# LANTNAVFACENGCOM Comments to ESE Preliminary Draft Reports

## RI (Hadnot Point) and SA (Sites 6, 48, and 69)

Reviewed by Laurie Boucher
7/26/91

(Encl (6)

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~~PRELIMINARY DRAFT~~

# REMEDIAL INVESTIGATION REPORT FOR HADNOT POINT INDUSTRIAL AREA

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

VOLUME 1

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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4902039-0150

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# 1.0 INTRODUCTION

Marine Corps Base (MCB) Camp Lejeune was listed on the National Priorities List (NPL) 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). In partial fulfillment of the FFA, the DON was required to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Hadnot Point Industrial Area (HPIA) at MCB Camp Lejeune.

The RI/FS at HPIA was performed by Environmental Science & Engineering, Inc. (ESE) in three phases under A&E Contract No. N62470-83-C-6106 with the Naval Facilities Engineering Command - Atlantic Division (LANTDIV).

A summary of the three RI phases and their findings are presented in this document. A FS report for the shallow groundwater at HPIA was submitted in May, 1988. The Risk Assessment and Feasibility Study for the deeper aquifer and the shallow soils will be presented under separate cover.

## 1.1 PURPOSE OF REPORT

The purpose of the RI Report is to present a description of the remedial investigation and the findings of that investigation. The Risk Assessment, an assessment of the RI findings in an evaluation of risks to public health and the environment, will be presented under separate cover.

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## 1.2 SITE BACKGROUND, LOCATION, AND DESCRIPTION

### 1.2.1 MCB Camp Lejeune

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.

The ~~HPIA~~ Hadnot Point Industrial Area (HPIA) site is located within MCB Camp Lejeune, and is described in the following section.

### 1.2.2 Hadnot Point Industrial Area

The HPIA of MCB Camp Lejeune is located on the east side of the New River estuary. For the purposes of this investigation, HPIA is defined as that area bounded by Holcomb Boulevard to the west, Sneads Ferry Road to the north, Louis Street to the east, and the Main Service Road to the south (Figure 1-2).

The HPIA is comprised of approximately 75 buildings and facilities. These include maintenance shops, gas stations, administrative offices, commissaries, snack bars, warehouses, storage yards and a dry cleaning facility. A steam plant

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## 2.0 SUMMARY OF INVESTIGATIONS

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~~ initiated by the Naval Energy and Environmental Support Activity (NEESA) and consisted of an Initial Assessment Studies (IAS), similar to the U.S. EPA's Preliminary Assessments (PA). Subsequent ~~Investigations (RI/FS), and~~ the DOI conducte 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. As a result of this study, ESE was contracted by LANTDIV to investigate these potential source areas as per NACIP program protocol. A number of these potential source areas are located within HPIA.

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 RI. These investigations are briefly described below.

facilities identified in the IAS report were evaluated with extra caution. In many cases, the physical facilities of the buildings (i.e, floor drains, sumps, and unmarked pipe lines) were inspected to identify the general purpose and any interconnections. Any pits, tanks, or other drainage structures outside of the buildings were also closely investigated.

## 3.2 SOIL INVESTIGATION

### 3.2.1 Soil Ga Survey

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To optimally site monitor well locations, soil gas sampling and analysis was conducted in the vicinity of all buildings that could potentially act as VOC source areas, as indicated by the records search effort.

VOCs, if present in groundwater or in the soil matrix, occupy the interstices or voids in the soil. Vapors from the interstitial space were sampled and characterized using a portable gas chromatograph (GC). Soil gas analysis provided a rapid method for tracing potential plumes resulting from leaks and/or spills of many VOCs. The method is particularly useful for compounds [such as trichloroethene (TCE)] that are more volatile than xylene [vapor pressure greater than 5 millimeters of mercury (mmHg)]. TCE was used as the indicator compound at HPIA to trace volatile plumes, as it was detected in the deep potable aquifer in the vicinity of HPIA. TCE has a high vapor pressure (57.9 mmHg), which made it ideal to track with the portable GC unit. In addition to providing rapid results, substantially more samples were analyzed at a much lower cost per sample compared to well drilling and gas chromatography/mass spectrometry (GC/MS) analysis of water samples.

#### Soil Gas Sampling Grids

The soil gas sampling locations were selected using various grids and spaced intervals along selected transects. The locations of these grids and transects were determined by the physical location of suspected disposal features (i.e., tank or

sites were resampled at this time if required. Data plots for each completed disposal structure/feature were then analyzed, and soil boring and monitor well locations were selected.

### 3.2.3 Soil Borings

Shallow soil borings were performed at HPIA at Camp Lejeune in January, 1991. The objective of the soil sampling program was to evaluate the extent of shallow (above the water table) soil contamination in three areas of concern at HPIA. These areas are located in the vicinity of Buildings 1601, 902, and 1202. Figures 3-1, 3-2, and 3-3 show the approximate locations of the soil borings.

Before any soil sampling was conducted, all carbon steel split spoons as well as the stainless steel bowls and implements used to homogenize and handle the soil were decontaminated in accordance with the procedure set forth in the Work Plan. The decontamination procedure is described in Appendix A.

Soil borings were drilled with 6.25-inch inner diameter hollow-stem augers. Two-inch and three-inch split spoons were utilized to obtain the soil samples ahead of the augers advance. In accordance with ASTM D1586-74, 2-inch split spoons were driven with a 140-pound hammer. Three-inch split spoons were driven with a 300-pound hammer.

Before any soil sampling was conducted, all carbon steel split spoons as well as the stainless steel bowls and implements used to homogenize and handle the soil were decontaminated in accordance with the procedure set forth in the Work Plan. The decontamination procedure is described in Appendix A.

Borings were monitored by a project geologist who noted blow counts, organic vapor readings, percent recovery of sample, and sample description. Samples were classified based on visual observance using the Unified Soil Classification System (USCS). Boring logs for each boring are presented in Appendix B.

Each soil boring was advanced to the water table, which varied from 1.5 to 14 feet below ground surface. Continuous split spoon sampling was conducted and samples were screened for organic vapors with an photoionization detector (PID). Three samples were selected from each boring for chemical analysis, based upon the three highest readings of organic vapor levels recorded. In cases where the PID recorded levels of organic vapors equivalent to background atmospheric concentrations, samples were selected according to visual inspection for possible contamination. In the absence of any visible "contamination", the three samples were selected randomly. Where the water table proved to be too shallow to permit three different sampling intervals, samples were decreased in number accordingly.

Ten percent of the analytical samples collected were analyzed for full Target Compound List (TCL) parameters. The remaining 90 percent were analyzed for volatile organic compounds (TCL VOAs), pesticides and PCBs, and Toxicity Characteristic Leaching Procedure (TCLP) metals. VOA samples were collected immediately upon opening the split spoon, while all other fractions were homogenized in a decontaminated stainless steel bowl, prior to filling the sample containers.

## 3.3 GROUNDWATER INVESTIGATION

### 3.3.1 Monitor Wells

Groundwater monitor wells were installed during ~~both~~ phases of investigation. The locations, depths, and screened intervals of monitor wells were selected to delineate contaminant distribution and the geohydrological environment. The selection was based on information gathered during previous studies and subsurface conditions observed during drilling.

Verification Step, ~~the Characterization Step~~ Characterization Step, & Supplemental Characterization Step

A total of 33 wells were installed during the Characterization phase (September 1986 through August 1987); 27 shallow wells, 3 intermediate wells, and 3 deep wells. Additionally, 2 shallow wells were installed at the Hadnot Point Fuel Farm

(Study Area 22) and one at the transformer storage yard (Study Area 21) during the verification investigation.

In December 1990, four groundwater monitoring well clusters were installed downgradient of the four areas of concern in the Hadnot Point area at Camp Lejeune. Both an intermediate and deep well were installed at each location in order to evaluate the vertical distribution of contaminants in the groundwater downgradient of specific areas of concern. The areas of concern are Building 1602, Building 902, Building 1202, and the Industrial Area Tank Farm (Site 22). The locations of the ground water monitoring wells within the HPIA are shown in Figure 3-4.

Shade these areas on Fig. 3-1

Monitoring wells were numbered sequentially within HPIA. All intermediate wells in the study area were denoted with an end designator number of "2", appearing after the main sequence number. Similarly, deep wells were assigned a designator number of "3" after the main sequence number. Main sequence numbers for shallow wells run from HPGW1 to HPGW29. Intermediate and deep wells which were not clustered to a shallow well are assigned the numbers HPGW30-2, HPGW30-3, HPGW31-2, HPGW31-3, HPGW32-2, and HPGW32-3. Wells within the other study areas inside of the HPIA were assigned numbers to correspond to those study areas (21GW-1, 22GW-1, and 22GW-2)

During all drilling activities at HPIA, 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 at HPIA, the following requirements were completed:

### 3.3.2 Monitoring Well Development

All monitoring wells were developed by air-lift pumping, or 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 shallow, intermediate and deep wells installed at Hadnot Point 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. An oil filter was installed between the compressor and hose when using air-lift to prevent any oil from entering the well. 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. Well development records are presented in Appendix E.

### 3.3.3 Groundwater Sampling

#### Characterization Phase

Each of the shallow wells installed during the Characterization were sampled three times during the phase, with a period of approximately 60 days between sampling events. The intermediate and deep wells were sampled once during this phase. All samples collected were analyzed for lead, oil and grease and volatile organics (EPA Method 624).

Mention where data of this sampling effort is provided

#### Supplemental Characterization

Thirty (30) existing shallow wells (27 at HPIA, 2 at Site 22, and 1 at Site 21), 8 newly installed intermediate and deep wells, 6 existing intermediate and deep wells, and 9 water supply wells were scheduled to be sampled during the field

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investigation. Figure 2-5 shows the locations of the wells. The monitoring wells scheduled to be sampled included HPGW1 through HPGW26, HPGW29, 22GW1, 22GW2, and 21GW1. The water supply wells scheduled to be sampled included 601 (replaced and renumbered as 660), 602, 603, 608, 634, 637, 642, and 652.

Shallow well HPGW18, and deep well HPGW17-3, could not be sampled because they could not be located after numerous attempts to find them. Water supply wells 608 and 630 were not sampled because the wells were either welded shut (608) or demolished (630).

~ Mention where data can be found.

All groundwater samples collected during this phase were analyzed for full TCL parameters. Field measurements of pH, specific conductivity and temperature for this 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.

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.

downward gradient is most pronounced in cluster 24. The occurrence of this downward gradient is most likely a result of pumping from the lower zones for potable uses and provides the hydrologic mechanism to carry contaminants from the shallow zones to the lower zones.

### 4.3.3 Hydraulic Conductivity

A 72 hour pumping test performed at HPIA by ESE in 1987 indicates average transmissivity and storage coefficient values of 9.6 x $10^3$ gallons per day per foot (gpd/foot) and 8 x $10^{-4}$ respectively, for the limestone portion of the deep (Castle Hayne) aquifer. These values are in general agreement with those reported by the USGS (Harned et. al., 1989). Horizontal hydraulic conductivity for the Castle Hayne in this area is reported by the USGS to be an average of 35 feet/day with a range between 19-82 feet/day (Harned et. al., 1989).

Analysis of the ESE pumping test data indicates that the limestone portion of the deep aquifer is semi-confined. Recharge occurs through a clayey layer overlying the aquifer. Vertical hydraulic conductivity for this layer is estimated at 4.6 x $10^{-3}$ foot/day, typical of silty sands and silty clays.

~~There is no available hydraulic conductivity data for the shallow aquifer at HPIA.~~

## 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

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# 5.0 RESULTS OF INVESTIGATION

This report is the result of three investigative phases which have been completed at the Hadnot Point Industrial Area. These investigations have included a records search to determine potential contaminant sources and have examined soil gas data, shallow soil samples and shallow and deep groundwater samples. The results have been summarized in the section by sample medium, and are broken down within each medium by area of investigation. The results of the pump test are also presented in Section 5.4.

## 5.1 RECORDS SEARCH

ESE survey crews conducted a detailed records and physical search within HPIA to identify the presence of potential waste solvent disposal features/structures. The physical facilities of the buildings (i.e, floor drains, sumps, and unmarked pipe lines) were inspected to identify the general purpose of each and note any interconnections. The records search identified several primary potential sources of contamination. They are:

- An underground tank utilized for storage of trichloroethene (TCE) adjacent to Bldg. 902. The area around Bldg. 902 was identified as a long-term vehicle maintenance area.

- The Base Maintenance Shop (Bldg 1202), located in the north-central portion of HPIA, was identified as a potential contaminant source because of documented VOC storage and usage.

- Bldg. 1602, located in the south-central portion of HPIA, was identified as a heavy vehicle maintenance facility with a long term record of VOC storage and usage.

• This section (5.1) should include those buildings identified in Section 5-1 5.2.1. As presently written, it only identifies a few of these areas.

Bldgs. 1709 and 1710

The area encompassing Bldgs. 1709 and 1710 has been a combat vehicle maintenance area, paint shop, and general maintenance area for much of its history. Underground "waste" tanks were identified at Bldg. 1709; the current status of these tanks is not known. Bags of soil marked as contaminated were found to the south of Bldg. 1709. These bags are exposed to weather and are in very poor condition.

The soil gas investigation identified TCE in the soil vapors in only two locations, adjacent to the bags of contaminated soil. However, in a large number of samples obtained from an area to the south of Bldg. 1710, the method detection limit was extremely high due to dilution of the samples in an attempt to resolve a large unknown peak in the data. Although not specifically analyzed, it appears that a large amount of O&G is present in the soil in the vicinity of these samples. TCE may be present, but was not detected because of the sample dilution process.

5.2.2 Soil Borings (state quantity)

Shallow soil borings were performed at HPIA at Camp Lejeune in January, 1991. The objective of the soil sampling program was to evaluate the extent of shallow (above the water table) soil contamination in three areas of concern at HPIA. These areas are located in the vicinity of Buildings 1601, 902, and 1202. Figures 3-1, 3-2, and 3-3 show the approximate locations of the soil borings.

Each soil boring was advanced to the water table, which varied from 1.5 to 14 feet below ground surface. Continuous split spoon sampling was conducted while vapor monitoring with an photoionization detector (PID). Three samples were selected from each boring for chemical analysis, based upon the three highest readings of organic vapor levels recorded. In cases where the PID recorded levels of organic vapors equivalent to background atmospheric concentrations, samples were selected according to visual inspection for possible contamination.

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These documents are somewhat difficult to follow. It may be beneficial to group all information regarding each site together (i.e. group results from soil gas, soil sampling, groundwater, etc. for each site) instead of discussing soil gas results for all the sites then the analysis results for all sites.

# 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

JUNE 1991

Prepared by:

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
Orlando, Florida

4902039-0250

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 1940's. 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.

Are you sure it was in the woods?

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)

### 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.

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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)

define in section on acronyms & abbreviations

Hazardous materials disposed of at Site 69 include pentachlorophenol, DDT, TCE, malathion, diazinon, lindane, gas cylinders, 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).

explain

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 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

check spelling

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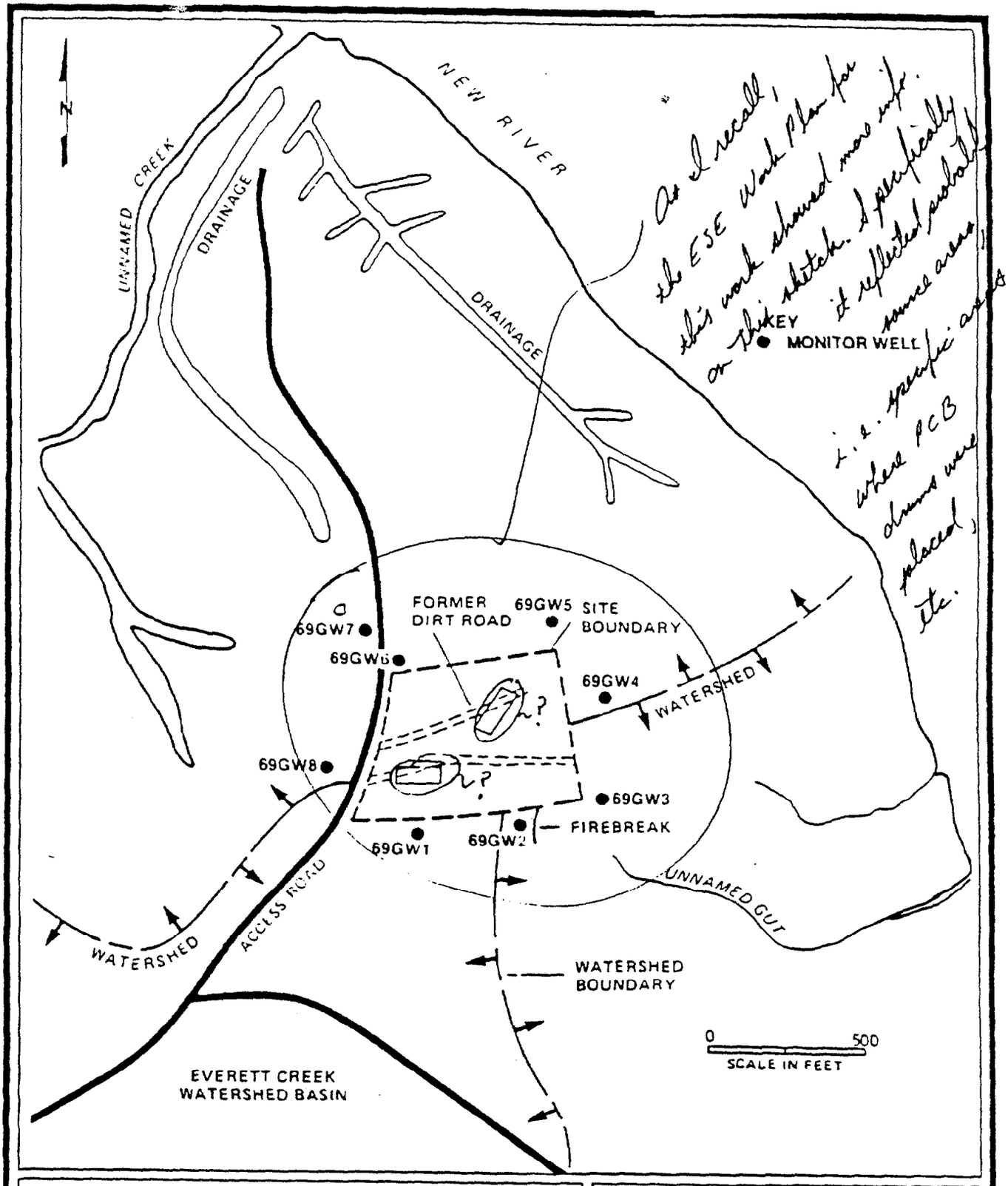


As I recall, the ESE Work Plan for this work showed more info. on this sketch. I specifically KEY it reflected probable or ● MONITOR WELL source areas, i.e. specific areas where PCB drums were placed, etc.

**FIGURE 1-4**
**SITE 69,**
**RIFLE RANGE CHEMICAL DUMP**

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

MARINE CORPS BASE
CAMP LEJEUNE

Environmental Science & Engineering, Inc.

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## 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

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.

This isn't very clear. Rewrite.

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 re-sampled on January 24, 1991 because the original sample containers arrived at the laboratory broken. All groundwater samples were analyzed for full TCL parameters.

↑ Does this include or imply cyanide or should it be stated?

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.

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# 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.

Can you show the locations of these samples?

## 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 1-ft 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 homoginized 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

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)

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.

Do you reference Appendix "A" before this? I don't see it.

### 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,

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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; numbered semicolons
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.

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

## 6.1 INTRODUCTION

This section is lacking, even for a prelim. risk assessment. More pertinent information should be included in regards to the characteristics of the contam. detected.

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. 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. Results of sample chemical analyses collected during the field investigation are presented in the Remedial Investigation Report (ESE, 1990). The following sections present the site background and description, data collection and evaluation, exposure assessment, toxicity assessment and conclusions for public 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 frequency of occurrence and comparison to published criteria for safety to humans and aquatic life. 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, North Carolina and Federal water quality standards for the

# DISCREPANCIES WITHIN ESE HPIA INVESTIGATION AND RI REPORT

Pg. 4-5 (Sec. 4.3.1) Groundwater depths range between 6.67 and 23.18 ft. below ground surface. ESE did not distinguish what date these water levels were taken, but Table 4-1 (1/25/91) data was consistent with this information. Water levels also were obtained on 2/20/91 and presented in Table 4-2, but were not mentioned in the text. Depth to groundwater on that date ranged from 8.12 to 23.82 ft. bgs.

On page 5-5 (Sec. 5.2.2) groundwater depths during soil borings were noted to be between 1.5 and 14 ft. bgs. No comments were provided in the report to justify these groundwater depth differences.

Groundwater mounding appears to occur (see Fig. 4-6, ESE Report) in the southern section of the site near wells HPGW2 and HPGW5. No explanation is given to possible cause(s) of this phenomenon. Surface features such as drainage swales or storm water sewers which could possibly produce unusual groundwater flow patterns were never investigated.

Pg. 5-11 Sampling Set One Oil and Grease data is listed on the data summary table as 0.8 mg/l. Concentration result is presented as 0.8 ug/l in text and is dismissed in the discussion as trace contamination. However, 0.8 mg/l converts to 800 ug/l.

Metals are presented as ug/l, but usually reported by the laboratory as mg/l. As raw data is unavailable, verification of calculations from mg/l to ug/l cannot be made. Errors could very possibly impact final site conclusions.