983; ESE.

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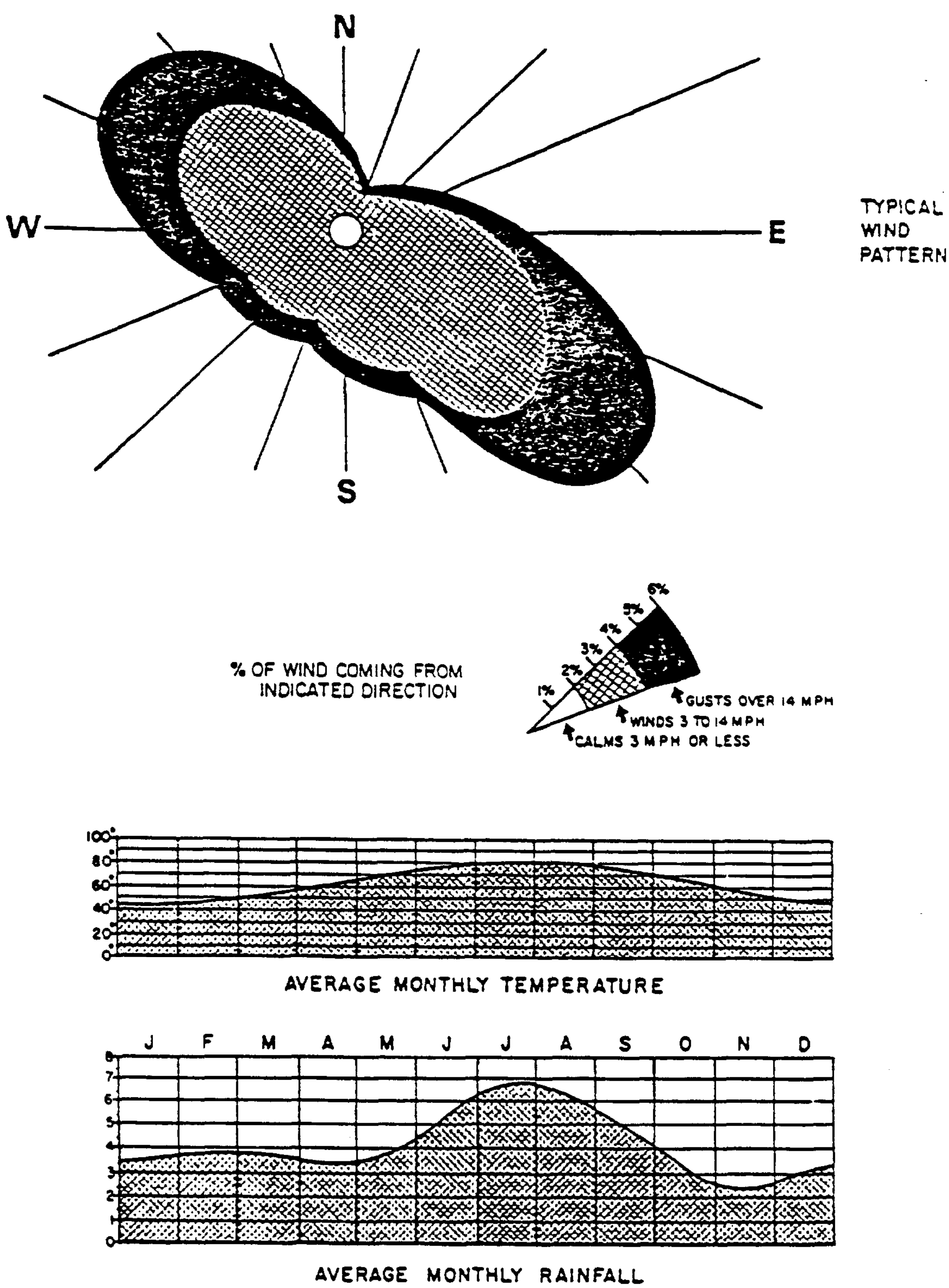

FIGURE 4-10
REGIONAL CLIMATIC CONDITIONS AT CAMP LEJEUNE

SOURCE: NAVFACENGCOM, 1975.

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5.0 RESULTS OF INVESTIGATION

This report is the result of three investigative phases which have been completed at the Sites 6, 48 and 69. These investigations have included a shallow soil samples and shallow groundwater samples. The results have been summarized in the section by sample medium, and are broken down within each medium by area of investigation.

QA/QC samples were collected and analyzed during the Supplemental Characterization in accordance with EPA procedures as required by the Federal Facilities Agreement. The results of these analysis is presented in the **Section 5.4**. One of the main concerns noted during the QA/QC program was the finding of laboratory contaminants in many of the QA/QC samples. These compounds (acetone, methylene chloride and carbon disulfide) were detected in many of the laboratory blanks as well as in field samples. Most of the hits were at concentrations which were below the certified reporting level of the analytical instrument. These compounds are routinely used within the laboratory for glassware cleaning, equipment cleaning and for sample extraction. No widespread use of these compounds was noted in the Record Search which would account for their presence in so many samples. Therefore, the presence of these compounds in the analytical samples is being attributed to laboratory contamination within this report.

Several samples contained unquantifiable identified compounds (UICs). These are compounds that have been identified during the analysis, but the concentration is below the certified reporting limit for the analytical instrument or the method.

5.1 SITE 6 - LOTS 201 AND 203

5.1.1 Soils Investigations

Verification Step

In August 1984, four locations within Storage Lots 201 and 203 were identified as most likely areas of contamination. Five borings were drilled at each of the four locations and composite soil samples were collected from the 0-to-3-foot depth range. The soil samples were analyzed for o,p - and p,p-isomers of DDD, DDE, and DDT. Soil boring samples 6S1 through 6S10 were collected from Lot 203, and 6S11 through 6S20 were collected from Lot 201.

Isomers of DDD, DDE, and DDT were detected in 3 of the 5 soil boring samples collected in the northern half of Lot 203. All soil boring samples collected from the southeast quadrant of Lot 203 contained one of the target isomers. The p,p-isomer of DDD, DDE, and DDT was predominant. All of the soil boring samples collected from Lot 201 contained at least one of the target isomers. Five of the samples contained all 6 isomers (6S13, 6S14, 6S15, 6S17, 6S19), and three of the samples contained 5 of 6 isomers (6S11, 6S18, 6S20). Verification Step soil sample analytical results are presented in **Table 5-1**.

5.1.2 Groundwater Sampling

It should be noted at this point that only unfiltered groundwater samples have been analyzed during all phases of this investigation. In many cases, the water collected from the shallow monitor wells were very turbid due to the fine nature of much of the shallow sediments and the slow yield of the wells which hampered development of the wells. Preservation of the turbid metals fraction (pH <2) can release metals which are a part of the sediment material, yielding higher concentrations of these metals.

Table 5-1. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SOIL SAMPLES

	6S1	6S1	6S2	6S2	6S3	6S4	6S5	6S6	6S7	6S8
DATE	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84	8/06/84
PARAMETER										
DDD,OP'	<0.000426	<0.000427	<0.000420	0.000657	<0.000535	<0.000419	<0.000418	<0.000430	<0.000432	<0.000437
DDE,OP'	<0.000319	<0.000321	<0.000315	<0.000323	<0.000401	<0.000314	<0.000313	<0.000322	<0.000324	<0.000323
DDT,OP'	0.00117	<0.00118	0.00231	<0.00119	<0.00147	<0.001150	0.00178	<0.001180	<0.00119	0.00480
DDD,PP'	<0.0005	0.0005	<0.000500	<0.0002	<0.00070	<0.000500	0.00107	0.00060	0.0006	0.00090
DDE,PP'	0.0012	0.0006	0.00140	0.0013	<0.00030	0.00050	<0.000200	0.00100	0.0016	0.00100
DDT,PP'	<0.0012	0.0010	<0.001200	<0.0006	<0.00150	<0.001200	0.00730	0.00270	0.0035	0.01400

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC soil standards.

Source: ESE, 1990.

Use of this data in the follow on Risk Assessment is considered a very conservative approach as risks are then calculated on all phases of the compound of concern, not just the dissolved phase.

Characterization Step

In November 1986, 8 shallow monitoring wells were installed at Site 6 **(Figure 1-2)**. Two rounds of groundwater sampling were performed at the site. The first round in November 1986, and the second round in January 1987. The samples collected during both rounds of sampling were analyzed for VOCs and the o,p - and p,p - isomers of DDD, DDE, and DDT. The pesticides DDD, DDE, and DDT, and their metabolites were not detected in any groundwater samples collected during the two rounds of sampling. Only three VOCs were detected in the groundwater samples. Benzene and 1,1,2,2 - tetrachloroethane were detected in monitoring well 6GW1 at concentrations of 3.1 and 63 parts per billion (ppb), respectively. Chloromethane was detected in monitoring well 6GW6 at a concentration of 6.5 ppb (ESE, 1990). Characterization Step groundwater analytical results are presented in **Table 5-2**.

Supplemental Characterization

Eight existing shallow monitoring wells (6GW1 through 6GW8) were scheduled to be sampled at Site 6 during the field investigation to obtain current information on groundwater quality at the site. Monitoring wells 6GW2 through 6GW8 were sampled during the period January 18 through January 19, 1991. 6GW1 was not sampled during the field investigation because the well was dry. All samples were analyzed for full TCL parameters.

Table 5-2. **SITE 6 - STORAGE LOTS 201 AND 203 DETECTED TARGET ANALYTES GROUNDWATER SAMPLES CHARACTERIZATION STEP**

Date	NC GW Standards	6GW1 11/19/86	6GW1 1/21/87	6GW2 11/20/86	6GW2 1/21/87	6GW3 11/20/86	6GW3 1/22/87	6GW4 11/19/86	6GW4 1/21/87	6GW5 11/19/86	6GW5 1/21/87	6GW6 11/19/86	6GW6 1/22/87	6GW7 11/20/86	6GW7 1/22/87	6GW8 11/20/86	6GW8 1/22/87
Parameter																	
Benzene	1	3.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	None	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	<4.3	6.5	<4.3	<4.3	<4.3	<4.3	<4.3
1,1,2,2-Tetrachloroethane	None	63	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1	<4.1

Values reported are concentrations in micrograms per liter (μg/L); this approximates parts per billion (ppb).

Source: ESE, 1990

Only one shallow well (6GW6) sample contained detectable concentrations of a volatile compound. Carbon disulfide was detected at a concentration of 10 ug/L. No semi-volatile compounds or pesticides were detected in any of the samples collected from the shallow groundwater monitor wells or the water supply wells.

All samples collected from the shallow wells contained inorganic compounds which exceeded the North Carolina Water Quality Standards (NCWQS). Ironand manganese concentrations exceeded the standards (300 and 50 ug/L) in every sample. Chromium and lead exceeded the standards (50 and 15 ug/L) in all samples except 6GW4. The sample collected from well 6GW3 also contained concentrations of cadmium and zinc which exceeded the standards (10 and 5,000 ug/L) while the sample from well 6GW7 exceeded the barium standard (1,000 ug/L).

All groundwater analytical results for Site 6 on samples collected during the Supplemental Characterization are presented in **Appendix F**.

<u>Potable Water Supply Wells</u>

Water supply wells WS651 and WS653 were sampled during the Supplemental Characterization on January 22, 1991. These wells are located on Piney Green Road to the east of Site 6. The total depth or screen interval of these wells is unavailable at this time. Both samples were analyzed for full TCL parameters.

Acetone, a laboratory solvent was detected in water supply well WS653 at a concentration of 12 ug/L. Several volatile compounds were detected in the sample collected from water supply well WS651. These compounds included vinyl chloride (70 ug/L), 1,2-dichloroethene (1,2-DCE) (75 ug/L), trichloroethene (TCE) (13 ug/L), and tetrachloroethene (53 ug/L). Acetone (2 ug/L) and toluene (0.9 ug/L) were also detected as UICs.

No semi-volatile compounds or pesticides were detected in any of the samples collected from the two water supply wells.

The Iron concentration (1,080 ug/L) exceeded the standard (300 ug/L) in the sample collected from WS651.

All water supply well analytical results for Site 6 on samples collected during the Supplemental Characterization are presented in **Appendix F**.

5.1.3 Surface Water/Sediment Sampling

Characterization Step

The November 1986 investigation included four surface water and four sediment samples which were collected from upstream and downstream locations in Wallace and Bearhead Creeks. Wallace and Bearhead Creeks border Site 6 to the north and south, respectively. Surface water and sediment sample locations are shown on **Figure 5-1**. The samples were analyzed for the o,p - and p,p-isomers of DDD,DDE, and DDT, and VOCs. VOCs were not detected in any surface water samples collected from Bearhead Creek. Three VOCs (trans -1,2-dichloroethene, trichloroethene, and vinyl chloride) were detected in surface water samples collected from Wallace Creek. Higher concentrations were detected in the downstream location compared with the upstream location. Neither DDT nor its metabolites were detected above Method Detection Limits (MDL) in any surface water or sediment samples collected from Wallace Creek. The p,p-isomer of DDE was detected in the upstream and downstream sediment sample locations in Bearhead Creek. The upstream concentration was higher than the downstream concentration. The p,p-isomer of DDT was detected only in the downstream location of Bearhead Creek.

Surface water and sediment sample analytical results for the Characterization step are presented in **Tables 5-3** and **5-4**.

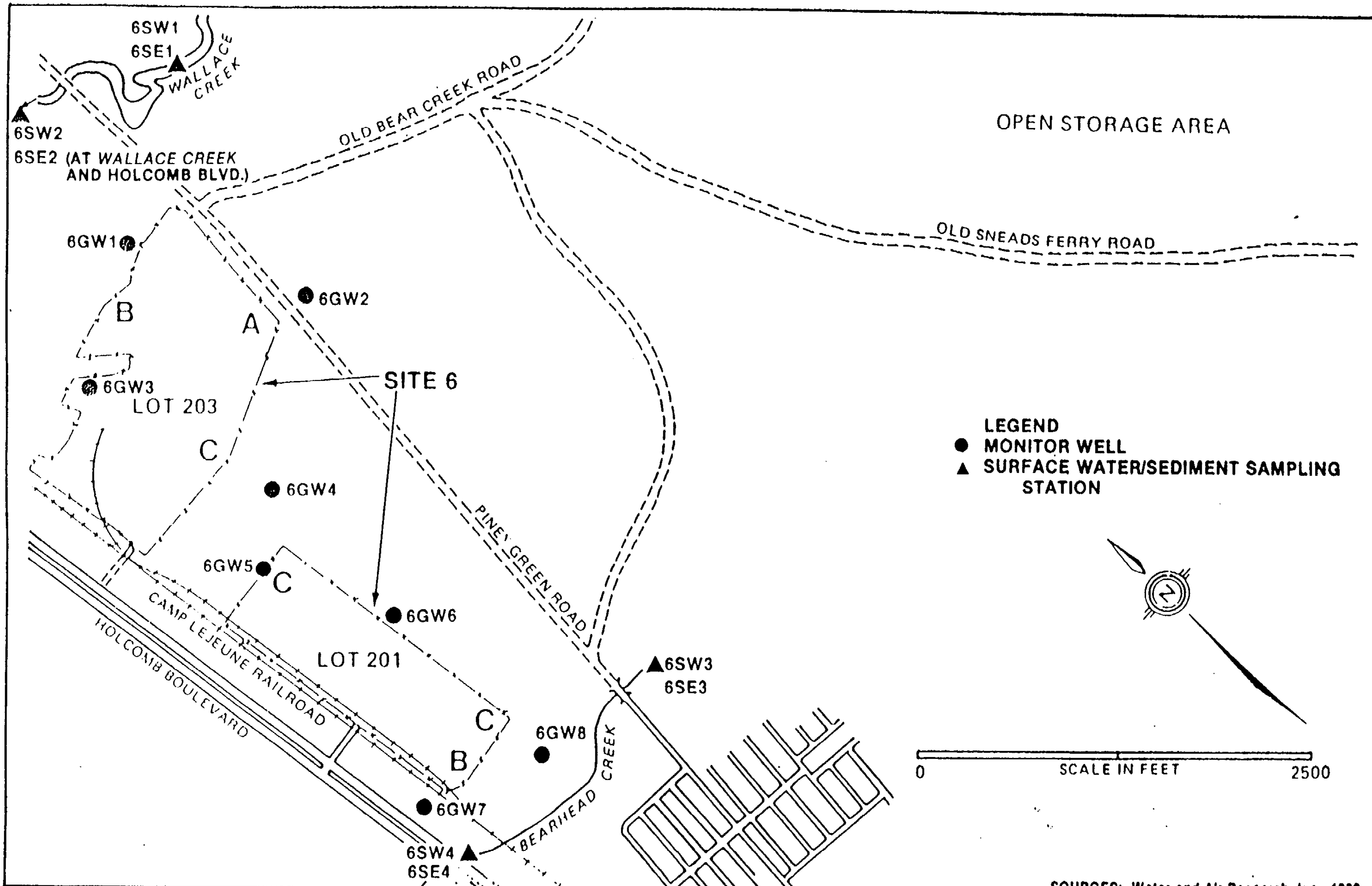

FIGURE 5-1
SITE 6
STORAGE LOTS 201 AND 203 - SW/SEDIMENT SAMPLING LOCATIONS

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**Table 5-3. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SURFACE WATER SAMPLES**

Date	NC SW Standards		6SW1 11/19/86	6SW2 11/19/86	6SW3 11/19/86	6GW4 11/19/86
Parameter	Aquatic	Human				
Trans-1,2-Dichloroethene	NS	NS	6.4	35	<1.6	<1.6
Trichloroethene	NS	92.4	<3.0	26	<3.0	<3.0
Vinyl Chloride	NS	525	1.9	3.6	<1.0	<1.0

NS = No Standard

Values reported are concentrations in micrograms per liter (μg/L); this approximates parts per billion (ppb).

Source: ESE, 1990

Table 5-4. SITE 6 - STORAGE LOTS 201 AND 203
DETECTED TARGET ANALYTES
SEDIMENT SAMPLES

	6SE1	6SE2	6S33	6SE4
DATE	11/19/86	11/19/86	11/19/86	11/19/86
PARAMETER				
DDE,PP'	<0.0142	<0.0137	0.0758	0.0131
DDT,PP'	<0.0711	<0.0685	0.2190	<0.0654

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

Supplemental Characterization Step

Two surface water and two sediment samples were collected from Wallace Creek during the field investigation. Surface water sample 6SW1 and sediment sample 6SE1, the designated upstream samples, were collected from Wallace Creek at Piney Green Road. Surface water sample 6SW2 and sediment sample 6SE2, the designated downstream samples, were collected from Wallace Creek at Holcomb Boulevard. These samples were collected on January 23, 1991.

The only volatile compounds detected in the surface water samples were detected in the downstream sample (6SW2) collected in Wallace Creek. TCE, which was detected during the Characterization sampling, was detected at a concentration of 5 ug/L and 1,2-DCE was detected as a UIC. 1,1,1-trichloroethane was detected as a UIC in the upgradient sediment sample. Acetone and methylene chloride, both laboratory solvents, were detected in both of the sediment samples.

No semi-volatile compounds were detected in either of the surface water samples collected. No semi-volatile compounds were detected in the upstream sample collected from Wallace Creek. Three semi-volatile compounds were detected in the downstream sample. These compounds included benzo(b)fluoranthene (600 ug/kg), benzo(k)fluoranthene (510 ug/kg), and benzo(a)pyrene (460 ug/kg). Several other compounds (acenaphthylene, acenaphthene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, indeno(1,2,3-cd)pyrene and benzo(g,h,i)perylene) were detected in the downgradient sediment sample as UICs.

One PCB compound, Aroclor-1260, was detected as a UIC in the upgradient sediment sample collected from Wallace Creek.

Reportable concentrations of several metals were detected in the two surface samples collected from Wallace Creek. Concentrations of aluminum, calcium, magnesium, potassium, sodium and zinc all increased in concentration from the upstream sample to the downstream sample. Only iron decreased in concentration. Aluminum, calcium and iron were also detected in the upstream sediment sample, but were below the detection limit in the downstream sample.

Analytical results of surface water and sediment samples collected in Wallace creek during the Supplemental Characterization show that most compounds detected increase in concentration from the upstream sample to the downstream sample. This indicates that degradation to the surface water and sediments of Wallace Creek is continuing adjacent to Site 6.

All analytical results of surface water and sediment samples collected from Site 6 during the Supplemental Characterization are presented in **Appendix F**.

5.2 SITE 48 - MCAS NEW RIVER MERCURY DUMP

5.2.1 Soils Investigations

Verification Step

Four hand augered soil borings to the water table were completed in August 1984. Five soil samples were collected from the soil-water interface and analyzed for mercury. Mercury was detected in all five samples collected in concentrations ranging from 0.009 mg/kg to 0.03 mg/kg.

5.2.2 Groundwater Sampling

No groundwater samples have been collected at this site

5.2.3 Surface Water/Sediment Sampling

Verification Step

In August 1984, four sediment samples were collected from the marshy area to the north of Building 804 (photo lab). The sediment samples were analyzed for mercury only. Mercury was detected in all sediment samples collected from the site. The concentrations of mercury detected in the sediment samples ranged from 0.02 mg/kg in 3 of the samples to 0.03 mg/kg in the fourth sample.

The presence of mercury in the sediments of the marshy area indicates that mercury has migrated into the surface water system of the marshy area via shallow groundwater movement.

Supplemental Characterization

Ten surface water and ten sediment samples were collected from the marsh area and inlet northeast of Building 804 (Photo Lab) at Site 48. One surface water and one sediment sample were also collected in the New River at a background location upstream and outside of the Site 48 marsh area. Surface water and sediment samples in the marsh area and inlet are designated 48SW1 through 48SW10 and 48SE1 through 48SE10, respectively. The background samples are designated 48SW11 and 48SE11. **Figure 5-2** shows the approximate locations of surface water and sediment samples collected at Site 48. The samples were collected on January 15 and 17, 1991. All samples were analyzed for TCL Metals only.

Four metals (calcium, magnesium, potassium, and sodium) were abundant in each of the surface water samples collected. The variations in concentrations detected did not correlate to where the samples were collected, and the background sample collected from in the New River typically fell within the middle of the reported range. Mercury was not detected in any of the samples collected. Other metals which would

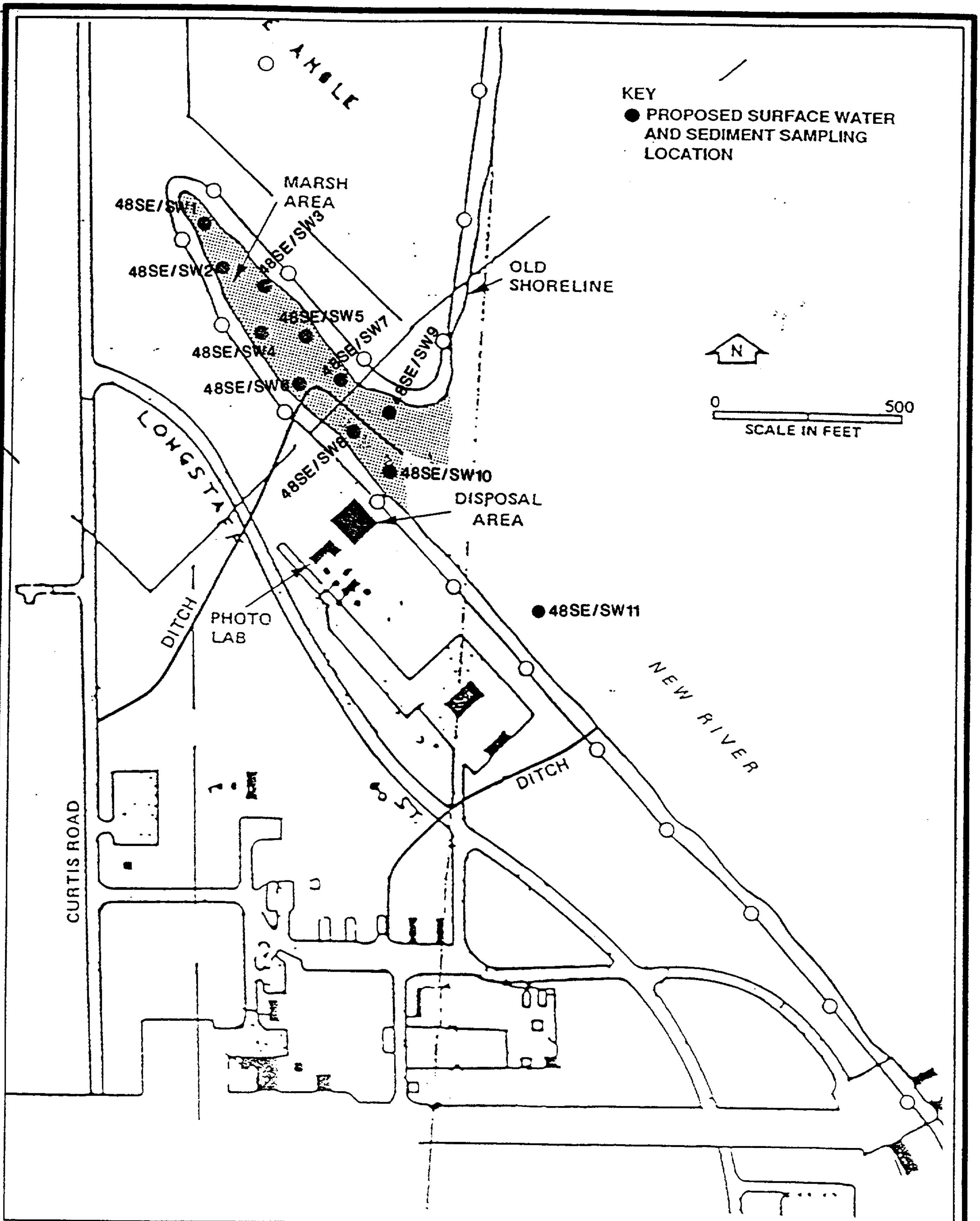

FIGURE 5-2
APPROXIMATE SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS - SITE 48

SOURCES: WATER AND AIR RESEARCH, INC., 1983.

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typically be of concern (arsenic, cadmium, chromium, lead, etc.) were either not detected at all or were detected only as UICs.

Those metals which were abundant in the surface water samples were also detected in large concentrations in the sediment samples along with iron. No mercury was detected in any of the sediment samples collected. Low concentrations (<25 mg/kg) of cadmium, chromium, lead and manganese were detected in each of the sediment samples.

The absence of mercury and the low or non-existent concentrations of other metals of concern within the surface water and sediment samples collected adjacent to Site 48 indicates that while the disposal itself area may have been impacted by the past dumping of mercury, no impacts are being seen in the surrounding wetlands.

All analytical results of surface water and sediment samples collected from Site 48 during the Supplemental Characterization are presented in **Appendix G**.

5.2.4 Tissue Sampling

Supplemental Characterization

The Site 48 sampling area provides limited fisheries habitat due to the shallow depths and lack of internal structure for cover. At the time of sampling, the area was devoid of any submerged aquatic vegetation, however, species of emergent vegetation and algae were present along the shoreline. This vegetation and algae could be used by small fish.

The background sampling location, outside and upstream of the channel showed similarity of structure to the fisheries habitat of the main sampling area, and was therefore expected to support similar species, without the potential exposure to Site 48 contamination.

Fish tissue sampling was attempted on two separate days (January 14 and 17, 1991), at periods of high and low tide. Two seine hauls were pulled through a small area of the sample site, however, no fish or shellfish were caught.

Observations of the entire sampling area revealed that shellfish did not occur along the shore or within the channel. The bottom was comprised of silty material, which may not provide a solid enough substrate for the shellfish to survive. Fine silt material can interfere with the shellfish's ability to breathe.

5.3 Site 69 - Rifle Range Chemical Dump

5.3.1 Soils Investigations

No soil samples have been collected from this site.

5.3.2 Groundwater Sampling

It should be noted at this point that only unfiltered groundwater samples have been analyzed during all phases of this investigation. In many cases, the water collected from the shallow monitor wells were very turbid due to the fine nature of much of the shallow sediments and the slow yield of the wells which hampered development of the wells. Preservation of the turbid metals fraction (pH <2) can release metals which are a part of the sediment material, yielding higher concentrations of these metals. Use of this data in the follow on Risk Assessment is considered a very conservative approach as risks are then calculated on all phases of the compound of concern, not just the dissolved phase.

Verification Step

During the period of July-August, 1984, 8 groundwater monitoring wells (69GW1 through 69GW8) were installed and sampled at Site 69. Groundwater monitor well locations are presented in **Figure 1-4**. The groundwater samples were analyzed for organochlorine pesticides, PCBs, pentachlorophenol, VOCs, mercury, and residual chlorine.

VOCs were detected in groundwater samples collected from monitoring wells 69GW2, 69GW3, 69GW4, and 69GW5. Target analytes detected in samples collected during the Verification Step are presented in **Table 5-5.**

Characterization Step

During December, 1986 a second round of groundwater samples was collected from 69GW1 through 69GW8. All samples were analyzed for the same target compounds as in the 1984 sampling event, plus tetrachlorodioxin, xylene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and ethylene dibromide. Like the first sampling event, VOCs were detected in the groundwater samples collected from monitoring wells 69GW2, 69GW3, 69GW4, and 69GW5. Target analytes detected in samples collected during the Characterization Step are presented in **Table 5-5.**

Supplemental Characterization Step

Eight existing shallow monitoring wells (69GW1 through 69GW8) were sampled at Site 69 during the field investigation. The monitoring wells were sampled during the period January 14 to January 16, 1991. Monitoring well 69GW1 was resampled on January 24, 1991 because the original sample containers arrived at the laboratory broken. All groundwater samples collected were analyzed for full TCL parameters.

Samples collected from wells 69GW2, 69GW3, 69GW4 and 69GW5 once again showed detectable concentrations of a number of solvent related volatile compounds. Additionally, 69GW6 also showed detectable concentrations of VOCs. The sample collected from well 69GW2 exhibited the highest concentrations of compounds

Table 5-5. SITE 69 - RIFLE RANGE CHEMICAL DUMP DETECTED TARGET ANALYTES GROUNDWATER SAMPLES (PAGE 1 OF 2)

DATE	NC GW STANDARDS	69GW1 7/18/84	69GW1 12/12/86	69GW2 7/18/84	69GW2 12/17/86	69GW3 7/18/84	69GW3 12/17/86	69GW4 7/18/84	69GW4 12/18/86
PARAMETER									
MERCURY	1.1	0.2	0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	NONE	<0.0001	<0.013	<0.0001	<0.013	<0.0001	0.087	<0.0001	<0.013
BHC,D	NONE	<0.0003	NR	<0.0003	0.034	<0.0003	2.44	<0.0003	<0.013
1,2-DIBROMOETHANE	NONE	NA	<0.02	NA	4.74	NA	0.363	NA	<0.02
BENZENE	1	<0.3	<1	0.7	<25	4	4	<0.6	<1
CHLOROBENZENE	300	<0.5	<6	<0.5	<150	49	55	<0.9	<6
CHLOROFORM	0.19	<0.7	<1.6	<0.6	<40	<0.6	<1.6	1.3	14
1,2-DICHLOROETHANE	0.38	<1	<2.8	5.9	<70	1.9	<2.8	<1.8	<2.8
1,1-DICHLOROETHYLENE	7	<1.2	<2.8	1.6	<70	2.7	<2.8	<2.4	<2.8
T-1,2-DICHLORO-									
ETHENE	70	<1.2	<1.6	9700	37000	4000	830	410	91
METHYLENE CHLORIDE	5	10	<2.8	<1	<70	<1	<2.8	<2	<2.8
1,1,2,2-TETRACHLORO-									
ETHANE	NONE	<0.9	<4.1	44	<100	<0.8	<4.1	2	5.4
TETRACHLOROETHENE	NONE	<1.7	<3	20	<75	<1.6	<3	<3.3	<3
1,1,2-TRICHLORO-									
ETHANE	NONE	<1.2	<5	7.9	<130	<1.2	<5	3.1	<5
TRICHLOROETHENE	NONE	<1.3	<3	340	710	4.9	<3	<2.5	<3
TOLUENE	1000	0.7	<6	5	<150	14	10	<1	<6
VINYL CHLORIDE	0.015	<0.9	<1	80	440	2	1.6	<2	<1

NA: not analyzed.

NR: not reported.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

T e 5-5. SITE 69 - RIFLE RANGE CHEMICAL DUM
DETECTED TARGET ANALYTES
GROUNDWATER SAMPLES
(PAGE 2 OF 2)

	NC GW	69GW5	69GW5	69GW6	69GW6	69GW7	69GW7	69GW8	69GW8
DATE	STANDARDS	7/18/84	12/18/86	7/18/84	12/18/86	7/18/84	12/18/86	7/18/84	12/18/86
PARAMETER									
MERCURY	1.1	<0.2	<0.2	<0.2	0.2	<0.2	0.2	<0.2	0.2
BHC,B	NONE	<0.0001	<0.017	<0.0001	<0.013	<0.0001	<0.013	<0.0001	<0.013
BHC,D	NONE	<0.0003	<0.017	<0.0003	<0.013	<0.0003	<0.013	<0.0003	<0.013
1,2-DIBROMOETHANE	NONE	NA	<0.02	NA	<0.02	NA	<0.02	NA	<0.02
BENZENE	1	<0.3	<1	<0.3	<1	<0.3	<1	<0.3	<1
CHLOROBENZENE	300	<0.5	<6	<0.5	<6	<0.5	<6	<0.5	<6
CHLOROFORM	0.19	<0.7	<1.6	<0.6	<1.6	<0.7	<1.6	<0.7	<1.6
1,2-DICHLOROETHANE	0.38	<1	<2.8	<0.9	<2.8	<1	<2.8	<1	<2.8
1,1-DICHLOROETHYLENE	7	<1.2	<2.8	<1.2	<2.8	<1.2	<2.8	<1.3	<2.8
T-1,2-DICHLORO-									
ETHENE	70	<1.2	4.2	<1.2	<1.6	<1.2	<1.6	<1.2	<1.6
METHYLENE CHLORIDE	5	<1	<2.8	<1	<2.8	<1	<2.8	<1	<2.8
1,1,2,2-TETRACHLORO-									
ETHANE	NONE	<0.9	<4.1	<0.8	<4.1	<0.9	<4.1	<0.9	<4.1
TETRACHLOROETHENE	NONE	<1.7	<3	<1.6	<3	<1.7	<3	<1.7	<3
1,1,2-TRICHLORO-									
ETHANE	NONE	<1.2	<5	<1.2	<5	<1.2	<5	<1.2	<5
TRICHLOROETHENE	NONE	<1.3	<3	<1.3	<3	<1.3	<3	<1.3	<3
TOLUENE	1000	<0.6	<6	<0.6	<6	<0.6	<6	<0.6	<6
VINYL CHLORIDE	0.015	<1	<1	<0.9	<1	<1	<1	<0.9	<1

NA: not analyzed.

Values reported are concentrations in micrograms per liter (ug/L); this approximates parts per billion (ppb).

Source: ESE, 1990.

including vinyl chloride (36 ug/L), 1,2-DCE (11,000 ug/L), TCE (67 ug/L), and 1,1,2,2-tetrachloroethane (7 ug/L). Several other compounds were detected as UICs. The sample collected from well 69GW3 contained concentrations of 1,2-DCE (220 ug/L), toluene (5 ug/L) and chlorobenzene (40 ug/L) as well as several other compounds as UICs. The sample collected from well 69GW4 contained a concentration of chloromethane (16 ug/L) as well as acetone (15 ug/L) and carbon disulfide (5 ug/L). A total of eleven other compounds were detected as UICs. Only carbon disulfide was quantified in the sample collected from 69GW5 at a concentration of 8 ug/L. Five other compounds were detected as UICs. Well 69GW6, which previously was free of detectable VOC contamination now exhibits concentrations of 1,2-DCE (70 ug/L) and TCE (92 ug/L) as well as benzene as a UIC. Carbon disulfide was detected in the sample collected from well 69GW1 (7 ug/L) and wells 69GW7 and 69GW8 contained the laboratory solvent methylene chloride as a UIC.

No detectable concentrations of semi-volatile compounds were detected in the samples collected from the site. One pesticide compound (alpha-BHC) was detected in a very low concentration (0.12 ug/L) in the sample collected from well 69GW3.

Iron exceeded the NCWQS in the sample collected from each of the monitor wells, and manganese exceeded the standard in wells 69GW1 through 69GW6. The zinc standard was exceeded in well 69GW4, and the silver standard in well 69GW8.

Solvent related VOC contamination still exists in the groundwater at site 69. The detection of VOC contamination in well 69GW6 which was previously uncontaminated shows that the plume is continuing to spread. This well is downgradient of the landfill.

All groundwater analytical results for samples collected from Site 69 during the Supplemental Characterization are presented in **Appendix H**.

5.3.3 Surface Water/Sediment Sampling

Characterization Step

During December, 1986 three surface water samples were collected from three locations on site. Additionally, two sediment samples were collected from two unnamed creeks that drain from the site into the New River estuary. Surface water and sampling locations are presented in **Figure 5-3**. All samples were analyzed for organochlorine pesticides, PCBs, pentachlorophenol, VOCs, mercury, residual chlorine, tetrachlorodioxin, xylene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and ethylene dibromide. VOCs were detected in the surface water samples 69SW1, 69SW2, and 69SW3. Additionally, pentachlorophenol and the p,p-isomer of DDE was detected in sediment sample 69SE4. The p,p-isomer of DDD was detected in sediment sample 69SE5 (ESE, 1990). Detected target analytes in the Characterization Step surface water and sediment samples are presented in **Tables 5-6** and **5-7**.

Supplemental Characterization

Seven surface water and seven sediment samples were scheduled to be collected at Site 69 during the field investigation. One sample of each media was scheduled to be collected at each of the Characterization Step locations, 69SW1, 69SW2, and 69SW3. Two samples of each media were to be collected at each of the Characterization Step locations 69SW4 and 69SW5.

Sample locations 69SW1, 69SW2, and 69SW3, can be described as small-scale depressions in the vicinity of Site 69 which accumulated water during the Characterization Step field investigation. These "wet areas" are intermittent in nature, and as a result, locations 69SW2 and 69SW3 were not present during the 1991 field investigation. Location 69SW1 was identified during the investigation. One surface

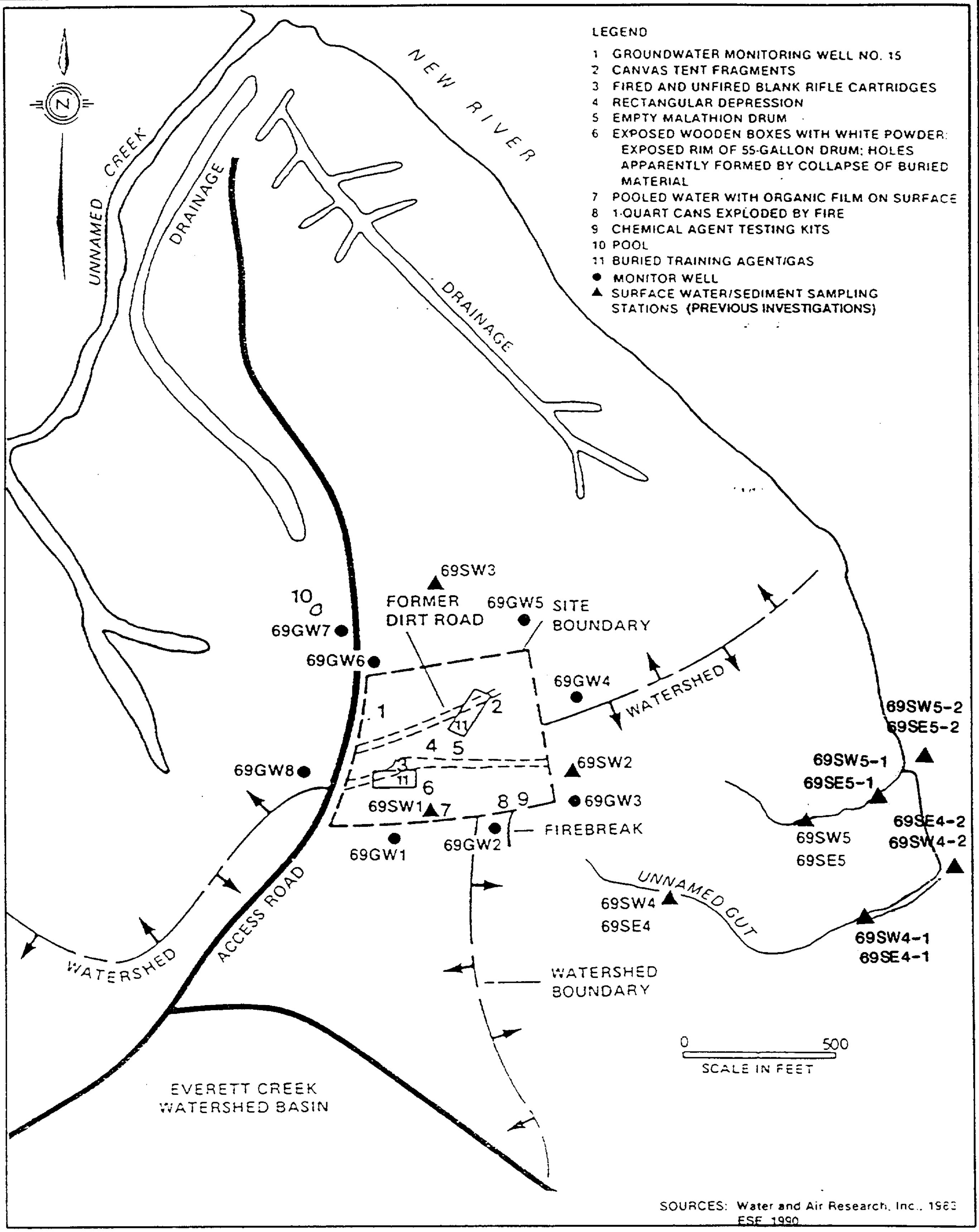

FIGURE 5-3
SITE 69
RIFLE RANGE CHEMICAL DUMP
SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

MARINE CORPS BASE
CAMP LEJEUNE

ESE Environmental Science & Engineering, Inc.

Table 5-6. SITE 69 - RIFLE RANGE CHEMICAL DUMP DETECTED TARGET ANALYTES SURFACE WATER SAMPLES

	NC SW		69SW1	69SW1	69SW2	69SW2	69SW2	69SW3
Date	Standards		8/4/84	8/4/84	12/12/86	8/4/84	12/12/86	12/12/86
Parameter	Aquatic	Human						
BHC, A	NS	NS	<0.001	<0.001	0.043	<0.001	0.056	<0.035
BHC, B	NS	NS	0.03	<0.0001	0.043	0.005	0.18	<0.013
BHC, D	NS	NS	0.2	<0.0003	NR	0.02	NR	NR
Pentachlorophenol	NS	NS	10	4	<0.89	<0.9	1.24	<0.89
Benzene	NS	71.4	0.4	NA	<1	<0.2	<1	<1
Chlorobenzene	NS	NS	2.1	NA	<6	<0.3	<6	<6
Chloroform	NS	NS	6	NA	<1.6	<0.5	<1.6	<1.6
1,2-Dichloroethane	NS	NS	0.9	NA	<2.8	<0.8	<2.8	<2.8
T-1,2-Dichloroethene	NS	NS	410	NA	310	10	170	<1.6
Ethylbenzene	NS	NS	3	NA	<7.2	<0.6	<7.2	<7.2
Methylene Chloride	NS	NS	<0.6	NA	<2.8	8	<2.8	<2.8
1,1,2,2-Tetrachloroethane	NS	10.8	59	NA	<4.1	<0.5	<4.1	<4.1
1,1,2-Trichloroethane	NS	NS	6	NA	<5	<0.8	<5	<5
Trichloroethene	NS	NS	55	NA	63	1.3	12	<3
Toluene	11	NS	11	NA	<6	<0.4	<6	<6
Vinyl Chloride	NS	525	15	NA	41	<0.6	<1	<1
Mercury	.012	NS	<0.2	<0.2	<0.2	<0.2	<0.2	0.2

NA = Not Analyzed
NS = No Standard
Values reported are concentrations in micrograms per liter ($\mu g/L$); this approximates parts per billion (ppb).

Source: ESE, 1990

Table 5-7. SITE 69 - RIFLE RANGE CHEMICAL DUMP DETECTED TARGET ANALYTES SEDIMENT SAMPLES

	69SE4	69SE5
DATE	12/12/86	12/12/86
PARAMETER		
DDD,PP'	<0.0129	0.113
DDE,PP'	0.0188	<0.0224
PENTACHLOROPHENOL	1.190	<0.0513

Values reported are concentrations in micrograms per gram (ug/g); this approximates parts per million (ppm).

Note: There are no NC sediment standards.

Source: ESE, 1990.

water (69SW1) and one sediment sample (69SE1) was collected from this location on January 16, 1991. 69SE1 was resampled for cyanide only on February 21, 1991 due to a missed holding time by the lab.

Characterization Step samples, 69SW4/69SE4 and 69SW5/69SE5, were collected from gullies in the vicinities of Site 69, which contained water during the previous sampling. These gullies were dry during the 1991 investigation, and, therefore, could not be sampled. As a means of investigating the impact of drainage through these gullies to the New River estuary, two surface water and sediment samples were collected at the confluences of each gully with the New River Estuary, or just downgradient of these confluences. The average depth is approximately 2 feet in these areas. These samples were collected on January 14, 1991.

Figure 5-3 shows the Site 69 surface water and sediment sampling locations.VOC contamination was detected in the standing water sample collected on the south side of the site (69SW1). This contamination included vinyl chloride (15 ug/L), 1,2-DCE (190 ug/L), TCE (7 ug/L), and 1,1,2,2-tetrachloroethane (5 ug/L). Chloroform and toluene were detected as UICs. Methylene chloride and acetone, both laboratory solvents) were detected in samples 69SW4-1 and 69SW4-2. No VOC contamination was detected in the sediment samples collected although the laboratory solvents methylene chloride and acetone were observed in all 4 samples.

No semi-volatile compounds were detected in the surface water samples collected from Site 69. One semi-volatile compound (4-methylphenol) was detected as a UIC in one sediment sample (69SE5-1). No pesticide compounds were detected in the surface water or sediment samples collected.

While past operations at the site have impacted the groundwater beneath the site, little current adverse impacts are being observed in the surface drainages with the exception of standing water on the actual site. The absence of water in the drainages near the site may be hiding the impacts of the site on those drainages.

All analytical results of surface water and sediment samples collected from Site 69 during the Supplemental Characterization are presented in **Appendix H.**

5.3.4 Tissue Sampling

Supplemental Characterization

Fish tissue sampling at Site 69 was performed in the New River estuary at the confluence of the dry gullies and the estuary as described in **Section 3.3.2**. The area was shallow with an average depth of two feet. The bottom substrate was comprised of a silty coarse sand, and lacked any submerged vegetation. The near shore area had an abundance of emergent grasses which would provide adequate habitat for juvenile fish. This area probably provides a source of food for fish in the spring and summer months, however, due to the depth, this area probably has limited usefulness as a fisheries habitat.

At the time of sampling, there was no observed fish activity in the sampling area. It was determined that sampling for fish further into the river channel would not provide information useful to determine contaminant uptake in organisms from the study area. The population of shellfish was scattered and concentrated in the near shore area. Shell fish (oysters and mussels) were collected at each sampling location. Approximately 10 oysters (Clostridius virginica) plus two to three mussels (Geukensia demissa) were composited for each of the four samples (69TI1 through 69TI4). Fish tissue sampling at Site 69 was performed on January 14, 1991.

As the tissue samples were the result of compositing, no collection locations can be referenced in association with the analytical results. The results should be interpreted as indicative of the organisms in the vicinity of the site.

The volatile compound chloromethane was detected in every tissue sample collected from Site 69 at concentrations ranging from 17 to 210 ug/L. Acetone, a laboratory solvent was also detected in one sample at a concentration of 28,000 ug/L. This compound was detected in many of the sample blanks used during this investigation and is routinely used in the laboratory for glassware cleaning and sample preparation. This compound was not used in quantity at Camp Lejeune according to the Record Search conducted.

Benzoic acid was also detected in every tissue sample collected from the site ranging in concentrations from 520 to 2,300 ug/L, and phenol was detected in two of the samples (250 and 300 ug/L).

No pesticides were detected in any of the tissue samples analyzed.

Almost all metals analyzed for were detected within the tissue samples. This is not unexpected due to the nature of the tissue itself. Notable in its absence are concentrations of mercury, thallium or cyanide in any of the samples analyzed.

All analytical results of tissue samples collected from Site 69 during the Supplemental Characterization are presented in **Appendix H**.

5.4 QA/QC SAMPLES

Surface Water and Sediment QA/QC Samples

Two duplicate sediment samples and 2 duplicate surface water samples as well as 6 equipment blanks (EB prefix) and 3 trip blanks were collected during the Supplemental Characterization surface water/sediment sampling program. Duplicate sediment samples (except volatile fractions) were collected from a homogenized portion of the sample collected. Duplicate surface water samples were prepared by alternately filling sample containers and duplicate containers from each volume of water drawn. Equipment blanks were collected by pouring ultrapure water over decontaminated soil sampling equipment and catching the rinsate in sample containers.

Trip blanks were prepared in the laboratory and accompanied the sample containers into the field. One trip blank was included with each sample shipment back to the lab.

One surface water duplicate (SWDUP1) and one sediment sample duplicate (SEDUP1) were analyzed for the full TCL parameters, with the remaining duplicates being analyzed for TCL metals only. Equipment blanks (except for EB009 and EB012) were also analyzed for full TCL parameters. Blanks associated with Site 48, where analytical samples were only run for TCL Metals were analyzed for these parameters only. Trip blanks were analyzed for volatile compounds only. A list of the QA/QC samples and their associated analytical samples is presented in **Table 3-2**.

The analytical results of duplicate samples was very close as most parameters tested were below the detection limit. No surface water/sediment equipment blanks had notable concentrations of parameters of concern (TCL). The only volatile components detected in the trip blanks were acetone and methylene chloride at concentrations which were below the certified reporting limit for the instrument. These compounds have also been detected in low concentrations in many of the samples collected during this investigation. These compounds are routinely used in laboratory analysis and equipment cleaning and, as they are not compounds typically used at Camp Lejeune, have therefore been determined to be laboratory contaminants.

Sample duplicates are presented in the appropriate appendix with the duplicated sample. All other analytical results for QA/QC samples is presented in **Appendix D** and a discussion of QA/QC samples is provided in **Appendix E**.

<u>Groundwater QA/QC Samples</u>

A total of 2 duplicate groundwater samples, 6 trip blanks (TB prefix) and 2 equipment blanks (EB prefix) were collected during the Supplemental Characterization groundwater sampling program. Duplicate samples were collected by alternately filling sample containers and duplicate containers from each bailer of water. Equipment blanks were collected by pouring ultrapure water over decontaminated soil sampling equipment and catching the rinsate in sample containers. These samples were analyzed for the full TCL parameters. Trip blanks were prepared in the laboratory and accompanied the sample containers into the field. One trip blank was included with each sample shipment back to the lab. Trip blanks were analyzed for volatile compounds only. A list of the QA/QC samples and their associated analytical samples is presented in **Table 3-2**.

The analysis of groundwater duplicates shows a no variability in the analytical results of paired samples as most results, with the exception of metals, were below the detection limit. One equipment blank (EB-001) had a high concentration of iron (888 ug/L) and a small amount of cyanide (15.1 ug/L). The iron concentration observed did not affect the associated groundwater samples as iron concentrations in these samples were at concentrations well above that found in the blank. Cyanide concentrations were all below the detection limit (10.0 ug/L).

The only volatile components detected in the trip blanks were acetone and methylene chloride at concentrations which were below the certified reporting limit for the instrument. These compounds have also been detected in low concentrations in many of the samples collected during this investigation. These compounds are routinely used in laboratory analysis and equipment cleaning and, as they are not compounds typically used at Camp Lejeune, have therefore been determined to be laboratory contaminants.

Sample duplicates are presented in the appropriate appendix with the duplicated sample. All other analytical results for QA/QC samples is presented in **Appendix D** and a discussion of QA/QC samples is provided in **Appendix E**.

Decon Water QA/QC Blanks

One sample of the potable water (FB-001) and 3 samples of the DI water (DI-001, 002, and 003) used for cleaning field equipment was sampled during this investigation. As the field blank was collected from the potable water supply, its analysis reflects the groundwater at the site containing high concentrations of calcium, iron and sodium. The DI water blanks contained concentrations of iron and zinc well below what was detected in the groundwater samples.

All analytical results for QA/QC samples is presented in **Appendix F** and a discussion of QA/QC samples is provided in **Appendix G**.

EPA Sample Spikes

EPA provided the sampling crew with laboratory spiked samples during their audit of the sampling program. These samples are meant as a blind test of the analytical laboratory. ESE has not received the sample spike values from EPA at the time this report was prepared. As this data becomes available it will be presented. Analytical results of the samples provided to ESE are presented in **Appendix D** as EPA-1 and EPA-2.

Chain of Custody

Chain of custody documentation was prepared for each sample at the time the sample was collected. These forms accompanied the samples in the field and back to the laboratory. Copies of this documentation is presented in **Appendix I.**

6.0 PRELIMINARY RISK EVALUATION FOR SITES 6, 48 AND 69 OF MCB CAMP LEJEUNE

6.1 INTRODUCTION

Previous investigations conducted by ESE on Sites 6, 48, and 69 have revealed potential risk to human and nonhuman populations (ESE, 1990). As a result, during the 1991 Remedial Investigation/Feasibility Study field activities a limited scope investigation of the locations was conducted to derive preliminary risk assessments for Sites 6, 48 and 69. A separate human health and ecological risk assessment will be completed for Hadnot Point Industrial area.

Results presented in the Interim Remedial Investigation (RI) report produced for the Marine Corps Base (MCB), Camp Lejeune, (ESE, 1990) recommended an assessment of human health and ecological risk should be conducted for three areas of concern (AOC). These areas of particular concern were identified as Site 6 (storage lots 201 and 203), Site 48 (mercury dump site), and Site 69 (rifle range chemical dump).

During the 1991 winter sampling activities conducted by ESE at Camp Lejeune, Sites 6, 48, and 69 were sampled for various matrices and characterized for the completion of site-specific preliminary risk assessments. During the field investigation activities potential exposed populations were identified, the areas were characterized for terrestrial and aquatic life habitat suitability and specific exposure pathways were identified.

Sample chemical analyses collected are presented in the Remedial Investigation Report (ESE, 1990). Results indicate that there is a potential risk posed to human and nonhuman receptors exposed to contamination associated with sites 6, 48 and 69. Specifically, a number of inorganic analytes (chromium, cadmium and lead) were detected in Site 6 groundwater at concentrations exceeding or approaching safe drinking water levels (MCLs). A number of organic chemicals (volatile and semi-volatile) were identified in groundwater from site 6 as well. Although the concentrations do not exceed safe drinking water criteria, the cumulative mixture of these chemicals can pose a potential risk to receptor populations.

Results from the comparison of analyte concentrations observed in the various matrices to applicable relevant and appropriate requirements revealed that average levels of cyanide, iron, copper in surface water exceeded the federal marine acute and chronic water quality standards. However, the frequency of detection for several of these analytes was low. Numerous organic chemicals were identified as potential chemicals of concern in the shallow groundwater. Due to the presence of, and to the variety of these chemicals it is possible that the mixture of these chemicals could pose a potential risk to receptor populations.

Site 48 results from the 1991 field efforts varied considerably from previous investigations. Mercury was identified as a chemical historically disposed of in the area and detected in previous investigations. However, the results of the 1991 investigations did not reveal the presence of mercury in either surface water or sediment from the area of concern. It is unknown as to why this chemical was not detected and it is suggested that this area be further investigated to determine if mercury is a potential chemical of concern.

The following sections present the site background and description, data collection and evaluation, exposure assessment, toxicity assessment and conclusions for human health and ecological risks associated with Site 6 (lots 201 and 203), Site 69 (rifle range chemical dump), and Site 48 (mercury dump site).

The selection of potential chemicals of concern (PCOCs) for each site were based upon the frequency of occurrence and comparison of observed concentrations to published criteria for safety to humans and aquatic life (i.e. ambient water quality criteria). Specifically, data from surface water and groundwater samples that meets or exceeds promulgated federal freshwater and marine acute-chronic water quality standards, North Carolina freshwater and marine acute-chronic water quality standards, and maximum concentration levels established by the Safe Drinking Water Act, were considered to represent a possible risk to human and aquatic life. Current federal and state water quality standards were used for the qualitative comparison to determine PCOCs are presented in **Table 6-1.**

Sediment data were compared to available sediment quality criteria and water quality criteria (both federal and state) for the protection of freshwater and marine life (NCWQS, 1990; SDWA, 1989). If concentrations were greater than criteria by a factor of ten, it was determined that a potential risk to aquatic life exists. In general, chemicals associated with sediment are not as available (and subsequently as toxic) as chemicals which are suspended within the water column. Therefore, with the exception of bottom dwellers, chemicals associated with sediment are less likely to pose a risk to aquatic life. Based upon these assumptions it is hypothesized that higher concentrations of chemicals in sediment would be required to elicit toxic effects. Therefore a factor of ten was applied to water quality criteria for a more appropriate comparison to determine if the concentrations observed in sediment would pose a potential risk to aquatic life.

Soil data were compared to background literature values derived for the United States and eastern United States (Shacklett and Boerngen, 1984). However, the conclusions drawn from these comparisons are highly qualitative. Concentrations of certain analytes (i.e. inorganics) are highly variable and dependent upon site specific conditions.

All of the organic chemicals identified in sampling matrices were considered potential chemicals of concern. Acetone, methylene chloride, toluene were debated as to whether these chemicals should be treated as PCOCs since they have been identified as possible laboratory contaminants (EPA, 1989).

Table 6-1. COMPARISON OF PROMULGATED STANDARDS IN VARIOUS MEDIA (μg/l)

Chemical	Federal Fresh Water Quality Standards		North Carolina Water Quality Standards		Federal Marine Water Quality Standards		Federal Water Quality Standards	Safe Water Drinking Water Act MCL
	Acute	Chronic	Fresh Water	Marine	Acute	Chronic	Water & Fish Ingestion	
Aluminum	NS	NS	NS	NS	NS	NS	NS	NS
Antimony	9000	1600	NS	NS	NS	NS	146	NS
Arsenic (Total)	NS	NS	50	50	2319	13	0.0022	50
Barium	NS	NS	NS	NS	NS	NS	1000	1000
Beryllium	130	5.3	NS	NS	NS	NS	0.0068	NS
Cadmium	HD	HD	2.0	5.0	43	9.3	10	10
Calcium	NS	NS	NS	NS	NS	NS	NS	NS
Chromium (Total)	HD	HD	50	20	1100	50	50	50
Cobalt	NS	NS	NS	NS	NS	NS	NS	NS
Copper	HD	7.0[1]	7.0	3.0	2.9	NS	1300	NS
Cyanide	22	5.2	5.0	1.0	1.0	1.0	200	NS
Iron	NS	NS	1000[1]	NS	NS	NS	300	NS
Lead	HD	HD	25	25	140	5.6	50	50
Magnesium	NS	NS	NS	NS	NS	NS	NS	NS
Manganese	NS	NS	NS	NS	NS	NS	50	NS
Mercury	2.4	0.012	0.012	0.025	2.1	0.025	0.000144	2.0
Nickel	HD	HD	88	8.3	75	8.3	13.4	NS
Potassium	NS	NS	NS	NS	NS	NS	NS	NS
Selenium	260	35	5	71	410	54	10	10
Silver	HD	HD	0.06[1]	0.1[1]	2.3	NS	50	50
Sodium	NS	NS	NS	NS	NS	NS	NS	NS
Thallium	1400	40	NS	NS	2130	NS	13	NS
Vanadium	NS	NS	NS	NS	NS	NS	NS	NS
Zinc	HD	HD	50[1]	86[1]	95	86	NS	NS

Table 6-1. COMPARISON OF PROMULGATED STANDARDS IN VARIOUS MEDIA (μg/l) (Continued)

Chemical	Federal Fresh Water Quality Standards		North Carolina Water Quality Standards		Federal Marine Water Quality Standards		Federal Water Quality Standards	Safe Water Drinking Water Act MCL
	Acute	Chronic	Fresh Water	Marine	Acute	Chronic	Water & Fish Ingestion	
1 2-DCA	118000	20000	NS	NS	113000	NS	0.94	5
1 2-DCE	11600	NS	NS	NS	224000	NS	NS	NS 0.07-1 mg/l*
Acenaphthene	1700	520	NS	NS	970	710	NS	NS
Benzene	5300	NS	NS	NS	5100	700	0.66	5
Di-n-butylphthalate	NS	NS	NS	NS	NS	NS	35 mg	NS
Dichlorobenzene	1120	763	NS	NS	1970	NS	400	NS
Ethyl Benzene	32000	NS	NS	NS	430	NS	1.4 mg	NS
Fluoranthene	3980	NS	NS	NS	40	16	42	NS
Methylene Chloride	NS	NS	NS	NS	300	NS	2.8 ng	NS
Naphtalene	2300	620	NS	NS	2350	NS	NS	NS
Tetrachloroethene	5280	840	NS	NS	2130	NS	13	NS
Toluene	17500	NS	NS	NS	6300	5000	14.30	NS
Trichloroethene	45000	21900	NS	NS	2000	NS	2.70	NS
Vinyl Chloride	NS	NS	NS	NS	NS	NS	2.00	NS
Xylene	NS	NS	NS	NS	NS	NS	1.4 mg	NS
DDE	1050	NS	NS	NS	14	NS	NS	NS
DDT	1.10	0.001	1.0	1.0	0.13	0.001	0.024	NS
Dieldrin	2.5	0.0019	2.0	2.0	0.71	0.0019	0.071	NS
PCB's	2.0	0.014	.001	.001	10	0.03	0.079	NS

NS = No Standard

HD = Hardness Dependent

[1] = Action Level, Not a Standard

* = Promulgated Criterion (enforceable criterion) under the National Primary Drinking Water Regulations

Sources: EPA, 1986c; NCWQS, 1990; SDWA, 1989.

6.2 CAMP LEJEUNE - SITE BACKGROUND

Camp Lejeune, Marine Corp Training Base is located in Onslow County, North Carolina. The facility covers approximately 170 square miles, and is bounded to the southeast by the Atlantic Ocean, to the west by U.S. 17, and to the northeast by State Road 24. The base is bisected by the New River Estuary, which occupies approximately 30 square miles of the total area of the facility.

The population of Camp Lejeune is comprised of approximately 40,928 active duty personnel with an additional population of 32,081 military dependents. An additional 4,412 civilian employees perform facilities management and support functions. Approximately 36,086 military personnel and dependents reside in base housing units. Due to the Gulf Crisis the number of onsite military personnel varies considerably.

Camp Lejeune has a mild climate. Summers are typically hot and humid while winters are cool with occasional subfreezing periods (with snow, of limited persistence). The average annual precipitation is 55.96 inches, with a mean temperature of 60.9 F. Prevailing winds are southwesterly; however, on-shore sea breezes regularly occur. The growing season typically is in excess of 230 days per year (Camp Lejeune, 1987).

6.2.1 Site 6 (Storage Lots 201 and 203) Background and Description

Site 6 (storage lots 201 and 203), is located on Holcomb Boulevard between Wallace and Bearhead Creeks. Lot 201 covers approximately 25 acres and lot 203 approximately 25 acres. Both lots have a history of various uses, including disposal and storage of hazardous materials. At the time of the 1991 field investigations tires, machinery, tarp material, and electrical transformers were observed in lot 203. Lot 201 was being used as a military vehicle storage area.

The topography of Lot 203 consists of a flat, unpaved surface with a variety of waste mounds. Lot 201 is also unpaved with few distinctive topographical features. Both areas lacked vegetation. Lot 201 was devoid of all vegetation except for occasional patches of grass. Lot 203 had a surface water drainage system (running north-south with no active flow) during the time of the 1991 field investigation. Some forested areas were located within lot 203 consisting primarily of Loblolly pine. During the 1991 investigation it was observed that both lots were subject to prevalent northeasterly winds.

The water table at Site 6 was encountered within silty sand at depths ranging from 2 to 22 feet (ESE, 1991). Ground water flow occurs in a radial direction toward Wallace and Bearhead Creeks (ESE, 1990).

6.2.1.1 Data Collection and Evaluation

During the 1984 ESE Confirmation study, eight shallow groundwater monitoring wells were installed and sampled. The groundwater monitoring wells were sampled again in January, 1987 and analyzed for volatile organic chemicals (VOCs) and the o,p- and p,p- isomers of DDD, DDE, and DDT. No chlorinated pesticides were detected in any groundwater samples collected during either sampling period. VOCs were detected in three groundwater samples: benzene and 1,1,2,2-tetrachloroethane were detected in monitoring well 6GW1 at concentrations of 3.1 and 63 ppb (ug/L), respectively. Chloromethane was detected in monitoring well 6GW6 at a concentration of 6.5 ppb (ESE, 1990).

During the groundwater sample collection period, four surface water and sediment samples were collected from upstream and downstream locations on Wallace and Bearhead Creeks. The samples were analyzed for VOCs, DDT and its metabolites. VOCs were not detected in samples collected from Bearhead Creek. In surface water samples from Wallace Creek trans-1,2-dichloroethene; trichloroethene and vinyl chloride were detected at concentrations in the downstream location greater than in the upstream location. DDT, DDE, DDD and their isomers were not detected in Wallace Creek sediment and surface water samples. However, the p,p-isomer of DDE was detected in both upstream and downstream sediment sample locations in Bearhead Creek, with the upstream location having the higher concentration. The p,p-isomer of DDT was detected in the downstream location of Bearhead Creek.

During the 1984 field activities, composited soil samples were collected from four areas considered to be the most likely contaminated. Samples were collected from boring composites and analyzed for VOCs, o,p and p,p-DDE, DDD and DDT. Isomers of DDE, DDD and DDT were detected in three of five soil boring samples collected from the northern half of lot 203. All soil borings from the southeast quadrant of lot 203 contained at least one of the target isomers, while samples collected from lot 201 also contained at least one of the target isomers. In addition, five of the samples contained all six isomers and three of the samples contained five of six isomers. Results of the surface water, groundwater and soil analyses from these studies are presented in **Table 6-2.**

As a result of previous investigations, it was concluded that widespread DDT, DDD and DDE contamination was present in Site 6 soils. While the possibility of contaminant table migration to shallow groundwater is low due to their physical and chemical characteristics, it should be investigated. Studies of DDT and its metabolites suggest that these chemicals undergo extensive adsorption to soil particles, as predicted by their organic partition coefficients (K_{oc}) of 2.4 $X10^5$, 4.4 X 10^6 and 7.7 X 10^5 for DDT, DDE and DDD respectively (EPA, 1986d). Since they are bound strongly to soil, they are not easily displaced from their site of application, nor do they tend to leach to groundwater. The occurrence of VOCs in the surface water from previous investigations also warrants further study.

Table 6-2. FREQUENCY OF DETECTION AND MAXIMUM CONCENTRATION OF CHEMICALS DETECTED IN GROUNDWATER, SURFACE WATER, SEDIMENT AND SOIL FROM SITE 6 (RESULTS OF THE 1984 AND 1986 FIELD INVESTIGATIONS).

	Frequency and Maximum Detections of Target Analytes in Each Media							
	Groundwater		Surf. Water		Sediment		Soil	
Chemical	Freq	Max[1]	Freq.	Max[1]	Freq.	Max[2]	Freq.	Max[2]
DDT	0/16	---	0/4	---	1/4	219	17/20	426
DDE	0/16	---	0/4	---	2/4	75.8	17/20	770
DDD	0/16	---	0/4	---	0/4	---	15/20	160
Benzene	1/16	3.1	0/4	---	0/4	---	N/A	---
Chloromethane	1/16	6.5	0/4	---	0/4	---	N/A	---
12 DCE	0/16	---	2/4	35	0/4	---	N/A	---
1122 TCE	1/16	63	0/4	---	0/4	---	N/A	---
Trichloroethene	0/16	---	1/4	26	0/4	---	N/A	---
Vinyl Chloride	0/16	---	2/4	3.6	0/4	---	N/A	---

[1] micrograms (ug) per liter
[2] ug/kg

--- = No detections
N/A = Not Analyzed

Source: Hunter/ESE 1990

Samples from the eight groundwater monitoring wells were collected and analyzed for a variety of organic and inorganic analytes during the winter of 1991. In addition, surface water and sediment samples collected from upstream and downstream locations in Wallace Creek were collected. All samples from Site 6 were analyzed for full target chemical parameters. Results of the analyses revealed the presence of a number of chemicals present in various matrices sampled. Chemicals that were detected are presented in **Table 6-3** with their corresponding site matrices. Averages were calculated from the samples with analyte concentrations above detection limits. Those values that fell below detectable levels were not incorporated for the average calculations.

Analytical results indicate that a number of inorganic analytes occurred in all matrices sampled. However, analytical results show the concentrations observed were comparable to background concentrations. Background concentrations of various inorganics in soil, freshwater and seawater are presented in **Tables 6-4** and **6-5**.

Results of surface water and groundwater analyses revealed levels of inorganic analytes greater than freshwater background concentrations. However, concentrations of these analytes in surface water samples did not exceed federal water quality criteria (acute and chronic) for the protection of freshwater. In addition, the levels of most of the inorganic analytes detected in shallow groundwater and water supply wells did not exceed the maximum concentration levels identified by the Safe Drinking Water Act or the North Carolina water quality standards with the exception of chromium, cadmium and lead in shallow groundwater samples. The concentrations of these analytes exceeded MCL values and were therefore identified as potential chemicals of concern **(Table 6-3)**.

Table 6-3. **INORGANIC, SEMIVOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 6 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND WATER SUPPLY WELL SAMPLES**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (µg/L or mg/kg)	Average (µg/Lor mg/kg)	PCOC[a]	Rationale
Surface Water					
Aluminum	2/2	650-684	667	NO	
Antimony	1/2 (1B)	19	19	NO	< FWQC W/F ing.
Barium	1/2 (1B)	13.70	13.70	NO	< MCL
Calcium	2/2	6,770-17,100	11,935	NO	
Chromium	1/2 (1B)	2.60	2.60	NO	< MCL
Copper	2/2 (2B)	6.40-7.80	7.10	YES	>NCFWS
Iron	2/2	352-365	358	?	>FWQS W/F ing. (300 µg/L)
Magnesium	2/2 (1B)	1,160-32,600	16,880	NO	
Manganese	2/2 (2B)	8.10-8.80	8.45	NO	
Potassium	2/2 (1B)	631-10,400	5,515	NO	
Silver	2/2 (1B)	1.60-18.10	9.80	NO	< MCL
Sodium	2/2	7,210-268,000	137,605	NO	
Vanadium	1/2 (1B)	2.70	2.70	NO	
Zinc	2/2	20.80-41	30.90	NO	
1,2 Dichloroethene	1/2	4	4	YES	
Trichloroethene	1/2	5	5	YES	
Shallow Groundwater (µg/l)					
Aluminum	7/7	46,800-332,000	192,828	?	concentrations appear elevated
Antimony	1/7 (1B)	14	14	NO	< FWQS W/F ing.
Arsenic	7/7 (6B)	4-21.40	8.33	NO	< MCL
Barium	7/7	248-1,030	635	NO	< MCL
Beryllium	7/7 (6B)	1.20-5.90	3.42	NO	
Cadmium	1/7	43.40	43.40	YES	> MCL
Calcium	7/7 (1B)	1,980-52,300	26,866	NO	
Chromium	7/7	41.60-451	228	YES	> MCL
Cobalt	5/7 (5B)	9.80-15.40	12.54	NO	

Table 6-3. **INORGANIC, SEMI-VOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 6 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND WATER SUPPLY WELL SAMPLES (Continued)**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/Lor mg/kg)	PCOC[a]	Rationale
Copper	7/7 (1B)	21-203	67.80	NO	< MCL
Iron	7/7	15,800-59,300	38,086	?	concentrations appear elevated
Lead	7/7	12-70.40	46.51	YES	> MCL
Magnesium	7/7 (1B)	2,090-12,900	7,837	NO	
Manganese	7/7	73.50-1,080	247	?	concentrations appear elevated
Mercury	5/7 (2B)	0.13-32	0.22	NO	< MCL
Nickel	7/7 (3B)	17.10-81.60	47	?	
Potassium	7/7 (1B)	3,110-14,800	10,404	NO	
Selenium	2/7 (2B)	3.60-4.60	4.10	NO	
Silver	4/7 (4B)	1.80-2.70	2.10	NO	< MCL
Sodium	7/7 (4B)	2,320-15,100	5,617	NO	
Vanadium	7/7	106-504	265	?	concentrations appear elevated
Zinc	7/7	98-9,540	1,501	?	concentrations appear elevated
Carbon Disulfide	1/7	10	10	YES	
<u>Sediment (mg/kg)</u>					
Aluminum	2/2	567-2,030	1,298	NO	
Beryllium	2/2 (2B)	0.97-1.20	1.08	NO	<FFWQS
Cadmium	1/2 (1B)	0.88	0.88	NO	<NCWQS
Calcium	2/2	169-3,270	1719	NO	
Chromium	2/2	2.70-3.80	3.25	NO	<NCFWQS
Copper	2/2 (2B)	0.73-3.50	2.11	NO	<NCFWQS action level
Iron	2/2	606-1,570	1,088	NO	<NCFWQS action level
Lead	2/2	1.30-5.70	3.50	NO	<NCFWQS
Magnesium	2/2 (2B)	72.10-154	113	NO	
Manganese	2/2 (1B)	0.97-6.20	3.58	NO	
Potassium	2/2 (2B)	115-138	126	NO	

Table 6-3. INORGANIC, SEMI-VOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 6 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND WATER SUPPLY WELL SAMPLES (Continued)

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/Lor mg/kg)	PCOC[a]	Rationale
Selenium	1/2 (1B)	0.44	0.44	NO	<FFWQS
Sodium	2/2 (2BE)	125-256	190	NO	
Vanadium	2/2 (2B)	0.97-2.70	1.83	NO	
Zinc	2/2	8.80-10.20	9.50	NO	<NCWQC action level
Acenaphthene	1/2	56	56	YES	
Fluoranthene	1/2	220	220	YES	
Pyrene	1/2	160	160	YES	
Benzo(a)anthracene	1/2	58	58	YES	
Arochlor 1260	1/2	190	190	YES	
Methylene Chloride	2/2 (2B)	2-4	3	NO	possible lab contaminant
Acetone	1/2	45	45	NO	possible lab contaminant
111 TCA	1/2	5	5	YES	
Toluene	1/2	2	2	?	possible lab contaminant
Water Supply Wells (μg/l)					
Beryllium	1/2 (1B)	0.85	0.85	?	>FWQS W/F ing. (0.0068 μg/L)
Calcium	2/2	50,100-61,200	55,650	NO	
Copper	2/2 (2B)	4.50-6.40	5	NO	<MCL
Iron	2/2	296-1,080	688	?	>FWQS W/F ing. (300 μg/L)
Magnesium	2/2 (2B)	1,100-1,470	1,285	NO	
Manganese	2/2	15.60-16.50	16	NO	
Potassium	2/2 (2B)	1,440-1,540	1,490	NO	
Selenium	1/2 (1B)	3.50	3.50	NO	<MCL
Sodium	2/2 (1B)	4,430-6,600	5,515	NO	
Vanadium	1/2 (1B)	3.10	3.10	NO	
Zinc	2/2	34-308	171	NO	

Table 6-3. **INORGANIC, SEMI-VOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 6 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND WATER SUPPLY WELL SAMPLES (Continued)**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/Lor mg/kg)	PCOC[a]	Rationale
Vinyl Chloride	1/2	70	70	YES	
Acetone	1/2	12	12	NO	possible lab contaminant
1,2 dichloroethene (total)	1/2	75	75	YES	
1,1 dichloroethene	1/2	2	2	YES	
Trichloroethene	1/2	13	13	YES	
Tetrachloroethene	1/2	53	53	YES	
Methylene Chloride	1/2	2	2	NO	possible lab contaminant
Toluene	1/2	0.90	0.90	?	possible lab contaminant

a = Potential Chemicals of Concern
b = Contract Laboratory Program; Laboratory Qualifiers

Note:
E (inorganic data) = value was estimated due to matrix interferences.
B (inorganic data) = reported value is below contract required detection limit, but greater than the instrument detection limit.
B (organic data) = analyte found in associated blank

NCFWS = North Carolina Fresh Water Standards

NCWQS = North Carolina Water Quality Standards

FFWQS = Federal Freshwater Quality Standards

FMQS = Federal Marine Quality Standards

FWQS W/F ing. = Federal Water Quality Standards for the ingestion of water and fish.

MCL = Maximum Concentration Level

Source: ESE, 1991

Table 6-4. **LITERATURE DERIVED VALUES OF BACKGROUND CONCENTRATIONS OF INORGANIC CHEMICALS IN SOIL FOR THE UNITED STATES (EXPRESSED IN MG/G OR PERCENT*).**

Analyte	Eastern United States (east of 96th meridian)[a]		Conterminous United States[a]	
	Average	Range	Average	Range
Aluminum	3.30*	0.70 - >10*	72,000	700 - <10,000
Arsenic	4.80	<0.10 - 73	7.20	<0.10 - 97
Barium	290	10 - 1500	580	10 - 5000
Beryllium	0.55	<1 - 7	0.92	<1 - 15
Cadmium	NA	NA	NA	NA
Calcium	0.34*	0.01 - 28*	24000	100 - 320000
Chromium	33	1 - 1000	54	1 - 2000
Cobalt	5.90	<0.30 - 70	9.10	<3 - 70
Copper	13	<1 - 700	25	<1 - 700
Iron	1.40*	0.01 - >10*	26000	100 - >100000
Lead	14	<10 - 300	19	<10 - 700
Magnesium	0.21*	0.005 - 5*	9000	50 - >100000
Manganese	260	<2 - 7000	550	<2 - 7000
Mercury	0.081	0.01 - 3.40	0.09	<0.01 - 4.60
Nickel	11	<5 - 700	19	<5 - 700
Potassium	1.20*	0.005 - 3.70*	15000	50 - 63000
Selenium	0.30	<0.10 - 3.90	0.39	<0.10 - 4.30
Silver	NA	NA	NA	NA
Sodium	0.25*	<0.05 - 5*	12000	<500 - 100000
Thallium	7.70	2.20 - 23	9.40	2.20 - 31
Vanadium	43	<7 - 300	80	<7 - 500
Zinc	40	<5 - 2900	60	<5 - 2900
Cyanide	NA	NA	NA	NA

a = Values were derived from (Boerngen, J.G. and H.T. Shacklett, 1984).

* = Values expressed as percent

Source: Shacklett and Boerngen, 1984

Table 6-5. LITERATURE DERIVED BACKGROUND CONCENTRATIONS OF TRACE METALS IN SEAWATER AND FRESHWATER (ug/L).

Analyte	Seawater	Reference	Freshwater	Reference
Aluminum	1	Sackett & Arthenius, 1962	<30	Kennedy et al. 1974
Antimony	0.21	Brewer et al. 1972	0.10	Brewer et al. 1972
Arsenic	2.10	Johnson and Pilson, 1972	2	Kanamori, 1965
Barium	20	Turekian and Johnson, 1966	10	Turekin, 1966
Beryllium	0.006	Merill et al. 1960	0.01	Reichert, 1973
Cadmium	0.01	Boyle et al. 1976	0.07	Boyle et al. 1976
Chromium	0.08	Cranston and Murray, 1978	0.5	Trefry and Presley, 1976
Cobalt	0.04	Robertson, 1970	0.05	Turekian et al. 1967
Copper	0.10	Boyle in Nriagu, 1979	1.80	Gibbs, 1977
Iron	1.3	Chester and Stoner, 1974	<30	Kennedy et al. 1974
Lead	0.005 - 0.015	Schaule and Patterson, 1978	0.20	Trefry and Presley, 1976
Manganese	0.2	Brewer, 1975	<5	Kennedy et al. 1974
Mercury	0.01	Gardener, 1975	0.01	--
Nickel	0.2	Sclater et al. 1976	0.30	Gibbs, 1977
Selenium	0.04	Measures and Burton, 1978	0.10	--
Silver	0.01	Robertson, 1970	0.30	Kharkar et al. 1968
Thallium	0.01	Riley, 1975	0.004	Florence and Batley, 1977
Vanadium	1.90	Sugawara et al. 1956	0.90	Sugawara et al. 1956
Zinc	0.01	Bruland et al. 1978	0.50	Forstner and Wittman, 1983

-- Reference unavailable

Source: Forstner and Wittman, 1983.

Several semi-volatile and volatile chemicals were identified in the four matrices (surface water, shallow groundwater, sediment and water supply well samples). However, a number of these chemicals can be considered laboratory contaminants (acetone, methylene chloride and toluene) and; therefore, may not be representative of actual concentrations that occur onsite. Other organic chemicals detected at Site 6 include: trichloroethene, vinyl chloride, 1,2-dichloroethene (total), tetrachloroethane and carbon disulfide. Results from a duplicate sediment sample revealed the presence of several polynuclear aromatic hydrocarbons (chrysene, benzo(b,k)fluoranthene and benzo(a)pyrene). These analytes were not detected in the corresponding sediment sample which would indicate a need for further sampling to determine the extent of contamination.

The organic chemicals were identified as potential contaminants of concern due to their presence onsite and known or suspected adverse health and environmental effects. Only a limited number of samples were collected from the area; therefore, the extent of contamination is unknown at the present time; future work will include additional sampling to fully delineate any areas of concern.

6.2.1.2 Exposure Assessment

This exposure assessment is qualitative in nature and describes possible human and nonhuman receptors, and outlines potential exposure pathways.

<u>Receptor Identification</u>

Current land use by the military for lot 201 includes the active transport of equipment and vehicles for loading or use. Lot 203 probably remains generally inactive, except for the occasional disposal or removal of waste. Both sites can be easily accessed by military personnel, as the gates appear to remain open during working hours. The areas immediately surrounding the lots are also used by army personnel. Both lots are situated in close proximity to Holcomb Boulevard, a major access road for the

Hadnot Point industrial area. During the 1991 winter field activities considerable evidence of small mammal activity was observed within Site 6. Raccoon, and possibly fox tracks, were observed within lot 203, and fox tracts were observed outside of lot 201.

Future use of this area will probably include the current uses already in practice. Because the locations of these sites are in close proximity with an active railroad and a major road, it is unlikely that future use would include residential development. In addition, the active use of lot 203 as a storage area for hazardous waste precludes any other use.

Any groundwater plume emanating from the site is expected to move downgradient towards Wallace and Bearhead Creeks. If groundwater discharges to the surface at this point, or at any intermediate point, there will be a high potential for contamination of surface water and sediment. Exposed aquatic organisms may bioaccummulate heavy metals and chlorinated pesticides. Terrestrial biota may be directly exposed to surface water or indirectly through drinking or consumption of exposed aquatic fauna used as food. The potential for overall degradation of water quality in the Wallace and Bearhead Creeks exists, but the extent to which they may be affected cannot be assessed at this time.

Sensitive Subpopulation Identification

In general, access to Site 6 is limited to nonmilitary personnel; therefore, the exposure of Site 6 related contaminants to sensitive subpopulations (i.e., children or compromised individuals) would be minimal. Occasional trespassers would be the most sensitive subpopulations currently identified.

Potential Exposure Pathways

An exposure pathway describes the way that human or nonhuman (nondomesticated) biological receptors become exposed to contaminants. An exposure pathway consists of a biological receptor, chemical source, transport mechanism, exposure point, and exposure route. The groups of potential indicator chemicals were examined to determine potential exposure pathways that will be analyzed in the site risk assessments.

Contaminants found at Site 6 include semi volatile and volatile organic chemicals (VOCs) and several metals (cadmium, chromium and lead). Inhalation, ingestion, and direct contact are the expected pathways to be addressed. At Site 6 the following exposure pathways for human and nonhuman receptors were confirmed during the winter 1991 field activities:

- ingestion of VOC and metals contaminated groundwater and surface water,
- inhalation of VOCs volatilized from groundwater and surface water,
- dermal exposure to VOCs and metals from direct contact with surface water or groundwater, and
- exposure to VOCs and metals by aquatic and terrestrial organisms.

Although previously identified potential chemicals of concern (i.e. DDT and its metabolites) were not detected in the 1991 field investigation, the potential for inhalation, ingestion and dermal exposure to these contaminants may still exist for human and nonhuman receptors. It is possible that these chemicals are still present, but are at concentrations below detectable levels.

6.2.1.3 Toxicity Assessment

Relevant EPA dose levels are also presented in **Table 6-6**. The reference doses (RfD) are given for acceptable doses based on noncarcinogenic effects. A chronic reference dose is an estimate (with an uncertainty of approximately 1 order of magnitude) of human daily exposure that is likely to be without risk of harmful effects

Table 6-6. HEALTH EFFECTS ASSESSMENT OF POTENTIAL CHEMICALS OF CONCERN FOR SITE 6 (CARCINOGENICITY AND CHRONIC TOXICITY)

Chemical	EPA Carcinogenicity Classification		Carcinogenicity Tumor Site		Non-Carcinogen Effect of Concern	
	Inhalation	Oral	Inhalation	Oral	Inhalation	Oral
Acetone					ND	Increased liver and kidney with nephrotoxicity
Acenaphthene					ND	Hepatoxicity
Benzo(a)anthracene	B2	B2	ND	ND	ND	ND
Carbon Disulfide						
Chrysene	B2	B2	ND	ND	ND	ND
1,1 Dichloroethylene	C	C			ND	Liver lesions
1,2 Dichloroethylene					ND	Decreased hematocrit and hemoglobin
Fluoranthene					ND	Nephropathy, liver with changes, hematological changes
Methylene Chloride	B2	B2	Lung/liver	Liver	ND	Liver toxicity
Pyrene					ND	Renal effects

Table 6-6. **HEALTH EFFECTS ASSESSMENT OF POTENTIAL CHEMICALS OF CONCERN FOR SITE 6 (CARCINOGENICITY AND CHRONIC TOXICITY) (Continued)**

Chemical	EPA Carcinogenicity Classification		Carcinogenicity Tumor Site		Non-Carcinogen Effect of Concern	
	Inhalation	Oral	Inhalation	Oral	Inhalation	Oral
Tetrachloroethene	B2	B2	Leukemia/liver	Liver	ND	ND
Toluene					CNS/Eyes/Nose	Liver/kidney
Trichloroethylene	B2	B2	Lung	Liver		
Vinyl Chloride	A	A	Liver	Lung	ND	ND

Group A = Human Carcinogen

Group B = Probably Human Carcinogen; B1 = limited evidence of carcinogenicity, B2 = sufficient evidence of carcinogenicity in animals with lack of evidence in humans

Group C = Possible Human Carcinogen

ND = Not Determined

Source; EPA, 1991.

during the lifetime (EPA, 1989). The RfD is equal to a no observed adverse effect level (NOAEL) or a lowest observed adverse effect level (LOAEL), divided by uncertainty factors and modifying factors.

The slope factor is representative of the upper-bound estimate of cancer risk due to exposure to a chemical, and is equivalent to the risk per unit dose. Cancer groups are also provided (**Table 6-6**). Group A chemicals are human carcinogens, Group B are probable human carcinogens, and Group C are possible human carcinogens (EPA, 1991). The cancer group ratings are based on the quantity of evidence or data supporting an effect of human carcinogenicity.

6.2.1.3 Conclusions

The results of the chemical analyses indicate that there is potential risk to human and nonhuman populations from exposure to Site 6 related contamination. A number of organic and inorganic analytes of variable toxicological characteristics were found present in possible exposure media. Of particular concern are the number and diversity of organic chemicals. Cumulatively, these chemicals can pose a potential risk to human and nonhuman receptors.

Results indicate that the detection of inorganic chemicals was widespread throughout the area, whereas the detection of organic constituents is sporadic. Results of the 1991 investigation did not reveal the presence of pesticides in any of the media sampled, as compared to the 1984 and 1986 investigation. The possibility exists that the sampling locations did not encompass areas contaminated by pesticides or that analytical methods did not detect these chemicals (concentrations fell below detection limits). It is suggested that Site 6 be further investigated for the completion of a quantifiable risk assessment.

6.2.2 Site 69 (Rifle Range Chemical Dump) Background and Description

The rifle range chemical dump (Site 69) is approximately six acres in size and is located east of the intersection of Range Road and Sneads Ferry Road, north of Everett Creek. This site was utilized as a chemical waste disposal area for the Camp Lejeune base from the early 1950's until 1976. Discarded materials dumped onsite include: pentachlorophenol, DDT, trichloroethylene, malathion, diazinon, lindane, gas cylinders, HTH, PCB's, drums that possibly containing chloroacetophenone (CN) gas, other hazardous materials generated or used on the base, and chemical agent test kits for chemical warfare (which contain no agent substances). The discarded material was placed in trenches or pits 6 to 20 feet deep. At least twelve different disposal events have been documented on the site.

Site 69 is a wooded area with several species of pine occurring onsite. Other tree species observed included dogwood and oak. The understory is comprised of sparse grasses and shrubs. Species of shrub observed during the winter 1991 field activities included buckeye, holly, red maple and chokeberry.

The groundwater is relatively shallow, occurring at depths ranging from 5 to 22 feet and occurs within silty sand with a flow that is broken by several watershed boundaries. In general, the flow is in a northwesterly direction towards the unnamed creek. Typical groundwater gradients beneath this site average 0.032 ft/ft (ESE, 1991).

Four surface water and sediment samples were collected within the New River Estuary at the confluence of the surface water drainage from the area of concern. The sampling area was shallow with an average depth of two feet. The bottom substrate was comprised of a silty, course sand and lacked submerged vegetation. The near shore area had an abundance of emergent grasses with a silt bottom substrate.

6.2.2.1 Data Collection and Evaluation

During the 1984 field activities performed by ESE for the Confirmation study, eight groundwater monitoring wells were installed and sampled. In addition, three surface water samples were also collected from two onsite locations. All the samples from the 1984 collection were analyzed for organochlorine pesticides, PCBs, pentachlorophenol, VOCs, mercury and residual chlorine. Results of the analyses of the 1984 samples found VOCs in groundwater and surface water samples. The concentrations observed were lower in groundwater than in surface water.

A second sampling event took place in December, 1986. The eight monitoring wells were sampled and three surface water samples were collected from three locations on the site. In addition, two sediment samples were collected from two unnamed creeks that drain from the site into the New River Estuary. Samples were analyzed for the target compounds, with the addition of tetrachlorodioxin, xylene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MICK), and ethylene dibromide.

The 1984 and 1986 analyses revealed VOCs in several groundwater and surface water locations. Pentachlorophenol and the p,p-isomer of DDE were detected in sediment samples, while the p,p-isomer of DDD was detected in a different sediment sample. It was concluded that VOC contamination at Site 69 is extensive and present in all matrices sampled, and the southeastern quadrant of the filled area appeared to be the most affected area. A summary of the chemicals detected at Site 69 during the 1984 and 1986 sampling activities is presented in **Table 6-7**.

During the winter 1991 field activities the eight shallow groundwater wells were sampled along with five surface water and sediment samples. The surface water and sediment samples were collected offsite. Four of the samples were collected from the confluence of the southeastern surface water drainages and the New River estuary. In addition, four composited shellfish samples were collected from these same areas.

Table 6-7. **FREQUENCY OF DETECTION AND MAXIMUM CONCENTRATION OF CHEMICALS DETECTED IN GROUNDWATER, SURFACE WATER AND SEDIMENT SAMPLES FROM SITE 69 (RESULTS OF THE 1984 AND 1986 FIELD INVESTIGATIONS).**

Chemical	Groundwater Freq.	Groundwater Max.(ug/l)	Surface Water Freq.	Surface Water Max.(ug/l)	Sediments Freq.	Sediments Max. (ug/kg)
DDT	N/A	---	0/4	---	0/2	---
DDE	N/A	---	0/4	---	1/2	18.8
DDD	N/A	---	0/4	---	1/2	113
Benzene	3/16	4	1/4	0.4	N/A	---
BHC,A	0/16	---	1/4	0.056	N/A	---
BHC,B	1/16	0.087	4/4	0.18	N/A	---
BHC,D	2/16	2.44	2/4	0.2	N/A	---
1,2 Dibromoethane	2/8	4.74	0/3	---	0/2	---
Chlorobenzene	2/16	55	1/4	2.1	N/A	---
Chloroform	2/16	14	1/4	6	N/A	---
1,2-Dichloroethane	2/16	5.9	1/4	0.9	N/A	---
1,1-Dichloroethylene	2/16	2.7	0/4	---	N/A	---
trns1,2-Dichloroethylene	7/16	37000	4/4	410	N/A	---
Mercury	8/16	0.2	1/4	0.2	0/2	---
Methylene Chloride	1/16	10	1/4	8	N/A	---
Pentachlorophenol	N/A	---	2/4	10	1/2	1190
1122-Tetrachloroethane	3/16	44	1/4	59	N/A	---
Tetrachloroethene	1/16	20	0/4	---	N/A	---
Toluene	4/16	14	1/4	11	N/A	---
1,1,2-Trichloroethane	2/16	7.9	1/4	6	N/A	---
Trichloroethene	3/16	710	4/4	63	N/A	---
Vinyl chloride	4/16	440	2/4	41	N/A	---

N/A - Not analyzed

Source: ESE, 1990.

The population of shellfish was concentrated in the near shore area. Shellfish (oysters and mussels) were collected at each sampling location. Approximately 10 oysters (Clostridius virginica) plus two to three mussels (Geukensia demissa) were composited for each of the four samples. Due to the location of the shellfish sampling it was surmised that levels of chemicals observed in the tissue would possibly be representative of background concentrations in the New River estuary. All groundwater, surface water, sediment and shellfish samples were analyzed for full target chemical analytes and the results are presented in **Table 6-8**. Average concentrations presented in **Table 6-8** were calculated using only those concentrations observed above detection limits. The results of the tissue analyses in their entirety are presented in **Appendix H**.

Results of the 1991 analyses of surface water demonstrated concentrations of inorganics that exceeded literature background values. Average levels of iron, cyanide, copper and silver in surface water exceeded federal marine acute and chronic water quality standards. However, copper was detected in only one of four samples and the average concentration of silver is comparable to the acute water quality criteria level of 2.30 ug/L.

Numerous inorganic and organic analytes were detected in Site 69 shallow groundwater. Most all of the organic compounds were considered as PCOCs with the exception of acetone and methylene chloride, and a few inorganic analytes were as well. Levels of aluminum, chromium, iron, silver, zinc and lead appear elevated as compared to background concentrations observed nationally for freshwater and seawater (refer to **Table 6-5**).

Concentrations of silver and zinc exceeded action levels described for North Carolina water quality standards.

Table 6-8. **INORGANIC, SEMIVOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 69 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND FISH TISSUE SAMPLES**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (µg/L or mg/kg)	Average (µg/L or mg/kg)	PCOC[a]	Rationale
Surface Water (ug/l)					
Aluminum	2/2	309-622	465.50	NO	
Barium	1/2 (1B)	28.20	28.2	NO	<WQS
Calcium	2/2 (1B)	3,630-241,000	122,315	NO	
Copper	1/2 (1B)	6.40	6.40	?	> WQS
Cyanide	1/2	11.20	11.20	YES	> WQS
Iron	2/2	159-4,420	2,289.5	?	> action level
Magnesium	2/2 (1B)	986-753,000	376,993	NO	
Manganese	1/2	223	223	NO	
Potassium	2/2 (1B)	710-318,000	159,355	NO	
Silver	2/2 (2B)	2.40-3.10	2.75	?	> WQS
Sodium	1/2	5,090	5,090	NO	
Vanadium	1/2 (1B)	5	5	NO	
Zinc	1/2	1,960	1,960	?	
Acetone	2/4	7-22	14.50	NO	possible lab contam
Carbon Disulfide	1/4	28	28	YES	
Chloroform	1/4	3	3	YES	
1,2-Dichloroethene (total)	1/4	190	190	YES	
Methylene Chloride	2/4 (1B)	1-2	1.50	NO	possible lab contam
1,1,2,2-Tetrachloroethane	1/4	5	5	YES	
Toluene	1/4	2	2	?	possible lab contam
Trichloroethene	1/4	7	7	YES	
Vinyl Chloride	1/4	15	15	YES	
Shallow Groundwater					
Aluminum	8/8	2,300-43,800	19,966	?	conc. appear elevated
Antimony	1/8	68.50	68.5	NO	
Arsenic	6/8 (5B)	2.80-11.40	5.58	NO	<NCWQS
Barium	8/8 (8B)	36.60-153	86.17	NO	
Beryllium	7/8 (7B)	0.85-3	1.44	NO	
Calcium	8/8 (5B)	2500-8,330	5,311	NO	
Chromium	8/8 (2B)	5.30-47	27.7	?	conc. appears elevated

Table 6-8. **INORGANIC, SEMIVOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 69 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND FISH TISSUE SAMPLES (Continued)**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/L or mg/kg)	PCOC[a]	Rationale
Cobalt	2/8	8.6-9.7	9.15	NO	
Copper	8/8 (7B)	4.90-27.50	12.08	NO	
Cyanide	1/8	11.20	11.20	YES	
Iron	8/8 (1B)	7740-792,000	122,652	?	conc. appears elevated
Lead	8/8 (1B)	2.60-23.90	13.46	?	toxic
Magnesium	8/8 (8B)	1,970-4,510	2,616	NO	
Manganese	8/8 (1B)	14.60-230	130.97	NO	
Nickel	5/8 (5B)	5.70-27.60	16.04	NO	
Potassium	8/8	1,450-4,190	2,550	NO	
Silver	7/8 (6B)	1.60-6.50235	4.62	NO	
Sodium	8/8 (1B)	4,880-18,900	8,766	NO	
Thallium	2/9 (2B)	4.90-5.20	5.05	NO	
Vanadium	8/8 (4B)	6.10-2,240	308	NO	
Zinc	8/8	51.80-10,200	1,810	?	
Acetone	2/8	4-15	9.50	NO	possible lab contam
Alpha-BHC	1/9	0.12	0.12	YES	
Benzene	5/8	0.4-3	1.46	YES	
Carbon Disulfide	6/8	4-8	6.40	YES	
Chlorobenzene	2/8	1-40.0	20.5	YES	
Chloroform	2/8	1	1	YES	
Chloromethane	1/8	16	16	YES	
11 DCA	1/8	1	1	YES	
1,2 Dichloroethane	2/8	3-4	3.5	YES	
1,2-Dichloroethene (T)	4/8	0.90-11,000	2,822	YES	
Ethyl Benzene	2/8	1-2	1.5	YES	
Methylene Chloride	4/8 (1B)	1-4	2.25	NO	possible lab contam
Styrene	1/8	0.80	0.80	YES	
1,1,2,2-Tetrachloroethane	1/8	7.0	7	YES	
Toluene	4/8	2-5.0	3.25	?	possible lab contam
Trichloroethene	2/8	67-92	79.50	YES	
111 Trichloroethane	1/8	1	1	YES	
112 Trichloroethane	2/8	0.6-0.8	0.7	YES	
Trichoroethene	1/8	2	2	YES	
Vinyl Chloride	1/8	36	36	YES	

Table 6-8. INORGANIC, SEMIVOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 69 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND FISH TISSUE SAMPLES (Continued)

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/L or mg/kg)	PCOC[a]	Rationale
Xylene	2/8	1.2	1.5	YES	
Sediment (mg/kg)					
Aluminum	5/5	1,950-2,650	2,324	NO	
Antimony	4/5 (4B)	3.40-9.70	7.02	NO	
Barium	5/5 (5B)	3.20-7.60	4.80	NO	
Beryllium	1/5 (1B)	0.74	0.74	NO	
Cadmium	3/5 (1B)	0.73-1.80	1.37	NO	<FMWQS
Calcium	5/5 (5B)	30.80-486	320	NO	
Chromium	5/5	3.50-6.40	5.30	NO	<FMWQS
Cobalt	4/5 (4B)	1.70-2	1.85	NO	
Copper	5/5 (5B)	0.69-2	1.12	NO	<FMWQS
Iron	5/5 (4E)	1,550-2,890	2,324	NO	
Lead	5/5	1.70-3.10	1.90	NO	<FMWQS
Magnesium	5/5 (5B)	74.20-902	502	NO	
Manganese	5/5 (1B)	2-12.40	8.98	NO	
Nickel	3/5 (3B)	2.80-4.70	3.86	NO	<FMWQS
Potassium	4/5 (4B)	456-582	525	NO	
Silver	1/5 (1B)	0.97	0.97	NO	<FMWQS
Sodium	5/5 (1B)	76.10-3,290	2,393	NO	
Vanadium	5/5 (5B)	3-6.90	5.20	NO	<FMWQS
Zinc	5/5	6.10-19.50	9.20	NO	
Acetone	4/4 (2B,2BE)	23-820	340.70	NO	possible lab contam
Methylene Chloride	4/4 (4B)	2-3	2.20	NO	possible lab contam
4 Methylphenol	1/4	55	55	YES	
Fish Tissue (ug/kg)					
Aluminum	4/4	106-1,740	534.50	NO	
Antimony	1/4	1.80	1.80	NO	<FWQS W/F ing.
Arsenic	4/4	0.50-1	0.77	YES	>FWQS W/F ing.
Barium	1/4	1.60	1.60	NO	<FWQS W/F ing.
Calcium	4/4	2,840-15,900	6,965	NO	essential element

Table 6-8. **INORGANIC, SEMIVOLATILE AND VOLATILE CHEMICALS DETECTED IN SITE 69 SURFACE WATER, SHALLOW GROUNDWATER, SEDIMENT, AND FISH TISSUE SAMPLES (Continued)**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (μg/L or mg/kg)	Average (μg/L or mg/kg)	PCOC[a]	Rationale
Chromium	4/4	0.70-11.20	4.60	NO	<FWQS W/F ing.
Copper	4/4	4.80-52.4	20.10	NO	essential element
Iron	4/4	128-1,790	566.70	?	>FWQS W/F ing.
Lead	2/4	2-2.20	2.10	NO	<FWQS W/F ing.
Magnesium	4/4	722-892	773.7	NO	essential element
Manganese	4/4	1.60-7.10	3.30	NO	<FWQS W/F ing.
Nickel	4/4	0.80-7.50	3.55	NO	<FWQS W/F ing.
Potassium	4/4	1,160-1,620	1,435	NO	essential element
Selenium	4/4	0.30-0.40	0.32	NO	<FWQS W/F ing.
Silver	4/4	0.30-0.40	0.35	NO	<FWQS W/F ing.
Sodium	4/4	4,440-4930	4,725	NO	essential element
Vandadium	4/4	0.30-3.60	1.08	NO	low toxicity
Zinc	4/4	92.90-151	116	NO	essential element
Benzoic Acid	4/4	640-2,300	1,140	YES	
Di-n-butylphthalate	4/4	150-440	232.5	?	possible lab contam
Phenol	2/4	250-300	150	YES	toxic
Acetone	1/4	28,000	28,000	NO	possible lab contam
Chloromethane	4/4	17-210	75	YES	

a = Potential Chemicals of Concern
b = Contract Laboratory Program; Laboratory Qualifiers
Note:
E (inorganic data) = value was estimated due to matrix interferences.
B (inorganic data) = reported value is below contract required detection limit, but greater than the instrument detection limit.
B (organic data) = analyte found in associated blank
NCWQS = North Carolina Water Quality Standards
FFWQS = Federal Freshwater Quality Standards
FMQS = Federal Marine Quality Standards
FWQS W/F ing. = Federal Water Quality Standards for the ingestion of water and fish.
MCL = Maximum Concentration Level

Sediment values were compared to federal water quality criteria for the protection of marine life. If concentrations were greater than criteria by a factor of ten, it was determined that a potential risk to aquatic life may exist. Results of the comparisons of inorganic analytes to criteria revealed no concentrations elevated above federal marine water quality standards.

The results of the tissue analyses and comparable concentrations from literature derived values are presented in **Table 6-9**. Comparisons of observed tissue concentrations from Site 69 to literature values reveal no obvious differences. It was surmised from the site observations, that the tissues from these areas would probably be unaffected by Site 69 contamination due to the sampling location.

6.2.2.2 Exposure Assessment

Receptor Identification

Current land use of Site 69 by the military is limited. The area is bordered by a locked fence, permitting no direct access to the area of concern. The area adjacent to the site has limited use and difficult access by dirt roads. Exposure to human populations would be limited to those personnel allowed access onsite or trespassers.

Observation of the area during the winter 1991 field activities revealed small mammal activity onsite. Deer tracks and other small mammal tracks were located within the fenced area and outside of the area as well. Several species of pine were located onsite, including loblolly and virginia pine. Other species of vegetation, which occur include buckeye, holly, chokeberry, and dogwood. The understory was comprised of sparse grasses and an abundance of forest litter.

Table 6-9. COMPARISON OF CHEMICAL CONCENTRATIONS IN SITE 69 SHELLFISH TISSUE TO BACKGROUND LITERATURE VALUES

Analyte	Average Concentration in Site 69 Shellfish Samples (wet weight)	Range of Reported Literature Values in Bivalves	
		Mytilus sp. (dry wt)[b]	*Crassotrea* sp. (wet wt)[a]
Aluminum	534.50	NA	NA
Antimony	1.80	NA	NA
Arsenic	0.77	5.40 -16.70	NA
Barium	1.60	NA	NA
Calcium	6965	NA	NA
Chromium	4.60	1.50 - 16	0.54
Copper	20.10	9 - 9.60	3.70 - 6480
Iron	566.70	1700 - 1960	12 - 422
Lead	2.10	9.10 - 12	0.34 - 17
Magnesium	773.70	NA	NA
Manganese	3.30	3.50 - 27	1.30 - 46
Nickel	3.55	3.70 - 7	0.25 - 6.501
Potassium	1435	NA	NA
Selenium	0.32	0.03 - 0.10	NA
Silver	0.35	NA	NA
Sodium	4725	NA	NA
Vanadium	1.08	NA	NA
Zinc	116	31 - 91	21 - 35120

a = References for these values include: Fourie, H.O., 1976 and Boyden, C.R. and M.G. Romeril, 1974.
b = References for these values include: Brooks, R.R. and M.G. Rumsby, 1965 and Segar, D.A. and R.E. Pellenbarg, 1971.

Source: Forstner and Witman, 1983.

The New River Estuary is located northeast of the site. At the time of sampling, little to no fish activity was observed in the area; however, possible animal populations that could be exposed within the estuary include fish, shellfish and waterfowl.

Sensitive Subpopulation Identification

A primary school, church, trailer park and other light industrial facilities are located within a two mile distance from Site 69. However, direct access to Site 69 is prohibited due to the surrounding fencing. Possible (however, unlikely) sensitive human populations would include children who might trespass into the area.

Potential Exposure Pathways

Volatile organic and inorganic chemicals were detected at Site 69. Sediment, surface water, and shallow groundwater all appeared to be potentially contaminated. The following potential exposure pathways to human and nonhuman receptors were identified:

- ingestion of VOC contaminated groundwater and surface water,
- inhalation of volatilized VOCs from groundwater and surface water,
- dermal exposure to VOCs from direct contact with surface water or groundwater,
- incidental ingestion of metals and VOCs in sediment,
- dermal exposure to metals in sediment,
- ingestion of aquatic organisms exposed to metals in sediment,
- ingestion of fish and shellfish contaminated with metals in surface water, and
- exposure to metals and VOCs in sediment or surface water by aquatic and terrestrial organisms.

Due to the heavy forestation and the abundance of bottom litter in the area, dust borne contaminants were not considered a significant source of exposure.

The area sampled within the New River Estuary probably provides a source of food for fish in the spring and summer months; however, due to the depth, this area probably has limited usefulness as a fisheries habitat.

Potentially, surface water runoff and groundwater discharge could contaminate the receiving waters of the estuary. Shellfish, fish and aquatic invertebrate species residing within the area could be exposed and subsequently be preyed upon, thereby providing another exposure route to predator species.

At the time of sampling, there was no observed fish activity in the sampling area. It was determined that sampling for fish further into the river channel would not provide information useful to determine contaminant uptake in organisms from the study area.

6.2.2.4 Toxicity Assessment

Relevant environmental protection agency dose levels (i.e. RfDs or CSFs) for the identified potential chemicals of concern are presented in **Table 6-10**.

6.2.2.5 Conclusions

Results of the chemical analyses from the 1991 field efforts revealed the presence of a number of chemicals of potential concern. Levels of inorganics observed were comparable to background levels described in the literature. Regardless of the elevated concentrations of zinc, silver, cyanide, copper and iron observed in surface water, it would be difficult to conclude that the levels observed are considered to be greater than typical concentrations for the area. The levels of cyanide observed; however, may be of concern. Whether the concentrations are related to possible site contamination is unknown.

Table 6-10. HEALTH EFFECTS ASSESSMENT OF POTENTIAL CHEMICALS OF CONCERN FOR SITE 69 (CARCINOGENICITY AND CHRONIC TOXICITY)

Chemical	EPA Carcinogenicity Classification		Carcinogenicity Tumor Site		Non-Carcinogen Effect of Concern	
	Inhalation	Oral	Inhalation	Oral	Inhalation	Oral
Acetone					ND	Liver/kidney
Benzene	A	A	Leukemia	Leukemia		
Carbon Disulfide					Fetal toxicity	Fetal Toxicity
Chlorobenzene					Liver/kidney	Liver/kidney
Chloroform	B2	B2	Liver	Kidney	ND	Liver
Chloromethane	C	C	Kidney	Kidney		
1,2 Dichloroethane	B2	B2	Circulatory System	Circulatory System	ND	ND
1,2 Dichloroethylene					ND	Decreased hematocrit and hemoglobin
Ethyl Benzene					Developmental toxicity	Liver/kidney
Methylene Chloride	B2	B2	Lung/liver	Liver	ND	Liver toxicity
Styrene	B2	B2	Leukemia	Leukemia	ND	Red blood cells/liver
1122 Tetrachloroethane	C	C	Liver	Liver		

Table 6-10. **HEALTH EFFECTS ASSESSMENT OF POTENTIAL CHEMICALS OF CONCERN FOR SITE 69 (CARCINOGENICITY AND CHRONIC TOXICITY) (Continued)**

Chemical	EPA Carcinogenicity Classification		Carcinogenicity Tumor Site		Non-Carcinogen Effect of Concern	
	Inhalation	Oral	Inhalation	Oral	Inhalation	Oral
Toluene					CNS/Eyes/Nose	Liver/kidney
111 Trichloroethane					Hepatoxicity	Hepatoxicity
112 Trichloroethane	C	C	Liver	Liver	ND	Clinical Chemistry
Trichloroethylene	B2	B2	Lung	Liver		
Vinyl Chloride	A	A	Liver	Lung		
Xylene					CNS/nose/throat/ liver	Hyperactivity/ decreased body weight

Group A = Human Carcinogen

Group B = Probably Human Carcinogen; B1 = limited evidence of carcinogenicity, B2 = sufficient evidence of carcinogenicity in animals with lack of evidence in humans

Group C = Possible Human Carcinogen

ND = Not Determined

Source; EPA, 1991.

Analyses of shallow groundwater revealed the presence of a variety of organic chemicals at low concentrations. Cumulatively, exposure to these mixtures could pose a potential risk to human receptors.

Results of the shellfish tissue analyses are inconclusive. Samples collected were composited and comprised of possibly two species of shellfish. Copper, zinc, iron, cobalt, sodium, potassium, magnesium, manganese and calcium are considered essential elements; therefore, certain levels of these would be expected to occur in tissue samples and should not be considered as potential chemicals of concern (Forstner and Wittman, 1983).

Due to the presence of mixed wastes in the various matrices, and the proximity of the site to significant aquatic environments, Site 69 should be considered a potential risk to human health and the environment.

6.2.3 Site 48 (MCAS Mercury Dump) Background and Description

The MCAS Mercury Dump site is located on Longstaff Road next to Building 804. The entire area covers a 100 to 200 foot wide corridor extending from the rear of Building 804 (photo lab) to the edge of the New River. Mercury was disposed of in the area from 1956 to 1966. Each year approximately one gallon of metallic mercury drained from the delay lines of the radar units was dumped or buried by hand.

The Site 48 sampling area is a forked shallow inlet in the New River Estuary. In addition, an unnamed channel supplies fresh water to the northeast end of the site. The average water depth is approximately 2 to 2.5 feet and the bottom substrate was comprised of silty clay material, with an abundance of decayed matter. The area was devoid of any submerged aquatic vegetation; however, there were species of emergent vegetation and algae along the shoreline.

6.2.3.1 Data Collection and Evaluation

During the 1984 field investigation, 5 soil samples were collected from 4 soil borings. In addition, 4 sediment samples were collected from the marshy area to the North of Building 804. The samples were analyzed for mercury only. Results demonstrated that all soil and sediment samples contained detectable levels of mercury ranging in concentration from 0.009 mg/kg to 0.03 mg/kg and 0.02 mg/kg to 0.03 mg/kg respectively (ESE, 1990). Sampling of Site 48 was not conducted during the 1986 - 1987 field investigations.

Results of the 1984 analyses are presented in **Table 6-11**. The presence of mercury in the soil and sediment from the area indicates that this contaminant has migrated to the surface water system.

Surface water, sediment and fish sampling at Site 48 took place at periods of high and low tide during the 1991 field activities. An attempt was made to sample fish and shellfish from Site 48 by seine; however, at the time of sampling no fish or shellfish were observed or caught. Observations of the entire area revealed that shellfish did not occur along the shore or within the channel and fish activity was limited to the occasional migration of schooling juveniles (less than one inch in length).

Ten samples of surface water and sediment were collected within Site 48. In addition, one background sediment and surface water sample was collected outside of Site 48, located within the New River estuary. The area chosen for the background sampling was located outside of the channel towards the New River. This site was chosen due to its proximity to the actual sampling area and the similarity of its structure to the fisheries habitat of the sampling area.

Table 6-11. RESULTS OF MERCURY ANALYSES OF SOIL AND SEDIMENT COLLECTED FROM SITE 48 (during the 1984 field investigation conducted by ESE).

Matrix	Frequency of Detections	Range (mg/kg)	Average (mg/kg)
Soil	5/5	0.009 - 0.03	0.019
Sediment	4/4	0.02 - 0.03	0.02

All samples were analyzed for inorganic target chemical analytes. Results of the 1991 winter analyses are presented in **Table 6-12**. Averages presented in **Table 6-12** were derived from the samples collected within the area of concern. Concentrations that fell below detection limits were not used in the average calculations.

Mercury was identified as a potential contaminant of concern from previous investigations due to the site history of mercury disposal and the detection of mercury in various matrices. However, results of the 1991 analyses revealed concentrations of mercury were below detection levels for all surface water and sediment samples.

The surface water sample collected from the background location had the highest detections of beryllium, cadmium, calcium, copper, magnesium, potassium, sodium, vanadium and cobalt as compared to concentrations in site samples. However, analyses of the background water sample yielded data qualified as having estimated concentrations; therefore, the levels could be falsely elevated. In addition, background sampling occurred in an area located within the New River Estuary which would account for the elevated levels of sodium, potassium, magnesium and calcium.

The background sediment sample had the lowest concentration of most all the analytes (aluminum, cadmium, calcium, chromium, copper, iron, magnesium, manganese, potassium, sodium, vanadium and zinc) as compared to concentrations observed in samples collected from within the site. Selenium, barium, nickel and lead concentrations for the background sample fell below detectable levels. Comparison of sediment levels from the background to the site samples revealed concentrationswithin similar orders of magnitude; therefore, were not considered different. In addition, analyses of equipment blanks indicated the dredge used for sediment sampling may have contributed to the levels of aluminum, calcium, iron, magnesium, manganese, sodium and zinc to the samples (data for equipment blanks was presented in the Remedial Investigation Report produced by ESE, 1991).

Table 6-12. INORGANIC ANALYTES DETECTED IN SURFACE WATER AND SEDIMENT FROM SITE 48

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (µg/L or mg/kg)	Background Concentration	Average (µg/L or mg/kg)	PCOC[a]/Rationale
<u>Surface Water (µg/l)</u>					
Aluminum	11/11 (3B)	212-2,060	207 (B)	556	NO <NCWQS
Antimony	4/11 (2B,2E)	15.60-192	133 (B)	127	NO <NCMQS & MCL
Arsenic	1/11	1.90	BDL	1.91	NO
Barium	3/11 (3B)	17	17 (B)	17	NO
Beryllium	3/11 (3E)	9-11	11 (E)	10.30	NO
Cadmium	3/11 (3B)	43	43 (B)	43	? >NCMQS & MCL
Calcium	11/11 (3E)	42,100-216,000	216000 (E)	116,236	NO
Chromium	3/11 (3B)	15	15 (B)	15	NO <NCMQS
Cobalt	3/11 (2B,1E)	24-60	60	49	NO
Copper	1/11 (1B)	32	32 (B)	32	? >NCFWS
Iron	11/11 (3E)	202-2,060	202 (E)	924	? >FMQS
Magnesium	11/11 (3E)	126,000-798,000	798000 (E)	328,818	NO
Manganese	11/11 (6B)	1.20-57.70	12 (B)	18.39	NO
Nickel	3/11 (2E,1B)	52-60	52 (B)	55	? >FMQS (chronic)
Potassium	11/11 (3E)	19,100-241,000	241000 (E)	110,736	NO
Selenium	1/11	12.80	12.80	12.80	NO <FMQS
Silver	9/11 (7B,1E)	2.40-36	BDL	13.18	? >FMQS (acute)
Sodium	11/11 (3E)	47,700-6,690,000	6690000 (E)	1,731,750	NO
Vandadium	8/11 (7B,1E)	2.90-24	24 (B)	11.31	NO <FMQS
Zinc	9/11 (3B,2E)	2.90-52	27 (B)	21.26	NO <FMQS
<u>Sediment (mg/kg)</u>					
Arsenic	10/11 (7N, 3B)	0.68-11.60	BDL	2.82	NO <MCL
Aluminum	11/11	465-11,900	465	4,676	NO
Barium	9/11 (9B)	0.44-9.70	BDL	5.84	NO <FMQS
Beryllium	11/11 (11B)	0.88-1.90	0.92 (B)	1.20	NO
Cadmium	11/11 (2B)	0.69-4.40	0.69 (B)	1.84	NO <FMQS
Calcium	11/11 (10B)	150-3,790	150 (B)	1,160	NO
Chromium	11/11 (1B)	2.10-22.90	2.10 (B)	11.04	NO <FMQS
Copper	11/11 (8B)	0.92-20.90	0.92 (B)	7.24	NO
Iron	11/11	1,010-32,600	1010	9925	NO
Lead	11/11	2.20-27.40	2.20	12.45	NO

Table 6-12. **INORGANIC ANALYTES DETECTED IN SURFACE WATER AND SEDIMENT FROM SITE 48 (Continued)**

Matrix/Analyte	Frequency of Detections (Qualifer)[b]	Range (µg/L or mg/kg)	Background Concentration	Average (µg/L or mg/kg)	PCOC[a]/Rationale
Sediment (cont.)					
Magnesium	11/11 (4B)	655-2,970	276	1,547	NO
Manganese	11/11 (1B)	1.40-19.20	140 (B)	10.56	NO
Nickel	4/11 (4B)	2-4.50	BDL	3.27	NO
Potassium	11/11 (11B)	219-1,630	219 (B)	822	NO
Selenium	5/11 (5B)	0.37-0.76	BDL	0.60	NO
Sodium	11/11 (11E)	1,510-11,000	1510 (E)	6,029	NO
Vanadium	11/11 (7B)	3.20-69.10	3.20 (B)	17.49	NO
Zinc	11/11 (1B)	2.80-28.80	2.80 (B)	23.30	NO

a = Potential Chemicals of Concern

b = Contract Laboratory Program; Laboratory Qualifiers

Note:

E (inorganic data) = value was estimated due to matrix interferences.

B (inorganic data) = reported value is below contract required detection limit, but greater than the instrument detection limit.

B (organic data) = analyte found in associated blank

NCFWS = North Carolina Fresh Water Standards

NCWQS = North Carolina Water Quality Standards

FFWQS = Federal Freshwater Quality Standards

FMQS = Federal Marine Quality Standards

FWQS W/F ing. = Federal Water Quality Standards for the ingestion of water and fish.

MCL = Maximum Concentration Level

6.2.3.2 Toxicity Assessment

Cadmium, copper, nickel and silver in surface water were identified as potential chemicals of concern due to levels exceeding water quality standards. No potential chemicals of concern were identified in the sediment samples.

6.2.3.3 Exposure Assessment

Receptor Identification

Site 48 would be best characterized as an area with light industrial and, possibly, recreational activity. The surrounding area is comprised of moderately vegetated shoreline. A minimal number of buildings are located within close proximity of the area (building 408 - photo lab). The inlet itself is adjacent to an area which may on occasion be used for recreational fishing by military personnel. Possible populations that would be exposed include; recreational fishermen, trespassers and personnel working in the adjacent building.

Nonhuman populations at risk include a variety of fish, waterfowl, bird and small mammal species. It is unlikely that the area would be occupied by shellfish due to the nature of the bottom substrate. During the winter 1991 field activities pelican activity was observed in the bay area adjacent to the site, indicating the presence of schooling fish populations. Area 48 would provide some habitat for fisheries. However, due to the shallowness and lack of within channel habitat, fish activity would probably be limited to occasional feeding.

Site 48 would provide habitat for invertebrate populations. As a result this area would provide a food source for populations of fish. Since the contaminants of concern for this area are highly bioaccumulative, area 48 would potentially provide exposure to human and nonhuman populations through bioaccumulation.

Potential Exposure Pathways

Results of the 1991 field activities revealed the presence of four possible inorganic chemicals of concern. Inhalation, ingestion, and direct contact pathways were considered as possible exposure routes. The specific potential exposure pathways to human receptors are as follows;

- ingestion of fish and shellfish exposed to metals in sediments by human and nonhuman consumers,
- ingestion of game exposed to metals in soils by human and nonhuman consumers,

During the 1991 field activities no fish (of catchable size) or shellfish were observed in the area. There was waterfowl activity observed within the inlet. These animals could become exposed to contaminants onsite via ingestion, direct contact and inhalation, as a result the ingestion of these animals by predators and humans could consequently expose these populations.

6.2.3.4 Conclusions

Evaluation of the winter 1991 data from Site 48 revealed four potential chemicals of concern in the surface water which include cadmium, iron, nickel and selenium. Whether the observed concentrations are actually attributable to site contamination is unknown since historically these analytes were not disposed of in this area. These concentrations may be representative of background levels for the area.

Mercury was not identified in any of the sediment and surface water samples collected from the 1991 field efforts. Previous investigations and historical use of the site would indicate that mercury would be a potential chemical of concern. However, it is possible that concentrations of mercury in the 1991 samples fell below detectable levels or that the mercury was assimilated by the environment. To establish whether or not mercury is a potential chemical of concern, further sampling is required.

6.3 RECOMMENDATIONS

For the completion of a full human health and ecological risk assessment for each site, modeling of exposure concentrations to receptor populations will need to be completed. If fate and transport modeling of the contaminated groundwater at Sites 6 and 69 is to be conducted in the future, the following additional parameters will be needed:

- Extent and direction of contaminant plume migration,
- Aquifer porosity, and
- Fraction of organic carbon (f_{oc}).

If fate and transport modeling of air is to be performed for any of the areas of concern, the following parameters will be needed:

- Depth and extent of soil contamination,
- f_{oc},
- Soil porosity,
- Soil moisture, and
- Meteorological parameters (such as wind speed, direction, precipitation, etc.).

Air monitoring data would reduce uncertainty for predicting exposure concentrations of any volatile contaminants that might be present.

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APPENDIX A

DECONTAMINATION PROCEDURES

DECONTAMINATION PROCEDURES

All equipment involved in field sampling was decontaminated as required by the Quality Assurance Project Plan and the Health and Safety Plan.

(A) Field Decontamination

Heavy equipment (e.g. drilling rigs, augers, and rods) was steamcleaned prior to performing any work on site. Heavy equipment was also steamcleaned in between sampling locations, and prior to leaving the site. Gross contamination was removed from drilling equipment with a brush when necessary. Steamcleaning was conducted at a designated decontamination area.

Down-hole sampling equipment such as split-spoons and equipment used to fill sample jars such as bowls, spatulas, scoops, and spoons, were decontaminated according to the following procedure:

1) Phosphate-free soap (Liquinox or alconox) and potable water wash;
2) Potable water rinse;
3) 10% nitric acid (Reagent-grade acid or deionized water) rinse if sampling for metals (use 1% for equipment other than stainless steel);
4) Deionized water rinse
5) Solvent (Pesticide-grade iospropanol, acetone, or methanol) rinse (2 times);
6) Air dry.

Extraneous contamination was minimized by wrapping sampling equipment in aluminum foil (shiny side out) when not in use, and changing the sampler's gloves prior to collection of each individual sample.

Probes on temperature, specific conductivity, and pH meters were rinsed with deionized water in between samples.

(B) Laboratory Decontamination (Bailers only):

1) Hand wash PVC bailers in hot water using Liquinox;
2) Machine wash PVC balls & stainless steel screws using Detergent-8 (Delete final DI rinse from wash cycle);
3) Rinse bailers twice with tap water;
4) Rinse bailers & balls with 1% nitric acid (use metals-grade acid);
5) Rinse stainless steel screws with 10% nitric (use metals-grade acid);
6) Rinse all items with DI water;
7) Rinse all items twice with B&J isopropanol. (pesticide grade solvent);
8) Allow all items to air dry.
9) Put a ball in the bottom of each bailer and secure with screws in pre-drilled holes, and
10) Wrap each bailer with aluminum foil with the shiny side out.

APPENDIX B

WELL LOGS - SITE 6

Boring No. 6 GW 1 | Location Coordinates N | p. 1 of 4
Hole Size 6" | Slot | E
Screen Size 2" | Mat'l PVC | Filter Materials Silica Sand
Casing Size 2" | Mat'l PVC | Grout Type Bentonite Seal / Cement
Geologist Paul Conrad | Development
Date Start 10/21/86 | Finish 10/21/86 | Static Water Level 15.65
Contractor Davis Drilling | Top of Well Elevation 18.17
Driller Charles Smith | Drill Type Hollow Stem Augur

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5			Top 6" Peat, 20-25% silt, Fine sand ~5%, low density, color 10YR 2/1 (blk)	Pt	1-2-5
			0.5'-1.5' Silty Fine Sand (qtz), silt 10-15%, dry, no cohesion, non-plastic, v. loose, color uniform 2.5y 5/2 (greyish brn).	SM	
3.0			Silty Fine Sand (qtz), silt 10-15%, no cohesion, ~~v. loose to loose~~ density, non-plastic, color 10YR 6/2 (light brownish grey), dry.	SM	4-6-10
3.0-4.5			Fine Sand (qtz), silt 5-10%, fairly clean, loose density, slightly moist low cohesion, non-plastic, color 10YR 6/4 (light yellowish brn)	SW	5-9-14
4.5-6.0			Fine Sand (qtz), silt 5-10%, moist, loose density, low cohesion, non-plastic, fairly clean, fairly uniform color 10YR 6/4 (light yellowish brn).	SW	9-9-9

Boring No. 6 GW 1

Location Coordinates N

E

Hole Size

Slot

Screen Size

Mat'l

Filter Materials

Casing Size

Mat'l

Grout Type

Geologist

Development

Date Start

Finish 10/21/86

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
6.0-7.5			Fine Sand, 5-10% silt, moist, loose density, non-plastic, fairly clean, mottled color - white and yellow-orange overall color - 10YR 8/4 (v. pale brn)	SW	4-7-10
7.5-9.0			Same description as 6.0-7.5'	SW	5-9-9
[illegible]-10.5			9'-10' Same description as 7.5-9.0'	SW	3-5-6
			10'-10.5' Silty Fine sand, silt ~15%, color slightly darker greyish, 10YR 5/3 (brn), color fairly uniform, moist, loose density	SM	
14-15.5			Silty Fine Sand, silt 25-30%, major color change, predominant color 10YR 2/1 (black) mottled w/ white, white sand has no cohesion, soil appears oil stained, but no oil odor, possible high organic silt, stains hands brown, dark portion is ~~slightly moist cohesive~~, non-plastic, wet.	SM	1-2-2

Boring No. 6 GW1 Location Coordinates N 3 of 4

Hole Size ______ Slot ______ E ______

Screen Size ______ Mat'l ______ Filter Materials ______

Casing Size ______ Mat'l ______ Grout Type ______

Geologist ______ Development ______

Date Start ______ Finish 10/21/86 Static Water Level ______

Contractor ______ Top of Well Elevation ______

Driller ______ Drill Type ______

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
19-20.5			Approx. 19-19.5' Clay, silt 5-10%, no sand, very stiff, high plasticity, uniform color 7.5 YR 3/0 (v. dark grey, very clean, wet.	CL	10-13-16
			Approx. 19.5-20.5' Silty Fine Sand, silt ~15%, color change to 2.5Y 5/2 (greyish brown), med. density, color uniform.	SM	
21-25.5			Sand (qtz.), Silt 5-10%, larger sand grains ~ 3-4 times, grains rounded to sub-rounded, clear & white qtz., non-plastic, medium density, mottled white and yellow w/ some greys, overall color 2.5Y 7/6 (yellow), saturated. [sample appears grey due to sides of core barrel]		

Boring No. 6 GW 1

11:30 am Driller washing rig & truck. Loading truck & filling w/ water.

12:00 Travel to boring location
12:15 pm Sampling & drilling commence
1:10 Drilling complete, Casing assembled and installed.
1:15 Backing out augurs & pouring sand. Casing capped
1:30 Augurs out.
1:40 Placing bentonite pellets
1:45 Left well loc'n for temp. storage area (intersection Piney Green & Old Bear Creek Roads.)
2:20 Driller noticed problem w/ rig. Kelly bar being checked at top. Commenced repair.
2:45 More ~~extensive~~ ~~repair~~ needed.!! Driller left for machine shop. No more wells today.

Length casing below ground - 25' + 5" cap
Stick up - 2.5'
Depth to top of screen - 5'
" " " " sand - 3' (2' above top of screen)
" " " " bentonite - 1' (1' bentonite)
Length of screen - 20'
5" cap on bottom of casing
Hole depth - 28'

10/21/86
DATE

Paul D. Conrad
SIGNED

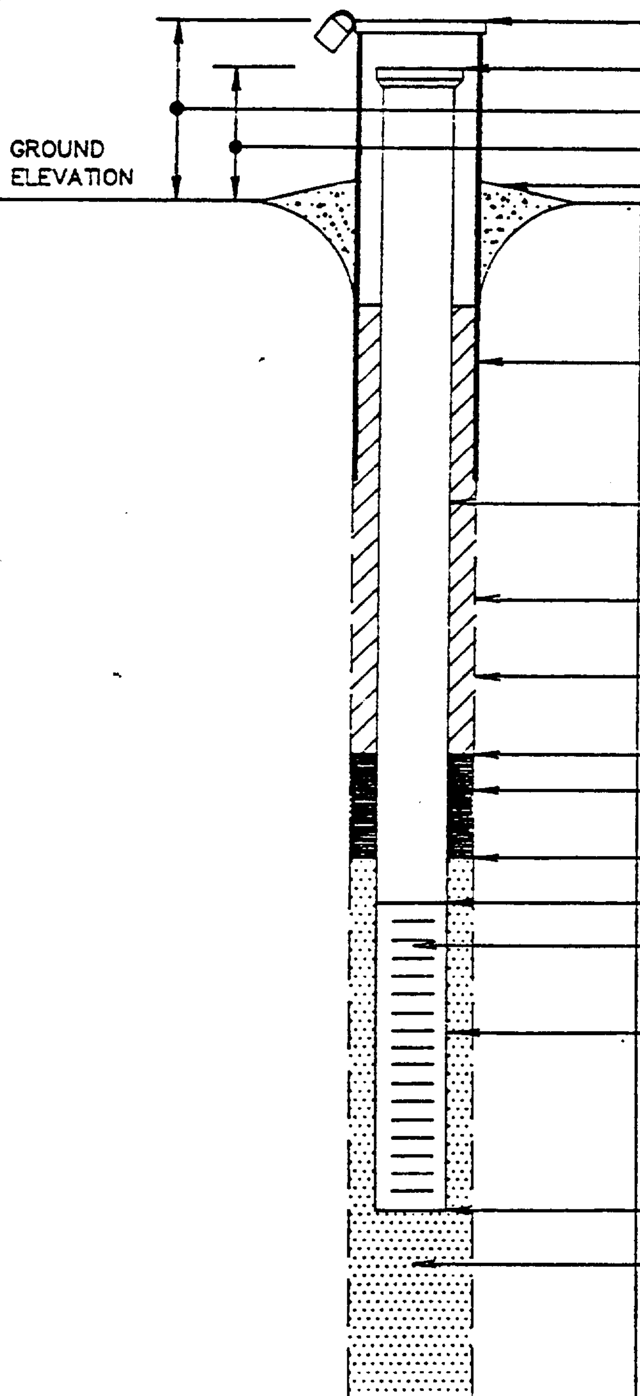
SOURCE: Environmental Science and Engineering, Inc., 198

T

OVERBURDEN MONITORING WELL SHEET

WELL NO. 66W1

PROJECT Camp Lejeune - Site 6	DRILLER Davis Drilling Co.
PROJECT NO. 49-02036 BORING NO. 6-GW1	DRILLING METHOD Hollow Stem Auger
ELEVATION ___ DATE 10/21/86	DELVELOPMENT METHOD ___
FIELD GEOLOGIST ___	



ELEVATION OF TOP OF SURFACE CASING: ___

ELEVATION OF TOP OF RISER PIPE: ___

STICK-UP TOP OF SURFACE CASING: ___

STICK-UP RISER PIPE: 2.42'

TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"

TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER: ___

TYPE OF BACKFILL: Concrete

ELEVATION/DEPTH TOP OF SEAL: 2'

TYPE OF SEAL: Clay

DEPTH TOP OF SAND PACK: 3'

ELEVATION/DEPTH TOP OF SCREEN: 5'

TYPE OF SCREEN: PVC (Schedule 40)

SLOT SIZE X LENGTH: 0.010" x 20'

TYPE OF SAND PACK: Coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'

ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'

TYPE OF BACKFILL BELOW OBSERVATION WELL: ___

ELEVATION/DEPTH OF HOLE: 25'

NOT TO SCALE

OVBDMW.DWG

Boring No. 6 GW 2

Location Coordinates N

E

Hole Size 6"

Slot

Screen Size 2"

Mat'l PVC

Filter Materials Silica Sand

Casing Size 2"

Mat'l PVC

Grout Type Bentonite Seal - 1' /cement

Geologist Paul D. Conrad

Development

Date Start 10/21/86 Finish 10/21/86

Static Water Level 13.08

Contractor Davis Drilling

Top of Well Elevation 15.58

Driller Charles Smith

Drill Type Hollow stem augur

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5			Fine Sand (qtz), ~5% fines, very loose, non-plastic, slightly moist, color closest to 5YR 8/1 (white), fairly uniform. At ~1.5 color change to 10YR 5/6, increase of fines to ~10% silt.	SW	1-1-1
1.5-3.0			Fine sand (qtz), silt ~5%, very loose density, slightly moist, non-plastic, uniform color 2.5Y 7/4 (pale yellow).	SW	2-2-4
3.0-4.5			Same description as 1.5-3.0'	SW	3-5-8
4.5-6.0			Fine Sand, silt 5-10%, very loose density, ~~slightly~~ moist, non-plastic, color uniform, and slightly darker than overlying sand, color 10YR 5/6 (yellowish brown)	SW	4-5-5
6.0-7.5			Fine Sand, Silt 5-10%, loose density, slightly moist, fairly uniform, color 10YR 6/4 (light yellowish brown) At 7 ft. sand mottled w/ clay 10-15% and more silts ~10%, mottled zones have slightly higer cohesion and slightly more dense. Colors 7.5YR 5/8 (strong brn) 10YR 5/4 (yellowish brn)	SW/SM	7-10-13

Boring No. 6 GW 2 Location Coordinates N ______ 2 of

Hole Size ______ Slot ______ E ______

Screen Size ______ Mat'l ______ Filter Materials ______

Casing Size ______ Mat'l ______ Grout Type ______

Geologist ______ Development ______

Date Start ______ Finish 10/21/86 Static Water Level ______

Contractor ______ Top of Well Elevation ______

Driller ______ Drill Type ______

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
7.5-9.0			Silty fine sand (qtz), silt 10-15%, minor clay fractions, moist, low to mod. cohesion, medium dense to dense, v. low plast., mottled color [light grey and brn grey], overall color 10YR 7/2 light grey.	SM	7-16-18
9.0-10.5			Fine sand (qtz), silt 10-12%, clay ~5%, uniform color 2.5Y 7/2 (light grey), yellowish banding, v. dense, saturated, non-plastic, fairly uniform grains	SW	12-22-35
19-20.5			Fine sand (qtz), silt ~10%, v. dense, saturated, color 2.5Y 8/2 (white), color fairly uniform, some yllwish mottling.	SW	9-17-30
24-25.5			Fine sand (qtz), silt ~10%, sand grains slightly coarser, dense, non-plastic, saturated, At 24.5' color change, 2.5Y 7/4 (pale yellow)	SW	9-17-21

Boring No. 6GW2

7:45 am Met drillers at storage yard. Rig on trailer, all nearly ready. Rig on trailer.

8:30 Arrived at drilling location.

8:40 Began drilling.

9:50 Drilling and sampling complete. Augers ~~stuck~~ coming out. Casing set & augers backing out. Sand/water being poured. Some casing stress.

10:15 Sand in. Travel to trailer to get bentonite.

10:45 well complete.

25' ft. casing below grd. elev.
hole depth - 30'
screen lngth - 20'
Top of sand - 2' down
top of bent. - 1.5' down

10/21/86
DATE

Paul D. Conrad
SIGNED

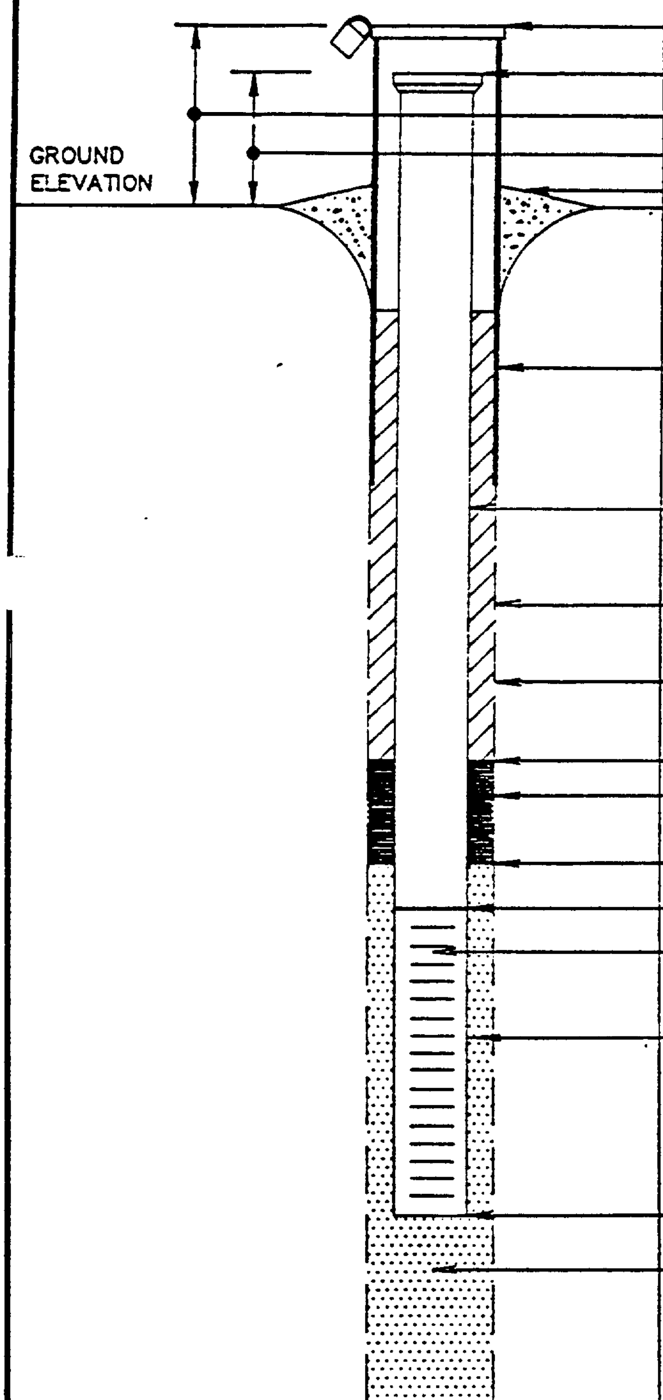
SOURCE: Environmental Science and Engineering, Inc., 198

OVERBURDEN MONITORING WELL SHEET

WELL NO. 6GW2

PROJECT: Camp Lejeune - Site 6
PROJECT NO.: 49-02036
BORING NO.: 6-GW2
ELEVATION:
DATE: 10/21/86
FIELD GEOLOGIST:

DRILLER: Davis Drilling Co
DRILLING METHOD: Hollow stem Auger
DELVELOPMENT METHOD:



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 2.16'
TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: Coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 25'

NOT TO SCALE

OVBDMW.DWG

Boring No. 16GW3 | Location Coordinates N ______
Hole Size 6" Slot 0.010" | E ______
Screen Size 2" Mat'l PVC | Filter Materials Silica Sand
Casing Size 2" Mat'l PVC | Grout Type 1' Bent. Seal / Cemen
Geologist Paul Conrad | Development ______
Date Start 10/24/86 Finish 10/24/86 | Static Water Level 14.75
Contractor Davis Drilling | Top of Well Elevation 17.25
Driller Charles Smith | Drill Type Hollow Stem Auger

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0 - 1.5			Silty Fine Sand, silt 20-25%, organics, Loose to medium density, non-plastic, at 6" depth hit concrete, moist, color 2.5Y 6/2 (lght brnish grey), (Organic zone near top (4") color 5Y 3/1 (v. drk grey).	SM	4-35-8
1.5-3.0			Silty Fine Sand, silt 20-25%, med dense, non-plastic, moist, color mottled w/ darker zones, overall color 2.5Y 3/2 (v. drk gryish brown)	SW	5-8-6
3.0-4.5			Fine Sand, silt ~12%, medium dense, moist, non-plastic, fairly uniform grains, color 2.5Y 7.5/4 (light yellwish brn)	SW	5-12-12
4.5-6.0			Fine Sand, silt 10-12%, Loose to med. dense, moist, non-plastic, fairly uniform grains, slightly mottled with yllwish brn, predominant color 2.5Y 7.5/4 (light yllwish brn)	SW	5-8-7

Boring No. 6 GW 3

Location Coordinates N

E

Hole Size ______ Slot ______

Screen Size ______ Mat'l ______

Filter Materials

Casing Size ______ Mat'l ______

Grout Type

Geologist

Development

Date Start ______ Finish ______

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
6-7.5			6-6.5' same description as 4.5-6'. 6.5-7.5' Silty Fine Sand (qtz), silt 20-25%, non-plast., moist, loose, color gradually changed to 2.5Y 8/8 (yellow) sand fairly uniform.	SW/SM	6-4-5
7.5-9.0			Fine Sand, silt 5-10%, loose density, moist, fairly clean, uniform grains, non-plast., uniform color 2.5Y 8/3 (pale yellow to white), qtz sand.	SW	2-5-6
9.0-10.5			Silty Fine Sand, silt 20-25%, moist, non-plastic, med. dense, color changed (9-10') 2.5Y 4/2 (drk greyish brn). 10-10.5', Sand, silt 5-10%, moist, med. dense, non-plastic, color change 10YR 8/1 (white), occ. orange mottles.	SM	23-7-9
14-15.5			Clayey Fine Sand, clay ~20%, saturated, mod. plasticity, med. density, color 10YR 7.5/1 (white to light grey), sand grns fairly unif., ~~[illegible]~~ ~~[illegible] 7.5/2 ([illegible] white)~~	SC	3-4-5

Boring No.
Hole Size Slot
Screen Size Mat'l
asing Size Mat'l
ologist
Date Start Finish
Contractor
Driller

Location Coordinates N
E
Filter Materials
Grout Type
Development
Static Water Level
Top of Well Elevation
Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
~~19~~-20.5			Sand, silt 10-15%, saturated, dense, non-plastic, occ. v. small clay lenses, ~~[illegible]~~ mod. uniform grading, qtz grains, rounded, 1% coarse white qtz gns (fine gravel, rounded.) color 7.5/2 (lght gry to wht)	SW	8-16-18
-4-25.5			Sand, silt 5-10%, saturated, dense, non-plast., grains rounded & sub-rnded, fairly uniform grading, ~~trace~~ white rounded qtz grains ~3 mm, color 10YR 7.5/2 (lght gry to wht.)	SW	7-12-17

7:30 am — Arr'd. at temp. stg. area. Travelled to drill lcn.

8:10 am — Began drilling & sampling

8:35 am — Dug out 1'x8"x8" concrete chunk hang up the bit. Visited by worker who stated that alot was buried under site.

9:15 am — Max. drilling depth reached.

9:25 am — Backing out augurs & pouring silica sand packing

10:00 am — Driller reports hole staying open v. well. (Best so far). No unusual problems.

10:10 am — Well Complete

Hole depth ~27.5
Depth casing below gnd surf - 25'
Stick up - 2.5
Top sand - 3' down from gnd. surf.
Screen lgth. - 20'
Top bentonite - 1.5' down (thickness - 1.5')

DATE: 10/24/86

SIGNED: Paul D. Conrad

SOURCE: Environmental Science and Engineering, Inc., 198[illegible]

Boring No. General (6 GW3)

SHEET 1 OF 1

1:15 Travel to well location.
1:20 Began drilling & sampling. David is logging soil. Paul assistin *breakin core
2:40 Assembling casing and pulling inner string w/ tricone bit at bottom.

2:55 Trouble getting casing in. Probably hanging up on bit tooth.

3:00 Casing in. Pouring silica sand. Backing augurs out.

3:30 Placing bentonite
3:35 Well complete. When lowering boom, hydraulic hose broke. Some fluid lost. Most hit ground 5-6' from hole. Driller quickly moved rig.
Driller back to temp. storage area.

4:00 Planning for next day.

4:15 Left. Driller fixing rig.

10/23/86 DATE

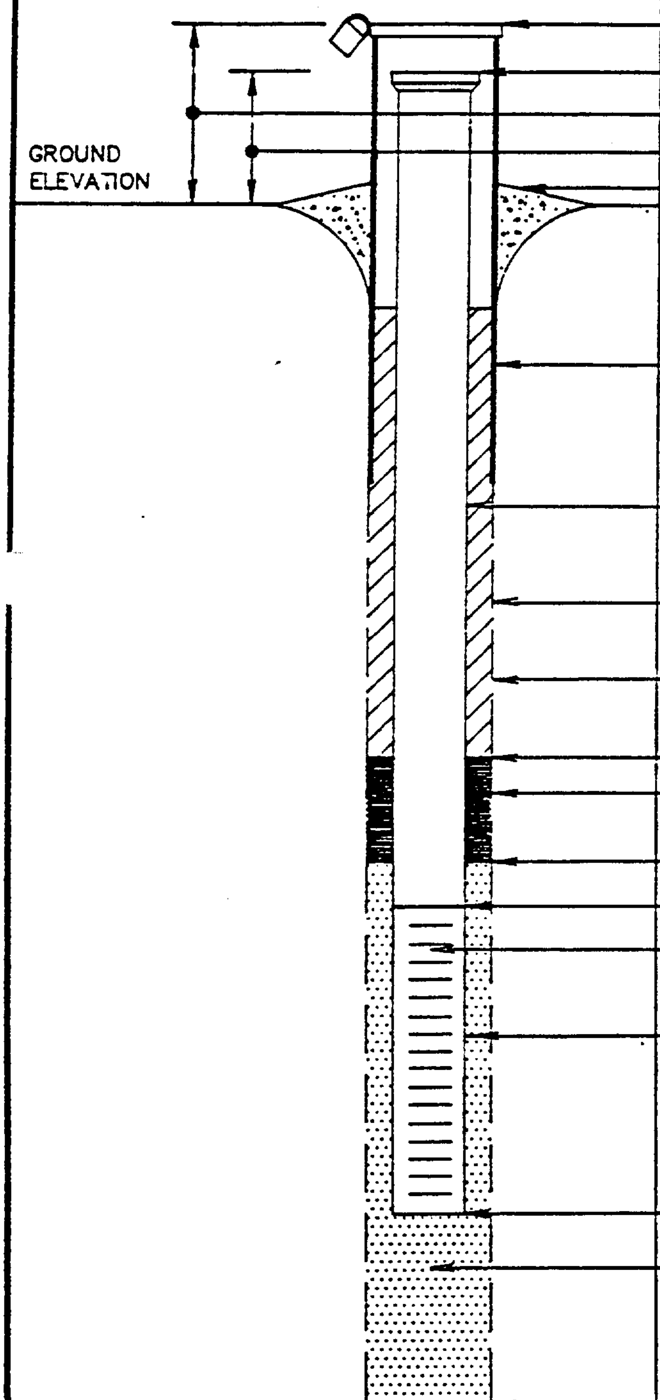
Paul D. Conrad SIGNED

SOURCE: Environmental Science and Engineering, Inc., 19

OVERBURDEN MONITORING WELL SHEET

WELL NO. 6GW3

PROJECT	Camp Lejeune - Site 6
PROJECT NO.	49-02036
BORING NO.	6-GW3
ELEVATION	
DATE	10/24/86
FIELD GEOLOGIST	
DRILLER	Davis Drilling Co.
DRILLING METHOD	Hollow Stem Auger
DELVELOPMENT METHOD	



NOT TO SCALE

ELEVATION OF TOP OF SURFACE CASING:	
ELEVATION OF TOP OF RISER PIPE:	
STICK-UP TOP OF SURFACE CASING:	
STICK-UP RISER PIPE:	2.25'
TYPE OF SURFACE SEAL:	concrete
I.D. OF SURFACE CASING:	5"
TYPE OF SURFACE CASING:	carbon steel
RISER PIPE I.D.	2"
TYPE OF RISER PIPE:	PVC (Schedule 40)
BOREHOLE DIAMETER:	
TYPE OF BACKFILL:	concrete
ELEVATION/DEPTH TOP OF SEAL:	2'
TYPE OF SEAL:	clay
DEPTH TOP OF SAND PACK:	3'
ELEVATION/DEPTH TOP OF SCREEN:	5'
TYPE OF SCREEN:	PVC (Schedule 40)
SLOT SIZE X LENGTH:	0.010" x 20'
TYPE OF SAND PACK:	Coarse sand
ELEVATION/DEPTH BOTTOM OF SCREEN:	25'
ELEVATION/DEPTH BOTTOM OF SAND PACK:	25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:	
ELEVATION/DEPTH OF HOLE	25'

Boring No. 6 GW 4 | Location Coordinates N | pg. 1 of.

Hole Size 6" Slot 0.010" | E

Screen Size 2" Mat'l PVC | Filter Materials Silica Sand

Casing Size 2" Mat'l PVC | Grout Type 1' bentonite seal /Cement

Geologist Paul Conrad | Development

Date Start 10/22/86 Finish 10/22/86 | Static Water Level 7.79'

Contractor Davis Drilling Co. | Top of Well Elevation 10.29'

Driller Charles Smith | Drill Type Hollow stem augur

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5			Silty Fine Sand, silt 20-25%, organics, ~~dry~~ loose density, non-plastic, mottled color, predominantly dark brownish grey w/white (appearance of oil stained white sand), silt fraction has drk color. moist. Color: 2.5Y 6/2 (light brnish grey).	SM	2-2-8
1.5-3.0			1.5 to 2.0' Same as above. 2.0-3.0' Silty Fine Sand, silt 15-20%, med-loose density, non-plastic, moist, color change, light brn color, fairly uniform color, fairly uniform grains, qtz sand. Color: 2.5Y 6/4 (light yellowish brown)	SM	7-7-11
3.0-4.5			Fine silty Sand, silt 15-20%, medium to loose density, non-plastic, non-cohesive, moist, color uniform, ~~light brn color~~, uniform grains, qtz sand, color: 2.5Y 7/2 (light grey).	SM	5-5-11

Boring No. 6 GW4 Location Coordinates N p. 2 of _

Hole Size ____ Slot ____ E ____

Screen Size ____ Mat'l ____ Filter Materials ____

Casing Size ____ Mat'l ____ Grout Type ____

Geologist ____ Development ____

Date Start ____ Finish 10/22/86 Static Water Level ____

Contractor ____ Top of Well Elevation ____

Driller ____ Drill Type ____

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
4.5-6.0			~~Silty Fine~~ Sand (qtz), silt 20-25%, loose density, non-plastic, moist, mottled color: light brn and grey, fairly uniform grains, color: 2.5Y 7/2 (light grey).	SM	3-5-8
-7.5			Silty Fine Sand (qtz), silt 25-30%, major color change - dark brown and uniform, more silt than overlying samples, loose density, non-plastic, moist, color: 10YR 3/3 (drk brn).	SM	3-6-6
7.5-9.0			Fine Sand (qtz); silt 5-10%, major color change, fairly clean white, w/ some light brn-grey mottling, med. density, saturated, non-plastic, color: 10YR 7/1.5 (light grey)	SW	6-8-15

Boring No. 6 GW 4

Location Coordinates N

E

Hole Size

Slot

Screen Size

Mat'l

Filter Materials

asing Size

Mat'l

Grout Type

ologist

Development

Date Start

Finish 10/22/86

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
9.0-10.5			Fine Sand, Silt 5-10%, qtz. sand, med. density, non-plastic, saturated ~50% of the grains 2 times larger than overlying sands, clear qtz, fairly well graded. Fairly clean white color, v. light grey-brn tint, Mottling: scarce, color: 10YR 8/1 (white)	SW	6-8-12
14-15.5			Fine Sand, same description as above.	SW	7-10-12
19.0-20.5		dense to	Fine Sand (qtz), silt 5-10%, saturated, medium dense, non-plastic, uniform fairly clean white color, lght brn-grey tint, v. nearly same as above Two samples, color: 10 YR 8/1 (white)	SW	12-15-18

Boring No. 6GW4

Location Coordinates N

E

Hole Size

Slot

Screen Size

Mat'l

Filter Materials

Casing Size

Mat'l

Grout Type

Geologist

Development

Date Start

Finish 10/22/86

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
24-25.5			Fine Sand (qtz), silt 5-10%, same description as 19'-20.5' sample, saturated.	SW	12-18-21

Boring No. 6 GW4 SHEET 5 OF 5

10/22/86

7:30 am Arr. at site. Drillers repairing rig

8:05 Loading sand on truck, Travel to boring location

8:25 Rig & Truck in place. Adjustment needed on repair job.

8:30 Begin drilling* & sampling. Minor caving after water tabl

9:50 Quit drilling, bottom ~30'. Backing out augurs, installed casing. Pouring silica sand slurry.

10:45 Well complete, load truck and heading back to temp. storage area.

11:00 Truck left for water refill.

11:15 Lunch break.

11:45 Washing rig & Truck

12:00 Travel to next boring location (#6GW5) (Truck following w/ more sample bottles)

12:15 pm setting up rig

~~2:30~~ Stop to get truck out - accident 12:45 Driller backs into ESE vehicle.

1:50 Started drilling & sampling. David describing soil. Paul breaking cores & assist

2:35 Final boring depth reached. No screen - driller left for wasteuir treatment area to get some.

* Using small tricone bit 6" ahead of augurs

2:55 Driller Returns, Assembling casing and installing. Pouring sand & backing augurs out.

3:45 Well 6GW5 complete. Travel to temp. storage area.

Hole depth ~30' (bottom 5' filled w/ silica sand)
depth casing in grd - 25'
Stick up - 2.5'
Depth to top of sand - 2'1"
Depth to top of bentonite - 1'

4:00 Washing rig & Truck. Drillers preping for tomorrow

4:15 Lv. site

10/22/86
DATE

Paul D. Conrad
SIGNED

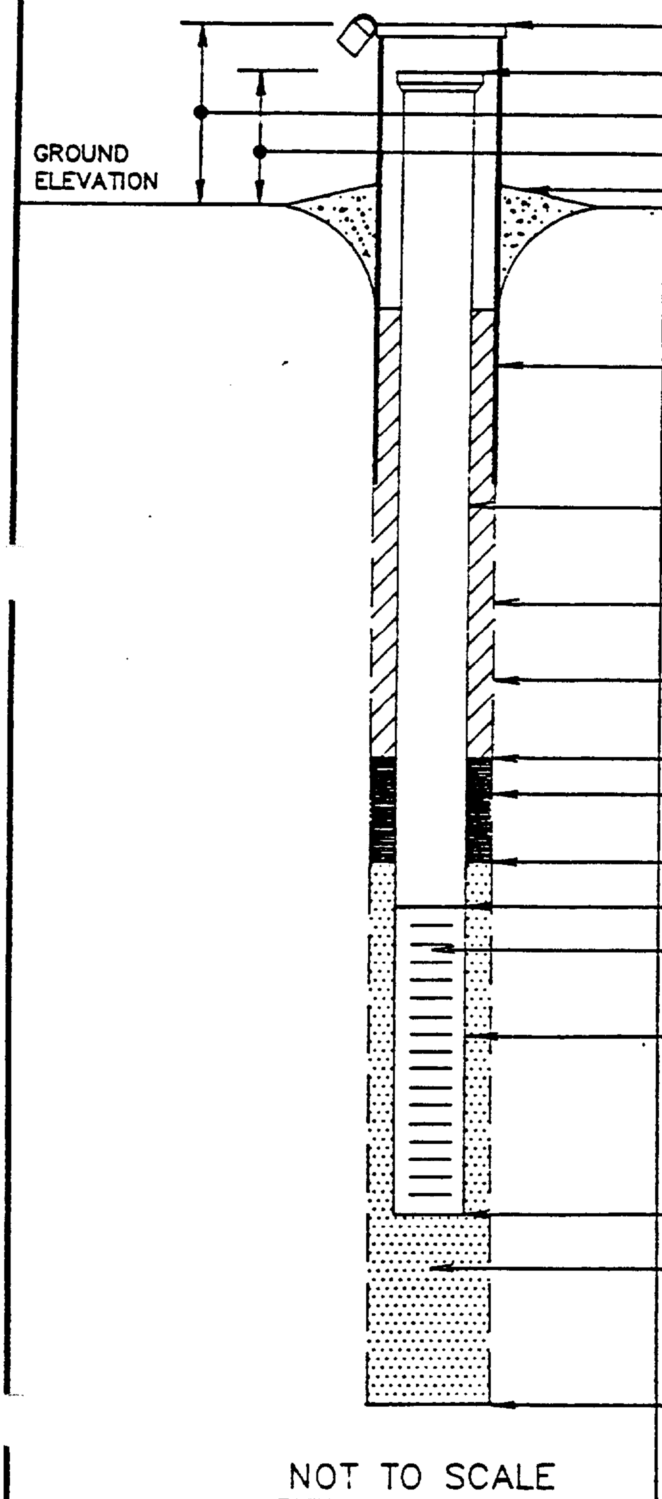
SOURCE: Environmental Science and Engineering, Inc., 19

OVERBURDEN MONITORING WELL SHEET

WELL NO. 6GW4

PROJECT: Camp Lejeune - Site 6
PROJECT NO. 49-02036 BORING NO. 6-GW4
ELEVATION: ________ DATE: 10/22/86
FIELD GEOLOGIST: ________

DRILLER: Davis Drilling Co.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD: ________



ELEVATION OF TOP OF SURFACE CASING: ________
ELEVATION OF TOP OF RISER PIPE: ________
STICK-UP TOP OF SURFACE CASING: ________
STICK-UP RISER PIPE: 2.45'
TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER: ________

TYPE OF BACKFILL: concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL: ________

ELEVATION/DEPTH OF HOLE 25'

OVBDMW.DWG

Boring No. 6 GW 5 | Location Coordinates N
Hole Size 6" | Slot 0.01" | E
Screen Size 2" | Mat'l PVC | Filter Materials Silica Sand
Casing Size 2" | Mat'l PVC | Grout Type Bentonite Pellets
Geologist David Brentlinger | Development
Date Start 10/22/86 | Finish 10/22 | Static Water Level 6.79
Contractor ESE | Top of Well Elevation 9.29
Driller Davis | Drill Type Hollow Stem Auger

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0 - 1.5			Silty Fine Sand (silt 20%), organic matter less 5%, 7.5YR 2/0, loose, Dry-moist, Black (USCS), non plastic.	SM	2 2 6
1.5 - 3.0			Silty Fine Sand (silt 20%) organic matter (5-10%), 2.5YR 2.5/2 loose, moist, non plastic, very dusky Red (USC'S).	SM	4 4 7
3.0 - 4.5			Silty Fine Sand (silt 10-15%) 10YR 8/1, moist, non plastic, loose, white (USCS).	SM	4 6 7
4.5 - 6.0			Silty-Clayey Fine Sand (Clay 5-10%) Silt 10-15%, 7.5YR 6/2, moist, slightly plastic, slightly dense, Pinkish Grey - Light grey (USCS)	SC	2 4 7

Boring No. 6GW5 | Location Coordinates N ______
Hole Size ______ Slot ______ | E ______
Screen Size ______ Mat'l ______ | Filter Materials ______
Casing Size ______ Mat'l ______ | Grout Type ______
Geologist ______ | Development ______
Date Start ______ Finish ______ | Static Water Level ______
Contractor ______ | Top of Well Elevation ______
Driller ______ | Drill Type ______

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
6.0-7.5			Silty Fine Sand (silt 15%), loose, moist, non plastic, 7.5 YR 7/2, Pinkish Grey (USCS).	sm	4 4 6
7.5 - 9.0 water table 9.0'			Silty fine Sand (silt 15-20%) Very Moist, Non plastic, loose, 7.5YR 8/2, Pinkish white (USCS).	sm	4 6 8
9.0-10.5			Silty Fine Sand (silt 10-15%), wet, slightly-loose, non plastic, Pinkish Grey (USCS). 7.5YR 6/2	sm	6 9 12
14.0 - 15.5			Silty Fine Sand (silt 15-20%) wet, loose, non plastic, white (USCS), 5YR 8/1.	sm	5 5 5
19.0 - 20.5			silty Fine Sand (silt 5-10%) wet, loose, non plastic, Olive grey (USCS). 5Y 6/1.	SW	5 10 10
24.0 - 25.5			Silty Sand (silt 5%), loose, Very wet, non plastic, Foul smelling, stains fingers Grey, 5G 6/1, Greenish Grey (USCS)	SW	6 8 14

Boring No. 6 GW 5 SHEET ____ OF ____

"1. Hle Foot"

10/22/86

150 drilling Begins (accident 1230 pm)
10 drilling stops drillers need pipe (screen), driller
brought wrong stuff.
310 Drillers Return and begun to pull auger out

315 Screen is in, drillers start packing with sand
~~344~~ 345 Auger is out
350 Bentonite is poured in

SPECS " Standard

1' Bentonite
2.5' Stick up
25' casing
20' Screen

* for details see
work plan

DATE SIGNED

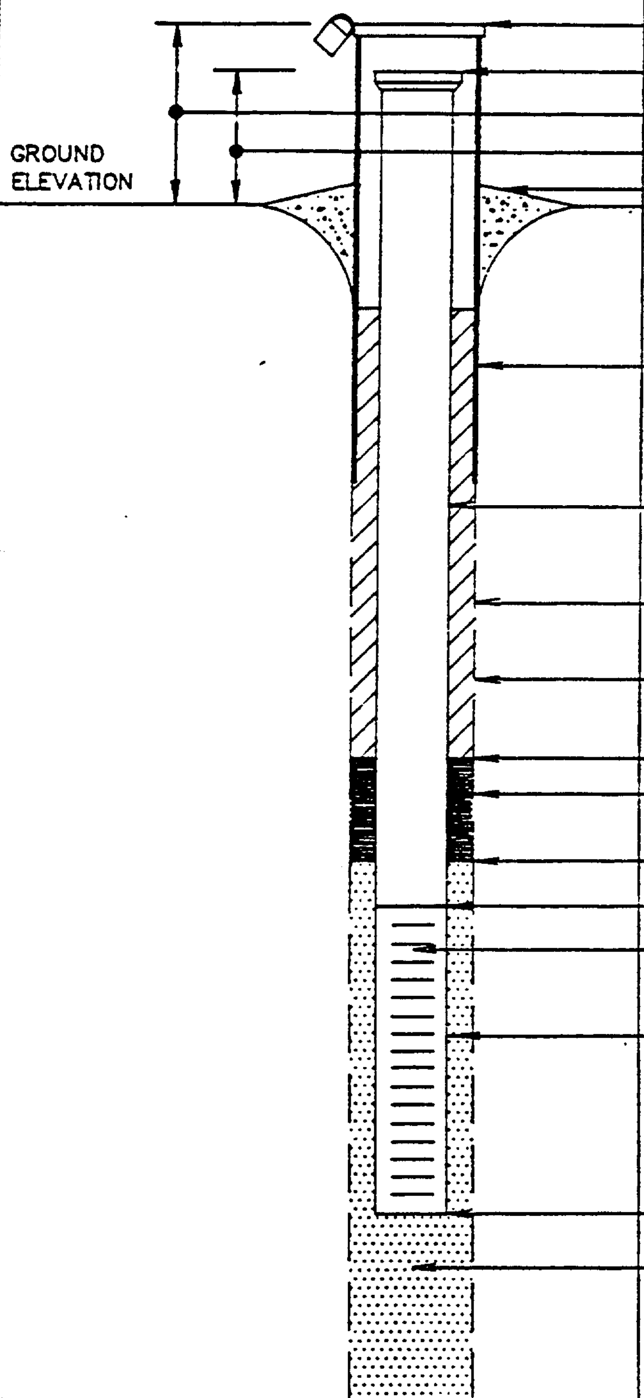
SOURCE: Environmental Science and Engineering, Inc., 198?

WELL NO. 6GW5

OVERBURDEN MONITORING WELL SHEET

PROJECT Camp Lejeune - Site 6
PROJECT NO. 49-02836 BORING NO. 6-GW5
ELEVATION DATE 10/22/86
FIELD GEOLOGIST

DRILLER Davis Drilling Co.
DRILLING METHOD
DELVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 2.33'
TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 25'

NOT TO SCALE

OVBDMW.DWG

Boring No. 6 GW 6

Hole Size 6" Slot 0.01

Screen Size 2" Mat'l PVC

Casing Size 2" Mat'l PVC

Geologist David Brentlinger

Date Start 10/23/86 Finish 10/23

Contractor ESE

Driller Davis

Location Coordinates N

E

Filter Materials Silica Sand

Grout Type Bentonite Pellets

Development

Static Water Level 8.04'

Top of Well Elevation 10.54'

Drill Type Hollow Stem Auger

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5		0-1.0	Silty Fine Sand (silt 25%), loose, Dry, non plastic, light grey (USCS), 10YR 6/1	SM	2 6 8
		1.0-1.5	Silty Fine Sand (silt 25-30%) loose, Dry, non plastic, Reddish Black (USCS) 10R 2.5/2	SM	
1.5-3.0			Silty Fine Sand (silt 35%), slightly loose, moist, non plastic, white (USCS), 10YR 8/1	SM	3 12 13
3.0-4.5		3.0-4.0	Silty Sand (silt 35%) sand less fine, loose, moist, non plastic, light Grey, 10YR 7/2	SM	6 12 15
		4.0-4.5	Silty Sand (silt 20%), loose, moist, non plastic, white (USCS), 10YR 8/1		
4.5-6.0		4.5-5.5	Silty very Fine Sand (silt 15%), loose, non plastic, moist, white, 10YR 8/1	SM	8 13 15
		5.5-6.0	Silty Sand (silt 40%) mod. dense moist, non plastic, light Grey Brown, 10YR 6/3	SM	
6.0-7.5			Silty Fine Sand silt (20-25%), loose, moist, non plastic, light Grey (USCS), 10YR 7/2	SM	6 8 15

Boring No. 6 GW 6

Location Coordinates N

E

Hole Size

Slot

Screen Size

Mat'l

Filter Materials

Casing Size

Mat'l

Grout Type

Geologist

Development

Date Start

Finish

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
7.5 - 9.0			Silty Very Fine Sand (Silt 30%) very moist, loose, non plastic, light Grey (UCS) 10YR 7/2	SM	8 10 17
9.0 - 10.5 → 10'			Silty Fine Sand interbedded with sandy silty layers, (Silt 30-40%), loose, moist, non plastic, white (UCS), 10YR 8/1	SM	8 10 13
14.0 - 15.5			Very fine sand, wet, loose, non plastic, white (UCS) 10YR 8/1	SW	14 8 8
19.0 - 20.5			Very fine Sand mod dense wet, non plastic, white (UCS) 10YR 8/1	SW	15 30 25
24.0 - 25.5			Very fine sand, wet, non plastic, loose, white (UCS), 10 YR 8.5/1	SW	10 12 15
		25.0'	1" thick sandy Clay layer mod. Plastic, soft, moist, 5G 7.5/2, pale green (UCS).		

Boring No. General (6GW6)

SHEET 1 OF 1

7:50 am. Arr'd at site and met drillers.
8:00 Setting up rig to drill.
8:05 Began drilling & sampling. David logging soil, Paul assisting, and break cores.
9:00 Installing casing. Plug out. Pouring sand and backing augurs.

9:30 Paul left to find next boring loc'n.

10:00 Met drillers & Dave at temp. storage area. Short coffee break, then washing rig & Truck.

— Go to Log 6GW8 —

10/23/86
DATE

Paul D. Conrad
SIGNED

SOURCE: Environmental Science and Engineering, Inc., 198

Boring No. 6 GW 6 SHEET ____ OF ____

On Site 800 AM 10/23/86
1st Spoon 810
last spoon 850
Screen in 900
Well Complete 945

[illegible] Specs

for details see work plan

DATE ____ SIGNED ____

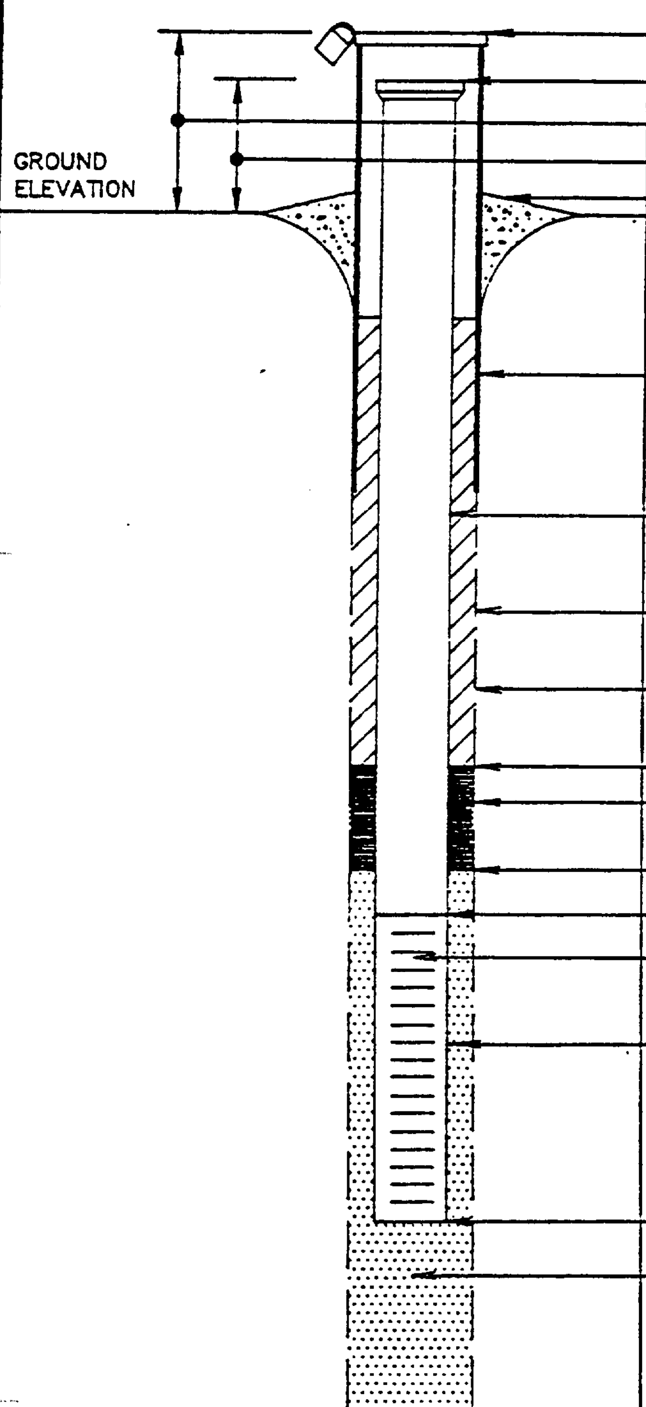
SOURCE: Environmental Science and Engineering, Inc., 198

OVERBURDEN MONITORING WELL SHEET

WELL NO. 6GW6

PROJECT: Camp Lejeune - Site 6
PROJECT NO. 49-02036
BORING NO. 6-GW6
ELEVATION:
DATE: 10/23/86
FIELD GEOLOGIST:

DRILLER: Davis Drilling Co.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD:



NOT TO SCALE

ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 2.32'
TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: Concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: Coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE: 25'

OVBDMW.DWG

Boring No. 6 GW7
Hole Size 6" Slot 0.010"
Screen Size 2" Mat'l PVC
Casing Size 2" Mat'l PVC
Geologist Paul Conrad
Date Start 10/24/86 Finish 10/24/86
Contractor Davis Drilling
Driller Charles Smith

Location Coordinates N
E
Filter Materials Silica Sand
Grout Type 1' Bent. Seal/Ceme
Development
Static Water Level 5.96
Top of Well Elevation 8.46
Drill Type Hollow Stem Augers

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5			Fine Sand (qtz) silt ~10%, loose, v. slightly moist, non-plastic, color uniform 10YR 7/2 (lght gry). Top 6" some gravel & organics.	SW	2-4-5
1.5-3			Fine Sand, silt 10-12%, med. dense, non-plast., color uniform w/ some grading to drkr color, 10YR 7.5/1 (lghT gry to whte.)	SW	4-7-7
3-4.5			Silty Fine Sand, silt 12-18%, clay 5-8%, moist, med. dense, ~~non slightly pl~~ non-plastic, color uniform, 10YR 6.5/2 (lght brnish grey) sand fairly uniform.	SM	5-11-11
4.5-6			Fine Sand, silt 10-12%, v. moist, non-plast, med. dense, color uniform 10YR 7.5/2 (lght grey to whte) sand gns. fairly uniform	SW	7-12-15

Boring No. 6 GW 7

Location Coordinates N

E

Hole Size Slot

Screen Size Mat'l

Filter Materials

Casing Size Mat'l

Grout Type

Geologist

Development

Date Start Finish 10/24/86

Static Water Level

Contractor

Top of Well Elevation

Driller

Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
6 -7.5			Fine Sand, silt 5-10%, fairly clean, non-plastic, med. dense, color 10YR 8/1 (white) w/ some bluish mottling, sand gras (qtz) fairly uniform, saturated.	SW	4-8-8
7.5-9			Silty Fine Sand, silt 10-15%, clay 5-8%, med. dense, saturd, occasl clayey zones of low plast, color unit 10YR 7/1.5 light grey to v. pale brown, sand (qtz) fairly uniform.	SM	5-12-14
9-10.5			9-10' same description as 7.5-9'.	SM	1-1-4
			10-13' Clayey Sand, clay ~45%, saturated, med. plasty, soft consistency, occ coarse rounded qtz grains, color 5GY 5/1 light greenish grey to [illegible]	SC	
14-15.5			[illegible] Sand [illegible] 10% [illegible] plastic [illegible] uniform, saturated, [illegible] 10YR 7/2 (lt. grey)	SW	3-2-2

Boring No. 6 GW 7
Location Coordinates N
Hole Size
Slot
E
Screen Size
Mat'l
Filter Materials
Casing Size
Mat'l
Grout Type
Geologist
Development
Date Start
Finish 10/24/86
Static Water Level
Contractor
Top of Well Elevation
Driller
Drill Type

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
19-20.5			19'-20', same descript. as 14'-15.5', med. dense. 20'-20.5' beds of color change 5YR 5/8 (yllwish red) "orange". silt fraction 15-20%	SW (SM)	5-7-10
24-25.5			24'-24.75' & 25'-25.5' same descript'n as 19'-20' 24.75'-25' same descript'n as 20-20.5'	SW (SM)	7-16-13

Boring No. 6 GW 7 SHEET 4 OF 4

Travel to 6 GW 7.

Set up rig. Well location at bottom of swale. No water in swale.

11:15 am Began Sampling & Drilling [redacted]

12:10 pm Installing casing & backing augers out.

12:40 Well complete, Bentonite in place.
12:45 Moved Equip ~ 60' from well to wash.
1:20 Lunch brk.
1:50 Travel back to temp stg. Locn.
2:10 lv. to find well lcn. 74 GW 3
2:30 Notice top of hammer almost complete broken thru. Drillers taking to fix.
3:00 Re convene on Mon.

Measurements same as 6GW3.
Ground Elev. used was swale bottom.

Standard Construction.

10/24/86
DATE

SIGNED

SOURCE: Environmental Science and Engineering, Inc.

WELL NO. 6 GW 7

OVERBURDEN MONITORING WELL SHEET

PROJECT Camp Lejeune - Site 6
PROJECT NO. 49-02036 BORING NO. 6-GW7
ELEVATION ____ DATE 10/24/86
FIELD GEOLOGIST ____

DRILLER Davis Drilling Co.
DRILLING METHOD Hollow Stem Auger
DELVELOPMENT METHOD ____

ELEVATION OF TOP OF SURFACE CASING: ____
ELEVATION OF TOP OF RISER PIPE: ____
STICK-UP TOP OF SURFACE CASING: ____
STICK-UP RISER PIPE: 2.27'
TYPE OF SURFACE SEAL: Concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER: ____

TYPE OF BACKFILL: concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____

ELEVATION/DEPTH OF HOLE 25'

NOT TO SCALE

OVBDMW.DWG

Boring No. 6GW8

Location Coordinates N Pg. 1 of 4

Hole Size 6" Slot 0.010

E

Screen Size 2" Mat'l PVC

Filter Materials Silica Sand

Casing Size 2" Mat'l PVC

Grout Type 1' Bentonite Seal/Cem[ent]

Geologist Paul D. Conrad

Development

Date Start 10/23/86 Finish 10/23/86

Static Water Level 6.77'

Contractor Davis Drilling

Top of Well Elevation 9.27'

Driller Charles Smith

Drill Type Hollow stem auger

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
0-1.5			Sandy Peat, sand 40-45%, organic, moist, non-plastic, v. loose to loose density, color uniform 10YR 2/2 (very dark brn.)	Pt	2-2-4
-3.0			1.5' to 2.5' same as above	Pt	2-3-6
			2.5' to 3.0' Silty Fine Sand, silt ≈ 35%, non-plastic, loose density, moist, color 10YR 7/1 (light grey), color uniform.	SM	
3.0-4.5			Silty Fine Sand (qtz), silt 30-40%, organic mtrl ≈15% (stains fingers), non-plastic, v. loose density, moist, color fairly uniform 10YR 3/3 (dark brn)	SM	3-3-1

Boring No. 6 GW 8

Location Coordinates N

E

Hole Size ______ Slot ______

Screen Size ______ Mat'l ______

Filter Materials ______

Casing Size ______ Mat'l ______

Grout Type ______

Geologist ______

Development ______

Date Start ______ Finish 10/23/86

Static Water Level ______

Contractor ______

Top of Well Elevation ______

Driller ______

Drill Type ______

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
4.5-6.0			Silty Fine Sand (qtz), silt 15-20%, very moist, medium density, non-plastic, sand grains fairly uniform, color 2.5Y 6.5/2 (light brownish grey).	SM	3-5-8
6.0-7.5 7' sat			Fine Sand (qtz), Silt 10-12%, saturated, medium density, non-plastic, ~~fairly well graded~~ color uniform 10YR 8/1 (white).	SW	9-8-15
7.5-9.0			same as 6.0-7.5' feet. [~~ss~~ slight bluer tint. Color ~5Y 7/1 (light grey)]	SW	3-3-6
9.0-10.5			Fine Sand - same description as 7.5' to 9.0'	SW	7-16-2[illegible]

Boring No. 6GW8

Location Coordinates N ______

E ______

Hole Size ______ Slot ______

Screen Size ______ Mat'l ______

Filter Materials ______

Casing Size ______ Mat'l ______

Grout Type ______

Geologist ______

Development ______

Date Start ______ Finish ______

Static Water Level ______

Contractor ______

Top of Well Elevation ______

Driller ______

Drill Type ______

Depth (feet)	Sample	Sketch	Lithology, Color	USCS	SPT (BL/FT)
14-15.5			silty Fine Sand (qtz), silt ~12-17%, saturated, non-plastic, medium dense, color: 10YR 7/2 (light grey), slightly coarser grains.	SM	2-2-11
[illegible]-20.5			silty Fine Sand (qtz), silt 10-12%, saturated, non-plastic, med dense to dense, same grain size as above, color 10YR 7/2 (light grey).	SM	10-21-22
24-25.5			Fine sand (qtz), silt 10-12% same description as 19-20.5'	SW	9-18-21

Boring No. 6 GW8 SHEET 4 OF 4

10:10 am left temp storage area for new coring locn.

10:30 am Rig in place. Sampling & drilling began.

11:20 Operation visited by Bob Alexander & Cheryl Buc
Casing being installed. Pouring silica sand and backing augurs out.

11:50 Augurs out.

12:10 Bentonite installed, well complete.

No unusual events.

depth casing below ground elev. - 25'
top of sand " " " - 2.5'
top of bentonite " " - 1.5'
stick up - 2.5'
depth of hole - 28'
screen length - 20'

10/23/86 DATE

Paul D. Conrad SIGNED

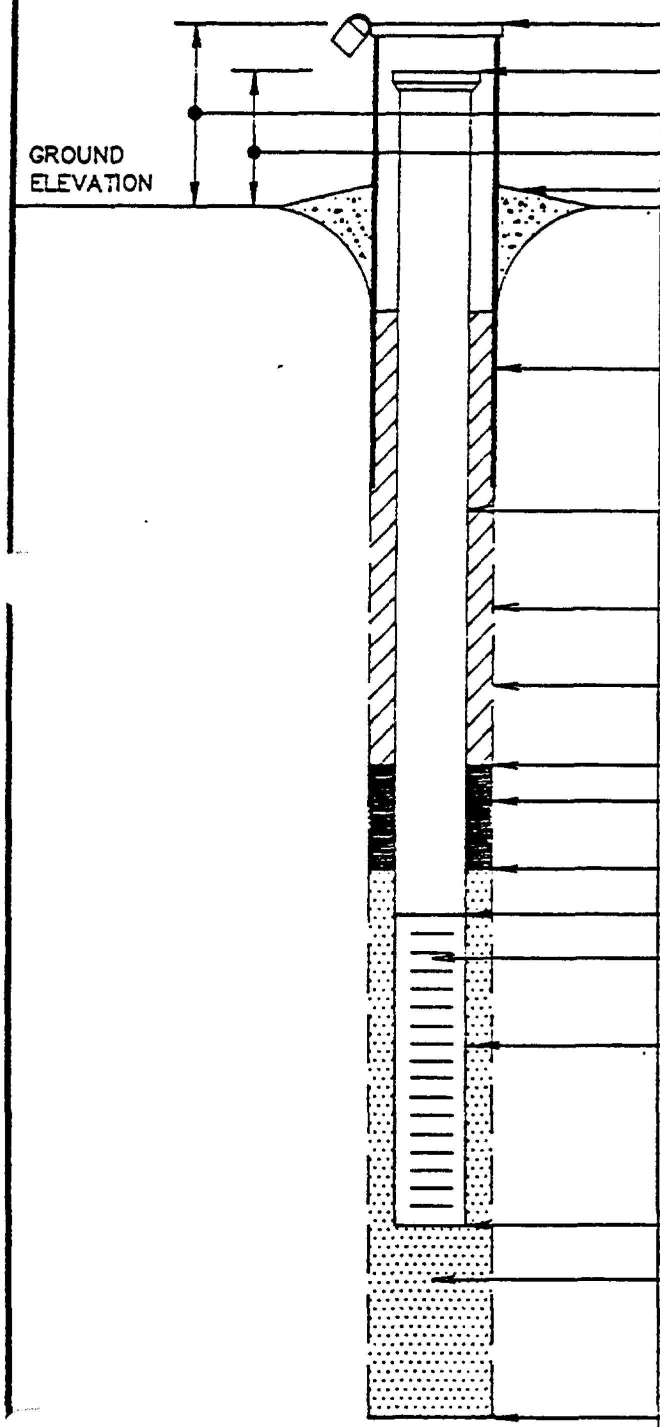
SOURCE: Environmental Science and Engineering, Inc., 198

WELL NO. 6GW8

OVERBURDEN MONITORING WELL SHEET

PROJECT: Camp Lejeune - Site 6
PROJECT NO. 49-02036 BORING NO. 6-GW8
ELEVATION: DATE: 10/23/86
FIELD GEOLOGIST:

DRILLER: Davis Drilling Co.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD:



NOT TO SCALE

ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 1.07
TYPE OF SURFACE SEAL: concrete

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: concrete

ELEVATION/DEPTH TOP OF SEAL: 2'
TYPE OF SEAL: clay

DEPTH TOP OF SAND PACK: 3'
ELEVATION/DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN: PVC (schedule 40)
SLOT SIZE X LENGTH: 0.010" x 20'
TYPE OF SAND PACK: coarse sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 25'

OVBDMW.DWG

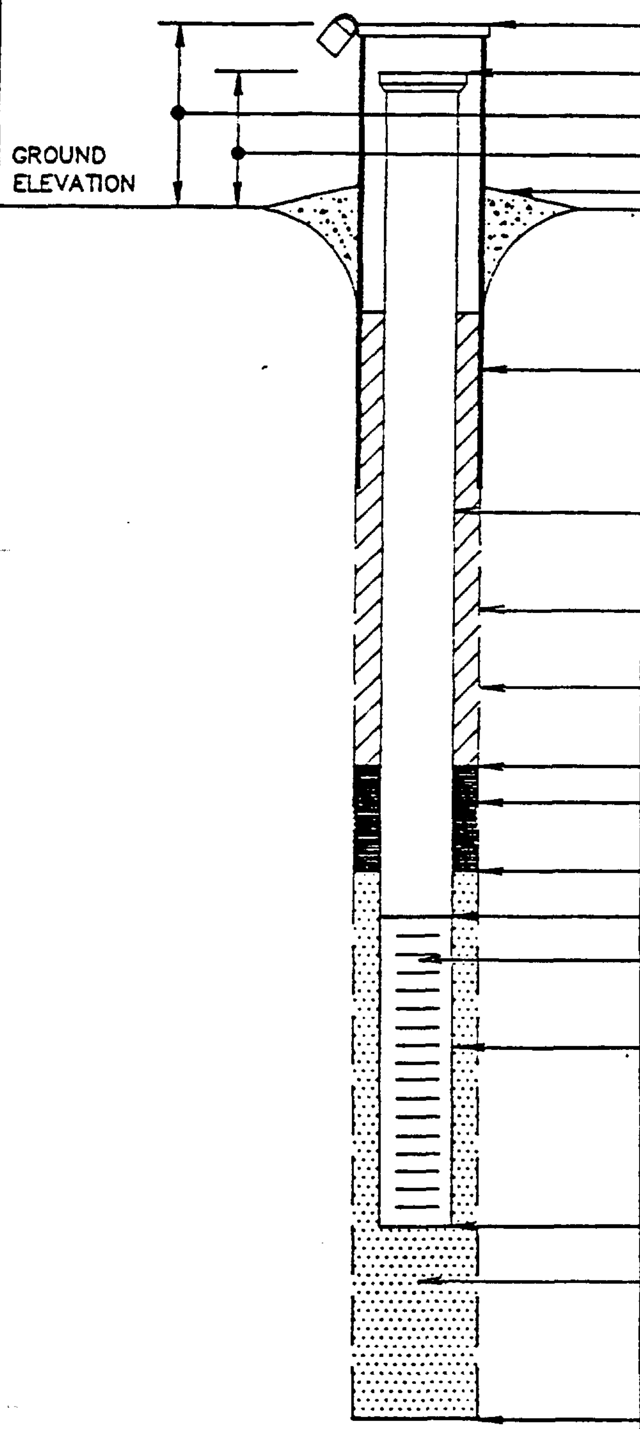
APPENDIX C

WELL LOGS - SITE 69

WELL NO. 69 GW1

OVERBURDEN MONITORING WELL SHEET

PROJECT: Camp Lejeune - Site 69	DRILLER: STS Consultants Ltd.
PROJECT NO.: 49-02036 BORING NO.: 69-GW1	DRILLING METHOD: Hollow Stem Auger
ELEVATION: DATE: 7/18/94	DELVELOPMENT METHOD: Pump and Surge
FIELD GEOLOGIST:	



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING:

STICK-UP RISER PIPE: 2.47'

TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"

TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: cement / sand (1 : 3)

ELEVATION/DEPTH TOP OF SEAL: 4.29'

TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 5.42'

ELEVATION/DEPTH TOP OF SCREEN: 6.52'

TYPE OF SCREEN: PVC (Schedule 40)

SLOT SIZE X LENGTH: 0.010"

TYPE OF SAND PACK: silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 21.04'

ELEVATION/DEPTH BOTTOM OF SAND PACK: 21.04'

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 21.04'

NOT TO SCALE

OVBDMW.DWG

WELL NO. 69 GW 2

OVERBURDEN MONITORING WELL SHEET

PROJECT Camp Lejeune - Site 69

PROJECT NO. 49-02036 BORING NO. 69-GW2

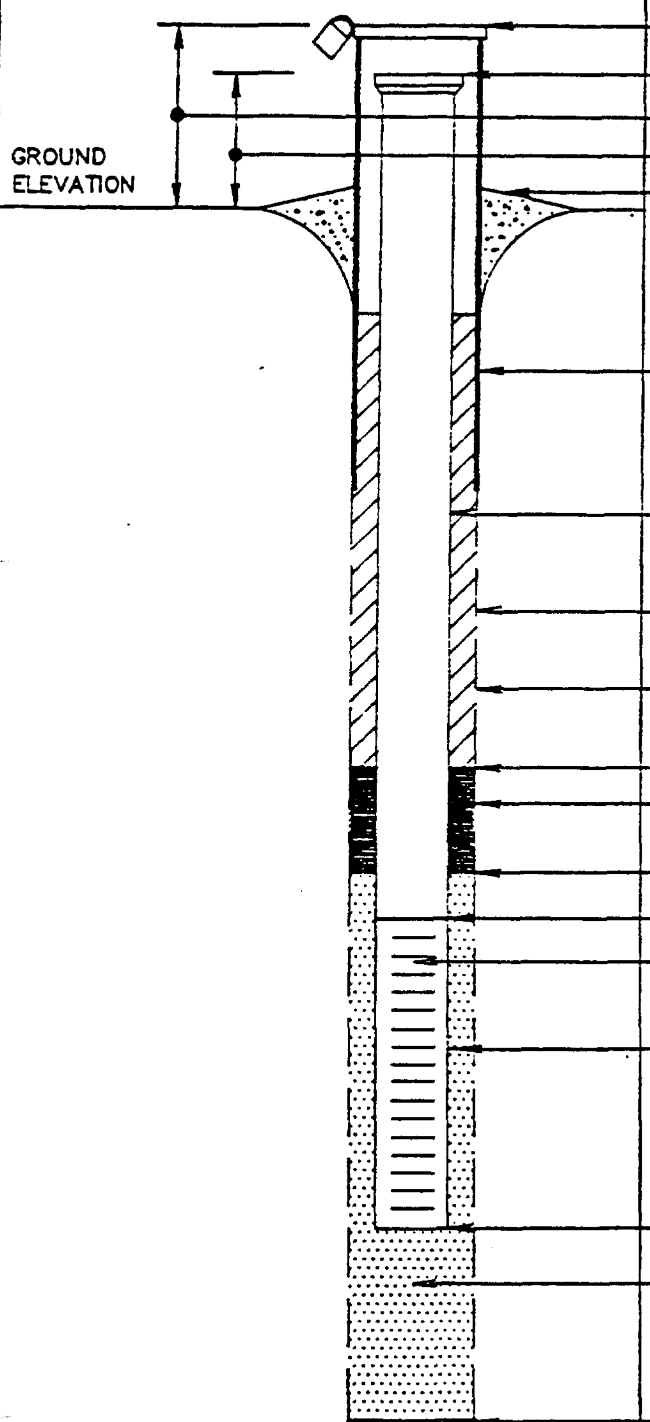
ELEVATION ______ DATE 7/19/94

FIELD GEOLOGIST ______

DRILLER GTB Consultants Ltd.

DRILLING METHOD Hollow Stem Auger

DELVELOPMENT METHOD Pump + Surge



ELEVATION OF TOP OF SURFACE CASING: ______

ELEVATION OF TOP OF RISER PIPE: ______

STICK-UP TOP OF SURFACE CASING: ______

STICK-UP RISER PIPE: 3.06'

TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"

TYPE OF SURFACE CASING: Carbon steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER: ______

TYPE OF BACKFILL: cement/sand (1:2)

ELEVATION/DEPTH TOP OF SEAL: 2.67'

TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 4.77'

ELEVATION/DEPTH TOP OF SCREEN: 5.94'

TYPE OF SCREEN: PVC (Schedule 40)

SLOT SIZE X LENGTH: 0.010"

TYPE OF SAND PACK: Silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 20.42'

ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.42'

TYPE OF BACKFILL BELOW OBSERVATION WELL: ______

ELEVATION/DEPTH OF HOLE 20.42'

NOT TO SCALE

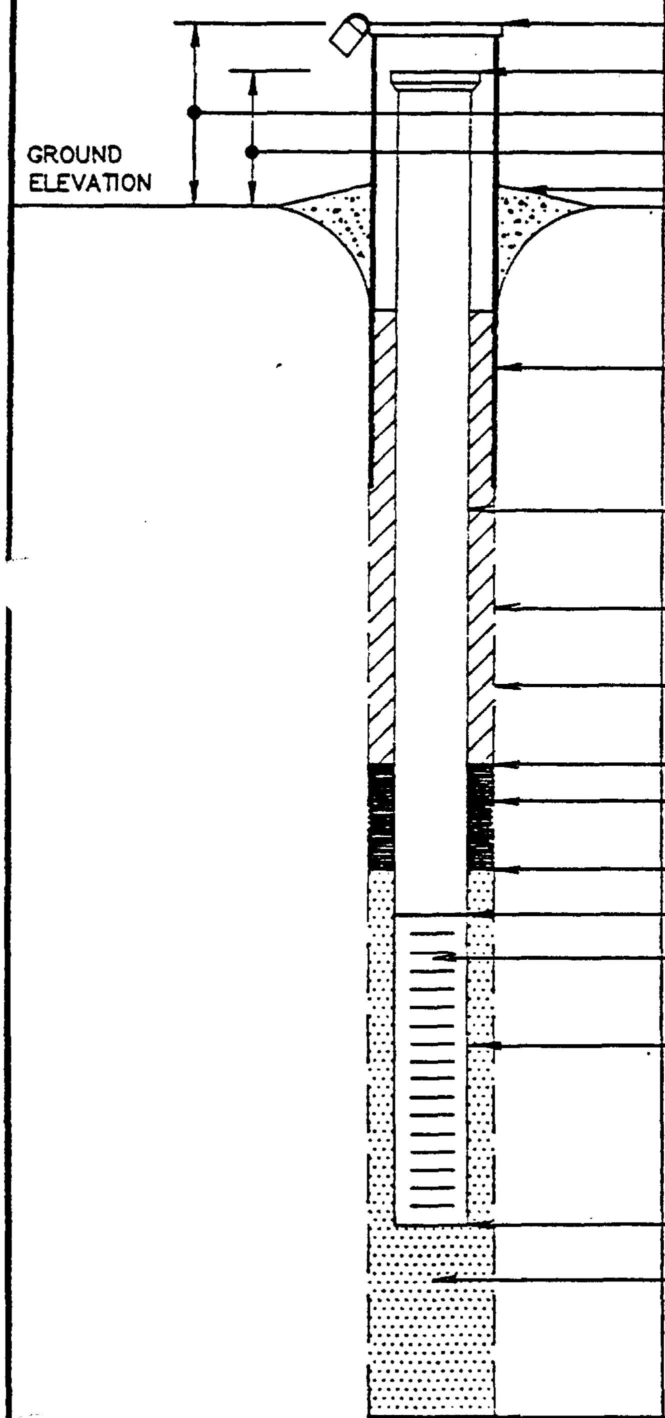
OVBDMW.DWG

WELL NO. 69GW3

OVERBURDEN
MONITORING WELL SHEET

PROJECT Camp Lejeune - Site 69
PROJECT NO. 49-02036 BORING NO. 69-GW3
ELEVATION DATE 7/18/84
FIELD GEOLOGIST

DRILLER STS Consultants Ltd.
DRILLING METHOD Hollow Stem Auger
DELVELOPMENT METHOD Pump + surge



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 1.80'
TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: Carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: cement/sand (1 2)

ELEVATION/DEPTH TOP OF SEAL: 3.71
TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 4.71
ELEVATION/DEPTH TOP OF SCREEN: 5.87
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010"
TYPE OF SAND PACK: silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 20.35'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.35'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 20.35'

NOT TO SCALE

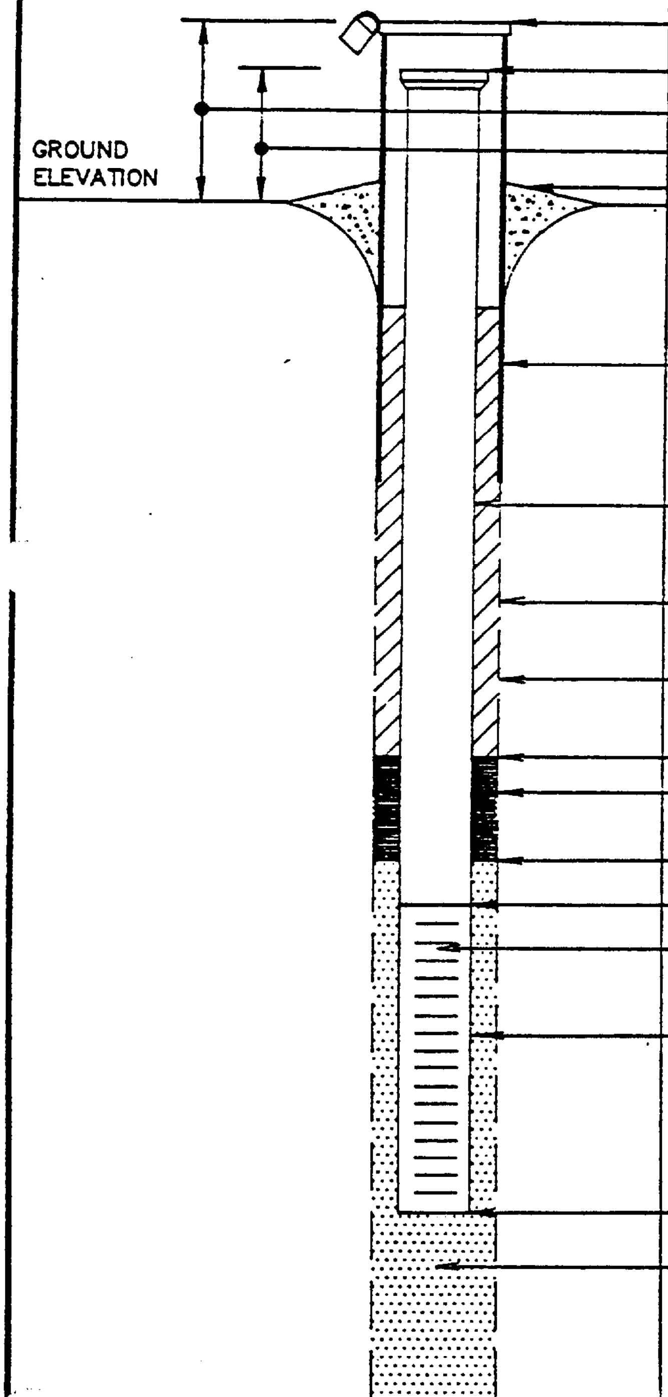
OVBDMW.DWG

WELL NO. 69GW4

OVERBURDEN MONITORING WELL SHEET

PROJECT Camp Lejeune - Site 69
PROJECT NO. 49-020-36
BORING NO. 69-GW4
ELEVATION
DATE 7/18/84
FIELD GEOLOGIST

DRILLER STB Consultants Ltd.
DRILLING METHOD Hollow Stem Auger
DELVELOPMENT METHOD Pump + surge



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: -0.61'
TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: Cement/sand (1:2)

ELEVATION/DEPTH TOP OF SEAL: 3.5
TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 4.54
ELEVATION/DEPTH TOP OF SCREEN: 5.77
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010"
TYPE OF SAND PACK: silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 20.25'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 20.25

NOT TO SCALE

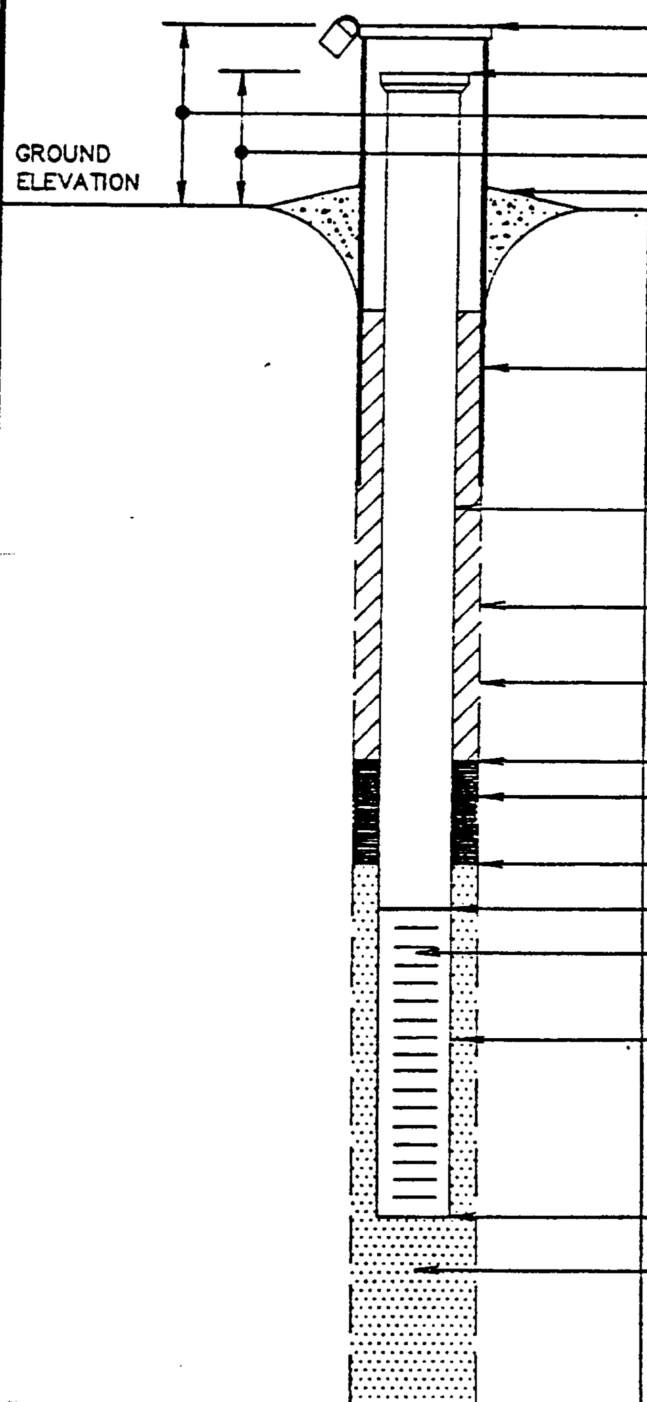
OVBDMW.DWG

OVERBURDEN MONITORING WELL SHEET

WELL NO. 69GW5

PROJECT: Camp Lejeune - Site 69
PROJECT NO. 49-02036 BORING NO. 69-GW5
ELEVATION: DATE 7/19/94
FIELD GEOLOGIST:

DRILLER: STS Consultants Ltd.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD: Pump + Surge



NOT TO SCALE

- ELEVATION OF TOP OF SURFACE CASING:
- ELEVATION OF TOP OF RISER PIPE:
- STICK-UP TOP OF SURFACE CASING:
- STICK-UP RISER PIPE: 2.35'
- TYPE OF SURFACE SEAL: cement/sand
- I.D. OF SURFACE CASING: 5"
- TYPE OF SURFACE CASING: carbon steel
- RISER PIPE I.D. 2"
- TYPE OF RISER PIPE: PVC (Schedule 40)
- BOREHOLE DIAMETER:
- TYPE OF BACKFILL: cement/sand (1:2)
- ELEVATION/DEPTH TOP OF SEAL: 3.71'
- TYPE OF SEAL: bentonite
- DEPTH TOP OF SAND PACK: 5.33'
- ELEVATION/DEPTH TOP OF SCREEN: 6.5'
- TYPE OF SCREEN: PVC (Schedule 40)
- SLOT SIZE X LENGTH: 0.010"
- TYPE OF SAND PACK: silica sand
- ELEVATION/DEPTH BOTTOM OF SCREEN: 20.98'
- ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.98'
- TYPE OF BACKFILL BELOW OBSERVATION WELL:
- ELEVATION/DEPTH OF HOLE: 20.98'

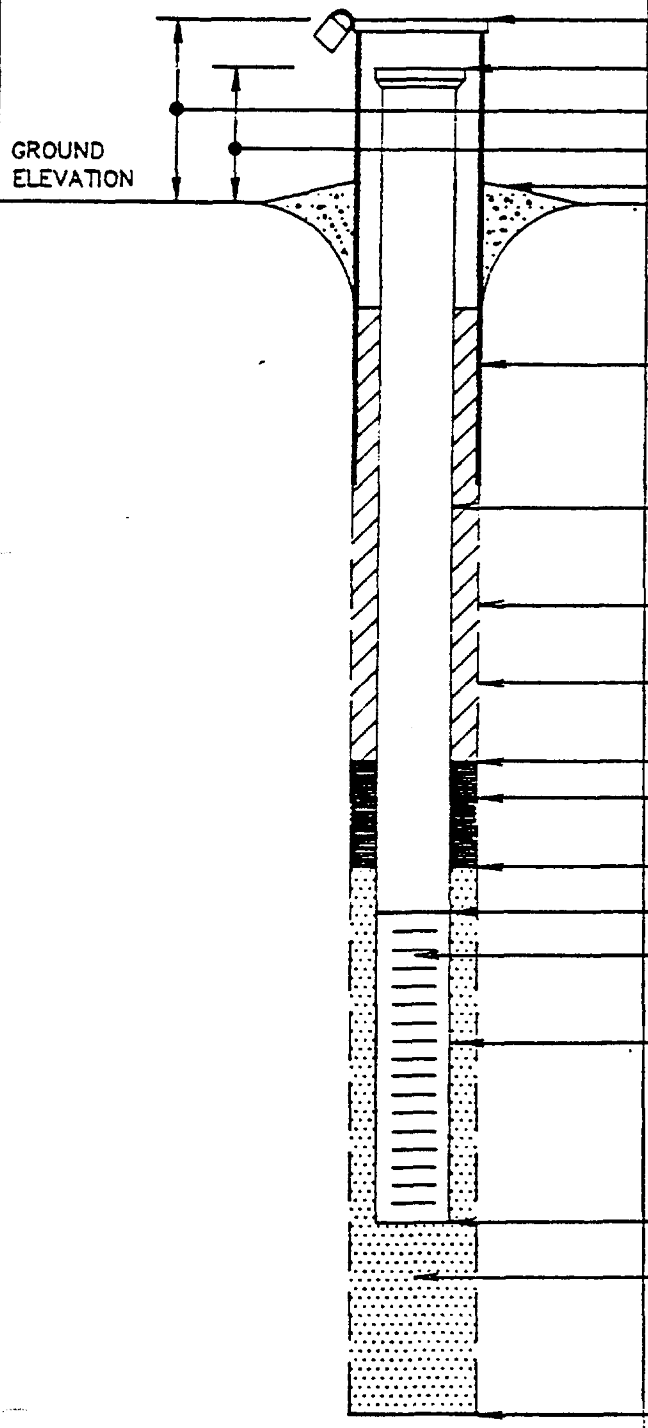
OVBOMW.DWG

WELL NO. 69GW6

OVERBURDEN MONITORING WELL SHEET

PROJECT: Camp Lejeune - Site 69
PROJECT NO.: 49-02036
BORING NO.: 69-GW6
ELEVATION:
DATE: 7/17/84
FIELD GEOLOGIST:

DRILLER: STS Consultants Ltd.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD: Pump + surge



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 1.84'
TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: cement/sand (1:2)

ELEVATION/DEPTH TOP OF SEAL: 14.37'
TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 15.37'
ELEVATION/DEPTH TOP OF SCREEN: 16.37'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010"
TYPE OF SAND PACK: silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 30.53'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 30.53'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE 30.53'

NOT TO SCALE

OVBDMW.DWG

WELL NO. 69GW7

OVERBURDEN MONITORING WELL SHEET

PROJECT: Camp Lejeune - Site 69

PROJECT NO.: 49-02234

BORING NO.: 69-GW7

ELEVATION:

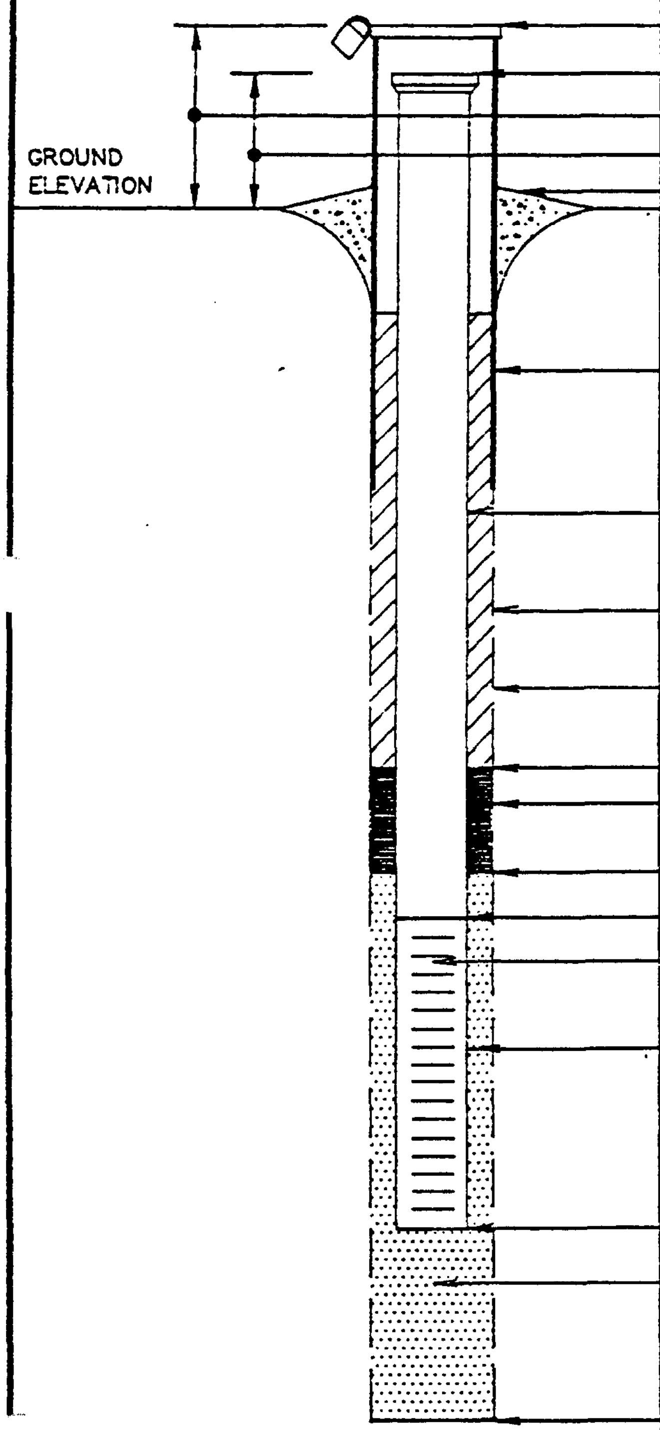
DATE: 7/17/84

FIELD GEOLOGIST:

DRILLER: STS Consultants Ltd

DRILLING METHOD: Hollow Stem Auger

DELVELOPMENT METHOD: Pump + surge



ELEVATION OF TOP OF SURFACE CASING:

ELEVATION OF TOP OF RISER PIPE:

STICK-UP TOP OF SURFACE CASING:

STICK-UP RISER PIPE: 2.25'

TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"

TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"

TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: cement/sand (1:2)

ELEVATION/DEPTH TOP OF SEAL: 2.71'

TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 5.08'

ELEVATION/DEPTH TOP OF SCREEN: 6.21'

TYPE OF SCREEN: PVC (Schedule 40)

SLOT SIZE X LENGTH: 0.010"

TYPE OF SAND PACK: silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 20.69'

ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.69'

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE: 20.69'

NOT TO SCALE

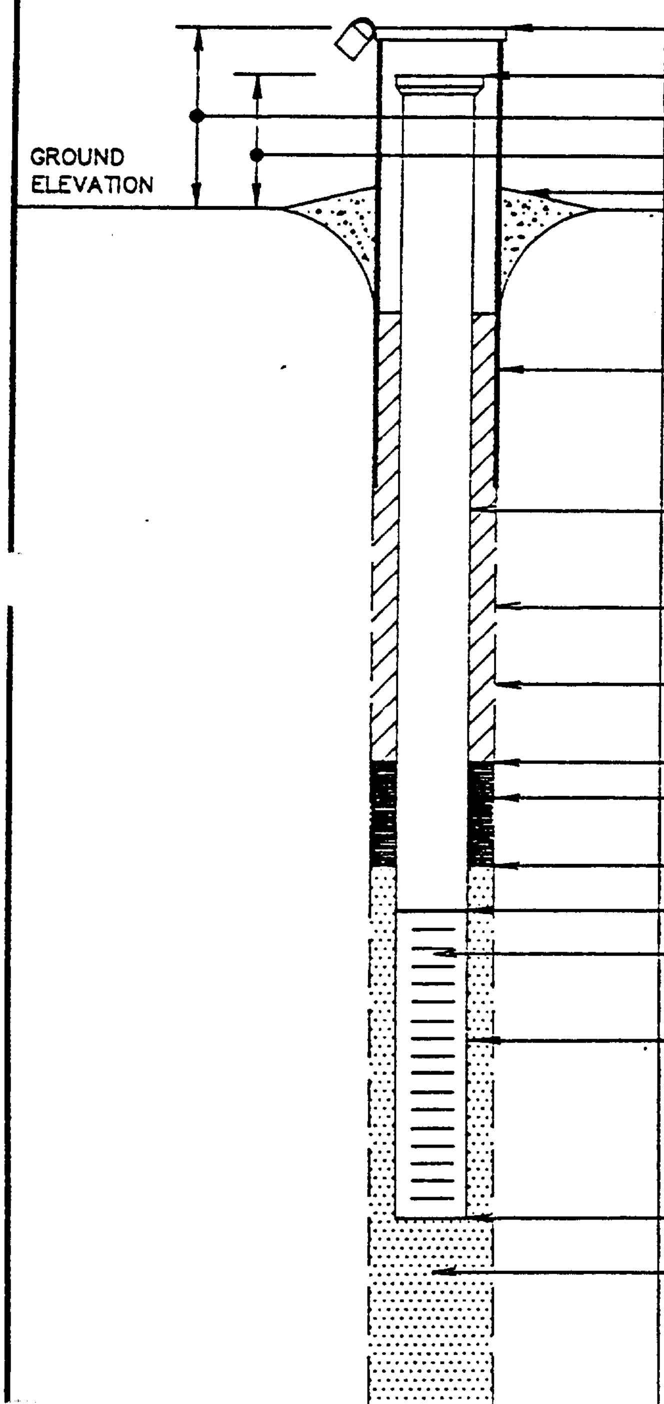
OVBDMW.DWG

WELL NO. 69GW8

OVERBURDEN MONITORING WELL SHEET

PROJECT: Camp Lejeune - Site 69
PROJECT NO.: 49-02036
BORING NO.: 69-GW8
ELEVATION:
DATE: 7/17/94
FIELD GEOLOGIST:

DRILLER: STS Consultants Ltd.
DRILLING METHOD: Hollow Stem Auger
DELVELOPMENT METHOD: Pump + Surge



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK-UP TOP OF SURFACE CASING:
STICK-UP RISER PIPE: 2.30'
TYPE OF SURFACE SEAL: cement/sand

I.D. OF SURFACE CASING: 5"
TYPE OF SURFACE CASING: carbon steel

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC (Schedule 40)

BOREHOLE DIAMETER:

TYPE OF BACKFILL: cement/sand (1 : 2)

ELEVATION/DEPTH TOP OF SEAL: 3.35'
TYPE OF SEAL: bentonite

DEPTH TOP OF SAND PACK: 4.63'
ELEVATION/DEPTH TOP OF SCREEN: 5.43'
TYPE OF SCREEN: PVC (Schedule 40)
SLOT SIZE X LENGTH: 0.010"
TYPE OF SAND PACK: Silica sand

ELEVATION/DEPTH BOTTOM OF SCREEN: 20.4'
ELEVATION/DEPTH BOTTOM OF SAND PACK: 20.4'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION/DEPTH OF HOLE: 20.4'

NOT TO SCALE

OVBDMW.DWG

APPENDIX D

QA/QC SAMPLES: ANALYTICAL RESULTS

CAMP LEJEUNE - SITE 69

VOLATILE ORGANIC COMPOUNDS IN EPA WATER SPIKE SAMPLES

Concentration in ug/kg

CHART = EPAVOL

wp8b\69-vol.wr1 (5)

COMPOUND	(=EPA-1) 69WSP01	(=EPA-2) 69WSP02
Chloromethane	10.U	33.
Bromomethane	10.U	36.
Vinyl Chloride	10.U	10.U
Chloroethane	10.U	10.U
Methylene Chloride	5.U	5.U
Acetone	3.BJ	10.U
Carbon Disulfide	5.U	5.U
1,1-Dichloroethene	5.U	25.
1,1-Dichloroethane	5.U	40.
1,2-Dichloroethene (total)	5.U	5.U
Chloroform	5.U	35.
1,2-Dichloroethane	5.U	5.U
2-Butanone	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U
Carbon Tetrachloride	5.U	29.
Vinyl Acetate	10.U	10.U
Bromodichloromethane	5.U	5.U
1,2-Dichloropropane	5.U	34.
cis-1,3-Dichloropropene	5.U	5.U
Trichloroethene	5.U	33.
Dibromochloromethane	5.U	5.U
1,1,2-Trichloroethane	5.U	82.
Benzene	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U
Bromoform	5.U	31.
4-Methyl-2-Pentanone	10.U	10.U
2-Hexanone	10.U	10.U
Tetrachloroethene	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	32.
Toluene	5.U	5.U
Chlorobenzene	5.U	36.
Ethylbenzene	5.U	5.U
Styrene	5.U	5.U
Xylene (total)	5.U	5.U

PROJECT Camp Lejeune

PREPARED BY Paul M. Feinberg

DATE April 1991

CHECKED BY Judy Grimm

DATE 5-13-91

COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN EPA WATER SPIKE SAMPLES
Concentration in ug/l

CHART = EPASVA wp8c\69-sv.wr1 (6-A)

COMPOUND	(=EPA-1) 69WSP01	(=EPA-2) 69WSP02
Phenol	10.U	34.
bis(2-Chloroethyl)ether	10.U	10.U
2-Chlorophenol	10.U	10.U
1,3-Dichlorobenzene	10.U	10.U
1,4-Dichlorobenzene	10.U	10.U
Benzyl Alcohol	10.U	10.U
1,2-Dichlorobenzene	10.U	10.U
2-Methylphenol	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U
4-Methylphenol	10.U	52.
N-Nitroso-di-n-propylamine	10.U	10.U
Hexachloroethane	10.U	10.U
Nitrobenzene	10.U	47.
Isophorone	10.U	10.U
2-Nitrophenol	10.U	10.U
2,4-Dimethylphenol	10.U	10.U
Benzoic acid	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U
2,4-Dichlorophenol	10.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U
Naphthalene	10.U	42.
4-Chloroaniline	10.U	32.
Hexachlorobutadiene	10.U	10.U
4-Chloro-3-methylphenol	10.U	10.U
2-Methylnaphthalene	10.U	44.
Hexachlorocyclopentadiene	10.U	10.U
2,4,6-Trichlorophenol	10.U	92.
2,4,5-Trichlorophenol	50.U	50.U
2-Chloronaphthalene	10.U	10.U
2-Nitroaniline	50.U	50.U
Dimethylphthalate	10.U	10.U
Acenaphthylene	10.U	43.
2,6-Dinitrotoluene	10.U	40.

PROJECT Camp Lejeune
PREPARED BY Paul M. Feinberg
DATE 5/12/91
CHECKED BY E C Kruger
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN EPA WATER SPIKE SAMPLES
Concentration in ug/l

CHART = EPASVB

wp8c\69-sv.wr1 (6-B)

COMPOUND	(=EPA-1) 69WSP01	(=EPA-2) 69WSP02
3-Nitroaniline	50.U	50.U
Acenaphthene	10.U	4.J
2,4-Dinitrophenol	50.U	46.J
4-Nitrophenol	50.U	50.U
Dibenzofuran	10.U	10.U
2,4-Dinitrotoluene	10.U	10.U
Diethylphthalate	10.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U
Fluorene	10.U	10.U
4-Nitroaniline	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U
N-Nitrosodiphenylamine	10.U	10.U
4-Bromophenyl-phenylether	10.U	10.U
Hexachlorobenzene	10.U	10.U
Pentachlorophenol	50.U	91.
Phenanthrene	10.U	10.U
Anthracene	10.U	39.
Di-n-butylphthalate	10.U	47.
Fluoranthene	10.U	41.
Pyrene	10.U	10.U
Butylbenzylphthalate	10.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U
Benzo(a)anthracene	10.U	10.U
Chrysene	10.U	17.
bis(2-Ethylhexyl)phthalate	28.	10.U
Di-n-octylphthalate	10.U	10.U
Benzo(b)fluoranthene	10.U	10.U
Benzo(k)fluoranthene	10.U	10.U
Benzo(a)pyrene	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U
Dibenz(a,h)anthracene	10.U	10.U
Benzo(g,h,i)perylene	10.U	10.U

CAMP LEJEUNE - SITE 69
PESTICIDES IN EPA WATER SPIKE SAMPLES
Concentration in ug/l

CHART = EPAPEST sy\wp8d\69-pest.wr1 (6)

PESTICIDE/PCB	(=EPA-1) 69WSP01	(=EPA-2) 69WSP02
alpha-BHC	.05U	.46
beta-BHC	.05U	.05U
delta-BHC	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U
Heptachlor	.05U	.53
Aldrin	.05U	.05U
Heptachlor epoxide	.05U	.05U
Endosulfan I	.05U	.05U
Dieldrin	.10U	.10U
4,4'-DDE	.10U	.89
Endrin	.10U	.10U
Endosulfan II	.10U	.10U
4,4'-DDD	.10U	.91
Endosulfan sulfate	.10U	.10U
4,4'-DDT	.10U	1.0
Methoxychlor	.50U	.50U
Endrin ketone	.10U	.10U
alpha-Chlordane	.50U	.50U
gamma-Chlordane	.50U	.50U
Toxaphene	1.0U	1.0U
Aroclor-1016	.50U	.50U
Aroclor-1221	.50U	.50U
Aroclor-1232	.50U	.50U
Aroclor-1242	.50U	.50U
Aroclor-1248	.50U	.50U
Aroclor-1254	1.0U	1.0U
Aroclor-1260	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY Judy Gumma
DATE April 1991
CHECKED BY El Knysfel
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 69
INORGANICS IN EPA WATER SPIKE SAMPLES
Concentration in ug/l

CHART = EPAING wp1e\69-inor.wr1 (6)

METAL/COMPOUND	(=EPA-1) 69WSP01	(=EPA-2) 69WSP02
Aluminum	20.7U	979
Antimony	13.3U	193
Arsenic	1.5U	12.0
Barium	4.3B	198B
Beryllium	1.5B	15.6
Cadmium	4.3U	18.5
Calcium	285B	489B
Chromium	1.5U	24.9
Cobalt	6.0U	45.3B
Copper	3.2U	63.4
Iron	87.8B	1060
Lead	1.7U	14.7
Magnesium	47.1B	728B
Manganese	1.2U	42.8
Mercury	0.10U	0.49
Nickel	5.2U	84.4
Potassium	343U	369B
Selenium	3.4U	12.2
Silver	1.6U	1.6U
Sodium	216B	1160B
Thallium	4.4U	20.8
Vanadium	2.4U	94.9
Zinc	30.0	84.9
Cyanide	10.0U	14.6

PROJECT Camp Lejeune
PREPARED BY Paul M. Feinberg
DATE April 1991
CHECKED BY Judy Guina
DATE 5-10-91
COMMENTS

CAMP LEJEUNE - SITE 69
VOLATILE ORGANIC COMPOUNDS IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in ug/kg (Sediment)

CHART = QAQCREFV (page 1 of 2) wp8b\qos-vol.wr1 (4-A)

COMPOUND	69RGW2	69RSW1	69RSE1
Chloromethane	10.U	10.U	66.U
Bromomethane	10.U	10.U	66.U
Vinyl Chloride	53.	10.U	66.U
Chloroethane	10.U	10.U	66.U
Methylene Chloride	3.JB	5.JB	39.B
Trichlorofluoromethane	5.U	5.U	33.U
Acetone	10.U	13	65.J
Carbon Disulfide	2.J	200.D	33.U
1,1-Dichloroethene	5.U	5.U	33.U
1,1-Dichloroethane	5.U	5.U	33.U
1,2-Dichloroethene (total)	5200.D	23.	33.U
Chloroform	5.U	6.J	3.J
1,2-Dichloroethane	4.J	5.U	33.U
2-Butanone	10.U	10.U	66.U
1,1,1-Trichloroethane	5.U	5.U	33.U
Carbon Tetrachloride	5.U	5.U	33.U
Vinyl Acetate	10.U	5.U	33.U
Bromodichloromethane	5.U	5.U	33.U
1,2-Dichloropropane	5.U	5.U	33.U
cis-1,3-Dichloropropene	5.U	5.U	33.U
Trichloroethene	99.	5.U	33.U
Dibromochloromethane	5.U	5.U	33.U
1,1,2-Trichloroethane	5.U	5.U	33.U
Benzene	.8J	5.U	33.U
trans-1,3-Dichloropropene	5.U	5.U	33.U
2-Chloroethylvinylether	10.U	10.U	66.U
Bromoform	5.U	5.U	33.U
4-Methyl-2-Pentanone	10.U	10.U	66.U
2-Hexanone	10.U	10.U	66.U
Tetrachloroethene	4.J	5.U	33.U
1,1,2,2-Tetrachloroethane	6.	5.U	33.U
Toluene	5.U	5.U	33.U
Chlorobenzene	5.U	5.U	33.U

PROJECT Camp Lejeune
PREPARED BY Vijay Gunna
DATE May 1991
CHECKED BY Ed Kreybel
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 69
VOLATILE ORGANIC COMPOUNDS IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in ug/kg (Sediment)

CHART = QAQCREFV (page 2 of 2) wp8b\qos-vol.wr1 (4-B)

COMPOUND	69RGW2	69RSW1	69RSE1
Ethylbenzene	5.U	5.U	33.U
Styrene	5.U	5.U	33.U
Xylene (total)	5.U	5.U	33.U
1,3-Dichlorobenzene	5.U	5.U	33.U
1,2 & 1,4-Dichlorobenzene	5.U	5.U	33.U

NOTE: PRELIMINARY RESULTS

PROJECT Camp Lejeune
PREPARED BY Judy Guerra
DATE May 1991
CHECKED BY Ed Knepel
DATE 5/14/91

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in ug/kg (Sediment)

CHART = QAQCREFSVA wp8c\qos-sv.wr1 (3-A)

COMPOUND	69RGW2	69RSW1	69RSE1
N-Nitrosodimethylamine	10.U	10.U	4500.UD
Phenol	10.U	10.U	4500.UD
bis(2-Chloroethyl)ether	10.U	10.U	4500.UD
2-Chlorophenol	10.U	10.U	4500.UD
1,3-Dichlorobenzene	10.U	10.U	4500.UD
1,4-Dichlorobenzene	10.U	10.U	4500.UD
Benzyl Alcohol	10.U	10.U	4500.UD
1,2-Dichlorobenzene	10.U	10.U	4500.UD
2-Methylphenol	10.U	10.U	4500.UD
bis(2-Chloroisopropyl)ether	10.U	10.U	4500.UD
4-Methylphenol	10.U	10.U	4500.UD
N-Nitroso-di-n-propylamine	10.U	10.U	4500.UD
Hexachloroethane	10.U	10.U	4500.UD
Nitrobenzene	10.U	10.U	4500.UD
Isophorone	10.U	10.U	4500.UD
2-Nitrophenol	10.U	10.U	4500.UD
2,4-Dimethylphenol	10.U	10.U	4500.UD
Benzoic acid	50.U	50.U	23000.UD
bis(2-Chloroethoxy)methane	10.U	10.U	4500.UD
2,4-Dichlorophenol	10.U	10.U	4500.UD
1,2,4-Trichlorobenzene	10.U	10.U	4500.UD
Naphthalene	10.U	10.U	4500.UD
4-Chloroaniline	10.U	10.U	4500.UD
Hexachlorobutadiene	10.U	10.U	4500.UD
4-Chloro-3-methylphenol	10.U	10.U	4500.UD
2-Methylnaphthalene	10.U	10.U	4500.UD
Hexachlorocyclopentadiene	10.U	10.U	4500.UD
2,4,6-Trichlorophenol	10.U	10.U	4500.UD
2,4,5-Trichlorophenol	50.U	50.U	23000.UD
2-Chloronaphthalene	10.U	10.U	4500.UD
2-Nitroaniline	50.U	50.U	23000.UD
Dimethylphthalate	10.U	10.U	4500.UD
Acenaphthylene	10.U	10.U	4500.UD

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE May 1991
CHECKED BY Ed Knopel
DATE 5/14/91

Note: Preliminary Results

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in ug/kg (Sediment)

CHART = QAQCREFSVB

wp8c\qos-sv.wr1 (3-B)

COMPOUND	69RGW2	69RSW1	69RSE1
2,6-Dinitrotoluene	10.U	10.U	4500.UD
3-Nitroaniline	50.U	50.U	23000.UD
Acenaphthene	10.U	10.U	4500.UD
2,4-Dinitrophenol	50.U	50.U	23000.UD
4-Nitrophenol	50.U	50.U	23000.UD
Dibenzofuran	10.U	10.U	4500.UD
2,4-Dinitrotoluene	10.U	10.U	4500.UD
Diethylphthalate	10.U	10.U	4500.UD
4-Chlorophenyl-phenylether	10.U	10.U	4500.UD
Fluorene	10.U	10.U	4500.UD
4-Nitroaniline	50.U	50.U	23000.UD
4,6-Dinitro-2-methylphenol	50.U	50.U	23000.UD
N-Nitrosodiphenylamine	10.U	10.U	4500.UD
4-Bromophenyl-phenylether	10.U	10.U	4500.UD
Hexachlorobenzene	10.U	10.U	4500.UD
Pentachlorophenol	50.U	50.U	23000.UD
Phenanthrene	10.U	10.U	4500.UD
Anthracene	10.U	10.U	4500.UD
Di-n-butylphthalate	10.U	10.U	4500.UD
Fluoranthene	10.U	10.U	4500.UD
Pyrene	10.U	10.U	4500.UD
Butylbenzylphthalate	10.U	10.U	4500.UD
3,3'-Dichlorobenzidine	20.U	20.U	9000.UD
Benzo(a)anthracene	10.U	10.U	4500.UD
Chrysene	10.U	10.U	4500.UD
bis(2-Ethylhexyl)phthalate	10.U	2JB	460.JBD
Di-n-octylphthalate	10.U	10.U	4500.UD
Benzo(b)fluoranthene	10.U	10.U	4500.UD
Benzo(k)fluoranthene	10.U	10.U	4500.UD
Benzo(a)pyrene	10.U	10.U	4500.UD
Indeno(1,2,3-cd)pyrene	10.U	10.U	4500.UD
Dibenz(a,h)anthracene	10.U	10.U	4500.UD
Benzo(g,h,i)perylene	10.U	10.U	4500.UD

PROJECT Camp Lejeune
PREPARED BY Judy Guerra
DATE May 1991
CHECKED BY E.C. Knypl
DATE 5/14/91
COMMENTS

Note: Preliminary Results

CAMP LEJEUNE - SITE 69
PESTICIDES IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in ug/kg (Sediment)

CHART = QAQCREFP sy\wp8d\qos-pest.wr1 (3)

PESTICIDE/PCB	69RGW2	69RSW1	69RSE1
alpha-BHC	.05U	.05U	11U
beta-BHC	.05U	.05U	11U
delta-BHC	.05U	.05U	11U
gamma-BHC (Lindane)	.05U	.05U	11U
Heptachlor	.05U	.05U	11U
Aldrin	.05U	.05U	11U
Heptachlor epoxide	.05U	.05U	11U
Endosulfan I	.05U	.05U	11U
Dieldrin	.10U	.10U	22U
4,4'-DDE	.10U	.10U	22U
Endrin	.10U	.10U	22U
Endosulfan II	.10U	.10U	22U
4,4'-DDD	.10U	.10U	22U
Endosulfan sulfate	.10U	.10U	22U
4,4'-DDT	.10U	.10U	22U
Methoxychlor	.50U	.50U	110U
Endrin ketone	.10U	.10U	22U
alpha-Chlordane	.50U	.50U	110U
gamma-Chlordane	.50U	.50U	110U
Toxaphene	1.0U	1.0U	220U
Aroclor-1016	.50U	.50U	110U
Aroclor-1221	.50U	.50U	110U
Aroclor-1232	.50U	.50U	110U
Aroclor-1242	.50U	.50U	110U
Aroclor-1248	.50U	.50U	110U
Aroclor-1254	1.0U	1.0U	220U
Aroclor-1260	1.0U	1.0U	220U

PROJECT Camp Lejeune
PREPARED BY Judy Kumma
DATE May 1991
CHECKED BY El Knypfel
DATE 5/14/91
COMMENTS

NOTE: PRELIMINARY RESULTS

CAMP LEJEUNE QA/QC - SITES 48, & 69
INORGANICS IN REFEREE QA/QC SAMPLES
Concentration in ug/l (Groundwater and Surface Water)
Concentration in mg/kg (Sediments)

CHART = QAQCREF1 wp8e\qos-inor.wr1 (3)

METAL/COMPOUND	69RGW2	69RSW1	69RSE1	48RSW2	48RSE2
Aluminum	2100	570	1200	480	2100
Antimony	<25U	<25U	<2.5U	<25U	<2.5U
Arsenic	<2U	<2U	0.2	<2U	0.9
Barium	<200U	<200U	<20U	<200U	<20U
Beryllium	<0.5U	<0.5U	<0.05U	<0.5U	0.06
Cadmium	<2.0U	<2.0U	<0.2U	<2.0U	<0.2U
Calcium	7700	2900	<50U	12,000	480
Chromium	35.0	<2.0U	2.3	2.0	4.5
Cobalt	<2.0U	2.0	<0.2U	<2.0U	0.3NW
Copper	191	<25U	3.2	<25U	7.0
Iron	1,042,000	4200	650	1380	56000
Lead	22.0	<2.0U	2.4	<2.0U	7.2
Magnesium	2000	540	<50U	8000	600
Manganese	80	190	2.2	35.0	5.2
Mercury	<0.2U	<0.2U	<0.07U	<0.2U	<0.07U
Nickel	<10.0U	<10.0U	<1.0U	<10.0U	<1.0U
Potassium	1600	750	<50.0U	32,000U	340
Selenium	<2.0US	<2.0US	<0.2US	<0.01UNS	<0.2UNS
Silver	<2.0UW	<2.0U	<0.2U	2N	<0.2UN
Sodium	18,200	8600	<50.0U	2,600,000U	7180
Thallium	<2.0U	<2.0U	<0.2U	<10.0US	<0.2U
Vanadium	180	<10.0U	2.0	<10.0U	5.3NS
Zinc	130	1800	9.0	<20.0U	23.0
Cyanide	<5U		<.25U		

Note: Preliminary Results

PROJECT Camp Lejeune
PREPARED BY Judy Lynn
DATE April 1991
CHECKED BY E. Kimford
DATE 5/14/91
COMMENTS

CAMP LEJEUNE QA/QC - SITES 6, 48, & 69

INORGANICS IN QA/QC SAMPLES

Concentration in ug/l

CHART = QAQCING

wp8e\qos-inor.wr1 (1)

METAL/COMPOUND	EB-001	EB-002	EB-009	EB-011	EB-012	EB-015	(cyanide only) EB-016
Aluminum	42.6B	28.5B	58.3B	56.00B	34.00B	48.00B	
Antimony	22.0U	22.0U	13.3U	27.00U	27.00U	27.00U	
Arsenic	1.8U	1.8U	1.5U	2.00U	2.00U	2.00U	
Barium	1.4U	1.2U	5.0B	2.00B	2.00U	2.00U	
Beryllium	2.1U	2.1U	0.50U	4.00B	5.00	4.00B	
Cadmium	4.3U	4.3U	4.3U	3.00U	3.00B	3.00B	
Calcium	281B	232B	583B	100.00U	106.00B	100.00U	
Chromium	6.2U	5.2U	1.5U	7.00B	12.00	3.00B	
Cobalt	6.4U	6.4U	6.0U	6.00U	6.00U	6.00U	
Copper	6.1B	3.9B	15.2B	4.00B	11.00B	4.00B	
Iron	888	145	119	9.00U	356.00	15.00B	
Lead	1.0U	1.0U	1.7U	1.00UW	2.40B	1.00U	
Magnesium	68.7B	63.1B	104B	136.00U	136.00U	136.00U	
Manganese	3.7B	2.6B	2.4B	1.00U	6.00U	1.00U	
Mercury	0.10U	0.10U	0.10U	0.20U	0.20U	0.20U	
Nickel	11.0U	11.0U	21.2B	9.00U	73.00	9.00U	
Potassium	446U	446U	343U	273.00U	307.00B	273.00U	
Selenium	1.6U	1.6U	3.4U	1.00U	1.00UW	1.00U	
Silver	6.2U	6.2U	4.2B	4.00U	4.00U	4.00U	
Sodium	617B	582B	1040B	401000.00	208.00B	98.00U	
Thallium	1.1U	1.1U	4.4U	1.00U	1.00U	1.00U	
Vanadium	4.3U	4.3U	2.4U	3.00B	3.00U	3.00U	
Zinc	13.2B	10.3B	58.0	2.00U	1210.00	2.00U	
Cyanide	15.1	10.0U	NR	5.00U	NR	5.00U	5.00U

CAMP LEJEUNE QA/QC - SITES 6, 48, & 69
INORGANICS IN QA/QC SAMPLES
Concentration in ug/l

CHART = QAQCING2 wp8e\qos-inor.wr1 (2)

METAL/COMPOUND	FB001	DI001	DI002	DI005
Aluminum	126B	23.0U	20.7U	20.7U
Antimony	22.0U	22.0U	13.3U	13.3U
Arsenic	1.8U	1.8U	1.5U	1.6U
Barium	1.2B	2.4B	1.7U	4.0B
Beryllium	2.1U	2.1U	0.50U	0.50U
Cadmium	4.3U	4.3U	4.3U	4.3U
Calcium	16400	241B	314B	510B
Chromium	5.2U	5.2B	1.5U	1.5U
Cobalt	6.4U	6.4U	6.0U	6.0U
Copper	3.9B	5.4B	10.7B	9.0B
Iron	154	144	85.4B	72.9B
Lead	1.0U	1.0U	1.7U	1.7U
Magnesium	1660B	66.5B	81.5B	70.3B
Manganese	3.2B	4.6B	1.2U	1.8B
Mercury	0.10U	0.10U	0.10U	0.10U
Nickel	11.0U	11.0U	4.8	5.2U
Potassium	1440B	446U	343U	481U
Selenium	1.6U	1.6U	3.4U	3.4U
Silver	6.2U	6.2B	1.6U	1.6U
Sodium	8240	614B	6.8U	908B
Thallium	1.1U	1.1U	4.4U	4.4U
Vanadium	4.3U	4.3U	2.4U	2.4U
Zinc	18.2B	11.0B	21.4	46.8
Cyanide	10.0U	10.0U	10.0U	10.0

PROJECT Camp Lejeune
PREPARED BY Ed Kny...
DATE April 1991
CHECKED BY Judy Duna
DATE 5-10-91
COMMENTS

CAMP LEJEUNE - SITES 6, 48 & 69
PESTICIDES IN QA/QC SAMPLES
Concentration in ug/l

CHART = QAQCOSP1 sy\wp8d\qos-pest.wr1 (1)

PESTICIDE/PCB	FB-001	DI-001	DI-002	DI-005
alpha-BHC	.05U	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U	.10U
Endrin	.10U	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY Judy Gunia
DATE April 1991
CHECKED BY E.O. Knyfel
DATE 5/13/91
COMMENTS

CAMP LEJEUNE - SITES 6, 48 & 69
PESTICIDES IN QA/QC SAMPLES
Concentration in ug/l

CHART = QAQCOSP2

sy\wp8d\qos-pest.wr1 (2)

PESTICIDE/PCB	EB-001	EB-002	EB-011	EB-015
alpha-BHC	.05U	.05U	0.050U	0.050U
beta-BHC	.05U	.05U	0.050U	0.050U
delta-BHC	.05U	.05U	0.050U	0.050U
gamma-BHC (Lindane)	.05U	.05U	0.050U	0.050U
Heptachlor	.05U	.05U	0.050U	0.050U
Aldrin	.05U	.05U	0.050U	0.050U
Heptachlor epoxide	.05U	.05U	0.050U	0.050U
Endosulfan I	.05U	.05U	0.050U	0.050U
Dieldrin	.10U	.10U	0.10U	0.10U
4,4'-DDE	.10U	.10U	0.10U	0.10U
Endrin	.10U	.10U	0.10U	0.10U
Endosulfan II	.10U	.10U	0.10U	0.10U
4,4'-DDD	.10U	.10U	0.10U	0.10U
Endosulfan sulfate	.10U	.10U	0.10U	0.10U
4,4'-DDT	.10U	.10U	0.10U	0.10U
Methoxychlor	.50U	.50U	0.50U	0.50U
Endrin ketone	.10U	.10U	0.10U	0.10U
alpha-Chlordane	.50U	.50U	0.50U	0.50U
gamma-Chlordane	.50U	.50U	0.50U	0.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	0.50U	0.50U
Aroclor-1221	.50U	.50U	0.50U	0.50U
Aroclor-1232	.50U	.50U	0.50U	0.50U
Aroclor-1242	.50U	.50U	0.50U	0.50U
Aroclor-1248	.50U	.50U	0.50U	0.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY Ed Kropp
DATE 5/13/91
COMMENTS

CAMP LEJEUNE - SITES 6, 48, & 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN QA/QC SAMPLES
Concentration in ug/l

CHART = QACOSS1A wp8c\qos-sv.wr1 (1-A)

COMPOUND	FB-001	DI-001	DI-002	DI-005
Phenol	10.U	10.U	10.U	10.U
bis(2-Chloroethyl)ether	10.U	10.U	10.U	10.U
2-Chlorophenol	10.U	10.U	10.U	10.U
1,3-Dichlorobenzene	10.U	10.U	10.U	10.U
1,4-Dichlorobenzene	10.U	10.U	10.U	10.U
Benzyl Alcohol	10.U	10.U	10.U	10.U
1,2-Dichlorobenzene	10.U	10.U	10.U	10.U
2-Methylphenol	10.U	10.U	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U	10.U
4-Methylphenol	10.U	10.U	10.U	10.U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U	10.U
Hexachloroethane	10.U	10.U	10.U	10.U
Nitrobenzene	10.U	10.U	10.U	10.U
Isophorone	10.U	10.U	10.U	10.U
2-Nitrophenol	10.U	10.U	10.U	10.U
2,4-Dimethylphenol	10.U	10.U	10.U	10.U
Benzoic acid	50.U	50.U	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U	10.U
2,4-Dichlorophenol	10.U	10.U	10.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U	10.U	10.U
Naphthalene	10.U	10.U	10.U	10.U
4-Chloroaniline	10.U	10.U	10.U	10.U
Hexachlorobutadiene	10.U	10.U	10.U	10.U
4-Chloro-3-methylphenol	10.U	10.U	10.U	10.U
2-Methylnaphthalene	10.U	10.U	10.U	10.U
Hexachlorocyclopentadiene	10.U	10.U	10.U	10.U
2,4,6-Trichlorophenol	10.U	10.U	10.U	10.U
2,4,5-Trichlorophenol	50.U	50.U	50.U	50.U
2-Chloronaphthalene	10.U	10.U	10.U	10.U
2-Nitroaniline	50.U	50.U	50.U	50.U
Dimethylphthalate	10.U	10.U	10.U	10.U
Acenaphthylene	10.U	10.U	10.U	10.U
2,6-Dinitrotoluene	10.U	10.U	10.U	10.U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/10/91
COMMENTS

CAMP LEJEUNE - SITES 6, 48, & 69

SEMI-VOLATILE ORGANIC COMPOUNDS IN QA/QC SAMPLES

Concentration in ug/l

CHART = QACOSS1B

wp8c\qos-sv.wr1 (1-B)

COMPOUND	FB-001	DI-001	DI-002	DI-005
3-Nitroaniline	50.U	50.U	50.U	50.U
Acenaphthene	10.U	10.U	10.U	10.U
2,4-Dinitrophenol	50.U	50.U	50.U	50.U
4-Nitrophenol	50.U	50.U	50.U	50.U
Dibenzofuran	10.U	10.U	10.U	10.U
2,4-Dinitrotoluene	10.U	10.U	10.U	10.U
Diethylphthalate	10.U	10.U	10.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U	10.U	10.U
Fluorene	10.U	10.U	10.U	10.U
4-Nitroaniline	50.U	50.U	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U	50.U
N-Nitrosodiphenylamine	10.U	10.U	10.U	10.U
4-Bromophenyl-phenylether	10.U	10.U	10.U	10.U
Hexachlorobenzene	10.U	10.U	10.U	10.U
Pentachlorophenol	50.U	50.U	50.U	50.U
Phenanthrene	10.U	10.U	10.U	10.U
Anthracene	10.U	10.U	10.U	10.U
Di-n-butylphthalate	10.U	10.U	10.U	10.U
Fluoranthene	10.U	10.U	10.U	10.U
Pyrene	10.U	10.U	10.U	10.U
Butylbenzylphthalate	10.U	10.U	10.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U	20.U	20.U
Benzo(a)anthracene	10.U	10.U	10.U	10.U
Chrysene	10.U	10.U	10.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U	10.U
Di-n-octylphthalate	10.U	10.U	10.U	10.U
Benzo(b)fluoranthene	10.U	10.U	10.U	10.U
Benzo(k)fluoranthene	10.U	10.U	10.U	10.U
Benzo(a)pyrene	10.U	10.U	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U	10.U
Dibenz(a,h)anthracene	10.U	10.U	10.U	10.U
Benzo(g,h,i)perylene	10.U	10.U	10.U	10.U

CAMP LEJEUNE - SITES 6, 48, & 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN QA/QC SAMPLES
Concentration in ug/l

CHART = QACOSS2A wp8c\qos-sv.wr1 (2-A)

COMPOUND	EB-001	EB-002	EB-011	EB-015
Phenol	10.U	10.U	10U	10U
bis(2-Chloroethyl)ether	10.U	10.U	10U	10U
2-Chlorophenol	10.U	10.U	10U	10U
1,3-Dichlorobenzene	10.U	10.U	10U	10U
1,4-Dichlorobenzene	10.U	10.U	10U	10U
Benzyl Alcohol	10.U	10.U	10U	10U
1,2-Dichlorobenzene	10.U	10.U	10U	10U
2-Methylphenol	10.U	10.U	10U	10U
bis(2-Chloroisopropyl)ether	10.U	10.U	10U	10U
4-Methylphenol	10.U	10.U	10U	10U
N-Nitroso-di-n-propylamine	10.U	10.U	10U	10U
Hexachloroethane	10.U	10.U	10U	10U
Nitrobenzene	10.U	10.U	10U	10U
Isophorone	10.U	10.U	10U	10U
2-Nitrophenol	10.U	10.U	10U	10U
2,4-Dimethylphenol	10.U	10.U	10U	10U
Benzoic acid	50.U	50.U	50U	50U
bis(2-Chloroethoxy)methane	10.U	10.U	10U	10U
2,4-Dichlorophenol	10.U	10.U	10U	10U
1,2,4-Trichlorobenzene	10.U	10.U	10U	10U
Naphthalene	10.U	10.U	10U	10U
4-Chloroaniline	10.U	10.U	10U	10U
Hexachlorobutadiene	10.U	10.U	10U	10U
4-Chloro-3-methylphenol	10.U	10.U	10U	10U
2-Methylnaphthalene	10.U	10.U	10U	10U
Hexachlorocyclopentadiene	10.U	10.U	10U	10U
2,4,6-Trichlorophenol	10.U	10.U	10U	10U
2,4,5-Trichlorophenol	50.U	50.U	50U	50U
2-Chloronaphthalene	10.U	10.U	10U	10U
2-Nitroaniline	50.U	50.U	50U	50U
Dimethylphthalate	10.U	10.U	10U	10U
Acenaphthylene	10.U	10.U	10U	10U
2,6-Dinitrotoluene	10.U	10.U	10U	10U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITES 6, 48, & 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN QA/QC SAMPLES
Concentration in ug/l

CHART = QACOSS2B wp8c\qos-sv.wr1 (2-B)

COMPOUND	EB-001	EB-002	EB-011	EB-015
3-Nitroaniline	50.U	50.U	50U	50U
Acenaphthene	10.U	10.U	10U	10U
2,4-Dinitrophenol	50.U	50.U	50U	50U
4-Nitrophenol	50.U	50.U	50U	50U
Dibenzofuran	10.U	10.U	10U	10U
2,4-Dinitrotoluene	10.U	10.U	10U	10U
Diethylphthalate	10.U	10.U	10U	10U
4-Chlorophenyl-phenylether	10.U	10.U	10U	10U
Fluorene	10.U	10.U	10U	10U
4-Nitroaniline	50.U	50.U	50U	50U
4,6-Dinitro-2-methylphenol	50.U	50.U	50U	50U
N-Nitrosodiphenylamine	10.U	10.U	10U	10U
4-Bromophenyl-phenylether	10.U	10.U	10U	10U
Hexachlorobenzene	10.U	10.U	10U	10U
Pentachlorophenol	50.U	50.U	50U	50U
Phenanthrene	10.U	10.U	10U	10U
Anthracene	10.U	10.U	10U	10U
Di-n-butylphthalate	10.U	10.U	10U	10U
Fluoranthene	10.U	10.U	10U	10U
Pyrene	10.U	10.U	10U	10U
Butylbenzylphthalate	10.U	10.U	10U	10U
3,3'-Dichlorobenzidine	20.U	20.U	20U	20U
Benzo(a)anthracene	10.U	10.U	10U	10U
Chrysene	10.U	10.U	10U	10U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10U	10U
Di-n-octylphthalate	10.U	10.U	10U	10U
Benzo(b)fluoranthene	10.U	10.U	10U	10U
Benzo(k)fluoranthene	10.U	10.U	10U	10U
Benzo(a)pyrene	10.U	10.U	10U	10U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10U	10U
Dibenz(a,h)anthracene	10.U	10.U	10U	10U
Benzo(g,h,i)perylene	10.U	10.U	10U	10U

CAMP LEJEUNE - SITES 6, 48, and 69
VOLATILE ORGANIC COMPOUNDS IN FIELD BLANKS & D.I. BLANKS
Concentration in ug/l

CHART = QAQCOV1 wp8b\qos-vol.wr1 (1)

COMPOUND	FB-001	DI-001	DI-002	DI-005
Chloromethane	10.U	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U
Vinyl Chloride	10.U	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U	10.U
Methylene Chloride	.8J	5.U	5.U	2.J
Acetone	10.U	10.U	10.U	10.U
Carbon Disulfide	5.U	5.U	5.U	5.U
1,1-Dichloroethene	5.U	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U	5.U
1,2-Dichloroethene (total)	5.U	5.U	5.U	5.U
Chloroform	7.	5.U	5.U	5.U
1,2-Dichloroethane	5.U	5.U	5.U	5.U
2-Butanone	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U
Bromodichloromethane	7.	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U
Trichloroethene	5.U	5.U	5.U	5.U
Dibromochloromethane	5.J	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U	5.U
Benzene	5.U	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U	5.U
Toluene	5.U	5.U	5.U	5.U
Chlorobenzene	5.U	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U	5.U
Styrene	5.U	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U	5.U

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY [illegible]
DATE 5/13/91
COMMENTS

O.K. EK 5/8/91

CAMP LEJEUNE - SITES 6, 48, and 69
VOLATILE ORGANIC COMPOUNDS IN EQUIPMENT BLANKS
Concentration in ug/l

CHART = QACOSV2 wp8b\qos-vol.wr1 (2)

COMPOUND	EB-001	EB-002	EB-011	EB-015
Chloromethane	10.U	10.U	10U	10U
Bromomethane	10.U	10.U	10U	10U
Vinyl Chloride	10.U	10.U	10U	10U
Chloroethane	10.U	10.U	10U	10U
Methylene Chloride	5.U	5.U	5U	5U
Acetone	10.U	10.U	9J	4BJ
Carbon Disulfide	5.U	5.U	5U	5U
1,1-Dichloroethene	5.U	5.U	5U	5U
1,1-Dichloroethane	5.U	5.U	5U	5U
1,2-Dichloroethene (total)	5.U	5.U	5U	5U
Chloroform	5.U	5.U	5U	5U
1,2-Dichloroethane	5.U	5.U	5U	5U
2-Butanone	10.U	10.U	10U	10U
1,1,1-Trichloroethane	5.U	5.U	5U	5U
Carbon Tetrachloride	5.U	5.U	5U	5U
Vinyl Acetate	10.U	10.U	10U	10U
Bromodichloromethane	5.U	5.U	5U	5U
1,2-Dichloropropane	5.U	5.U	5U	5U
cis-1,3-Dichloropropene	5.U	5.U	5U	5U
Trichloroethene	5.U	5.U	5U	5U
Dibromochloromethane	5.U	5.U	5U	5U
1,1,2-Trichloroethane	5.U	5.U	5U	5U
Benzene	5.U	5.U	5U	5U
trans-1,3-Dichloropropene	5.U	5.U	5U	5U
Bromoform	5.U	5.U	5U	5U
4-Methyl-2-Pentanone	10.U	10.U	10U	10U
2-Hexanone	10.U	10.U	10U	10U
Tetrachloroethene	5.U	5.U	5U	5U
1,1,2,2-Tetrachloroethane	5.U	5.U	5U	5U
Toluene	5.U	5.U	5U	5U
Chlorobenzene	5.U	5.U	5U	5U
Ethylbenzene	5.U	5.U	5U	5U
Styrene	5.U	5.U	5U	5U
Xylene (total)	5.U	5.U	5U	5U

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY Ed Kupfer
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITES 6, 48, and 69
VOLATILE ORGANIC COMPOUNDS IN TRIP BLANKS
Concentration in ug/l

CHART = QACOSV3 wp8b\qos-vol.wr1 (3)

COMPOUND	TB-007	TB-008	TB-009	TB-011	TB-012	TB-014	TB-015	TB-069
Chloromethane	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Vinyl Chloride	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Methylene Chloride	5.J	5.U	5.U	5.U	5.U	5.U	5.U	4.JB
Acetone	10.U	10.U	4.BJ	10.U	10.U	10.U	12.	3.J
Carbon Disulfide	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,1-Dichloroethene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethene (total)	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Chloroform	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
2-Butanone	2.J	2.BJ	10.U	10.U	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Trichloroethene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Dibromochloromethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Benzene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Toluene	5.U	5.U	5.U	5.U	3.J	5.U	5.U	5.U
Chlorobenzene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Styrene	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U	5.U	5.U	5.U	5.U	5.U

APPENDIX E

QA/QC DISCUSSION OF RESULTS

Environmental
Science &
Engineering, Inc.

A CILCORP Company

April 22, 1991

Environmental Science
& Engineering
201 Route 17 North
Rutherford, NJ 07070

The purpose of this letter is to present you with the results of my examination of the field QC sample results for Camp Lejeune. You may recall that earlier this month, you asked me to summarize the results for all field blanks, equipment blanks, trip blanks and field duplicates that were generated for this project. You asked that this information be compiled not only for ESE's water analysis data but also for those field QC samples that were analyzed by CEIMIC. This effort has been completed, and the attached tables contain the extracted field QC data as taken from the data packages generated by ESE and CEIMIC. In the paragraphs below I will present my observations as to the significance of the values seen in this data.

Equipment Blanks

The water equipment blanks did not show significant levels of contamination for any analyte except for iron. This is not unexpected since iron is a ubiquitous element in the environment, and could have come from the sampling equipment. There was one equipment blank (EB-001) that showed a relatively high concentration of iron, and a small amount of cyanide. Zinc showed up once in blank EB-009, which is also not surprising, since it too is a ubiquitous element in nature, and is an occasional laboratory contaminant at trace levels. All blanks were free of detectable levels of organics except for one that had low levels of toluene and xylenes.

The soil equipment blanks showed a wider range of metals present, with cadmium, iron and zinc predominant. There was a notable value for sodium reported in blank EB-011. This is well above what might be expected for possible laboratory contamination, and its presence in the absence of any other target analytes is puzzling. Blank EB-012 seemed to have the highest number of metal contaminants, and the highest concentrations as well. Again, it appears that there was no organic contamination present in the blanks. The values for acetone, methylene chloride and carbon disulfide that are reported for the two blanks are very near the detection limits. In addition, acetone and methylene chloride are ubiquitous laboratory contaminants, and I would closely examine the laboratory VOA's blanks for the presence of these compounds before I would describe the presence of these analytes in the blank a result of field operations.

Trip Blanks

These field QC samples were only generated for water samples, and are analyzed only for volatiles. Only three trip blanks showed values above the detection limits for GC/MS volatiles analysis, and all analysis results were very close to the method's detection limits. The value for acetone is just over twice the method's detection limit for that analyte, and you should be aware that since it is a common laboratory contaminant, the CLP protocol allows laboratory blank values to be up to five (5) times the detection limit before the laboratory has to take corrective action. In general, these blanks look very clean.

D.I. Blanks

These field QC samples were only generated for water samples only, and were collected each time a new batch of deionized water was received by the field team. Analysis of this water showed low levels of zinc and iron for only three of these blanks. No other inorganic or organic target analytes were found in these samples.

Field Blanks

Field blanks were only generated for water analysis, and came from the potable water supply that was used for general cleaning/support operations in the field. Only one field blank was generated, and both organic and inorganic analyses were performed on this sample. There were substantial amounts of calcium, iron and sodium present in the blank, and trace levels of chloroform and bromodichloromethane. These last two organics are common materials in municipal water supplies, and are formed as a result of the chlorination of water to kill bacteria.

Sample Duplicates

Sample duplicate data has been summarized for both the water (ESE) and soil analyses (CHEIMIC). The water values show an astonishing variety in the analysis results between pairs of duplicate samples. In some cases (eg. sample HPGW12 and it's duplicate) there is a tremendous variability between the two analysis results. For other samples (eg. sample HPGW-4 and it's duplicate) the agreement between the two samples is excellent.

The only explanation for this variability in the water analyses comes from a physical inspection of the water samples themselves. In most cases where there is a substantial difference between the two analyses, there is a substantial difference in the amount of sediment contained in the two samples. For some duplicate pairs, one sample will be very cloudy and murky and the other sample will be crystal clear. Whenever both samples of the duplicate pairs were relatively clear and free of suspended sediment, the duplicate sample analyses results showed good agreement.

The soil analysis results are about what is expected for the analysis of soil matrices. The high variability seen between water duplicates is not present, but shows the same RPD values from sample to sample. The RPD's are in the 40% to 80% range for a number of analytes, which would be unacceptable for water analyses but are not unexpected when dealing with typical non-uniform environmental soils.

This completes my review of field QC data that is available to me for this project. I assume that there are samples in the data set that are field spikes or reference materials that have been submitted to the laboratories as blind field spikes, but of course I have no information available that allows me to evaluate the accuracy and precision of the analysis results for these samples. I hope that this review and my comments are useful to you, and if you have any questions on this matter please call me at your earliest convenience.

Sincerely,

Kenneth E. Dahlin

Kenneth E. Dahlin
Quality Assurance Supervisor

ATTACHMENTS

EQUIPMENT BLANKS

The following contaminants were found in the equipment blanks analyzed by ESE.

INORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
EB-001	Iron	888.0
	Cyanide	15.0
EB-002	Iron	145.0
EB-009	Iron	119.0
	Zinc	58.0

ORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
EB-013	Toluene	10.0
	Xylene(T)	10.0

The following contaminants were found in the equipment blank analyzed by CEIMIC.

INORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
EB-003	Cadmium	5.0
	Zinc	20.0
EB-004	Cadmium	6.0
	Iron	174.0
	Zinc	24.0
EB-005	Cadmium	5.0
	Iron	119.0
	Zinc	23.0
EB-008	Cadmium	11.0
	Iron	208.0
	Zinc	28.0
EB-011	Sodium	401000.0
EB-012	Beryllium	5.0
	Chromium	12.0
	Iron	356.0
	Nickel	73.0
	Zinc	1210.0

ORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
EB-003	Acetone	17.0
EB-008	Methylene Chloride	5.0
	Carbon Disulfide	5.0

TRIP BLANKS

The following contaminants were found in the trip blanks analyzed by ESE.

ORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
TB-002	1,2 Dichloro-ethene (T)	7.0
TB-006	Carbon Disulfide	8.0
TB-015	Acetone	12.0

DI BLANKS

The following contaminants were found in the DI blanks analyzed by ESE.

INORGANIC ANALYSIS

Sample ID	Analyte	Conc. UG/L
DI-001	Iron	144.0
DI-002	Zinc	21.4
DI-005	Zinc	46.8

FIELD BLANKS

The following contaminants were found in the field blanks analyzed by ESE.

INORGANIC ANALYSIS			ORGANIC ANALYSIS		
Sample ID	Analyte	Conc. UG/L	Sample ID	Analyte	Conc. UG/L
FB-001	Calcium	16400.0	FB-001	Chloroform	7.0
	Iron	154.0		Bromodichloromethane	7.0
	Sodium	8240.0			

SAMPLE DUPLICATE
ESE

Sample ID Analyte	HPGW12 Sample Conc. UG/L[1]	GWDUP2 Dup. Conc. UG/L	 RPD %[2]
Aluminum	24000.00	2110.00	167.7
Antimony	U 22.0	U 22.0	----
Arsenic	U 1.80	U 1.80	----
Barium	91.50	46.30	65.6
Beryllium	U 2.10	U 2.10	----
Cadmium	U 4.30	U 4.30	----
Calcium	34100.0	170000.0	133.2
Chromium	25.50	U 5.20	----
Cobalt	6.40	U 6.40	----
Copper	5.90	3.20	59.3
Iron	5600.00	100.00	193.0
Lead	15.70	U 1.00	----
Magnesium	7700.00	119.00	193.9
Manganese	18.30	U 1.80	----
Mercury	U 0.10	U 0.10	----
Nickel	U 11.0	U 11.0	----
Potassium	2600.00	5280.00	68.0
Selenium	5.80	U 1.60	----
Silver	U 6.20	U 6.20	----
Sodium	9310.00	6560.00	34.7
Thallium	U 1.10	U 1.10	----
Vanadium	31.10	6.60	130.0
Zinc	46.60	44.60	4.4
Cyanide	U 10.0	U 10.0	----

Sample ID Analyte	HPGW9-3 Sample Conc. UG/L	GWDUP3 Dup. Conc. UG/L	 RPD %
Aluminum	2200.00	19000.00	158.5
Antimony	U 22.0	U 22.0	----
Arsenic	U 1.80	2.40	----
Barium	49.10	88.80	57.6
Beryllium	U 2.10	U 2.10	----
Cadmium	U 4.30	U 4.30	----
Calcium	120000.0	33200.0	113.3
Chromium	U 5.20	25.60	----
Cobalt	U 6.40	8.40	----
Copper	4.60	12.20	90.5
Iron	149.00	4490.00	187.2
Lead	U 1.00	12.30	----
Magnesium	131.00	7700.00	193.3
Manganese	U 1.80	17.10	----
Mercury	U 0.10	U 0.10	----
Nickel	U 11.0	U 11.0	----
Potassium	5540.00	2990.00	59.8
Selenium	U 1.60	4.00	----
Silver	U 6.20	U 6.20	----
Sodium	6440.00	7040.00	8.9
Thallium	U 1.10	U 1.10	----
Vanadium	7.30	28.80	119.1
Zinc	38.60	40.40	4.6
Cyanide	U 10.0	U 10.0	----

Sample ID	HPGW30-2	GWDUP4	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Aluminum	1860.00	1830.00	1.6
Antimony	U 13.3	U 13.3	----
Arsenic	U 1.50	U 1.50	----
Barium	28.70	19.00	40.7
Beryllium	0.61	0.61	0.0
Cadmium	U 4.30	U 4.30	----
Calcium	138000.0	132000.0	4.4
Chromium	4.90	7.00	35.3
Cobalt	U 6.00	U 6.00	----
Copper	7.30	11.20	42.2
Iron	4950.00	4850.00	2.0
Lead	5.00	6.20	21.4
Magnesium	2350.00	2260.00	3.9
Manganese	51.10	49.00	4.2
Mercury	U 0.10	U 0.10	----
Nickel	U 5.20	U 5.20	----
Potassium	7180.00	7230.00	0.7
Selenium	U 3.40	U 3.40	----
Silver	U 1.60	U 1.60	----
Sodium	18600.00	215000.0	168.2
Thallium	U 4.40	U 4.40	----
Vanadium	5.70	6.10	6.8
Zinc	44.50	61.30	31.8
Cyanide	U 10.0	U 10.0	----

Sample ID	HPGW-4	GWDUP5	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Aluminum	97000.00	96800.00	0.2
Antimony	21.90	34.60	45.0
Arsenic	15.50	19.40	22.3
Barium	268.00	273.00	1.8
Beryllium	6.70	6.40	4.6
Cadmium	U 4.30	U 4.30	----
Calcium	296000.0	310000.0	4.6
Chromium	187.00	195.00	4.2
Cobalt	14.40	18.20	23.3
Copper	35.40	39.20	10.2
Iron	100000.0	106000.0	5.8
Lead	66.60	45.60	37.4
Magnesium	12100.00	12500.00	3.3
Manganese	425.00	436.00	2.6
Mercury	U 0.10	U 0.10	----
Nickel	57.00	64.30	12.0
Potassium	9710.00	9520.00	2.0
Selenium	U 3.40	U 3.40	----
Silver	U 1.60	2.40	----
Sodium	11400.00	11100.00	2.7
Thallium	U 4.40	U 4.40	----
Vanadium	213.00	222.00	4.1
Zinc	228.00	272.00	17.6
Cyanide	U 10.0	U 10.0	----

Sample ID Analyte	69GW-8 Sample Conc. UG/L	GWDUP6 Dup. Conc. UG/L	RPD %
Aluminum	24100.00	U 20.7	----
Antimony	U 13.3	U 13.3	----
Arsenic	U 1.50	1.80	----
Barium	188.00	2.80	194.1
Beryllium	1.30	0.97	29.1
Cadmium	U 4.30	U 4.30	----
Calcium	7460.00	15.60	199.2
Chromium	22.10	U 1.50	----
Cobalt	U 6.00	U 6.00	----
Copper	7.40	U 3.20	----
Iron	10700.00	63.10	197.7
Lead	20.40	16.40	21.7
Magnesium	3100.00	U 0.00	----
Manganese	168.00	2.00	195.3
Mercury	U 0.10	U 0.10	----
Nickel	5.70	U 5.20	----
Potassium	2510.00	U 343	----
Selenium	U 3.40	U 3.40	----
Silver	2.40	235.00	196.0
Sodium	4880.00	U 6.80	----
Thallium	U 4.40	U 4.40	----
Vanadium	25.60	U 2.40	77.5
Zinc	53.20	11.30	----
Cyanide	U 10.0	U 10.0	----

Sample ID Analyte	6-GW-8 Sample Conc. UG/L	GWDUP7 Dup. Conc. UG/L	RPD %
Aluminum	332000.0	281000.0	16.6
Antimony	U 13.30	U 13.3	----
Arsenic	6.00	2.90	69.7
Barium	792.00	716.00	10.1
Beryllium	2.90	3.20	9.8
Cadmium	U 4.30	U 4.30	----
Calcium	38200.00	35800.00	6.5
Chromium	342.00	283.00	18.9
Cobalt	15.40	13.70	11.7
Copper	75.80	65.50	14.6
Iron	50400.00	40300.00	22.3
Lead	70.40	63.00	11.1
Magnesium	12300.00	9900.00	21.6
Manganese	157.00	102.00	42.5
Mercury	0.32	0.27	16.9
Nickel	81.60	58.30	33.3
Potassium	14300.00	11700.00	20.0
Selenium	U 3.40	U 3.40	----
Silver	1.80	6.90	117.2
Sodium	2530.00	2410.00	4.9
Thallium	U 0.10	U 4.40	----
Vanadium	274.00	216.00	23.7
Zinc	151.00	120.00	22.9
Cyanide	U 10.0	U 10.0	----

Sample ID	HPGW26 Sample Conc.	GWDUP8 Dup. Conc.	
Analyte	UG/L	UG/L	RPD %
Aluminum	10400.00	7830.00	28.2
Antimony	U 13.3	U 13.3	----
Arsenic	U 1.50	U 1.50	----
Barium	72.00	67.70	6.2
Beryllium	U 0.50	U 0.50	----
Cadmium	U 4.30	U 4.30	----
Calcium	2830.00	2770.00	2.1
Chromium	13.00	10.30	23.2
Cobalt	U 6.00	U 6.00	----
Copper	9.10	7.20	23.3
Iron	19000.00	10900.00	54.2
Lead	9.00	5.20	53.5
Magnesium	1830.00	1710.00	6.8
Manganese	10.60	8.80	18.6
Mercury	U 0.10	U 0.10	----
Nickel	U 5.20	U 5.20	----
Potassium	2230.00	1580.00	34.1
Selenium	U 3.40	U 3.40	----
Silver	U 1.60	U 1.60	----
Sodium	5910.00	5690.00	3.8
Thallium	U 4.40	U 4.40	----
Vanadium	149.00	83.60	56.2
Zinc	68.10	43.10	45.0
Cyanide	U 10.0	U 10.0	----

Sample ID	WS-634 Sample Conc.	GWDUP9 Dup. Conc.	
Analyte	UG/L	UG/L	RPD %
Aluminum	U 20.7	U 20.7	----
Antimony	U 13.3	U 13.3	----
Arsenic	U 1.50	U 1.50	----
Barium	10.20	10.40	1.9
Beryllium	U 0.50	0.86	----
Cadmium	U 4.30	U 4.30	----
Calcium	58900.00	61200.00	3.8
Chromium	U 1.50	U 1.50	----
Cobalt	U 6.00	U 6.00	----
Copper	4.90	4.00	20.2
Iron	1420.00	1550.00	8.8
Lead	U 1.70	U 1.70	----
Magnesium	1190.00	1240.00	4.1
Manganese	12.50	12.50	0.0
Mercury	U 0.10	U 0.10	----
Nickel	U 5.20	U 5.20	----
Potassium	890.00	1090.00	20.2
Selenium	U 3.40	U 3.40	----
Silver	U 1.60	U 1.60	----
Sodium	5410.00	5900.00	8.7
Thallium	U 4.40	U 4.40	----
Vanadium	U 2.40	2.50	----
Zinc	23.40	14.30	48.3
Cyanide	U 10.0	U 10.0	----

Sample ID	49SW-1	SWDUP1	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Aluminum	1180.00	1390.00	16.3
Antimony	U 13.3	U 13.3	----
Arsenic	U 1.50	U 1.50	----
Barium	U 1.70	U 1.70	----
Beryllium	U 0.50	U 0.50	----
Cadmium	U 4.30	U 4.30	----
Calcium	123000.0	140000.0	12.9
Chromium	U 1.50	U 1.50	----
Cobalt	U 6.00	U 6.00	----
Copper	U 3.20	U 3.20	----
Iron	1560.00	1550.00	0.6
Lead	U 1.70	U 1.70	----
Magnesium	343000.0	404000.0	16.3
Manganese	2.60	1.20	73.7
Mercury	U 0.10	U 0.10	----
Nickel	U 5.20	U 5.20	----
Potassium	122000.0	150000.0	20.6
Selenium	U 3.40	U 3.40	----
Silver	3.80	3.30	14.1
Sodium	986000.0	968000.0	1.8
Thallium	U 4.40	U 4.40	----
Vanadium	4.40	4.80	8.7
Zinc	U 2.70	13.00	----
Cyanide	NR	NR	----

Sample ID	6-SW-1	SWDUP2	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Aluminum	650.00	639.00	1.7
Antimony	U 13.3	13.50	----
Arsenic	U 1.50	U 1.50	----
Barium	13.70	15.00	9.1
Beryllium	U 0.50	U 0.50	----
Cadmium	U 4.30	U 4.30	----
Calcium	6770.00	6850.00	1.2
Chromium	2.60	U 1.50	----
Cobalt	U 6.00	U 6.00	----
Copper	6.40	9.70	41.0
Iron	365.00	365.00	0.0
Lead	U 1.70	U 1.70	----
Magnesium	1160.00	1190.00	2.6
Manganese	8.10	7.50	7.7
Mercury	U 0.10	U 0.10	----
Nickel	U 5.20	U 5.20	----
Potassium	631.00	763.00	18.9
Selenium	U 3.40	U 3.40	----
Silver	18.10	U 1.60	----
Sodium	7210.00	7490.00	3.8
Thallium	U 4.40	U 4.40	----
Vanadium	2.70	2.70	0.0
Zinc	20.80	45.80	75.1
Cyanide	U 10.0	U 10.0	----

1. The "U" qualifier indicates the analyte value was below the instrument detection limit, which is the value listed to the right of the qualifier.

2. Blank RPD values indicate that either the sample or the duplicate or both contained analyte values below the instrument detection limit. Percent values for the RPD cannot be calculated under these circumstances.

SAMPLE DUPLICATE
CEIMIC

Sample ID	HPSO2-2	HPSOD-2	
	Sample Conc.	Dup. Conc.	RPD
Analyte	UG/L[3]	UG/L	%[4]
Arsenic	75.00	112.00	39.6
Barium	255.00	584.00	78.4
Cadmium	4.00	3.00	28.6
Chromium	3.00	6.00	66.7
Lead	69.00	54.00	24.4
Mercury	U 0.20	U 0.20	----
Selenium	110.00	U 63.00	----
Silver	U 4.00	U 4.00	----

Sample ID	HPSO3-1	HPSOD-3	
	Sample Conc.	Dup. Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	75.00	92.00	20.4
Barium	382.00	244.00	44.1
Cadmium	27.00	15.00	57.1
Chromium	5.00	4.00	22.2
Lead	79.00	47.00	50.8
Mercury	U 0.20	U 0.20	----
Selenium	76.00	100.00	27.3
Silver	U 4.00	U 4.00	----

Sample ID	HPSO4-2	HPSOD-4	
	Sample Conc.	Dup. Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	111.00	101.00	9.4
Barium	188.00	166.00	12.4
Cadmium	3.00	3.00	0.0
Chromium	5.00	4.00	22.2
Lead	53.00	50.00	5.8
Mercury	U 0.20	U 0.20	----
Selenium	89.00	168.00	61.5
Silver	U 4.00	U 4.00	----

Sample ID	HPSO11-3	HPSOD-5	
	Sample Conc.	Dup. Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	81.00	63.00	25.0
Barium	199.00	299.00	40.2
Cadmium	4.00	U 3.00	----
Chromium	7.00	6.00	15.4
Lead	45.00	30.00	40.0
Mercury	U 0.20	1.00	----
Selenium	U 63.00	U 63.00	----
Silver	U 4.00	U 4.00	----

Sample ID	HPSO17-1	HPSOD-6	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	117.00	102.00	13.7
Barium	331.00	363.00	9.2
Cadmium	4.00	6.00	40.0
Chromium	7.00	6.00	15.4
Lead	59.00	80.00	30.2
Mercury	U 0.20	U 0.20	----
Selenium	U 63.00	84.00	----
Silver	U 4.00	4.00	----

Sample ID	HPSO22-1	HPSOD-7	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	58.00	111.00	62.7
Barium	320.00	247.00	25.7
Cadmium	U 3.00	U 3.00	----
Chromium	4.00	U 3.00	----
Lead	45.00	46.00	2.2
Mercury	U 0.20	U 0.20	----
Selenium	U 63.00	U 63.00	----
Silver	U 4.00	U 4.00	----

Sample ID	HPSO26-1	HPSOD-8	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	U 40.00	56.00	----
Barium	596.00	609.00	2.2
Cadmium	U 3.00	U 3.00	----
Chromium	5.00	U 3.00	----
Lead	38.00	47.00	21.2
Mercury	U 0.20	U 0.20	----
Selenium	U 63.00	U 63.00	----
Silver	U 4.00	U 4.00	----

Sample ID	HPSO24-1	HPSOD-9	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	UG/L	UG/L	%
Arsenic	92.00	554.00	143.0
Barium	137.00	136.00	0.7
Cadmium	3.00	3.00	0.0
Chromium	10.00	7.00	35.3
Lead	U 27.00	37.00	----
Mercury	U 0.20	U 0.20	----
Selenium	100.00	96.00	4.1
Silver	U 4.00	U 4.00	----

Sample ID	HPSO1-1	HPSOD-1	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	MG/KG	MG/KG	%
Aluminum	3590.00	4140.00	14.2
Antimony	U 5.40	5.90	----
Arsenic	0.55	0.50	9.5
Barium	6.00	6.10	1.7
Beryllium	U 0.20	U 0.16	----
Cadmium	0.80	U 0.47	----
Calcium	1450.00	1660.00	13.5
Chromium	5.00	5.00	0.0
Cobalt	1.40	0.93	40.3
Copper	1.40	1.10	24.0
Iron	1790.00	2030.00	12.6
Lead	2.40	3.70	42.6
Magnesium	128.00	116.00	9.8
Manganese	3.80	2.50	41.3
Mercury	U 0.11	U 0.09	----
Nickel	2.60	1.70	41.9
Potassiu,	124.00	127.00	2.4
Selenium	U 0.16	0.21	----
Silver	U 0.80	U 0.62	----
Sodium	120.00	297.00	84.9
Thallium	U 0.16	U 0.17	----
Vanadium	5.20	6.10	15.9
Zinc	0.80	1.40	54.5
Cyanide	U 0.69	U 0.69	----

Sample ID	48SE1	SEDUP1	
	Sample	Dup.	
	Conc.	Conc.	RPD
Analyte	MG/KG	MG/KG	%
Aluminum	6130.00	9650.00	44.6
Antimony	U 8.20	U 9.40	----
Arsenic	5.50	5.70	3.6
Barium	5.20	5.20	0.0
Beryllium	1.20	1.40	15.4
Cadmium	3.00	2.80	6.9
Calcium	1250.00	1280.00	2.4
Chromium	14.00	18.80	29.3
Cobalt	U 1.80	U 2.10	----
Copper	5.80	5.20	10.9
Iron	16700.00	17900.00	6.9
Lead	13.40	11.50	15.3
Magnesium	1670.00	1840.00	9.7
Manganese	11.90	12.90	8.1
Mercury	U 0.18	U 0.18	----
Nickel	U 2.70	U 3.10	----
Potassiu,	1030.00	1200.00	15.2
Selenium	U 0.35	0.42	----
Silver	U 1.20	U 1.40	----
Sodium	5850.00	6080.00	3.9
Thallium	U 0.35	U 0.28	----
Vanadium	29.30	34.40	16.0
Zinc	18.90	22.60	17.8
Cyanide	U 1.10	U 1.10	----

Sample ID Analyte	6SE2 Sample Conc. MG/KG	SEDUP2 Dup. Conc. MG/KG	RPD %
Aluminum	567.00	557.00	1.8
Antimony	U 6.50	U 4.90	----
Arsenic	U 0.35	U 0.36	----
Barium	U 0.48	U 0.36	----
Beryllium	0.97	0.73	28.2
Cadmium	U 0.73	U 0.55	----
Calcium	169.00	165.00	2.4
Chromium	2.70	1.50	57.1
Cobalt	U 1.50	U 1.10	----
Copper	0.73	0.55	28.1
Iron	606.00	644.00	6.1
Lead	1.30	1.10	16.7
Magnesium	72.10	83.50	14.7
Manganese	0.97	0.91	6.4
Mercury	U 0.12	U 0.13	----
Nickel	U 2.20	U 1.6	----
Potassiu,	115.00	86.30	28.5
Selenium	U 0.18	U 0.91	----
Silver	U 0.97	U 0.73	----
Sodium	125.00	159.00	23.9
Thallium	U 0.18	U 0.18	----
Vanadium	0.97	0.55	55.3
Zinc	10.20	0.91	167.2
Cyanide	U 0.75	U 0.83	----

3. The "U" qualifier indicates the analyte value was below the instrument detection limit, which is the value listed to the right of the qualifier.

4. Blank RPD values indicate that either the sample or the duplicate or both contained analyte values below the instrument detection limit. Percent values for the RPD cannot be calculated under these circumstances.

APPENDIX F

SUPPLEMENTAL CHARACTERIZATION INVENTORY ANALYTICAL RESULTS SITE 6

CAMP LEJEUNE - SITE 6

SEMI-VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT

Concentration in ug/l (surface water) and ug/kg (sediment)

CHART = 6SWSESVA

wp8c\6-sv.wr1 (3-A)

COMPOUND	6SW1	6SW1D (SWDUP2)	6SW2	6SE1	6SE2	6SE2D (SEDUP2)
Phenol	10.U	10.U	10.U	510U	430U	420U
bis(2-Chloroethyl)ether	10.U	10.U	10.U	510U	430U	420U
2-Chlorophenol	10.U	10.U	10.U	510U	430U	420U
1,3-Dichlorobenzene	10.U	10.U	10.U	510U	430U	420U
1,4-Dichlorobenzene	10.U	10.U	10.U	510U	430U	420U
Benzyl Alcohol	10.U	10.U	10.U	510U	430U	420U
1,2-Dichlorobenzene	10.U	10.U	10.U	510U	430U	420U
2-Methylphenol	10.U	10.U	10.U	510U	430U	420U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U	510U	430U	420U
4-Methylphenol	10.U	10.U	10.U	510U	430U	420U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U	510U	430U	420U
Hexachloroethane	10.U	10.U	10.U	510U	430U	420U
Nitrobenzene	10.U	10.U	10.U	510U	430U	420U
Isophorone	10.U	10.U	10.U	510U	430U	420U
2-Nitrophenol	10.U	10.U	10.U	510U	430U	420U
2,4-Dimethylphenol	10.U	10.U	10.U	510U	430U	420U
Benzoic acid	50.U	50.U	50.U	2500U	2100U	2000U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U	510U	430U	420U
2,4-Dichlorophenol	10.U	10.U	10.U	510U	430U	420U
1,2,4-Trichlorobenzene	10.U	10.U	10.U	510U	430U	420U
Naphthalene	10.U	10.U	10.U	510U	430U	420U
4-Chloroaniline	10.U	10.U	10.U	510U	430U	420U
Hexachlorobutadiene	10.U	10.U	10.U	510U	430U	420U
4-Chloro-3-methylphenol	10.U	10.U	10.U	510U	430U	420U
2-Methylnaphthalene	10.U	10.U	10.U	510U	430U	420U
Hexachlorocyclopentadiene	10.U	10.U	10.U	510U	430U	420U
2,4,6-Trichlorophenol	10.U	10.U	10.U	510U	430U	420U
2,4,5-Trichlorophenol	50.U	50.U	50.U	2500U	2100U	2000U
2-Chloronaphthalene	10.U	10.U	10.U	510U	430U	420U
2-Nitroaniline	50.U	50.U	50.U	2500U	2100U	2000U
Dimethylphthalate	10.U	10.U	10.U	510U	430U	420U
Acenaphthylene	10.U	10.U	10.U	510U	430U	46J
2,6-Dinitrotoluene	10.U	10.U	10.U	510U	430U	420U

PROJECT Camp Lejeune

PREPARED BY [illegible]

DATE April 1991

CHECKED BY [illegible]

DATE 5/14/91

COMMENTS

CAMP LEJEUNE - SITE 6
SEMI-VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER AND SEDIMENT
Concentration in ug/l (surface water) and ug/kg (sediment)

CHART = 6SWSESVB wp8c\6-sv.wr1 (3-B)

COMPOUND	6SW1	6SW1D (SWDUP2)	6SW2	6SE1	6SE2	6SE2D (SEDUP2)
3-Nitroaniline	50.U	50.U	50.U	2500U	2100U	2000U
Acenaphthene	10.U	10.U	10.U	510U	56J	420U
2,4-Dinitrophenol	50.U	50.U	50.U	2500U	2100U	2000U
4-Nitrophenol	50.U	50.U	50.U	2500U	2100U	2000U
Dibenzofuran	10.U	10.U	10.U	510U	430U	420U
2,4-Dinitrotoluene	10.U	10.U	10.U	510U	430U	420U
Diethylphthalate	10.U	10.U	10.U	510U	430U	420U
4-Chlorophenyl-phenylether	10.U	10.U	10.U	510U	430U	420U
Fluorene	10.U	10.U	10.U	510U	430U	420U
4-Nitroaniline	50.U	50.U	50.U	2500U	2100U	2000U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U	2500U	2100U	2000U
N-Nitrosodiphenylamine	10.U	10.U	10.U	510U	430U	420U
4-Bromophenyl-phenylether	10.U	10.U	10.U	510U	430U	420U
Hexachlorobenzene	10.U	10.U	10.U	510U	430U	420U
Pentachlorophenol	50.U	50.U	50.U	2500U	2100U	2000U
Phenanthrene	10.U	10.U	10.U	510U	430U	420U
Anthracene	10.U	10.U	10.U	510U	430U	95J
Di-n-butylphthalate	10.U	10.U	10.U	510U	430U	420U
Fluoranthene	10.U	10.U	10.U	510U	220J	83J
Pyrene	10.U	10.U	10.U	510U	160J	110J
Butylbenzylphthalate	10.U	10.U	10.U	510U	430U	420U
3,3'-Dichlorobenzidine	20.U	20.U	20.U	1000U	860U	840U
Benzo(a)anthracene	10.U	10.U	10.U	510U	58J	220J
Chrysene	10.U	10.U	10.U	510U	430U	420
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U	510U	430U	420U
Di-n-octylphthalate	10.U	10.U	10.U	510U	430U	420U
Benzo(b)fluoranthene	10.U	10.U	10.U	510U	430U	600
Benzo(k)fluoranthene	10.U	10.U	10.U	510U	430U	510
Benzo(a)pyrene	10.U	10.U	10.U	510U	430U	460
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U	510U	430U	150J
Dibenz(a,h)anthracene	10.U	10.U	10.U	510U	430U	420U
Benzo(g,h,i)perylene	10.U	10.U	10.U	510U	430U	89J

CAMP LEJEUNE - SITE 6
PESTICIDES IN SURFACE WATER & SEDIMENT
Concentration in ug/l (Surface Water)
Concentration in ug/kg (Sediment)

CHART = 6SWSEPES

sy\wp8b\6-pest.wr1 (3)

PESTICIDE/PCB	6SW1	6SW1D (SWDUP2)	6SW2	6SE1	6SE2	6SE2D (SEDUP2)
alpha-BHC	.05U	.05U	.05U	12U	10U	10U
beta-BHC	.05U	.05U	.05U	12U	10U	10U
delta-BHC	.05U	.05U	.05U	12U	10U	10U
gamma-BHC (Lindane)	.05U	.05U	.05U	12U	10U	10U
Heptachlor	.05U	.05U	.05U	12U	10U	10U
Aldrin	.05U	.05U	.05U	12U	10U	10U
Heptachlor epoxide	.05U	.05U	.05U	12U	10U	10U
Endosulfan I	.05U	.05U	.05U	12U	10U	10U
Dieldrin	.10U	.10U	.10U	25U	21U	20U
4,4'-DDE	.10U	.10U	.10U	25U	21U	20U
Endrin	.10U	.10U	.10U	25U	21U	20U
Endosulfan II	.10U	.10U	.10U	25U	21U	20U
4,4'-DDD	.10U	.10U	.10U	25U	21U	20U
Endosulfan sulfate	.10U	.10U	.10U	25U	21U	20U
4,4'-DDT	.10U	.10U	.10U	25U	21U	20U
Methoxychlor	.50U	.50U	.50U	120U	100U	100U
Endrin ketone	.10U	.10U	.10U	25U	21U	20U
alpha-Chlordane	.50U	.50U	.50U	120U	100U	100U
gamma-Chlordane	.50U	.50U	.50U	120U	100U	100U
Toxaphene	1.0U	1.0U	1.0U	250U	210U	200U
Aroclor-1016	.50U	.50U	.50U	120U	100U	100U
Aroclor-1221	.50U	.50U	.50U	120U	100U	100U
Aroclor-1232	.50U	.50U	.50U	120U	100U	100U
Aroclor-1242	.50U	.50U	.50U	120U	100U	100U
Aroclor-1248	.50U	.50U	.50U	120U	100U	100U
Aroclor-1254	1.0U	1.0U	1.0U	250U	210U	200U
Aroclor-1260	1.0U	1.0U	1.0U	190J	210U	200U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITE 6
INORGANICS IN SURFACE WATER & SEDIMENT
Concentration in ug/l (Surface Water)
Concentration in mg/kg (Sediment)

CHART = 6SWSEING   wp8c\6-inor.wr1 (3)

METAL/COMPOUND	6SW1	6SW1D (SWDUP2)	6SW2	6SE1	6SE2	6SE2D (SEDUP2)
Aluminum	650	639	684	2030.00	567.00	557.00
Antimony	13.3U	13.5B	19.0B	8.00UN	6.50UN	4.90UN
Arsenic	1.5U	1.5U	1.5U	0.50UNW	0.35UN	0.36UN
Barium	13.7B	15.0B	1.7U	0.59U	0.48U	0.36U
Beryllium	0.50U	0.50U	0.50U	1.20B	0.97B	0.73B
Cadmium	4.3U	4.3U	4.3U	0.88B	0.73U	0.55U
Calcium	6770	6850	17100	3270.00	169.00B	165.00B
Chromium	2.6B	1.5U	1.5U	3.80	2.70	1.50B
Cobalt	6.0U	6.0U	6.0U	1.80U	1.50U	1.10U
Copper	6.4B	9.7B	7.8B	3.50B	0.73B	0.55B
Iron	365	365	352	1570.00	606.00	644.00
Lead	1.7U	1.7U	1.7U	5.70*	1.30*	1.10*
Magnesium	1160B	1190B	32600	154.00B	72.10B	83.50B
Manganese	8.1B	7.5B	8.8B	6.20	0.97B	0.91B
Mercury	0.10U	0.10U	0.10U	0.16U	0.12U	0.13U
Nickel	5.2U	5.2U	5.2U	2.70U	2.20U	1.60U
Potassium	631B	763B	10400	138.00B	115.00B	86.30B
Selenium	3.4U	3.4U	3.4U	0.44B	0.18UW	0.91UW
Silver	18.1	1.6U	1.6B	1.20U	0.97U	0.73U
Sodium	7210	7490	268000	256.00BE	125.00BE	159.00BE
Thallium	4.4U	4.4U	4.4U	0.25UN	0.18UN	0.18UN
Vanadium	2.7B	2.7B	2.4U	2.70B	0.97B	0.55B
Zinc	20.8	45.8	41.0	8.80	10.20	0.91B
Cyanide	10.0U	10.0U	10.0U	1.00U	0.75U	0.83U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5-8-91
COMMENTS

CAMP LEJEUNE - SITE 6
VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER & SEDIMENT
Concentration in ug/l (Surface Water)
Concentration in ug/kg (Sediment)

CHART = 6VOLSWSE

wp8b\6-vol.wr1 (3)

COMPOUND	6SW1	6SW1-D (SWDUP2)	6SW2	6SE1	6SE2	6SE2D (SEDUP2)
Chloromethane	10.U	10.U	10.U	15U	13U	13U
Bromomethane	10.U	10.U	10.U	15U	13U	13U
Vinyl Chloride	10.U	10.U	10.U	15U	13U	13U
Chloroethane	10.U	10.U	10.U	15U	13U	13U
Methylene Chloride	5.U	5.U	5.U	4BJ	2BJ	3BJ
Acetone	10.U	10.U	10.U	45	13U	28
Carbon Disulfide	5.U	5.U	5.U	7U	7U	7U
1,1-Dichloroethene	5.U	5.U	5.U	7U	7U	7U
1,1-Dichloroethane	5.U	5.U	5.U	7U	7U	7U
1,2-Dichloroethene (total)	2.J	5.U	4.J	7U	7U	7U
Chloroform	5.U	5.U	5.U	7U	7U	7U
1,2-Dichloroethane	5.U	5.U	5.U	7U	7U	7U
2-Butanone	10.U	10.U	10.U	15U	13U	13U
1,1,1-Trichloroethane	5.U	5.U	5.U	5J	7U	7U
Carbon Tetrachloride	5.U	5.U	5.U	7U	7U	7U
Vinyl Acetate	10.U	10.U	10.U	15U	13U	13U
Bromodichloromethane	5.U	5.U	5.U	7U	7U	7U
1,2-Dichloropropane	5.U	5.U	5.U	7U	7U	7U
cis-1,3-Dichloropropene	5.U	5.U	5.U	7U	7U	7U
Trichloroethene	5.U	5.U	5.	7U	7U	7U
Dibromochloromethane	5.U	5.U	5.U	7U	7U	7U
1,1,2-Trichloroethane	5.U	5.U	5.U	7U	7U	7U
Benzene	5.U	5.U	5.U	7U	7U	7U
trans-1,3-Dichloropropene	5.U	5.U	5.U	7U	7U	7U
Bromoform	5.U	5.U	5.U	7U	7U	7U
4-Methyl-2-Pentanone	10.U	10.U	10.U	15U	13U	13U
2-Hexanone	10.U	10.U	10.U	15U	13U	13U
Tetrachloroethene	5.U	5.U	5.U	7U	7U	7U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U	7U	7U	7U
Toluene	5.U	5.U	5.U	2J	7U	7U
Chlorobenzene	5.U	5.U	5.U	7U	7U	7U
Ethylbenzene	5.U	5.U	5.U	7U	7U	7U
Styrene	5.U	5.U	5.U	7U	7U	7U
Xylene (total)	5.U	5.U	5.U	7U	7U	7U

PROJECT Camp Lejeune
PREPARED BY Paul M. Fuchs
DATE April 1991
CHECKED BY Judy Lerma
DATE 5-9-91
COMMENTS

CAMP LEJEUNE - SITE 6

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW AND WATER SUPPLY WELLS)

Concentration in ug/l

CHART = 6GWSV2A   wp8c\6-sv.wr1 (2-A)

COMPOUND	6GW7	6GW8	6GW8D (GWDUP7)	WS651	WS653
Phenol	10.U	10.U	10.U	10.U	10.U
bis(2-Chloroethyl)ether	10.U	10.U	10.U	10.U	10.U
2-Chlorophenol	10.U	10.U	10.U	10.U	10.U
1,3-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
1,4-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
Benzyl Alcohol	10.U	10.U	10.U	10.U	10.U
1,2-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
2-Methylphenol	10.U	10.U	10.U	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U	10.U	10.U
4-Methylphenol	10.U	10.U	10.U	10.U	10.U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U	10.U	10.U
Hexachloroethane	10.U	10.U	10.U	10.U	10.U
Nitrobenzene	10.U	10.U	10.U	10.U	10.U
Isophorone	10.U	10.U	10.U	10.U	10.U
2-Nitrophenol	10.U	10.U	10.U	10.U	10.U
2,4-Dimethylphenol	10.U	10.U	10.U	10.U	10.U
Benzoic acid	50.U	50.U	50.U	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U	10.U	10.U
2,4-Dichlorophenol	10.U	10.U	10.U	10.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U	10.U	10.U	10.U
Naphthalene	10.U	10.U	10.U	10.U	10.U
4-Chloroaniline	10.U	10.U	10.U	10.U	10.U
Hexachlorobutadiene	10.U	10.U	10.U	10.U	10.U
4-Chloro-3-methylphenol	10.U	10.U	10.U	10.U	10.U
2-Methylnaphthalene	10.U	10.U	10.U	10.U	10.U
Hexachlorocyclopentadiene	10.U	10.U	10.U	10.U	10.U
2,4,6-Trichlorophenol	10.U	10.U	10.U	10.U	10.U
2,4,5-Trichlorophenol	50.U	50.U	50.U	50.U	50.U
2-Chloronaphthalene	10.U	10.U	10.U	10.U	10.U
2-Nitroaniline	50.U	50.U	50.U	50.U	50.U
Dimethylphthalate	10.U	10.U	10.U	10.U	10.U
Acenaphthylene	10.U	10.U	10.U	10.U	10.U
2,6-Dinitrotoluene	10.U	10.U	10.U	10.U	10.U

PROJECT Camp Lejeune

PREPARED BY Judy Guma

DATE April 1991

CHECKED BY E. Knopf

DATE 5/13/91

COMMENTS

CAMP LEJEUNE - SITE 6

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW AND WATER SUPPLY WELLS)

Concentration in ug/l

CHART = 6GWSV2B

wp8c\6-sv.wr1 (2-B)

COMPOUND	6GW7	6GW8	6GW8D (GWDUP7)	WS651	WS653
3-Nitroaniline	50.U	50.U	50.U	50.U	50.U
Acenaphthene	10.U	10.U	10.U	10.U	10.U
2,4-Dinitrophenol	50.U	50.U	50.U	50.U	50.U
4-Nitrophenol	50.U	50.U	50.U	50.U	50.U
Dibenzofuran	10.U	10.U	10.U	10.U	10.U
2,4-Dinitrotoluene	10.U	10.U	10.U	10.U	10.U
Diethylphthalate	10.U	10.U	10.U	10.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U	10.U	10.U	10.U
Fluorene	10.U	10.U	10.U	10.U	10.U
4-Nitroaniline	50.U	50.U	50.U	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U	50.U	50.U
N-Nitrosodiphenylamine	10.U	10.U	10.U	10.U	10.U
4-Bromophenyl-phenylether	10.U	10.U	10.U	10.U	10.U
Hexachlorobenzene	10.U	10.U	10.U	10.U	10.U
Pentachlorophenol	50.U	50.U	50.U	50.U	50.U
Phenanthrene	10.U	10.U	10.U	10.U	10.U
Anthracene	10.U	10.U	10.U	10.U	10.U
Di-n-butylphthalate	10.U	10.U	10.U	10.U	10.U
Fluoranthene	10.U	10.U	10.U	10.U	10.U
Pyrene	10.U	10.U	10.U	10.U	10.U
Butylbenzylphthalate	10.U	10.U	10.U	10.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U	20.U	20.U	20.U
Benzo(a)anthracene	10.U	10.U	10.U	10.U	10.U
Chrysene	10.U	10.U	10.U	10.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U	10.U	10.U
Di-n-octylphthalate	10.U	10.U	10.U	10.U	10.U
Benzo(b)fluoranthene	10.U	10.U	10.U	10.U	10.U
Benzo(k)fluoranthene	10.U	10.U	10.U	10.U	10.U
Benzo(a)pyrene	10.U	10.U	10.U	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U	10.U	10.U
Dibenz(a,h)anthracene	10.U	10.U	10.U	10.U	10.U
Benzo(g,h,i)perylene	10.U	10.U	10.U	10.U	10.U

CAMP LEJEUNE - SITE 6

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 6GWSV1A wp8c\6-sv.wr1 (1-A)

COMPOUND	6GW2	6GW3	6GW4	6GW5	6GW6
Phenol	10.U	10.U	10.U	10.U	10.U
bis(2-Chloroethyl)ether	10.U	10.U	10.U	10.U	10.U
2-Chlorophenol	10.U	10.U	10.U	10.U	10.U
1,3-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
1,4-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
Benzyl Alcohol	10.U	10.U	10.U	10.U	10.U
1,2-Dichlorobenzene	10.U	10.U	10.U	10.U	10.U
2-Methylphenol	10.U	10.U	10.U	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U	10.U	10.U
4-Methylphenol	10.U	10.U	10.U	10.U	10.U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U	10.U	10.U
Hexachloroethane	10.U	10.U	10.U	10.U	10.U
Nitrobenzene	10.U	10.U	10.U	10.U	10.U
Isophorone	10.U	10.U	10.U	10.U	10.U
2-Nitrophenol	10.U	10.U	10.U	10.U	10.U
2,4-Dimethylphenol	10.U	10.U	10.U	10.U	10.U
Benzoic acid	50.U	50.U	50.U	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U	10.U	10.U
2,4-Dichlorophenol	10.U	10.U	10.U	10.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U	10.U	10.U	10.U
Naphthalene	10.U	10.U	10.U	10.U	10.U
4-Chloroaniline	10.U	10.U	10.U	10.U	10.U
Hexachlorobutadiene	10.U	10.U	10.U	10.U	10.U
4-Chloro-3-methylphenol	10.U	10.U	10.U	10.U	10.U
2-Methylnaphthalene	10.U	10.U	10.U	10.U	10.U
Hexachlorocyclopentadiene	10.U	10.U	10.U	10.U	10.U
2,4,6-Trichlorophenol	10.U	10.U	10.U	10.U	10.U
2,4,5-Trichlorophenol	50.U	50.U	50.U	50.U	50.U
2-Chloronaphthalene	10.U	10.U	10.U	10.U	10.U
2-Nitroaniline	50.U	50.U	50.U	50.U	50.U
Dimethylphthalate	10.U	10.U	10.U	10.U	10.U
Acenaphthylene	10.U	10.U	10.U	10.U	10.U
2,6-Dinitrotoluene	10.U	10.U	10.U	10.U	10.U

PROJECT Camp Lejeune

PREPARED BY

DATE April 1991

CHECKED BY

DATE 5/10/91

COMMENTS

CAMP LEJEUNE - SITE 6

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 6GWSV1B

wp8c\6-sv.wr1 (1-B)

COMPOUND	6GW2	6GW3	6GW4	6GW5	6GW6
3-Nitroaniline	50.U	50.U	50.U	50.U	50.U
Acenaphthene	10.U	10.U	10.U	10.U	10.U
2,4-Dinitrophenol	50.U	50.U	50.U	50.U	50.U
4-Nitrophenol	50.U	50.U	50.U	50.U	50.U
Dibenzofuran	10.U	10.U	10.U	10.U	10.U
2,4-Dinitrotoluene	10.U	10.U	10.U	10.U	10.U
Diethylphthalate	10.U	10.U	10.U	10.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U	10.U	10.U	10.U
Fluorene	10.U	10.U	10.U	10.U	10.U
4-Nitroaniline	50.U	50.U	50.U	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U	50.U	50.U
N-Nitrosodiphenylamine	10.U	10.U	10.U	10.U	10.U
4-Bromophenyl-phenylether	10.U	10.U	10.U	10.U	10.U
Hexachlorobenzene	10.U	10.U	10.U	10.U	10.U
Pentachlorophenol	50.U	50.U	50.U	50.U	50.U
Phenanthrene	10.U	10.U	10.U	10.U	10.U
Anthracene	10.U	10.U	10.U	10.U	10.U
Di-n-butylphthalate	10.U	10.U	10.U	10.U	10.U
Fluoranthene	10.U	10.U	10.U	10.U	10.U
Pyrene	10.U	10.U	10.U	10.U	10.U
Butylbenzylphthalate	10.U	10.U	10.U	10.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U	20.U	20.U	20.U
Benzo(a)anthracene	10.U	10.U	10.U	10.U	10.U
Chrysene	10.U	10.U	10.U	10.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U	10.U	10.U
Di-n-octylphthalate	10.U	10.U	10.U	10.U	10.U
Benzo(b)fluoranthene	10.U	10.U	10.U	10.U	10.U
Benzo(k)fluoranthene	10.U	10.U	10.U	10.U	10.U
Benzo(a)pyrene	10.U	10.U	10.U	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U	10.U	10.U
Dibenz(a,h)anthracene	10.U	10.U	10.U	10.U	10.U
Benzo(g,h,i)perylene	10.U	10.U	10.U	10.U	10.U

CAMP LEJEUNE - SITE 6
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 6GWVOL1 wp8b\6-vol.wr1 (1)

COMPOUND	6GW2	6GW3	6GW4	6GW5	6GW6
Chloromethane	10.U	10.U	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U	10.U
Vinyl Chloride	10.U	10.U	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U	10.U	10.U
Methylene Chloride	5.U	5.U	5.U	5.U	5.U
Acetone	10.U	10.U	10.U	10.U	10.U
Carbon Disulfide	5.U	5.U	5.U	5.U	10.
1,1-Dichloroethene	5.U	5.U	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethene (total)	5.U	5.U	5.U	5.U	5.U
Chloroform	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethane	5.U	5.U	5.U	5.U	5.U
2-Butanone	10.U	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U
Trichloroethene	5.U	5.U	5.U	5.U	5.U
Dibromochloromethane	5.U	5.U	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U	5.U	5.U
Benzene	5.U	5.U	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U	5.U	5.U
Toluene	5.U	5.U	5.U	5.U	5.U
Chlorobenzene	5.U	5.U	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U	5.U	5.U
Styrene	5.U	5.U	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U	5.U	5.U

PROJECT Camp Lejeune
PREPARED BY E C Kyle
DATE April 1991
CHECKED BY Judy Guna
DATE 5-6-91
COMMENTS

CAMP LEJEUNE - SITE 6

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS & WATER SUPPLY WELLS)

Concentration in ug/l

CHART = 6GWVOL2 wp8b\6-vol.wr1 (2)

COMPOUND	6GW7	6GW8	6GW8D (GWDUP7)	WS651	WS653
Chloromethane	10.U	10.U	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U	10.U
Vinyl Chloride	10.U	10.U	10.U	70.	10.U
Chloroethane	10.U	10.U	10.U	10.U	10.U
Methylene Chloride	5.U	5.U	5.U	2.J	5.U
Acetone	10.U	10.U	10.U	10.U	12.
Carbon Disulfide	5.U	5.U	5.U	5.U	5.U
1,1-Dichloroethene	5.U	5.U	5.U	2.J	5.U
1,1-Dichloroethane	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethene (total)	5.U	5.U	5.U	75.	5.U
Chloroform	5.U	5.U	5.U	5.U	5.U
1,2-Dichloroethane	5.U	5.U	5.U	5.U	5.U
2-Butanone	10.U	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U
Trichloroethene	5.U	5.U	5.U	13.	5.U
Dibromochloromethane	5.U	5.U	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U	5.U	5.U
Benzene	5.U	5.U	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U	53.	5.U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U	5.U	5.U
Toluene	5.U	5.U	5.U	.9J	5.U
Chlorobenzene	5.U	5.U	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U	5.U	5.U
Styrene	5.U	5.U	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U	5.U	5.U

PROJECT Camp Lejeune

PREPARED BY Ed Kyba

DATE April 1991

CHECKED BY Judy Gunna

DATE 5-7-91

COMMENTS

CAMP LEJEUNE - SITE 6
PESTICIDES IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 6GWPEST1 sy\wp8b\6-pest.wr1 (1)

PESTICIDE/PCB	6GW2	6GW3	6GW4	6GW5	6GW6
alpha-BHC	.05U	.05U	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U	.10U	.10U
Endrin	.10U	.10U	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITE 6

PESTICIDES IN GROUNDWATER (SHALLOW/WATER SUPPLY WELLS)

Concentration in ug/l

CHART = 6GWPEST2 sy\wp8b\6-pest.wr1 (2)

PESTICIDE/PCB	6GW7	6GW8	6GW8D (GWDUP7)	WS651	WS653
alpha-BHC	.05U	.05U	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U	.10U	.10U
Endrin	.10U	.10U	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U	1.0U

PROJECT Camp Lejeune

PREPARED BY [signature]

DATE April 1991

CHECKED BY [signature]

DATE 5/8/91

COMMENTS

CAMP LEJEUNE - SITE 6

INORGANICS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 6GWING1 wp8c\6-inor.wr1 (1)

METAL/COMPOUND	6GW2	6GW3	6GW4	6GW5	6GW6
Aluminum	226000	107000	46800	242000	118000
Antimony	13.3U	13.3U	13.3U	13.3U	14.0B
Arsenic	9.0B	4.1B	8.4B	4.0B	5.4B
Barium	248	776	564	603	446
Beryllium	2.7B	5.9	1.7B	3.5B	1.2B
Cadmium	4.3U	43.4	4.3U	4.3U	4.3U
Calcium	1980B	44800	6160	32500	11100
Chromium	219	115	41.6	219	210
Cobalt	10.6B	12.1B	6.0U	9.8B	6.0U
Copper	40.3	203	21.0B	43.0	25.1
Iron	59300	15800	19900	34100	31700
Lead	61.6	44.1	12.0	45.8	30.0
Magnesium	7330	6670	2090B	7130	6440
Manganese	84.0	1080	73.5	91.2	84.4
Mercury	0.13B	0.13B	0.10U	0.24	0.10U
Nickel	27.4B	68.8	17.1B	53.6	19.6B
Potassium	11300	11900	3110B	9210	8210
Selenium	3.4U	4.6B	3.4U	3.4U	3.6B
Silver	1.6U	1.6U	1.9B	1.6U	2.0B
Sodium	2480B	5650	4860B	6380	15100
Thallium	4.4U	4.4U	4.4U	4.4U	4.4U
Vanadium	311	120	106	200	504
Zinc	98.0	9540	240	102	174
Cyanide	10.0U	10.0U	10.0U	10.0U	10.0U

PROJECT Camp Lejeune

PREPARED BY Paul [illegible]

DATE April 1991

CHECKED BY Judy Guna

DATE 5-8-91

COMMENTS

CAMP LEJEUNE - SITE 6
INORGANICS IN GROUNDWATER (SHALLOW WELLS & WATER SUPPLY WELLS)
Concentration in ug/l

CHART = 6GWING2 wp8c\6-inor.wr1 (2)

METAL/COMPOUND	6GW7	6GW8	6GW8D (GWDUP7)	WS651	WS653
Aluminum	278000	332000	281000	20.7U	20.7U
Antimony	13.3U	13.3U	13.3U	13.3U	13.3U
Arsenic	21.4	6.0B	2.9B	1.5U	1.5U
Barium	1030	782	716	1.7U	1.7U
Beryllium	6.1	2.9B	3.2B	0.85B	0.50U
Cadmium	4.3U	4.3U	4.3U	4.3U	4.3U
Calcium	52300	38200	35800	50100	61200
Chromium	451	342	283	1.5U	1.5U
Cobalt	14.8B	15.4B	13.7B	6.0U	6.0U
Copper	66.4	75.8	65.5	6.4B	4.5B
Iron	55400	50400	40300	1080	296
Lead	61.7	70.4	63.0	2.6B	1.7U
Magnesium	12900	12300	9900	1100B	1470B
Manganese	163	157	102	16.5	15.6
Mercury	0.28	0.32	0.27	0.10U	0.10U
Nickel	61.2	81.6	58.3	5.2U	5.2U
Potassium	14800	14300	11700	1440B	1540B
Selenium	3.4U	3.4U	3.4U	3.4U	3.5B
Silver	2.7B	1.8B	6.9B	1.6U	1.6U
Sodium	2320B	2530B	2410B	4430B	6600
Thallium	4.4U	0.1U	4.4U	4.4U	4.4U
Vanadium	344	274	216	3.1B	2.4U
Zinc	207	151	120	308	34.0
Cyanide	10.0U	10.0U	10.0U	10.0U	10.0U

PROJECT Camp Lejeune
PREPARED BY El Rygbd
DATE April 1991
CHECKED BY Judy Gunna
DATE 5-8-91
COMMENTS

APPENDIX G

SUPPLEMENTAL CHARACTERIZATION INVENTORY ANALYTICAL RESULTS SITE 48

CAMP LEJEUNE - SITE 48
INORGANICS IN SEDIMENT
Concentration in mg/kg

CHART = 48SEING1 wp8e\48-inor.wr1 (3)

METAL/COMPOUND	48SE1	48SE1-D) (SEDUP1)	48SE2	48SE3	48SE4	48SE5	48SE6
Aluminum	6130.00	9650.00	3410.00	2920.00	1820.00	5580.00	4690.00
Antimony	8.20UN	9.40UN	6.00UN	7.80UN	6.00UN	8.40UN	9.60UN
Arsenic	5.50N+	5.70N+	1.40BNW	1.10BNW	0.68BNW	1.20BNW	0.95BNW
Barium	5.20B	5.20B	0.44B	3.20B	3.60B	9.40B	7.80B
Beryllium	1.20B	1.40B	0.88B	1.20B	0.89B	1.20B	1.40B
Cadmium	3.00	2.80	1.30	1.50	0.89B	1.90	1.80
Calcium	1250.00B	1280.00B	830.00B	709.00B	398.00B	1010.00B	980.00B
Chromium	14.00	18.80	7.50	8.70	4.90	10.60	10.60
Cobalt	1.80U	2.10U	1.30U	1.70U	1.30U	1.90U	2.10U
Copper	5.80B	5.20B	5.10B	4.40B	2.50B	8.10	6.70B
Iron	16700.00	17900.00	6610.00	4870.00	2630.00	7900.00	7370.00
Lead	13.40*	11.50*	12.00*	9.40*	5.20*	12.30*	12.20*
Magnesium	1670.00	1840.00	1240.00	1010.00B	655.00B	1560.00	1630.00B
Manganese	11.90	12.90	6.00	7.80	4.00	12.80	12.80
Mercury	0.18U	0.18U	0.15U	0.14U	0.15U	0.19U	0.16U
Nickel	2.70U	3.10U	2.00U	2.60U	2.00B	2.80B	3.20U
Potassium	1030.00B	1200.00B	653.00B	593.00B	347.00B	864.00B	877.00B
Selenium	0.35UW	0.42BW	0.28U	0.66B	0.20U	0.63B	0.37B
Silver	1.20U	1.40U	0.88U	1.20U	0.89U	1.20U	1.40U
Sodium	5850.00E	6080.00E	5140.00E	4350.00E	3200.00E	6110.00E	6830.00E
Thallium	0.35UNW	0.28UN	0.28UNW	0.25UNW	0.20UNW	0.29UNW	0.33UNW
Vanadium	29.30	34.40	11.70	7.30B	4.20B	11.20B	10.30B
Zinc	18.90	22.60	16.10	15.70	16.10	27.40	23.40
Cyanide	1.10U	1.10U	1.10U	0.96U	0.88U	1.30U	1.20U

PROJECT Camp Lejeune
PREPARED BY Judy Gumma
DATE April 1991
CHECKED BY [illegible]
DATE 5/13/91
COMMENTS

CAMP LEJEUNE - SITE 48
INORGANICS IN SEDIMENT
Concentration in mg/kg

CHART = 48SEING2

wp8e\48-inor.wr1 (4)

METAL/COMPOUND	48SE7	48SE8	48SE9	48SE10	48SE11
Aluminum	6340.00	11900.00	3540.00	4650.00	465.00
Antimony	8.70UN	9.40UN	7.00UN	13.10UN	6.20UN
Arsenic	1.40BNW	6.10NS	1.10BNW	11.60N	0.38UN
Barium	9.70B	8.40B	4.90B	0.97U	0.46U
Beryllium	1.30B	1.40B	1.00B	1.90B	0.92B
Cadmium	1.60	1.70	1.50	4.40	0.69B
Calcium	1120.00B	1490.00B	1040.00B	3790.00	150.00B
Chromium	11.70	20.30	8.20	22.90	2.10B
Cobalt	1.90U	2.10U	1.50U	2.90U	1.40U
Copper	9.40	8.40B	7.50	20.90	0.92B
Iron	9410.00	13400.00	6680.00	32600.00	1010.00
Lead	12.50*	24.50*S	13.30*	27.40*S	2.20*
Magnesium	1870.00	2680.00	1460.00	2970.00	276.00B
Manganese	16.20	19.20	8.50	15.60	1.40B
Mercury	0.17U	0.18U	0.19U	0.23U	0.10U
Nickel	4.50B	3.80B	2.30U	4.40U	2.10U
Potassium	1100.00B	1630.00B	798.00B	936.00B	219.00B
Selenium	0.76BW	0.59BW	0.38U	0.44U	0.19U
Silver	1.30U	1.40U	1.00U	1.90U	0.92U
Sodium	7330.00E	9020.00E	5960.00E	11000.00E	1510.00E
Thallium	0.39UNW	0.29UNW	0.38UNW	0.44UN	0.19UN
Vanadium	13.60B	22.70	9.80B	69.10	3.20B
Zinc	28.80	25.20	20.10	61.80	2.80B
Cyanide	1.20U	1.40U	1.20U	1.50U	0.75U

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY Ed Knopf
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 48
INORGANICS IN SURFACE WATER
Concentration in ug/l

CHART = 48SWING1 wp8e\48-inor.wr1 (1)

METAL/COMPOUND	48SW-1	48SW1D (SWDUP1)	48SW-2	48SW-3	48SW-4	48SW-5	48SW-6
Aluminum	1180	1390	352	212	408	242	2060
Antimony	13.3U	13.3U	13.3U	13.3U	13.3U	13.3U	15.6B
Arsenic	1.5U	1.5U	1.5U	1.5U	1.5U	1.5U	1.5U
Barium	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U
Beryllium	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U	0.50U
Cadmium	4.3U	4.3U	4.3U	4.3U	4.3U	4.3U	4.3U
Calcium	123000	140000	95900	42100	143000	62100	90300
Chromium	1.5U	1.5U	1.5U	1.5U	1.5U	1.5U	1.5U
Cobalt	6.0U	6.0U	6.0U	6.0U	6.0U	6.0U	6.0U
Copper	3.2U	3.2U	3.2U	3.2U	3.2U	3.2U	3.2U
Iron	1560	1550	884	997	590	957	2060
Lead	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U	1.7U
Magnesium	343000	404000	246000	53000	412000	126000	230000
Manganese	2.6B	1.2B	19.5	57.7	7.3B	45.5	24.1
Mercury	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U
Nickel	5.2U	5.2U	5.2U	5.2U	5.2U	5.2U	5.2U
Potassium	122000	150000	87300	19100	150000	43700	83200
Selenium	3.4U	3.4U	3.4U	3.4U	3.4U	3.4U	3.4U
Silver	3.8B	3.3B	3.3B	4.2B	1.6U	39.0	3.4B
Sodium	986000	968000	1000000	477000	965000	1100000	1000000
Thallium	4.4U	4.4U	4.4U	4.4U	4.4U	4.4U	4.4U
Vanadium	4.4B	4.8B	2.4U	2.4U	2.9B	2.4U	5.5B
Zinc	2.7U	13.0B	15.8B	29.7	2.7U	22.9	21.2
Cyanide	NR	NR	NR	NR	NR	NR	NR

CAMP LEJEUNE - SITE 48
INORGANICS IN SURFACE WATER
Concentration in ug/l

CHART = 48SWING2 wp8e\48-inor.wr1 (2)

METAL/COMPOUND	48SW7	48SW8	48SW9	48SW10	48SW11
Aluminum	604	436	207B	207B	207B
Antimony	13.3U	13.3U	192E	169E	133B
Arsenic	1.5U	1.5U	1.5U	1.9B	1.5U
Barium	1.7U	1.7U	17.0B	17.0B	17.0B
Beryllium	0.50U	0.50U	9.0E	11.0E	11.0E
Cadmium	4.3U	4.3U	43.0B	43.0B	43.0B
Calcium	143000	114000	150000E	99200E	216000E
Chromium	1.5U	1.5U	15.0B	15.0B	15.0B
Cobalt	6.0U	6.0U	60.0B	24.0E	60.0B
Copper	3.2U	3.2U	32.0U	32.0U	32.0B
Iron	585	596	612E	1130E	202E
Lead	1.7U	1.7U	1.7U	1.7U	1.7U
Magnesium	410000	316000	431000E	252000E	798000E
Manganese	1.5B	8.1B	12.0B	12.0B	12.0B
Mercury	0.10U	0.10U	0.10U	0.10U	0.10U
Nickel	5.2U	5.2U	60.0E	53.0E	52.0B
Potassium	152000	116000	125000E	78800E	241000E
Selenium	3.4U	3.4U	3.4U	3.4U	12.8
Silver	2.4B	3.7B	36.0E	36.0B	1.6U
Sodium	968000	987000	3520000E	2120000E	6690000E
Thallium	4.4U	4.4U	4.4U	4.4U	4.4U
Vanadium	3.2B	3.5B	24.0B	23.0E	24.0B
Zinc	23.4	2.9B	39.0E	52.0E	27.0B
Cyanide	NR	NR	NR	NR	NR

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/14/91
COMMENTS

APPENDIX H

SUPPLEMENTAL CHARACTERIZATION INVENTORY
ANALYTICAL RESULTS
SITE 69

CAMP LEJEUNE - SITE 69
VOLATILE ORGANIC COMPOUNDS IN FISH TISSUE SAMPLES
Concentration in ug/kg

CHART = 69FISHV wp8b\69-vol.wr1 (6)

COMPOUND	69TI4-1	69TI4-2	69TI5-1	69TI5-2
Chloromethane	47	210	26	17
Bromomethane	<22	<15	<13	<13
Vinyl Chloride	<3.0	<2.0	<1.8	<1.8
Chloroethane	<1.7	<1.1	<1.0	<1.0
Methylene Chloride	<11	<7.0	<6.2	<6.4
Acetone	28000	<4.8	<4.3	<4.4
Carbon Disulfide	<4.7	<3.1	<2.8	<2.9
1,1-Dichloroethene	<4.7	<3.2	<2.8	<2.9
1,1-Dichloroethane	<1.6	<1.1	<0.96	<0.98
1,2-Dichloroethene (total)	<9.8	<6.5	<5.8	<5.9
Chloroform	<2.6	<1.7	<1.5	<1.6
1,2-Dichloroethane	<1.7	<1.1	<1.0	<1.0
2-Butanone	<5.1	<3.4	<3.0	<3.1
1,1,1-Trichloroethane	<1.7	<1.1	<0.99	<1.0
Carbon Tetrachloride	<2.3	<1.6	<1.4	<1.4
Vinyl Acetate	<9.7	<6.5	<5.8	<5.9
Bromodichloromethane	<2.1	<1.4	<1.2	<1.3
1,2-Dichloropropane	<2.2	<1.4	<1.3	<1.3
cis-1,3-Dichloropropene	<2.0	<1.3	<1.2	<1.2
Trichloroethene	<1.1	<0.72	<0.64	<0.66
Dibromochloromethane	<2.5	<1.6	<1.5	<1.5
1,1,2-Trichloroethane	<2.7	<1.8	<1.6	<1.6
Benzene	<5.6	<3.7	<3.3	<3.4
trans-1,3-Dichloropropene	<1.9	<1.3	<1.1	<1.1
Bromoform	<3.9	<2.6	<2.3	<2.4
4-Methyl-2-Pentanone	<5.1	<3.4	<3.0	<3.1
2-Hexanone	<6.3	<4.2	<3.8	<3.8
Tetrachloroethene	<0.97	<0.65	<0.58	<0.59
Toluene	<1.2	<0.81	<0.72	<0.74
1,1,2,2-Tetrachloroethane	<5.0	<3.3	<3.0	<3.0
Chlorobenzene	<0.87	<0.58	<0.52	<0.53
Ethylbenzene	<1.2	<0.82	<0.73	<0.75
Styrene	<2.6	<1.7	<1.5	<1.6
Xylene (total)	<2.0	<1.3	<1.2	<1.2

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 69

SEMI-VOLATILE ORGANIC COMPOUNDS IN FISH TISSUE

Concentration in ug/kg (dry)

CHART = 69FSSVA wp8c\69-sv.wr1 (5-A)

COMPOUND	69T14-1	69T14-2	69T15-1	69T15-2
Phenol	<490	300	250	<150
bis(2-Chloroethyl)ether	<220	<67	<67	<67
2-Chlorophenol	<240	<74	<74	<74
1,3-Dichlorobenzene	<680	<210	<210	<210
1,4-Dichlorobenzene	<750	<230	<230	<230
Benzyl Alcohol	<270	<85	<85	<84
1,2-Dichlorobenzene	<820	<260	<260	<260
2-Methylphenol	<270	<85	<85	<84
bis(2-Chloroisopropyl)ether	<360	<110	<110	<110
4-Methylphenol	<830	<260	<260	<260
N-Nitroso-di-n-propylamine	<260	<80	<80	<80
Hexachloroethane	<960	<300	<300	<300
Nitrobenzene	<200	<63	<63	<63
Isophorone	<190	<61	<61	<61
2-Nitrophenol	<150	<48	<48	<48
2,4-Dimethylphenol	<730	<230	<230	<230
Benzoic acid	2300	640	1100	520
bis(2-Chloroethoxy)methane	<250	<78	<78	<78
2,4-Dichlorophenol	<300	<95	<95	<94
1,2,4-Trichlorobenzene	<630	<200	<200	<200
Naphthalene	<630	<200	<200	<200
4-Chloroaniline	<360	<110	<110	<110
Hexachlorobutadiene	<760	<240	<240	<240
4-Chloro-3-methylphenol	<340	<110	<110	<110
2-Methylnaphthalene	<670	<210	<210	<210
Hexachlorocyclopentadiene	<440	<140	<140	<140
2,4,6-Trichlorophenol	<310	<98	<98	<98
2,4,5-Trichlorophenol	<290	<92	<92	<92
2-Chloronaphthalene	<270	<85	<85	<84
2-Nitroaniline	<230	<71	<71	<71
Dimethylphthalate	<560	<170	<170	<170
Acenaphthylene	<290	<91	<91	<91
2,6-Dinitrotoluene	<350	<110	<110	<110

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE [illegible]
CHECKED BY [illegible]
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN FISH TISSUE
Concentration in ug/kg (dry)

CHART = 69FSSVB wp8c\69-sv.wr1 (5-B)

COMPOUND	69TI4-1	69TI4-2	69TI5-1	69TI5-2
3-Nitroaniline	<380	<120	<120	<120
Acenaphthene	<410	<130	<130	<130
2,4-Dinitrophenol	<650	<200	<200	<200
4-Nitrophenol	<560	<170	<170	<170
Dibenzofuran	<220	<69	<69	<69
2,4-Dinitrotoluene	<240	<75	<75	<75
Diethylphthalate	<500	<160	<160	<160
4-Chlorophenyl-phenylether	<250	<79	<79	<79
Fluorene	<330	<100	<100	<100
4-Nitroaniline	<580	<180	<180	<180
4,6-Dinitro-2-methylphenol	<510	<160	<160	<160
N-Nitrosodiphenylamine	<230	<72	<72	<72
4-Bromophenyl-phenylether	<210	<66	<66	<66
Hexachlorobenzene	<290	<91	<91	<91
Pentachlorophenol	<470	<150	<150	<150
Phenanthrene	<210	<64	<64	<64
Anthracene	<230	<71	<71	<71
Di-n-butylphthalate	440	150	180	160
Fluoranthene	<340	<110	<110	<110
Pyrene	<220	<67	<67	<67
Butylbenzylphthalate	<440	<140	<140	<140
3,3'-Dichlorobenzidine	<340	<110	<110	<110
Benzo(a)anthracene	<190	<59	<59	<59
Chrysene	<290	<92	<92	<92
bis(2-Ethylhexyl)phthalate	<420	<130	<130	<130
Di-n-octylphthalate	<210	<67	<67	<67
Benzo(b)fluoranthene	<410	<130	<130	<130
Benzo(k)fluoranthene	<510	<160	<160	<160
Benzo(a)pyrene	<550	<170	<170	<170
Indeno(1,2,3-cd)pyrene	<290	<91	<91	<90
Dibenz(a,h)anthracene	<190	<59	<59	<59
Benzo(g,h,i)perylene	<220	<70	<70	<70

CAMP LEJEUNE - SITE 69
PESTICIDES IN FISH TISSUE SAMPLES
Concentration in ug/kg - dry

CHART = 69FISHP   sy\wp8d\69-pest.wr1 (5)

PESTICIDE/PCB	69T14-1	69T14-2	69T15-1	69T15-2
alpha-BHC	<140	<120	<97.0	<110
beta-BHC	<140	<120	<97.0	<110
delta-BHC	<140	<120	<97.0	<110
gamma-BHC (Lindane)	<140	<120	<97.0	<110
Heptachlor	<140	<120	<97.0	<110
Aldrin	<140	<120	<97.0	<110
Heptachlor epoxide	<140	<120	<97.0	<110
Endosulfan, A	<140	<120	<97.0	<110
Dieldrin	<270	<230	<190	<220
DDE, PP'	<270	<230	<190	<220
Endrin	<270	<230	<190	<220
Endosulfan, B	<270	<230	<190	<220
DDD, PP'	<270	<230	<190	<220
Endosulfan sulfate	<270	<230	<190	<220
DDT, PP'	<270	<230	<190	<220
Methoxychlor	<1400	<1200	<970	<1100
Endrin ketone	<270	<230	<190	<220
alpha-Chlordane	<1400	<1200	<970	<1100
gamma-Chlordane	<1400	<1200	<970	<1100
Toxaphene	<2700	<2300	<1900	<2200
PCB-1016	<1400	<1200	<970	<1100
PCB-1221	<1400	<1200	<970	<1100
PCB-1232	<1400	<1200	<970	<1100
PCB-1242	<1400	<1200	<970	<1100
PCB-1248	<1400	<1200	<970	<1100
PCB-1254	<2700	<2300	<1900	<2200
PCB-1260	<2700	<2300	<1900	<2200

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/10/91
COMMENTS

CAMP LEJEUNE - SITE 69
INORGANICS IN FISH TISSUE
Concentration in mg/kg (wet)

CHART = 69FISHIN

wp1e\69-inor.wr1 (5)

METAL/COMPOUND	69T14-1	69T14-2	69T15-1	69T15-2
Aluminum	1740	106	150	142
Antimony	<1.3	<1.3	<1.3	1.8
Arsenic	1.0	1.0	0.5	0.6
Barium	1.6	<0.2	<0.2	<0.2
Beryllium	<0.2	0.02	0.04	<0.2
Cadmium	<0.4	<0.4	<0.4	<0.4
Calcium	4590	4530	2840	15900
Chromium	11.2	5.2	1.3	0.7
Cobalt	<0.6	<0.6	<0.6	<0.6
Copper	16.2	52.4	4.8	6.9
Iron	1790	128	144	165
Lead	2.0	2.2	<0.2	<0.2
Magnesium	892	728	722	753
Manganese	7.1	1.6	1.6	2.9
Mercury	<0.05	<0.05	<0.05	<0.05
Nickel	4.5	7.5	0.8	1.4
Potassium	1160	1580	1620	1380
Selenium	0.3	0.3	0.3	0.4
Silver	0.3	0.4	0.4	0.3
Sodium	4440	4930	4800	4730
Thallium	<0.4	<0.4	<0.4	<0.4
Vanadium	3.6	0.4	0.3	0.4
Zinc	92.9	118	102	151
Cyanide	<2.0	<2.0	<2.0	<2.0

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY E.C. Krypfel
DATE 5/13/91
COMMENTS

CAMP LEJEUNE - SITE 69
INORGANICS IN SURFACE WATER
Concentration in ug/l

CHART = 69SWING

wp1e\69-inor.wr1 (3)

METAL/COMPOUND	69SW1	69SW5-1
Aluminum	622	309
Antimony	13.3U	13.3U
Arsenic	1.5U	1.5U
Barium	28.2B	1.7U
Beryllium	0.50U	0.50U
Cadmium	4.3U	4.3U
Calcium	3630B	241000
Chromium	1.5U	1.5U
Cobalt	6.0U	6.0U
Copper	6.4B	3.2U
Iron	4420	159
Lead	1.7U	1.7U
Magnesium	986B	753000
Manganese	223	1.2U
Mercury	0.10U	0.10U
Nickel	5.2U	5.2U
Potassium	710B	318000
Selenium	3.4U	3.4U
Silver	2.4B	3.1B
Sodium	5090	6.8U
Thallium	4.4U	8.8U
Vanadium	2.4U	5.0B
Zinc	1960	2.7U
Cyanide	10.0U	11.2

PROJECT Camp Lejeune
PREPARED BY Judy Gumma
DATE April 1991
CHECKED BY E.C. Knapp
DATE 5/14/91

CAMP LEJEUNE - SITE 69
INORGANICS IN SEDIMENT
Concentration in mg/kg

CHART = 69SEING wp1e\69-inor.wr1 (4)

METAL/COMPOUND	69SE1	69SE4-1	69SE4-2	69SE5-1	69SE5-2
Aluminum	2430.00	2650.00	2510.00	1950.00	2080.00
Antimony	3.40B	7.20BN	7.80BN	9.70BN	6.60UN
Arsenic	0.42U	0.48U	0.49U	0.45U	0.45U
Barium	7.60B	5.40B	4.40B	3.60B	3.20B
Beryllium	0.74B	0.26U	0.23U	0.24U	0.25U
Cadmium	0.56U	1.80	1.60	0.73B	0.74U
Calcium	30.80B	465.00B	295.00B	486.00B	324.00B
Chromium	3.50	6.40	6.00	5.60	4.90
Cobalt	1.10U	2.00B	1.80B	1.90B	1.70B
Copper	0.74B	2.00B	0.69B	0.97B	1.20B
Iron	1550.00	2890.00E	2700.00E	2140.00E	2340.00E
Lead	1.70	2.70N*	2.60N*	2.60N*	3.10N*
Magnesium	74.20B	902.00B	766.00B	833.00B	829.00B
Manganese	2.00B	14.10	12.40	7.80	8.60
Mercury	0.12U	0.11U	0.13U	0.13U	0.12U
Nickel	1.70U	4.10B	2.80B	2.20U	4.70B
Potassium	50.70U	582.00B	527.00B	535.00B	456.00B
Selenium	0.21U	0.24U	0.25UW	0.23UW	0.23UW
Silver	0.74U	1.00U	0.92U	0.97B	0.98U
Sodium	76.10B	3290.00	2400.00	3230.00	2970.00
Thallium	0.21U	0.24U	0.25U	0.23U	0.23U
Vanadium	3.00B	6.90B	6.20B	4.60B	5.40B
Zinc	19.50	7.40	6.70	6.10	6.10
Cyanide	1.40U	0.84U	0.80U	0.86U	0.82U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5-9-91

CAMP LEJEUNE - SITE 69
PESTICIDES IN SURFACE WATER
Concentration in ug/l

CHART = 69SWPEST sy\wp8d\69-pest.wr1 (3)

PESTICIDE/PCB	69SW1	69SW4-1	69SW4-2	69SW5-2
alpha-BHC	.05U	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U	.10U
Endrin	.10U	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY Judy Guma
DATE April 1991
CHECKED BY E.C. Kimpel
DATE 5/13/91
COMMENTS

CAMP LEJEUNE - SITE 69
PESTICIDES IN SEDIMENT
Concentration in ug/kg

CHART = 69SEPEST   sy\wp8d\69-pest.wr1 (4)

PESTICIDE/PCB	69SE1	69SE4-1	69SE4-2	69SE5-1	69SE5-2
alpha-BHC	12U	12U	11U	12U	12U
beta-BHC	12U	12U	11U	12U	12U
delta-BHC	12U	12U	11U	12U	12U
gamma-BHC (Lindane)	12U	12U	11U	12U	12U
Heptachlor	12U	12U	11U	12U	12U
Aldrin	12U	12U	11U	12U	12U
Heptachlor epoxide	12U	12U	11U	12U	12U
Endosulfan I	12U	12U	11U	12U	12U
Dieldrin	24U	23U	22U	23U	23U
4,4'-DDE	24U	23U	22U	23U	23U
Endrin	24U	23U	22U	23U	23U
Endosulfan II	24U	23U	22U	23U	23U
4,4'-DDD	24U	23U	22U	23U	23U
Endosulfan sulfate	24U	23U	22U	23U	23U
4,4'-DDT	24U	23U	22U	23U	23U
Methoxychlor	120U	120U	110U	120U	120U
Endrin ketone	24U	23U	22U	23U	23U
alpha-Chlordane	120U	120U	110U	120U	120U
gamma-Chlordane	120U	120U	110U	120U	120U
Toxaphene	240U	230U	220U	230U	230U
Aroclor-1016	120U	120U	110U	120U	120U
Aroclor-1221	120U	120U	110U	120U	120U
Aroclor-1232	120U	120U	110U	120U	120U
Aroclor-1242	120U	120U	110U	120U	120U
Aroclor-1248	120U	120U	110U	120U	120U
Aroclor-1254	240U	230U	220U	230U	230U
Aroclor-1260	240U	230U	220U	230U	230U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April [illegible]
CHECKED BY [illegible]
DATE 5/8/91
COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER
Concentration in ug/l

CHART = 69SWSVA wp8c\69-sv.wr1 (3-A)

COMPOUND	69SW1	69SW4-1	69SW4-2	69SW5-2
Phenol	10.U	20.U	10.U	10.U
bis(2-Chloroethyl)ether	10.U	20.U	10.U	10.U
2-Chlorophenol	10.U	20.U	10.U	10.U
1,3-Dichlorobenzene	10.U	20.U	10.U	10.U
1,4-Dichlorobenzene	10.U	20.U	10.U	10.U
Benzyl Alcohol	10.U	20.U	10.U	10.U
1,2-Dichlorobenzene	10.U	20.U	10.U	10.U
2-Methylphenol	10.U	20.U	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	20.U	10.U	10.U
4-Methylphenol	10.U	20.U	10.U	10.U
N-Nitroso-di-n-propylamine	10.U	20.U	10.U	10.U
Hexachloroethane	10.U	20.U	10.U	10.U
Nitrobenzene	10.U	20.U	10.U	10.U
Isophorone	10.U	20.U	10.U	10.U
2-Nitrophenol	10.U	20.U	10.U	10.U
2,4-Dimethylphenol	10.U	20.U	10.U	10.U
Benzoic acid	50.U	100.U	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	20.U	10.U	10.U
2,4-Dichlorophenol	10.U	20.U	10.U	10.U
1,2,4-Trichlorobenzene	10.U	20.U	10.U	10.U
Naphthalene	10.U	20.U	10.U	10.U
4-Chloroaniline	10.U	20.U	10.U	10.U
Hexachlorobutadiene	10.U	20.U	10.U	10.U
4-Chloro-3-methylphenol	10.U	20.U	10.U	10.U
2-Methylnaphthalene	10.U	20.U	10.U	10.U
Hexachlorocyclopentadiene	10.U	20.U	10.U	10.U
2,4,6-Trichlorophenol	10.U	20.U	10.U	10.U
2,4,5-Trichlorophenol	50.U	100.U	50.U	50.U
2-Chloronaphthalene	10.U	20.U	10.U	10.U
2-Nitroaniline	50.U	100.U	50.U	50.U
Dimethylphthalate	10.U	20.U	10.U	10.U
Acenaphthylene	10.U	20.U	10.U	10.U
2,6-Dinitrotoluene	10.U	20.U	10.U	10.U

PROJECT Camp Lejeune
PREPARED BY Judy Gunn
DATE April 1991
CHECKED BY Micky Sayre
DATE 5/10/91
COMMENTS

CAMP LEJEUNE - SITE 69

SEMI-VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER

Concentration in ug/l

CHART = 69SWSVB wp8c\69-sv.wr1 (3-B)

COMPOUND	69SW1	69SW4-1	69SW4-2	69SW5-2
3-Nitroaniline	50.U	100.U	50.U	50.U
Acenaphthene	10.U	20.U	10.U	10.U
2,4-Dinitrophenol	50.U	100.U	50.U	50.U
4-Nitrophenol	50.U	100.U	50.U	50.U
Dibenzofuran	10.U	20.U	10.U	10.U
2,4-Dinitrotoluene	10.U	20.U	10.U	10.U
Diethylphthalate	10.U	20.U	10.U	10.U
4-Chlorophenyl-phenylether	10.U	20.U	10.U	10.U
Fluorene	10.U	20.U	10.U	10.U
4-Nitroaniline	50.U	100.U	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	100.U	50.U	50.U
N-Nitrosodiphenylamine	10.U	20.U	10.U	10.U
4-Bromophenyl-phenylether	10.U	20.U	10.U	10.U
Hexachlorobenzene	10.U	20.U	10.U	10.U
Pentachlorophenol	50.U	100.U	50.U	50.U
Phenanthrene	10.U	20.U	10.U	10.U
Anthracene	10.U	20.U	10.U	10.U
Di-n-butylphthalate	10.U	20.U	10.U	10.U
Fluoranthene	10.U	20.U	10.U	10.U
Pyrene	10.U	20.U	10.U	10.U
Butylbenzylphthalate	10.U	20.U	10.U	10.U
3,3'-Dichlorobenzidine	20.U	40.U	20.U	20.U
Benzo(a)anthracene	10.U	20.U	10.U	10.U
Chrysene	10.U	20.U	10.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	20.U	10.U	10.U
Di-n-octylphthalate	10.U	20.U	10.U	10.U
Benzo(b)fluoranthene	10.U	20.U	10.U	10.U
Benzo(k)fluoranthene	10.U	20.U	10.U	10.U
Benzo(a)pyrene	10.U	20.U	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	20.U	10.U	10.U
Dibenz(a,h)anthracene	10.U	20.U	10.U	10.U
Benzo(g,h,i)perylene	10.U	20.U	10.U	10.U

PROJECT Camp Lejeune

PREPARED BY [illegible]

DATE April 1991

CHECKED BY [illegible]

DATE 5/10/91

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN SEDIMENT
Concentration in ug/kg

CHART = 69SESVA wp8c\69-sv.wr1 (4-A)

COMPOUND	69SE1	69SE4-1	69SE4-2	69SE5-1	69SE5-2
Phenol	2400U	490U	450U	480U	480U
bis(2-Chloroethyl)ether	2400U	490U	450U	480U	480U
2-Chlorophenol	2400U	490U	450U	480U	480U
1,3-Dichlorobenzene	2400U	490U	450U	480U	480U
1,4-Dichlorobenzene	2400U	490U	450U	480U	480U
Benzyl Alcohol	2400U	490U	450U	480U	480U
1,2-Dichlorobenzene	2400U	490U	450U	480U	480U
2-Methylphenol	2400U	490U	450U	480U	480U
bis(2-Chloroisopropyl)ether	2400U	490U	450U	480U	480U
4-Methylphenol	2400U	490U	450U	55J	480U
N-Nitroso-di-n-propylamine	2400U	490U	450U	480U	480U
Hexachloroethane	2400U	490U	450U	480U	480U
Nitrobenzene	2400U	490U	450U	480U	480U
Isophorone	2400U	490U	450U	480U	480U
2-Nitrophenol	2400U	490U	450U	480U	480U
2,4-Dimethylphenol	2400U	490U	450U	480U	480U
Benzoic acid	12000U	2400U	2200U	2300U	2300U
bis(2-Chloroethoxy)methane	2400U	490U	450U	480U	480U
2,4-Dichlorophenol	2400U	490U	450U	480U	480U
1,2,4-Trichlorobenzene	2400U	490U	450U	480U	480U
Naphthalene	2400U	490U	450U	480U	480U
4-Chloroaniline	2400U	490U	450U	480U	480U
Hexachlorobutadiene	2400U	490U	450U	480U	480U
4-Chloro-3-methylphenol	2400U	490U	450U	480U	480U
2-Methylnaphthalene	2400U	490U	450U	480U	480U
Hexachlorocyclopentadiene	2400U	490U	450U	480U	480U
2,4,6-Trichlorophenol	2400U	490U	450U	480U	480U
2,4,5-Trichlorophenol	12000U	2400U	2200U	2300U	2300U
2-Chloronaphthalene	2400U	490U	450U	480U	480U
2-Nitroaniline	12000U	2400U	2200U	2300U	2300U
Dimethylphthalate	2400U	490U	450U	480U	480U
Acenaphthylene	2400U	490U	450U	480U	480U
2,6-Dinitrotoluene	2400U	490U	450U	480U	480U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/8/91

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN SEDIMENT
Concentration in ug/kg

CHART = 69SESVB wp8c\69-sv.wr1 (4-B)

COMPOUND	69SE1	69SE4-1	69SE4-2	69SE5-1	69SE5-2
3-Nitroaniline	12000U	2400U	2200U	2300U	2300U
Acenaphthene	2400U	490U	450U	480U	480U
2,4-Dinitrophenol	12000U	2400U	2200U	2300U	2300U
4-Nitrophenol	12000U	2400U	2200U	2300U	2300U
Dibenzofuran	2400U	490U	450U	480U	480U
2,4-Dinitrotoluene	2400U	490U	450U	480U	480U
Diethylphthalate	2400U	490U	450U	480U	480U
4-Chlorophenyl-phenylether	2400U	490U	450U	480U	480U
Fluorene	2400U	490U	450U	480U	480U
4-Nitroaniline	12000U	2400U	2200U	2300U	2300U
4,6-Dinitro-2-methylphenol	12000U	2400U	2200U	2300U	2300U
N-Nitrosodiphenylamine	2400U	490U	450U	480U	480U
4-Bromophenyl-phenylether	2400U	490U	450U	480U	480U
Hexachlorobenzene	2400U	490U	450U	480U	480U
Pentachlorophenol	12000U	2400U	2200U	2300U	2300U
Phenanthrene	2400U	490U	450U	480U	480U
Anthracene	2400U	490U	450U	480U	480U
Di-n-butylphthalate	2400U	490U	450U	480U	480U
Fluoranthene	2400U	490U	450U	480U	480U
Pyrene	2400U	490U	450U	480U	480U
Butylbenzylphthalate	2400U	490U	450U	480U	480U
3,3'-Dichlorobenzidine	4900U	970U	900U	960U	960U
Benzo(a)anthracene	2400U	490U	450U	480U	480U
Chrysene	2400U	490U	450U	480U	480U
bis(2-Ethylhexyl)phthalate	2400U	490U	450U	480U	480U
Di-n-octylphthalate	2400U	490U	450U	480U	480U
Benzo(b)fluoranthene	2400U	490U	450U	480U	480U
Benzo(k)fluoranthene	2400U	490U	450U	480U	480U
Benzo(a)pyrene	2400U	490U	450U	480U	480U
Indeno(1,2,3-cd)pyrene	2400U	490U	450U	480U	480U
Dibenz(a,h)anthracene	2400U	490U	450U	480U	480U
Benzo(g,h,i)perylene	2400U	490U	450U	480U	480U

CAMP LEJEUNE - SITE 69
VOLATILE ORGANIC COMPOUNDS IN SURFACE WATER
Concentration in ug/l

CHART = 69VOLSW wp8b\69-vol.wr1 (3)

COMPOUND	69SW1	69SW4-1	69SW4-2	69SW5-2
Chloromethane	10.U	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U
Vinyl Chloride	15.	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U	10.U
Methylene Chloride	5.U	1.BJ	2.J	5.U
Acetone	22.	7.J	10.U	10.U
Carbon Disulfide	28.	5.U	5.U	5.U
1,1-Dichloroethene	5.U	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U	5.U
1,2-Dichloroethene (total)	190.	5.U	5.U	5.U
Chloroform	3.J	5.U	5.U	5.U
1,2-Dichloroethane	5.U	5.U	5.U	5.U
2-Butanone	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U
Trichloroethene	7.	5.U	5.U	5.U
Dibromochloromethane	5.U	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U	5.U
Benzene	5.U	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.	5.U	5.U	5.U
Toluene	2.J	5.U	5.U	5.U
Chlorobenzene	5.U	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U	5.U
Styrene	5.U	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U	5.U

PROJECT Camp Lejeune
PREPARED BY Paul M. Feinberg
DATE April 1991
CHECKED BY Judy Guna
DATE 5-10-91
COMMENTS

CAMP LEJEUNE - SITE 69
VOLATILE ORGANIC COMPOUNDS IN SEDIMENT
Concentration in ug/kg

CHART = 69VOLSE   wp8b\69-vol.wr1 (4)

COMPOUND	69SE4-1	69SE4-2	69SE5-1	69SE5-2
Chloromethane	15U	14U	14U	14U
Bromomethane	15U	14U	14U	14U
Vinyl Chloride	15U	14U	14U	14U
Chloroethane	15U	14U	14U	14U
Methylene Chloride	3BJ	2BJ	2BJ	2BJ
Acetone	490BE	820BE	23B	30B
Carbon Disulfide	7U	7U	7U	7U
1,1-Dichloroethene	7U	7U	7U	7U
1,1-Dichloroethane	7U	7U	7U	7U
1,2-Dichloroethene (total)	7U	7U	7U	7U
Chloroform	7U	7U	7U	7U
1,2-Dichloroethane	7U	7U	7U	7U
2-Butanone	15U	14U	14U	14U
1,1,1-Trichloroethane	7U	7U	7U	7U
Carbon Tetrachloride	7U	7U	7U	7U
Vinyl Acetate	15U	14U	14U	14U
Bromodichloromethane	7U	7U	7U	7U
1,2-Dichloropropane	7U	7U	7U	7U
cis-1,3-Dichloropropene	7U	7U	7U	7U
Trichloroethene	7U	7U	7U	7U
Dibromochloromethane	7U	7U	7U	7U
1,1,2-Trichloroethane	7U	7U	7U	7U
Benzene	7U	7U	7U	7U
trans-1,3-Dichloropropene	7U	7U	7U	7U
Bromoform	7U	7U	7U	7U
4-Methyl-2-Pentanone	15U	14U	14U	14U
2-Hexanone	15U	14U	14U	14U
Tetrachloroethene	7U	7U	7U	7U
1,1,2,2-Tetrachloroethane	7U	7U	7U	7U
Toluene	7U	7U	7U	7U
Chlorobenzene	7U	7U	7U	7U
Ethylbenzene	7U	7U	7U	7U
Styrene	7U	7U	7U	7U
Xylene (total)	7U	7U	7U	7U

PROJECT Camp Lejeune
PREPARED BY Paul M. Feinberg
DATE April 1991
CHECKED BY Judy Guma
DATE 5-10-91
COMMENTS

CAMP LEJEUNE - SITE 69
INORGANICS IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWING1 wp1e\69-inor.wr1 (1)

METAL/COMPOUND	69GW1	69GW2	69GW3	69GW4	69GW5	69GW6
Aluminum	2300	19900	28900	43800	33700	2520
Antimony	13.3U	68.5	13.3U	13.3U	13.3U	13.3U
Arsenic	4.6B	1.5U	11.4	3.5B	7.4B	3.8B
Barium	54.5B	63.0B	70.8B	77.0B	153B	46.5B
Beryllium	1.9B	1.2B	0.94B	0.50U	3.0B	0.85B
Cadmium	4.3U	4.3U	4.3U	4.3U	4.3U	4.3U
Calcium	4340B	7670	4560B	2500B	8330	3330B
Chromium	5.3B	46.6	36.4	47.6	42.3	9.7B
Cobalt	6.0U	6.0U	9.7B	8.6B	6.0U	6.0U
Copper	3.3B	13.5B	14.6B	12.7B	27.5	12.8B
Iron	7740	792000	51900	59000	39600	10900
Lead	2.6B	14.6	22.6M	14.0	23.9	3.4
Magnesium	2350B	2030B	2390B	1970B	4510B	2390B
Manganese	67.5	99.6	193	207	230	68.1
Mercury	0.10U	0.10U	0.10U	0.10U	0.10U	0.10U
Nickel	5.2U	5.2U	15.4B	12.5B	27.6B	19.0B
Potassium	2120B	1900B	4190B	3050B	3430B	1450B
Selenium	3.4U	3.4U	3.4U	3.4U	3.4U	3.4U
Silver	1.7B	13.9	1.8B	6.5B	1.6B	1.6U
Sodium	10400	18900	8530	6840	6000	8830
Thallium	5.2B	4.9B	4.4U	4.4U	4.4U	4.4U
Vanadium	6.1B	2240	53.6	65.3	57.8	6.5B
Zinc	67.3	143	3710	10200	155	101
Cyanide	10.0U	11.2	10.0U	10.0U	10.0U	10.0U

PROJECT Camp Lejeune
PREPARED BY ED [illegible]
DATE April 1991
CHECKED BY Judy [illegible]
DATE 5-6-91
COMMENTS

CAMP LEJEUNE - SITE 69
INORGANICS IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWING2

wp1e\69-inor.wr1 (2)

METAL/COMPOUND	69GW7	69GW8	69GW8D (GWDUP6)
Aluminum	4510	24100	20.7U
Antimony	13.3U	13.3U	13.3U
Arsenic	2.8B	1.5U	1.8B
Barium	36.6B	188B	2.8B
Beryllium	0.91B	1.3B	0.97B
Cadmium	4.3U	4.3U	4.3U
Calcium	4300B	7460	15.6B
Chromium	12.1	22.1	1.5U
Cobalt	6.0U	6.0U	6.0U
Copper	4.9B	7.4B	3.2U
Iron	9380	10700	63.1B
Lead	6.2	20.4	16.4
Magnesium	2190B	3100B	12.0U
Manganese	14.6B	168	2.0B
Mercury	0.10U	0.10U	0.10U
Nickel	5.2U	5.7B	5.2U
Potassium	1750B	2510B	343U
Selenium	3.4U	3.4U	3.4U
Silver	4.5B	2.4B	235
Sodium	5750	4880B	6.8U
Thallium	4.4U	4.4U	4.4U
Vanadium	10.3B	25.6B	2.4U
Zinc	51.8	53.2	11.3B
Cyanide	10.0U	10.0U	10.0U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY [illegible]
DATE 5/14/91
COMMENTS

CAMP LEJEUNE - SITE 69
PESTICIDES IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWPES1 sy\wp8d\69-pest.wr1 (1)

PESTICIDE/PCB	69GW1	69GW2	69GW3	69GW4	69GW5	69GW6
alpha-BHC	.05U	.05U	.12	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U	.10U	.10U	.10U
Endrin	.10U	.10U	.10U	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U	1.0U	1.0U	1.0U

CAMP LEJEUNE - SITE 69
PESTICIDES IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWPES2 sy\wp8d\69-pest.wr1 (2)

PESTICIDE/PCB	69GW7	69GW8	69GW8D (GWDUP6)
alpha-BHC	.05U	.05U	.05U
beta-BHC	.05U	.05U	.05U
delta-BHC	.05U	.05U	.05U
gamma-BHC (Lindane)	.05U	.05U	.05U
Heptachlor	.05U	.05U	.05U
Aldrin	.05U	.05U	.05U
Heptachlor epoxide	.05U	.05U	.05U
Endosulfan I	.05U	.05U	.05U
Dieldrin	.10U	.10U	.10U
4,4'-DDE	.10U	.10U	.10U
Endrin	.10U	.10U	.10U
Endosulfan II	.10U	.10U	.10U
4,4'-DDD	.10U	.10U	.10U
Endosulfan sulfate	.10U	.10U	.10U
4,4'-DDT	.10U	.10U	.10U
Methoxychlor	.50U	.50U	.50U
Endrin ketone	.10U	.10U	.10U
alpha-Chlordane	.50U	.50U	.50U
gamma-Chlordane	.50U	.50U	.50U
Toxaphene	1.0U	1.0U	1.0U
Aroclor-1016	.50U	.50U	.50U
Aroclor-1221	.50U	.50U	.50U
Aroclor-1232	.50U	.50U	.50U
Aroclor-1242	.50U	.50U	.50U
Aroclor-1248	.50U	.50U	.50U
Aroclor-1254	1.0U	1.0U	1.0U
Aroclor-1260	1.0U	1.0U	1.0U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE 5-13-91
CHECKED BY Judy Guma
DATE 5-13-91

CAMP LEJEUNE - SITE 69

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 69GWSV1A wp8c\69-sv.wr1 (1-A)

COMPOUND	69GW1	69GW2	69GW3	69GW4	69GW5	69GW6
Phenol	10.U	10.U	10.U	10.U	11.U	10.U
bis(2-Chloroethyl)ether	10.U	10.U	10.U	10.U	11.U	10.U
2-Chlorophenol	10.U	10.U	10.U	10.U	11.U	10.U
1,3-Dichlorobenzene	10.U	10.U	10.U	10.U	11.U	10.U
1,4-Dichlorobenzene	10.U	10.U	10.U	10.U	11.U	10.U
Benzyl Alcohol	10.U	10.U	10.U	10.U	11.U	10.U
1,2-Dichlorobenzene	10.U	10.U	10.U	10.U	11.U	10.U
2-Methylphenol	10.U	10.U	10.U	10.U	11.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U	10.U	11.U	10.U
4-Methylphenol	10.U	10.U	10.U	10.U	11.U	10.U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U	10.U	11.U	10.U
Hexachloroethane	10.U	10.U	10.U	10.U	11.U	10.U
Nitrobenzene	10.U	10.U	10.U	10.U	11.U	10.U
Isophorone	10.U	10.U	10.U	10.U	11.U	10.U
2-Nitrophenol	10.U	10.U	10.U	10.U	11.U	10.U
2,4-Dimethylphenol	10.U	10.U	10.U	10.U	11.U	10.U
Benzoic acid	50.U	50.U	50.U	50.U	54.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U	10.U	11.U	10.U
2,4-Dichlorophenol	10.U	10.U	10.U	10.U	11.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U	10.U	10.U	11.U	10.U
Naphthalene	10.U	10.U	10.U	10.U	11.U	10.U
4-Chloroaniline	10.U	10.U	10.U	10.U	11.U	10.U
Hexachlorobutadiene	10.U	10.U	10.U	10.U	11.U	10.U
4-Chloro-3-methylphenol	10.U	10.U	10.U	10.U	11.U	10.U
2-Methylnaphthalene	10.U	10.U	10.U	10.U	11.U	10.U
Hexachlorocyclopentadiene	10.U	10.U	10.U	10.U	11.U	10.U
2,4,6-Trichlorophenol	10.U	10.U	10.U	10.U	11.U	10.U
2,4,5-Trichlorophenol	50.U	50.U	50.U	50.U	54.U	50.U
2-Chloronaphthalene	10.U	10.U	10.U	10.U	11.U	10.U
2-Nitroaniline	50.U	50.U	50.U	50.U	54.U	50.U
Dimethylphthalate	10.U	10.U	10.U	10.U	11.U	10.U
Acenaphthylene	10.U	10.U	10.U	10.U	11.U	10.U
2,6-Dinitrotoluene	10.U	10.U	10.U	10.U	11.U	10.U

PROJECT Camp Lejeune

PREPARED BY [illegible]

DATE April 1991

CHECKED BY [illegible]

DATE 5/6/91

COMMENTS

CAMP LEJEUNE - SITE 69

SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 69GWSV1B wp8c\69-sv.wr1 (1-B)

COMPOUND	69GW1	69GW2	69GW3	69GW4	69GW5	69GW6
3-Nitroaniline	50.U	50.U	50.U	50.U	54.U	50.U
Acenaphthene	10.U	10.U	10.U	10.U	11.U	10.U
2,4-Dinitrophenol	50.U	50.U	50.U	50.U	54.U	50.U
4-Nitrophenol	50.U	50.U	50.U	50.U	54.U	50.U
Dibenzofuran	10.U	10.U	10.U	10.U	11.U	10.U
2,4-Dinitrotoluene	10.U	10.U	10.U	10.U	11.U	10.U
Diethylphthalate	10.U	10.U	10.U	10.U	11.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U	10.U	10.U	11.U	10.U
Fluorene	10.U	10.U	10.U	10.U	11.U	10.U
4-Nitroaniline	50.U	50.U	50.U	50.U	54.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U	50.U	54.U	50.U
N-Nitrosodiphenylamine	10.U	10.U	10.U	10.U	11.U	10.U
4-Bromophenyl-phenylether	10.U	10.U	10.U	10.U	11.U	10.U
Hexachlorobenzene	10.U	10.U	10.U	10.U	11.U	10.U
Pentachlorophenol	50.U	50.U	50.U	50.U	54.U	50.U
Phenanthrene	10.U	10.U	10.U	10.U	11.U	10.U
Anthracene	10.U	10.U	10.U	10.U	11.U	10.U
Di-n-butylphthalate	10.U	10.U	10.U	10.U	11.U	10.U
Fluoranthene	10.U	10.U	10.U	10.U	11.U	10.U
Pyrene	10.U	10.U	10.U	10.U	11.U	10.U
Butylbenzylphthalate	10.U	10.U	10.U	10.U	11.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U	20.U	20.U	21.U	20.U
Benzo(a)anthracene	10.U	10.U	10.U	10.U	11.U	10.U
Chrysene	10.U	10.U	10.U	10.U	11.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U	10.U	11.U	10.U
Di-n-octylphthalate	10.U	10.U	10.U	10.U	11.U	10.U
Benzo(b)fluoranthene	10.U	10.U	10.U	10.U	11.U	10.U
Benzo(k)fluoranthene	10.U	10.U	10.U	10.U	11.U	10.U
Benzo(a)pyrene	10.U	10.U	10.U	10.U	11.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U	10.U	11.U	10.U
Dibenz(a,h)anthracene	10.U	10.U	10.U	10.U	11.U	10.U
Benzo(g,h,i)perylene	10.U	10.U	10.U	10.U	11.U	10.U

PROJECT Camp Lejeune

PREPARED BY

DATE

CHECKED BY

DATE 5/6/91

COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWSV2A wp8c\69-sv.wr1 (2-A)

COMPOUND	69GW7	69GW8	69GW8D (GWDUP6)
Phenol	10.U	10.U	10.U
bis(2-Chloroethyl)ether	10.U	10.U	10.U
2-Chlorophenol	10.U	10.U	10.U
1,3-Dichlorobenzene	10.U	10.U	10.U
1,4-Dichlorobenzene	10.U	10.U	10.U
Benzyl Alcohol	10.U	10.U	10.U
1,2-Dichlorobenzene	10.U	10.U	10.U
2-Methylphenol	10.U	10.U	10.U
bis(2-Chloroisopropyl)ether	10.U	10.U	10.U
4-Methylphenol	10.U	10.U	10.U
N-Nitroso-di-n-propylamine	10.U	10.U	10.U
Hexachloroethane	10.U	10.U	10.U
Nitrobenzene	10.U	10.U	10.U
Isophorone	10.U	10.U	10.U
2-Nitrophenol	10.U	10.U	10.U
2,4-Dimethylphenol	10.U	10.U	10.U
Benzoic acid	50.U	50.U	50.U
bis(2-Chloroethoxy)methane	10.U	10.U	10.U
2,4-Dichlorophenol	10.U	10.U	10.U
1,2,4-Trichlorobenzene	10.U	10.U	10.U
Naphthalene	10.U	10.U	10.U
4-Chloroaniline	10.U	10.U	10.U
Hexachlorobutadiene	10.U	10.U	10.U
4-Chloro-3-methylphenol	10.U	10.U	10.U
2-Methylnaphthalene	10.U	10.U	10.U
Hexachlorocyclopentadiene	10.U	10.U	10.U
2,4,6-Trichlorophenol	10.U	10.U	10.U
2,4,5-Trichlorophenol	50.U	50.U	50.U
2-Chloronaphthalene	10.U	10.U	10.U
2-Nitroaniline	50.U	50.U	50.U
Dimethylphthalate	10.U	10.U	10.U
Acenaphthylene	10.U	10.U	10.U
2,6-Dinitrotoluene	10.U	10.U	10.U

PROJECT Camp Lejeune
PREPARED BY Judy Guna
DATE April 1991
CHECKED BY
DATE 5-6-91
COMMENTS

CAMP LEJEUNE - SITE 69
SEMI-VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)
Concentration in ug/l

CHART = 69GWSV2B   wp8c\69-sv.wr1 (2-B)

COMPOUND	69GW7	69GW8	69GW8D (GWDUP6)
3-Nitroaniline	50.U	50.U	50.U
Acenaphthene	10.U	10.U	10.U
2,4-Dinitrophenol	50.U	50.U	50.U
4-Nitrophenol	50.U	50.U	50.U
Dibenzofuran	10.U	10.U	10.U
2,4-Dinitrotoluene	10.U	10.U	10.U
Diethylphthalate	10.U	10.U	10.U
4-Chlorophenyl-phenylether	10.U	10.U	10.U
Fluorene	10.U	10.U	10.U
4-Nitroaniline	50.U	50.U	50.U
4,6-Dinitro-2-methylphenol	50.U	50.U	50.U
N-Nitrosodiphenylamine	10.U	10.U	10.U
4-Bromophenyl-phenylether	10.U	10.U	10.U
Hexachlorobenzene	10.U	10.U	10.U
Pentachlorophenol	50.U	50.U	50.U
Phenanthrene	10.U	10.U	10.U
Anthracene	10.U	10.U	10.U
Di-n-butylphthalate	10.U	10.U	10.U
Fluoranthene	10.U	10.U	10.U
Pyrene	10.U	10.U	10.U
Butylbenzylphthalate	10.U	10.U	10.U
3,3'-Dichlorobenzidine	20.U	20.U	20.U
Benzo(a)anthracene	10.U	10.U	10.U
Chrysene	10.U	10.U	10.U
bis(2-Ethylhexyl)phthalate	10.U	10.U	10.U
Di-n-octylphthalate	10.U	10.U	10.U
Benzo(b)fluoranthene	10.U	10.U	10.U
Benzo(k)fluoranthene	10.U	10.U	10.U
Benzo(a)pyrene	10.U	10.U	10.U
Indeno(1,2,3-cd)pyrene	10.U	10.U	10.U
Dibenz(a,h)anthracene	10.U	10.U	10.U
Benzo(g,h,i)perylene	10.U	10.U	10.U

PROJECT Camp Lejeune
PREPARED BY Judy Hume
DATE April 1991
CHECKED BY
DATE 5-6-91
COMMENTS

CAMP LEJEUNE - SITE 69

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 69GWVOL1 wp8b\69-vol.wr1 (1)

COMPOUND	69GW1	69GW2	69GW3	69GW4	69GW5	69GW6
Chloromethane	10.U	10.U	10.U	16.	10.U	10.U
Bromomethane	10.U	10.U	10.U	10.U	10.U	10.U
Vinyl Chloride	10.U	36.	10.U	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U	10.U	10.U	10.U
Methylene Chloride	5.U	4.J	2.J	5.U	1.BJ	5.U
Acetone	10.U	10.U	10.U	15.	4.J	10.U
Carbon Disulfide	7.	5.J	3.J	5.	8.	5.U
1,1-Dichloroethene	5.U	5.U	5.U	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U	1.J	5.U	5.U
1,2-Dichloroethene (total)	5.U	11000.D	220.	.9J	5.U	70.
Chloroform	5.U	5.U	5.U	1.J	5.U	5.U
1,2-Dichloroethane	5.U	3.J	5.U	4.J	5.U	5.U
2-Butanone	10.U	10.U	10.U	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U	1.J	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U	5.U
Trichloroethene	5.U	67.	5.U	5.U	5.U	92.
Dibromochloromethane	5.U	5.U	5.U	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	.6J	5.U	.8J	5.U	5.U
Benzene	5.U	.9J	2.J	1.J	3.J	.4J
trans-1,3-Dichloropropene	5.U	5.U	5.U	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U	10.U	10.U	10.U
Tetrachloroethene	5.U	2.J	5.U	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	7.	5.U	5.U	5.U	5.U
Toluene	5.U	3.J	5.	2.J	3.J	5.U
Chlorobenzene	5.U	5.U	40.	1.J	5.U	5.U
Ethylbenzene	5.U	5.U	2.J	1.J	5.U	5.U
Styrene	5.U	5.U	5.U	.8J	5.U	5.U
Xylene (total)	5.U	1.J	5.U	5.U	2.J	5.U

PROJECT Camp Lejeune
PREPARED BY [illegible]
DATE April 1991
CHECKED BY Judy Dunn
DATE 5-8-91
COMMENTS 5/14/91 EK

CAMP LEJEUNE - SITE 69

VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER (SHALLOW WELLS)

Concentration in ug/l

CHART = 69GWVOL2 wp8b\69-vol.wr1 (2)

COMPOUND	69GW7	69GW8	69GW8D (GWDUP6)
Chloromethane	10.U	10.U	10.U
Bromomethane	10.U	10.U	10.U
Vinyl Chloride	10.U	10.U	10.U
Chloroethane	10.U	10.U	10.U
Methylene Chloride	2.J	5.U	2.J
Acetone	10.U	10.U	10.U
Carbon Disulfide	5.U	4.J	9.
1,1-Dichloroethene	5.U	5.U	5.U
1,1-Dichloroethane	5.U	5.U	5.U
1,2-Dichloroethene (total)	5.U	5.U	5.U
Chloroform	5.U	1.J	5.U
1,2-Dichloroethane	5.U	5.U	5.U
2-Butanone	10.U	10.U	10.U
1,1,1-Trichloroethane	5.U	5.U	5.U
Carbon Tetrachloride	5.U	5.U	5.U
Vinyl Acetate	10.U	10.U	10.U
Bromodichloromethane	5.U	5.U	5.U
1,2-Dichloropropane	5.U	5.U	5.U
cis-1,3-Dichloropropene	5.U	5.U	5.U
Trichloroethene	5.U	5.U	5.U
Dibromochloromethane	5.U	5.U	5.U
1,1,2-Trichloroethane	5.U	5.U	5.U
Benzene	5.U	5.U	5.U
trans-1,3-Dichloropropene	5.U	5.U	5.U
Bromoform	5.U	5.U	5.U
4-Methyl-2-Pentanone	10.U	10.U	10.U
2-Hexanone	10.U	10.U	10.U
Tetrachloroethene	5.U	5.U	5.U
1,1,2,2-Tetrachloroethane	5.U	5.U	5.U
Toluene	5.U	5.U	5.U
Chlorobenzene	5.U	5.U	5.U
Ethylbenzene	5.U	5.U	5.U
Styrene	5.U	5.U	5.U
Xylene (total)	5.U	5.U	5.U

PROJECT Camp Lejeune

PREPARED BY Ed Kopf

DATE April 1991

CHECKED BY Judy Guma

DATE 5-7-91

APPENDIX I

Hunt ESE, Inc. 01-04-91 *** FIELD LOGSHEET *** F. .D GROUP: 90210001
PROJ... NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
*127	TB-024		T			
*128	TB-025		T			
*129	TB-026		T			
*130	TB-027		T			
*131	TB-028		T			
*132	TB-029		T			
*133	TB-030		T			
*134	TB-031		T			
*135	TB-032		T			
*136	EB-001		T Full TCL	1-7-91	12:50	(7 containers) ✓
*137	EB-002		T Full TCL	1-7-91	14:45	(7 containers) ✓
*138	EB-003		T			
*139	EB-004		T			
*140	EB-005		T			
*141	EB-006		T			
*142	EB-007		T			
*143	EB-008		T			
*144	EB-009		T			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1	[signature] /ESE/1-7-91/17:00	FEDEX AirBill # 9868702174	
2			Jeff Wilson -ESC 1/8/91
3			

SAMPLER: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 5 TO SHIP ON 1/8/91
SAMPLE CUSTODIAN: Custody Seals Intact? ___ Samples Iced? ___ Preservations Audited? ___ Problems? ___

Hunte ˉSE, Inc. 01-04-91 *** FIELD LOGSHEET *** F) GROUP: 90210001

PROJE NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
*199	EB-064	T				
*200	EB-065	T				
*201	EB-066	T				
*202	EB-067	T				
*203	EB-068	T				
*204	MB-001	T				
*205	FB-001	T				
*206	FB-002	T				
*207	DI-001	T	full TCL	1/7/91	1305	(7 containers) ✓
*208	DI-002	T				
*209	DI-003	T				
*210	DI-004	T				
*211	48TI1	T				
*212	48TI2	T				
*213	48TI3	T				
*214	48TI4	T				
*215	48TI5	T				
*216	48TI6	T				

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1	M Sayres/ESE/1/7/91/1700hrs	Fed EX Airbill # 9868702174	
2			Jeff [illegible] - ESE 1/8/91
3			

SAMPLER: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 5 TO SHIP ON 1/8 91

SAMPLE CUSTODIAN: Custody Seals Intact? ___ Samples Iced? ___ Preservations Audited? ___ Problems? ___

Hunter/ESF. Inc. 01-04-91 *** FIELD LOGSHEET *** FIELD)UP: 90210001
PROJECT ! ER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
*199	EB-064	T				
*200	EB-065	T				
*201	EB-066	T				
*202	EB-067	T				
*203	EB-068	T				
*204	MB-001	T				
*205	FB-001	T	Full TCL	1/7/91	1540	(7 containers) ✓
*206	FB-002	T				
*207	DI-001	T				
*208	DI-002	T				
*209	DI-003	T				
*210	DI-004	T				
*211	48TI1	T				
*212	48TI2	T				
*213	48TI3	T				
*214	48TI4	T				
*215	48TI5	T				
*216	48TI6	T				

IOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD: IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

LINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1 M Sayres /ESE/1-7/91/1700 hrs Fed EX Airbill # 9868702174
2 Jeff Ulozing 1/8/91 ESC
3

AMPLER: MORE SAMPLES TO BE SHIPPED? ✓ IF YES, ANTICIPATED # 5 TO SHIP ON 1/8/91
MPLE CUSTODIAN: Custody Seals Intact? ___ Samples Iced? ___ Preservations Audited? ___ Problems? ___

Hunte. ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST
69SW4-1 ✓			V V V W W N N S S	1-14-91	1310	VOA, BNA, Pest/PCB
69SW4-2 ✓			V V V W W N N S S	1-14-91	1315	" "
~~69SW5-2X~~			V V V W W N N S S	~~1-14-91~~	~~1010~~	"
69SW5-2 ✓			V V V W W N N S S	1-14-91	1020	" "
TB007 ✓			V V V W W N N S S	1-14-91	0717	VOA
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1 K. Kluma/ESE/1-14-91/1722 Fed ex airbill # 9868702222

Jeff [signature] 1/15/91 ESE

MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 10 TO SHIP ON 1 15 91

Hunter ?E, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001
PROJEC. NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
			V V V W W N N S S			
	69SW5	✓	V V V W W N N S S	1-14-91	1010	TCL Metals, CN
	69GW6	✓	V V V W W N N S S	1-14-91	1055	Full TCL
	69GW5	✓	V V V W W N N S S	1-14-91	0948	Full TCL
	69GW7	✓	V V V W W N N S S	1-14-91	1200	Full TCL
	69GW4	✓	V V V W W N N S S	1-14-91	1320	Full TCL
	69GW3	✓	V V V W W N N S S	1-14-91	1605	Full TCL
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1. [signature] /ESE/ 1-14-91/ 1700 FED EX 9868707222 [signature] -ESE 1/15/91

SAMPLES TO BE SHIPPED? Yes IF YES, ANTICIPATED # 8 TO SHIP ON 1/15/91

Hunter ESE, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
48SW1 ✓			V V V W W N N S S	1-15-91	0945	TCL metals (1 container)
48SW2 ✓			V V V W W N N S S	1-15-91	1013	TCL metals (1 container)
48SW3 ✓			V V V W W N N S S	1-15-91	1133	TCL metals (1 container)
48SW4 ✓			V V V W W N N S S	1-15-91	1150	TCL metals (1 container)
48SW5 ✓			V V V W W N N S S	1-15-91	1410	TCL metals (1 container)
48SW6 ✓			V V V W W N N S S	1-15-91	1422	TCL metals (1 container)
48SW7 ✓			V V V W W N N S S	1-15-91	1505	TCL metals (1 container)
48SW8 ✓			V V V W W N N S S	1-15-91	1510	TCL metals (1 container)
SWDUP1 ✓			V V V W W N N S S	1-15-91	0945	TCL metals (1 container) * Please see attached note
EB009			V V V W W N N S S	1-15-91	0725	TCL metals (1 container)
69TI 4-2			~~V V V W W N N S S~~ NA	1-14-91	1345	FULL TCL (1 composit package of oysters & mussels)
69TI 5-1			~~V V V W W N N S S~~ NA	1-14-91	1125	FULL TCL " "
69TI 5-2			~~V V V W W N N S S~~ NA	1-14-91	1125	FULL TCL " "
69TI 4-1			~~V V V W W N N S S~~ NA	1-14-91	1345	FULL TCL " "

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 K. Kluna / ESE / 1-15-91 / 1700	Fed Ex Airbill # 9868702233	
2		Jeff [illegible] - ESE 1/16/91

MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 10 TO SHIP ON 1/16/91

Hunt 'ESE, Inc. 01-07-91 *** FIELD LOGSHEET FIELD GROUP: 90210001
PROJ. NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	
			V V V W W N N S S				
	GWDUP6		V V V W W N N S S	1-15-91	1150	Full TCC MS/MSD	14 containers
	GWDUP6		V V V W W N N S S	1-15-91	1150	Full TLC MS/MSD	
	TB008	✓	V V V W W N N S S	1-15-91	0705	Full TLC	3 containers
	696W2	✓	V V V W W N N S S	1-15-91	1545	Full TLC	4 containers
	696W8	✓	V V V W W N N S S	1-15-91	1150	Full TLC	7 containers
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Eric Gertson/ESE/1-15-91/1800	FED EX	FED EX (Air Bill # 9868702060
2		Jeff [illegible] - ESE 1/17/91

: MORE SAMPLES TO BE SHIPPED? Yes IF YES, ANTICIPATED # 1 TO SHIP ON 1-17-91

Hunter ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
69SW1	✓		V V V W W N N S S	1-16-91	1130	Full TCL
69GW1	✓		V V V W W N N S S	1-16-91	1105	Full TCL
TB009	✓		V V V W W N N S S	1-16-91	0735	VOA Full TCL
WSP001			V V V W W N N S S	1-16-91	1530	Full TCL EG
WSP002			V V V W W N N S S	1-16-91	1535	Full TCL
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Eric Carlson/ESE/1-16-91/1700	FEDEX	~~FEDEX~~ 9868702012
2		Jeff [illegible] ESE 1/17/91

…R: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 7 TO SHIP ON 1/17/91

Hunter/ E, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001

PROJECT .UMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

EST #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
DI 002			V V V W W N N S S	1-17-91	1317	Full TCL 7 containers
EB013 ✓			V V V W W N N S S	1-17-91	1350	Full TCL 7 containers
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

ELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] ESE 1-17-91 1800	Fed Ex # 9868701986	
2		[signature] 1/18/91 ESE

: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 8 TO SHIP ON 1/18/91

Hunter/ESE, Inc. 01-07-91 *** FIELD LOGSHEET * FIELD GROUP: 90210001

PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJEUNE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST	
	HPGW31-3	✓	V V V W W N N S S	1-17-91	1010	Full TCL	7 containers
	HPGW31-2	✓	V V V W W N N S S	1-17-91	1035	Full TCL	7 containers
	48SW10	✓	V V V W W N N S S	1-17-91	0915	TCL Metals	1 container
	48SW11	✓	V V V W W N N S S	1-17-91	0930	TCL Metals	1 container
	48SW09	✓	V V V W W N N S S	1-17-91	0855	TCL Metals	1 container
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1 Jim Cace / ESE / 1-17-91 1800 hrs Fed Ex # 9868701986

2 Jeff Wlosi 1/18/91 ESE

MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 8 TO SHIP ON 1/18/91

Hunter/ E, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST
	GWDUP 7		V V V W W N N S S	1-18-91	1515	Full TCL
	GWDUP 7		V V V W W N N S S	1-18-91	1515	Full TCL
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

$\}$ 14 Containers

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Tim Eva / ESE / 1-18-91 1800	Fed Ex # 9868701953	
2		Jeff [illegible] - ESC 1/19/91

: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 6 TO SHIP ON 1/19/91

Hunter ESE, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001

PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJEUNE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS (CIRCLE)	DATE	TIME	PARAMETER LIST
6GW5	✓		V V V W W N N S S W W	1-18-91	1055	Full TCL 9 containers
TB011	✓		V V V W W N N S S	1-18-91	0740	TCL VOA 3 containers
HPGW25	✓		V V V W W N N S S	1-18-91	1445	Full TCL 7 containers
HPGW22	✓		V V V W W N N S S	1-18-91	1340	Full TCL 7 containers
6GW8	✓		V V V W W N N S S	1-18-91	1515	Full TCL 7 containers
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME) VIA: REC'D BY (NAME/ORGANIZATION/DATE/TIME)

1 Tim Cree / ESE / 1-18-91 / 1800 — 4868701953

2 — Jeff Glass - ESE 1/19/91

3

FOR: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 8 TO SHIP ON 1/19/91

Hunter/ ', Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001

PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	
	HPGW23 ✓		V V V W W N N S S	1-18-91	1055	Full TCL	7 containers
	22GW1 ✓		V V V W W N N S S	1-18-91	0925	Full TCL	7 containers
	6GW7 ✓		V V V W W N N S S W W	1-18-91	1300	Full TCL	9 containers
	6GW4 ✓		V V V W W N N S S	1-18-91	1010	Full TCL	7 containers
	6GW6 ✓		V V V W W N N S S W W	1-18-91	1208	Full TCL	9 containers
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

ELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] / ESE / 1-18-91 1800	Fed Ex #	9868701953
2		[signature] - ESE 1/19/91

: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 5 TO SHIP ON 1/19/91

Hunter /E, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
	6GW3	✓	V V V W W N N S S	1-19-91	1055	Full TCL 7 containers
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
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-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] /ESE / 1-19-91 1500	Fed Ex # 9868701942	
2		[signature] 1/21/91

R: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 6 TO SHIP ON 1/21/91

Hunter)E, Inc. 01-07-91 *** FIELD LOGSHEET **. FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
	TB-012		V V V W W N N S S	1-19-91	0745	Full TCL VOA 3 containers
	6GW2 ✓		V V V W W N N S S	1-19-91	0840	Full TCL 6 containers
	HPGW26 ✓		V V V W W N N S S	1-19-91	0920	Full TCL MS/MSD 7 containers
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
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-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

ELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Tim Cau / ESE / 1-19-91 / 1500	Fed Ex # 9868701942	
2		[signature] 1/21/91

ER: MORE SAMPLES TO BE SHIPPED? Y IF YES, ANTICIPATED # 8 TO SHIP ON 1/21/91

Hunter/ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
			V V V W W N N S S			
WS634	✓		V V V W W N N S S	1/22/91	1355	FULL TCL (7 CONTAINERS)
WS651			V V V W W N N S S	1/22/91	1434	FULL TCL (7 CONTAINERS)
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
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-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 [signature] /ESE/ 1-22-91/	Fed EX. Airbill # 9868701931	
2		[signature] -ESE 1/23/91

MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # ___ TO SHIP ON __/__/__

Hunter ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
			V V V W W N N S S			
	WS637	✓	V V V W W N N S S	1/22/91	1015	FULL TCL (7 CONTAINERS)
	WS602 ✓		V V V W W N N S S	1/22/91	1047	FULL TCL (7 CONTAINERS)
	WS660		V V V W W N N S S	1/22/91	1120	FULL TCL (7 CONTAINERS)
	TB013		V V V W W N N S S	1/22/91	0910	TCL VOA (3 CONTAINERS)
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
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-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 E. [illegible] /ESE/ 1-22-91/	Fed Ex. Airbill # 9868701931	
2		[illegible] ESE 1/23/91

MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # ___ TO SHIP ON __/__/__

Hunter /E, Inc. 01-07-91 *** FIELD LOGSHEET ** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
			V V V W W N N S S			
	WS652V		V V V W W N N S S	1/22/91	1322	FULL TCL (7 containers)
	GWDUP9		V V V W W N N S S V V V W W	1/22/91	1355	FULL TCL (14 containers) MS/MSD
	WS653		V V V W W N N S S	1/22/91	1517	FULL TCL (7 containers)
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

ELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Ed Hyfeld / ESE / 1/22/91 / 1615	Fed Ex Airbill # 9868701931	
2		Jeff Ulessing - ESC 1/23/91

MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # ___ TO SHIP ON __/__/__

Hunter /E, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUCH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
6SW1 ✓			V V V W W N N S S	1/23/91	1140	FULL TCL, field Screen (7 containers)
6SW2 ✓			V V V W W N N S S	1/23/91	1043	FULL TCL, Field Screen (7 containers)
SWDUP2 ✓			V V V W W N N S S V V V W W	1/23/91	1140	FULL TCL, field Screen (14 containers) MS/MSD
TB014			V V V W W N N S S	1/23/91	0756	TCL VOA 3 containers
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			
			V V V W W N N S S			

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-CIRCLE FRACTIONS COLLECTED. ENTER DATE, TIME, FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1	Ed Knight / ESE / 1-23-91 / 1700	Fed. Ex. Airbill # 9868701264	
2			[signature] - ESC 1/24/91

R: MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # ___ TO SHIP ON __/__/__

Hunte./ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST	
			V V V W W N N S S				
	696W1		V V V W W N N S S	1-24-91	0750	PH 3.88 Cond. 256	Full TCL (7 containers)
	69SW1		V V V W W N N S S	1-24-91	0810	PH 3.72 Cond 148	Full ~~T~~ TCL (7 containers)
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				
			V V V W W N N S S				

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1 Jerome Fiore / ESE / ~~1700~~ 1-24-91 / 1700		Fed Exp 9868701286
2		Jeff [illegible] - ESE 1/25/91
3		

SAMPLER: MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # 0 TO SHIP ON / /

Hunter/ESE, Inc. 01-07-91 *** FIELD LOGSHEET *** FIELD GROUP: 90210001
PROJECT NUMBER 6902021-0001 PROJECT NAME: CAMP LEJUENE LAB COORD. KEVIN MCHUGH

ESE #	SITE/STA HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
DI 005 ✓		V V V W W N N S S	1/24/91	1415	Full TCL: TCL VOA, BNA, Pest/PCB, TCL Metals, Cyanide
		V V V W W N N S S			
		V V V W W N N S S			
		V V V W W N N S S			
		V V V W W N N S S			
		V V V W W N N S S			
		V V V W W N N S S			
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		V V V W W N N S S			

ATTENTION DOYCE:
PLEASE DO NOT EXTRACT THIS SAMPLE UNTIL YOU SPEAK WITH MINDY SAYRES, THE PROJECT MANAGER IN THE RUTHERFORD NJ OFFICE. It is for Barnstead Water of 1-12-91, which may have already been analyzed by your lab.

Thanks!

Paul Feinberg

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY; UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I=IGNITABLE C=CORROSIVE R=REACTIVE T=TOXIC WASTE H=OTHER ACUTE HAZARD; IDENTIFY
-PLEASE RETURN COMPLETED LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

	RELINQUISHED BY: (NAME/ORGANIZATION/DATE/TIME)	VIA:	REC'D BY (NAME/ORGANIZATION/DATE/TIME)
1	Paul M. Feinberg, 1-24-91, 1800	Fed Ex (Air Bill #9868701916)	
2			Jeff [signature] -ESE 1/25/91
3			

SAMPLER: MORE SAMPLES TO BE SHIPPED? Possibly IF YES, ANTICIPATED # 1 TO SHIP ON __/__/__