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Final

Action Memorandum  
for  
Interim Response Action  
Operable Unit No. 6  
Sites 36 and 43

Marine Corps Base  
Camp Lejeune, North Carolina



Prepared For  
**Department of the Navy**  
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## LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or relevant and appropriate requirements
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminants of Concern
CY	Cubic Yards
DoN	Department of the Navy
EE/CA	Engineering Evaluation/Cost Analysis
FFA	Federal Facilities Agreement
FS	Feasibility Study
IR	Installation Restoration
IAS	Initial Assessment Study
LANTDIV	Atlantic Division, Navy Facilities Engineering Command
LUCIP	Land Use Control Implementation Plan
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
mg/kg	milligrams per kilograms
NC DENR	North Carolina Department of Environment and Natural Resources
NC DOT	North Carolina Department of Transportation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OSWER	Office of Solid Waste Emergency Response
OU	Operable Unit
O&M	Operation and Maintenance
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
ppm	parts per million
PRG	preliminary remediation goal
RA	Risk Assessment
RAB	Restoration Advisory Board
RAC	Remedial Action Contractor
RI	Remedial Investigation
ROD	Record of Decision

**LIST OF ACRONYMS AND ABBREVIATIONS**  
*(Continued)*

SARA	Superfund Amendments and Reauthorization Act
SI	Site Inspection
SSLs	Soil Screening Levels
SVOC	Semivolatile Organic Compounds
TCLP	Toxicity Characteristic Leachate Procedure
TCRA	Time Critical Removal Action
TRV	Terrestrial Reference Value
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

**ACTION MEMORANDUM  
INTERIM RESPONSE ACTION  
OU NO. 6 – SITES 36 and 43  
MARINE CORPS BASE  
CAMP LEJEUNE, NORTH CAROLINA**

**I. PURPOSE**

This Action Memorandum documents approval of the interim response action described herein for Operable Unit (OU) No. 6, Sites 36 and 43, the Camp Geiger Area Dump and the Agan Street Dump, located on Marine Corps Air Station (MCAS), New River. MCAS, New River is under the environmental jurisdiction of Marine Corps Base (MCB), Camp Lejeune. The other two sites comprising OU No. 6, Sites 44 and 54, do not warrant interim response actions. Therefore, they will not be addressed in this document.

This Action Memorandum, which serves as the decision document for the interim response actions, has been completed in accordance with the program requirements defined by: the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); the Superfund Amendments and Reauthorization Act of 1986 (SARA); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); and the United States Environmental Protection Agency's (USEPA) Superfund Removal Procedures - Action Memorandum Guidance dated December 1990 (USEPA, 1990). This Action Memorandum follows the guidelines published in the Navy/Marine Corps Installation Restoration (IR) Manual, dated June 2001 (DoN, 2001).

The Department of the Navy (DoN) has broad authority under CERCLA Section 104 and Executive Order 12580 to carry out removal actions when a release or threatened release is on, or the sole source is from, a military installation. The IR Program was initiated to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills at military installations.

The primary focus of the interim response action for Site 36 is the removal of polynuclear aromatic hydrocarbons (PAH) and pesticide contaminated soil and to institute land use controls for lead contaminated areas. The primary focus of the interim response action for Site 43 is the removal of PAH contaminated soil. The purpose of these interim response actions is to remove localized areas

of soil contamination, or “hot spots”, and to protect future receptors from lead contaminated soil by imposing land use restrictions at Site 36.

An Engineering Evaluation/Cost Analysis (EE/CA) has been submitted in October 2002 to evaluate potential technologies and remedial alternatives that may be implemented to address residual contamination and to provide public comment on these alternatives.

## **II. SITE CONDITIONS AND BACKGROUND**

### **A. Site Description**

#### **1. Camp Lejeune Description**

MCB, Camp Lejeune is located on the coastal plain of North Carolina in Onslow County. The facility encompasses approximately 236 square miles and is bisected by the New River (Figure 1). The New River flows to the southeast and forms a large estuary before entering the Atlantic Ocean. The southeastern border of MCB, Camp Lejeune is the Atlantic Ocean shoreline. The western and northeastern boundaries of the facility are U.S. Route 17 and State Route 24 (Highway 24), respectively. The City of Jacksonville, North Carolina borders MCB, Camp Lejeune to the north.

#### **2. Site Description**

##### *Site 36*

Site 36 is located approximately 1,000 feet east of Camp Geiger and 500 feet west of the New River, adjacent to the Camp Geiger Sewage Treatment Plant. Camp Geiger is situated directly north of MCAS, New River, and approximately 3 miles southwest of Jacksonville, North Carolina.

Figure 2 shows the features of Site 36. The site encompasses nearly 20 acres and is comprised primarily of open fields and wooded areas. A gravel road bisects the site and provides access to Jack’s Point Recreation Area, located approximately one-quarter mile to the east. The site is bordered to the north and east by Brinson Creek, and a wooded area to the south, by an unnamed

tributary to Brinson Creek, and to the west by an improved (i.e., coarse gravel) road. Further to the west of the improved road lies an abandoned railroad right-of-way, once part of the Seaboard Coastline Railroad.

Site 36 reportedly has been used for the disposal of municipal wastes and mixed industrial wastes including trash, waste oils, solvents, and hydraulic fluids that were generated at MCAS, New River. The dump was active from the late 1940s to the late 1950s. Burned and unburned material was buried. Reportedly, less than five percent of all waste hydrocarbon material generated at MCAS, New River was disposed at Site 36. The remaining waste oil was reportedly used for dust control on roads or discharged directly to storm drains.

Parts of the site have been changed due to the construction of the North Carolina Department of Transportation (NC DOT) Route 17 bypass project. Several of the gravel roads that ran through the site have been widened and the elevation raised, serving as the subgrade for the Route 17 bypass. The Route 17 bypass construction extends outside the boundaries of the Site 36 study area and lies to the west of the site.

#### *Site 43*

Site 43 is comprised of approximately 11 acres and is located within the operations area of MCAS, New River, two miles west of the New River. Vehicle access to the site is via Agan Street from Curtis Road.

Figure 3 shows the site features for Site 43. The site is located at the northern terminus of Agan Street, adjacent to an abandoned wastewater treatment plant. The site is bordered to the north by Edwards Creek, to the east and south by Strawhorn Creek, and to the west by Agan Street and the former sewage disposal facility. Strawhorn Creek discharges into Edwards Creek at Site 43. Edwards Creek then discharges into the New River approximately 2,000 feet north of the study area, near Site 36.

Much of this site is heavily vegetated with dense shrubs and trees greater than three inches in diameter. Marsh areas prone to flooding surround both the Strawhorn and Edwards Creeks. An

improved gravel loop road provides access to the main portion of the study area; other, smaller unimproved paths extend outward from the gravel loop road.

The Agan Street Dump reportedly received mainly inert material such as construction debris (i.e., fiberglass and lumber) and trash. Sludge from the former sewage disposal facility, located adjacent to the study area, was also dumped at Site 43. The time period during which disposal activities occurred is not known.

### **3. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant, or Contaminant**

#### *Site 36*

Table 1 summarizes the analytical results from the Remedial Investigation (RI) at Site 36. Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganics were detected in surface and subsurface soil samples, however, the highest levels of these compounds occurred in the surface soil. VOCs and SVOCs appeared to be the compounds most directly linked to past disposal practices. A majority of the SVOCs were PAH compounds. PAHs, pesticides, and inorganics were compared against USEPA Region IX Preliminary Remediation Goals (PRGs). Contaminants of concern were retained only when they exceeded the PRG.

Lead was detected in 48 of 52 surface soil samples and 50 of 51 subsurface soil samples, with higher detections in subsurface soil than surface soil. The highest detection in the subsurface soil was 2,680 parts per million (ppm), which exceeds the USEPA Office of Solid Waste and Emergency Response (OSWER) directive of 400 ppm. Three surface soil samples and eight subsurface soil samples were greater than the USEPA directive of 400 ppm.

In the south central portion of Site 36, four small excavation areas have been delineated as locations of higher PAH and pesticide concentrations. These areas total approximately 950 cubic yards (CY). Surface and subsurface soil lead contamination exceeds the directive of 400 ppm in the Former Disposal Area, with the exception of one surface soil sample in the northwest portion of the site. These areas will be addressed with land use controls.

### *Site 43*

Table 2 summarizes RI analytical results for Site 43. SVOCs, pesticides, and inorganics were detected in surface and subsurface soil samples. The presence and dispersion of SVOCs in soil, particularly PAH compounds, are most likely the result of past disposal operations at Site 43. SVOCs were identified in both surface and subsurface soil samples obtained from the cleared portion of the study area, adjacent to the gravel access road. Concentrations of SVOCs were more prevalent and detected at higher concentrations in surface samples, compared to SVOC concentrations in subsurface samples. In general, soil analytical results correspond directly to the visual identification of fill or graded material (including possible wastewater treatment plant sludge material) observed during the field investigation.

There is an area in the western portion of Site 43, approximately 750 CY adjacent to the gravel road, in which PAHs exceed the Region IX PRGs. This localized area of contamination will be addressed with the interim response action.

#### **4. National Priority List Status**

MCB, Camp Lejeune was placed on the CERCLA National Priorities List (NPL) on October 4, 1989. Subsequent to this listing, the USEPA, Region IV; the North Carolina Department of Environment and Natural Resources (NC DENR); and the United States DoN entered into a Federal Facilities Agreement (FFA) for MCB, Camp Lejeune. The Fiscal Year 2003 Site Management Plan for MCB, Camp Lejeune, a primary document referenced in the FFA, identifies 42 sites, including Sites 36 and 43 that require Remedial Investigation/Feasibility Study (RI/FS) activities.

#### **5. Maps, Pictures, and Other Graphic Representations**

Attachment A contains figures that depict the site locations and the overall scope of the proposed interim response actions for Site 36 and Site 43. These figures are referenced throughout the text.

## **B. Other Actions**

### **1. Previous Investigations**

#### *Site 36*

- Initial Assessment Study, 1983
- Confirmation/Verification Study, 1984 through 1987
- Aerial Photographic Investigation, 1992
- RI Scoping Investigation, 1994
- Remedial Investigation, 1996
- Time Critical Removal Action for PCBs, 1997
- Temporary Well Investigation, 2000
- Post-RI Sampling, 1998 through 2002

The findings from these investigations are summarized in Section II D of this document.

#### *Site 43*

- Initial Assessment Study, 1983
- Site Inspection, 1991
- Remedial Investigation, 1995
- Time Critical Removal Action for Surficial Metallic Debris, 1995

The findings from these investigations are also summarized in Section II D of this document.

### **2. Future Actions**

Future actions proposed include the evaluation (via the Final EE/CA) and implementation of interim response actions to address residual soil contamination at Sites 36 and 43, as described in this Action Memorandum. In addition, land use control implementation plans (LUCIPs) for both sites will be imposed for future land management purposes.

**C. State and Local Authorities' Roles**

The USEPA and NC DENR have been involved in planning and reviewing site investigation reports, the EE/CA, and this Action Memorandum. At the local level, the general public is also involved via the Restoration Advisory Board (RAB) and publicly available site information. Comments on the Draft Action Memorandum were solicited from the USEPA, NC DENR, and MCB, Camp Lejeune and incorporated into this final document. Involvement by all parties in the planning process will continue throughout the interim response action implementation period through meetings and correspondence. Response to public notice is anticipated throughout the interim response action implementation period.

**D. Quantities and Types of Substances Present**

Several investigations have been completed to date at Sites 36 and 43 and have confirmed the presence of PAHs and pesticides (Site 36 only) in soil. Lead was also detected in surface and subsurface soil at Site 36 above the USEPA directive of 400 ppm. A summary description of the results from previous site investigations at Site 36 and Site 43 follows.

*Site 36*

Previous investigations conducted at Site 36 include an Initial Assessment Study (IAS), a Confirmation/ Verification Study, a RI Scoping Investigation, an Aerial Photographic Investigation, a RI/FS and a Time Critical Removal Action (TCRA). The following paragraphs briefly discuss these investigations. Other investigations that have focused primarily on groundwater are documented in the Pre-Final Record of Decision (ROD) (Baker, 2002b).

Initial Assessment Study

An IAS was conducted at Site 36 in 1983. The IAS evaluated the potential hazards at various sites throughout the Base, including Site 36. The IAS was based on historical records, aerial photographs, inspections, and personnel interviews; sampling was not conducted of any media. Due to the indication that hazardous substances were disposed at Site 36, a Confirmation Study was recommended.

### Confirmation Study

A two-part Confirmation Study was conducted at Site 36 from 1984 through 1987. The study consisted of a Verification Step performed in 1984 and a Confirmation Step performed in 1986 and 1987. Field activities included groundwater, surface water, and sediment investigations.

Based on the results of the Confirmation Study, it was recommended that further characterization of shallow and deep groundwater be implemented due to low levels of VOCs and metals. Supplemental surface water and sediment investigations were also suggested to determine possible upstream sources of contamination. In addition, a thorough characterization of unsaturated soil within the identified disposal area was recommended to assess soil quality. Following the characterization of potentially impacted environmental media, a risk assessment was recommended to evaluate potential risks to human health and the environment.

### RI Scoping Investigation

A RI Scoping Investigation was conducted in 1994 at Site 36. Following the identification of 11 abandoned containers (5-gallon containers and 55-gallon drums) during the March 1994 initial site survey, a limited drum and soil sampling program was proposed to address potentially impacted media. The objective of the drum sampling program was to collect representative samples from each of the containers and determine appropriate disposal actions. During the intervening months between the initial site survey and the drum investigation, a majority of the containers were removed from the study area. Accordingly, only four five-gallon containers were sampled during the investigation. These four containers were located near the south central portion of the study area.

Based upon test kit results and field observations, the containerized substance was determined to be a non-reactive flammable liquid. One composite sample representing the contents of the four containers was submitted for analysis of toxicity characteristic leachate procedure (TCLP) contaminants and hazardous waste characteristics (i.e., corrosivity, reactivity, and ignitability). Results of these analyses and visual inspections indicated that the material was a weathered paint product.

### Aerial Photographic Investigation

Surface conditions at Site 36 were examined via black-and-white aerial photographs taken in 1949, 1956, 1960, 1964, and 1970. Visual data from these photographs was used to evaluate previous site operations and to identify potential source areas of contamination. Additional photographs from 1938 and 1943 were used to establish a basis of comparison, as they depicted the area prior to development of the Camp Lejeune Military Reservation.

### Remedial Investigations

From February through July 1995, a RI was conducted at Site 36. The RI consisted of a soil investigation, groundwater investigation, surface water and sediment investigation, an aquatic investigation, and a habitat evaluation. During the RI, sample results detected concentrations of VOCs, SVOCs, pesticides, PCBs and inorganics in soil at Site 36. Among the organic constituents, VOCs and SVOCs are most directly linked to past disposal practices. The majority of the SVOCs detected were PAH compounds. Because constituents related to historical use at the site were detected in localized areas at levels greater than screening criteria, surface soil and subsurface soil were retained as media of concern at this site. PAHs, pesticides and lead were retained as contaminants of concern (COC).

### Time Critical Removal Action

A TCRA was performed at Site 36 in 1997 based on the results of the 1995 RI. Results of the RI found that the surface soil may have presented an imminent threat to human health and the environment. The TCRA included excavation of the PCB contaminated soil and disposal of the soil in an appropriate treatment /disposal facility. Approximately 92 tons of regulated PCB-contaminated soil and approximately 148 tons of non-regulated PCB-contaminated soil was removed from Site 36.

Upon completion of excavation activities, confirmation sampling was performed and revealed that soil remaining on site exhibited concentrations of PCBs below the action levels specified in the work plans (10 milligrams per kilogram [mg/kg]) for PCBs. Site restoration included the placement of

clean backfill from an off-site borrow pit, the replacement of gravel on the gravel road, and revegetation.

### *Site 43*

Previous investigations conducted at Site 43 include an IAS, a Site Inspection (SI), a RI, and a TCRA. The following paragraphs briefly describe these investigations.

#### Initial Assessment Study

In 1983, an IAS was conducted at MCB, Camp Lejeune and MCAS, New River. The IAS evaluated the potential hazardous at various sites throughout the facilities, including Site 43. The evaluation included a review of historical records, aerial photographs, inspections, and personnel interviews. Sampling was not conducted of environmental media. The IAS concluded that waste quantities at Site 43, regardless of their nature, were minor; therefore, a Confirmation Study was not recommended for the site.

#### Site Inspection

In 1991, a SI was conducted at Site 43. The SI consisted of the following field activities: the installation and sampling of three monitoring wells (43-GW01, 43-GW02, and 43-GW03); the collection of two soil samples from each monitoring well test boring (one near the surface and one just above the water table); the collection of two soil samples from five additional soil borings; and the collection of five surface water and five sediment samples from the adjacent creeks and marsh. Contaminants detected during the SI included PAHs in surface soil, carbon disulfide and inorganics in groundwater, benzoic acid and inorganics in surface water, and PAHs and pesticides in sediment. Based on the findings of the SI, an RI/FS, including a human health and ecological risk assessment (RA), was recommended to further evaluate the nature and extent of soil, sediment, surface water, and groundwater contamination. Also, further characterization of upgradient groundwater and background soil, surface water, and sediment sampling was recommended.

### Remedial Investigation

From February through May 1995, a RI was conducted at Site 43. The RI consisted of the following field activities: a soil investigation, which included drilling and sampling; a groundwater investigation, which included monitoring well installation, groundwater sampling, and aquifer testing; a surface water and sediment investigation; a habitat evaluation; and a bioassay study of Edwards Creek.

SVOCs, pesticides, and inorganics were detected in surface and subsurface soil samples at Site 43. The presence and dispersion of SVOCs in soil, particularly PAH compounds, are most likely the result of former disposal operations at Site 43. SVOCs were identified in both surface and subsurface soil samples obtained from the cleared portion of the study area, adjacent to the gravel access road. SVOC concentrations were much higher in surface soil than subsurface soil.

### Time Critical Removal Action

During 1995, a TCRA was performed at Site 43 by the RAC to remove surficial metallic debris found on site during the SI. Project activities involved the removal of all surficial metallic debris, including empty drums, various scrap metals and an old tank vehicle. Additionally, the RAC collected, sampled and shipped off-site four drums (1,400 lbs.) of materials for disposal. Site restoration included regrading the site due to the removal of the old tank vehicle and other debris.

## **III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES**

### *Site 36*

#### Human Health Risk Assessment

Military personnel, recreational fisherman, recreational users of the site surface water, trespassers, and construction workers were all assessed as potential current receptors. Potential risks from surface soil, surface water, sediment, fish tissue, and crab tissue were within acceptable risk levels

for all receptors except the current fisherman. For the current fisherman, the total noncarcinogenic risk (9.1) and total carcinogenic risk ( $1 \times 10^{-3}$ ) were greater than acceptable noncarcinogenic and carcinogenic risk levels of one and  $1 \times 10^{-4}$ , respectively. This risk was mainly due to levels of arsenic and mercury found in fish tissue and levels of arsenic and lead found in crab tissue. Although a potential risk resulted, data indicate that the source generating the risk was not from Site 36.

Future potential child and adult residents were assessed for possible exposure to groundwater, surface soil, subsurface soil, surface water, and sediment. A future construction worker was evaluated for surface and subsurface soil exposure. Potential noncarcinogenic risks were calculated for the child resident from groundwater (5.2) and subsurface soil (2.3) exposure. A noncarcinogenic risk (2.2) was calculated for the adult resident from groundwater. The iron in groundwater and surface soil contributed to these risks.

### Ecological Risk Assessment

Based upon the assessment of ecological risks, there is a slight potential for metals in the surface water and sediment, and a moderate potential for pesticides (4,4'-DDD and 4,4'-DDT), and diethylphthalate in the sediment, to decrease the population of aquatic life at the freshwater stations. There is a slight potential for metals in the surface water (copper, nickel) and sediment, and a moderate potential for lead, pesticides (4,4'-DDD and 4,4'-DDE), and diethylphthalate in the sediment, to decrease the population of aquatic life at the saltwater stations. The benthic macroinvertebrates do not appear to be impacted based upon the results of the sampling events.

A comparison of chronic daily intake (CDI) versus terrestrial reference values (TRV) was performed for Site 36. The CDI exceeded the TRV for all five terrestrial species evaluated, but the risks were higher for the cottontail rabbit and the raccoon. Aldrin, dieldrin, 4,4'-DDD, and 4,4'-DDE were the only pesticides detected in the whole body fish tissue samples at concentrations above the proposed piscivorous wildlife criteria. None of the pesticides generated a risk to the raccoon ingesting the fish. Lead in fish and crab tissue also did not pose a risk to the raccoon ingesting the tissue. Cadmium was the only metal detected in the whole-body tissue samples above wildlife dietary levels that posed a risk to the raccoon. However, cadmium does not appear to be site-related.

Some potential impacts to soil invertebrates and plants may occur as a result of potential exposure to site contaminants. There is also a slight potential for a decrease in the terrestrial vertebrate population from exposure to site contaminants based on the terrestrial intake model.

### *Site 43*

#### Human Health Risk Assessment

Current military personnel and adult and child trespassers were evaluated as potential receptors, and risk values were calculated for exposure to surface soil, surface water, and sediment. There are no unacceptable risks for current receptors identified at Site 43.

Future child and adult residents were evaluated for exposure to groundwater, surface soil, surface water, and sediment. Future construction workers were also evaluated for exposure to subsurface soil. There were no unacceptable carcinogenic risks identified for future receptors. However, noncarcinogenic risks were identified for groundwater ingestion for future child and adult residents. This is mostly the result of iron in groundwater at Site 43, which is considered to be a naturally occurring constituent throughout MCB, Camp Lejeune.

#### Ecological Risk Assessment

Pesticides in the surface water and sediment may potentially affect aquatic receptors. SVOCs in the sediment and inorganics in the surface water and sediment may also potentially affect aquatic receptors. However, SVOCs and pesticides only slightly exceeded the screening values, and thus indicate only a slight potential for risk. Based on this information, the potential ecological risks to the aquatic ecosystem are minimal and do not warrant remedial action at Site 43.

## **IV. ENDANGERMENT DETERMINATION**

Based upon the concentrations and the frequency of detections, the soil at Sites 36 and 43 warrants further actions to mitigate or abate potential adverse impacts to human health and the environment.

Exposure to hazardous substances, if not addressed by implementing the proposed remedial actions discussed in this Action Memorandum, may endanger public health, welfare, and the environment.

## **V. PROPOSED ACTIONS AND ESTIMATED COSTS**

### **A. Proposed Actions**

#### **1. Proposed Action Description**

##### *Site 36*

The interim response actions for Site 36 include:

1. Excavation and removal of PAH and pesticide contaminated “hot spots” in four small areas.
2. Implementation of land use controls to protect future receptors from the following:
  - Lead contaminated surface and subsurface soil
  - Former disposal areas

The primary component of the proposed interim response action at Site 36 is the removal of the elevated levels of PAH and pesticide contaminated soil. This action consists of removal of soil with elevated levels of residual PAHs and pesticides and returning the site to pre-excavation conditions. Table 3 presents the final soil contaminants of concern (COCs) for the proposed interim response action at Site 36. PAHs, pesticides and inorganics in Site 36 surface and subsurface soil were compared to various standards and risk-based criteria including North Carolina Soil Screening Levels (SSLs) and USEPA Region IX Residential PRGs for estimating the volumes of soil and costs. Contaminants of concern were retained only when they exceeded the PRG. Institutional controls will be implemented at this site to minimize exposure to potential hazards from lead contamination in surface and subsurface soil. The contaminated soil will likely be disposed off-site in the Base landfill.

The excavation area for this option can be seen in Figure 4 and the total volume for site-wide excavation is approximately 950 CY. Prior to excavation, the contamination at Site 36 may need to

be further delineated since the areas have not been sampled since the RI in 1995. Because areas of Site 36 are heavily vegetated, clearing may be necessary before excavation can take place. Underground utility lines running parallel to the improved gravel road near the OF-SB03 sampling cluster will have to be located prior to excavation. Confirmatory sampling will take place to ensure that PAH and pesticide contaminated soil have been excavated. The excavated soil will be transported to the Base landfill for proper disposal.

Following the excavation operation, the site would be restored by placing clean backfill (assumed to be from an on-Base borrow area) to bring the site back to its original grade. All disturbed areas would be revegetated with native grasses and plant species to control erosion. Access roads or other infrastructure that are disturbed or destroyed in the excavation process would be restored to original conditions.

Lead contamination at Site 36 is concentrated in soil in the southeastern portion of the site. The EPA residential action level for lead in soil is 400 ppm. Therefore, any sampling location exceeding this concentration will be designated for institutional controls. There are only three surface soil locations with a lead concentration above this action level. The majority of the lead contamination is in subsurface soils. Figure 4 shows the areas to be designated for institutional controls for lead contamination at Site 36.

Institutional controls can be implemented at this site to minimize exposure to potential hazards from lead contamination in surface and subsurface soil at the site. Under this proposed action, defining areas that will have land use controls placed on them will minimize exposure to contaminated soil. These controls include future use restrictions. Excavation restrictions (i.e., intrusive activities) will also be necessary. These restrictions will be implemented through modifications of the Base Master Planning Process and presented in the "Notice of Inactive Hazardous Waste Disposal Site" plat maps prepared for the Onslow County register of deeds. These restrictions will remain in place until it can be demonstrated that the remediation goals are achieved.

### *Site 43*

The interim response actions for Site 43 include:

1. Excavation and removal of PAH contaminated “hot spots” in one small area.
2. Implementation of land use controls for intrusive activities within the site boundary

The primary component of the proposed interim response actions at Site 43 is the removal of the elevated levels of PAH contaminated soil. This action consists of removal of soil contaminated with elevated levels of PAHs and returning the site to pre-excavation conditions. Table 4 presents the final soil COCs for the proposed interim response action at Site 43. PAHs detected in Site 43 surface and subsurface soil were compared to various standards and risk-based criteria including North Carolina SSLs and USEPA Region IX Residential PRGs for estimating the volumes of soil and costs. The contaminated soil will likely be disposed off-site in the Base landfill. This alternative also includes institutional controls that would be applied to the entire site boundary of Site 43.

For this proposed action, an area of elevated PAH contamination would be excavated and removed. The excavation area for this option can be seen in Figure 5 and the total volume for site-wide excavation is approximately 750 CY.

Confirmatory sampling will take place to ensure that all contaminants exceeding screening criteria have been excavated. Samples will be analyzed for PAHs. The excavated soil will be transported to the Base landfill for proper disposal.

Following the excavation operation, the site would be restored by placing clean backfill (assumed to be from an on-Base borrow area) to bring the site back to its original grade. All disturbed areas would be revegetated with native grasses and plant species to control erosion. Access roads or other infrastructure that are disturbed or destroyed in the excavation process would be restored to original conditions.

Because this site is a former disposal area materials and debris may potentially remain on site; therefore, land use restrictions will prohibit intrusive activities within the site boundary. Land use controls will include restrictions on intrusive activities at the site (e.g., excavation or construction) other than for monitoring or future remediation purposes. These restrictions will be implemented through modifications of the Base Master Planning Process and presented in the "Notice of Inactive Hazardous Substances or Waste Disposal Site" plat maps prepared for the Onslow County register of deeds. These restrictions will remain in place until it can be demonstrated that remedial goals are achieved.

## **2. Contribution to Remedial Performance**

These interim response actions include the removal of several areas with elevated PAH and pesticide contaminated soil at Site 36 and one area of elevated PAH contaminated soil at Site 43. The removal actions will be protective of human health for future receptors of the site by eliminating the direct-contact risk presented by the soil. This conclusion is based upon the 2002 EE/CA (Baker, 2002a).

Other components of the interim response action that are being implemented following the soil removal actions are also protective of human health. These actions include land use controls for former disposal areas at Sites 36 and 43 and for the lead contaminated areas at Site 36.

### *Extent of Remediation Accomplished with the Interim Response Actions:*

The interim response actions will significantly reduce direct contact exposures by removal of the contaminated surface and subsurface soil. Removal of elevated residual contamination in soil, will be verified through confirmation samples. Further, the land use controls will protect future receptors from lead contamination at Site 36 and from the former disposal areas at Site 36 and Site 43. Institutional controls will limit future land use and excavation.

### **3. Description of Alternative Technologies**

Capping was also considered in the EE/CA as an alternative to excavation at both Sites 36 and 43. This alternative technology is described below.

#### *Capping:*

A capping process option (i.e., soil cover) for Site 36 and 43 would consist of placing compacted soil fill, with topsoil and vegetation, on top of the compacted fill. The soil cover would reduce the potential for direct exposure to the contaminated soil and would minimize the potential for contaminant migration via surface water runoff and erosion. A soil cover does not prevent infiltration from precipitation. As contaminants do remain in the soil, permanent erosion controls are required as well as excavation restrictions. A budgetary cost estimate for the capping alternatives are provided in Attachment B.

### **4. Applicable or Relevant and Appropriate Requirements**

The 1990 NCP requires that removal actions attain applicable or relevant and appropriate federal and state requirements (ARARs) with limited exception, to the extent practicable. Four factors are applied to determine whether the attainment of ARARs is practicable in a particular removal situation: (1) the exigencies of the situation; (2) the scope of the removal action to be taken; (3) the effect of ARAR attainment on the statutory limits for removal action duration and cost; and (4) the criteria listed under SARA Section 121(d) providing conditions under which ARARs may be waived. The criteria listed under SARA Section 121(d)(4) for which ARARs may be waived include the following:

- Interim remedy waiver
- Greater risk to health and the environment
- Technical impracticability
- Inconsistent application of State requirements

The interim removal actions set forth in this memorandum will comply with all applicable, relevant, and appropriate environmental and health requirements.

ARARs are divided into three categories: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are particular to individual contaminants. Location-specific ARARs depend upon the location of the contamination and potential restrictions on activities conducted in these areas (i.e., wetlands, floodplains, etc.). Action-specific ARARs govern the remedial action and are usually technology- or Base-specific directions or limitations that control actions taken at CERCLA sites. In addition to ARARs, USEPA may, as appropriate, identify other Federal or State advisories, criteria, or guidance to be considered for specific releases.

The following ARARs may be applicable to the interim removal actions at Sites 36 and 43 and will be considered:

- Chemical-specific ARARs:
  - ◆ USEPA Region IX Residential PRGs
  - ◆ OSWER Directive for Lead
  - ◆ Oil Pollution and Hazardous Substances Control Act (NCGS 143-215.75 et seq.)
  - ◆ North Carolina Air Pollution Control Regulations (15A NCAC 2D, 2H, 2Q)
  - ◆ North Carolina Hazardous Waste Management Rules (15A NCAC 13A .0009 & .0012)
  
- Location-specific ARARs:
  - ◆ Fish and Wildlife Coordination Act
  - ◆ Federal Endangered Species Act
  - ◆ North Carolina Endangered Species Act
  - ◆ Executive Order 11988 on Floodplain Management
  - ◆ RCRA Location Requirements
  - ◆ North Carolina Hazardous Waste Management Rules
  - ◆ North Carolina Solid Waste Management Rules



**VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN**

If no action is taken or the action is significantly delayed, future site receptors may be at risk. However, no current receptors are at risk from PAH or pesticide contamination at Site 36 or PAH contamination at Site 43. Therefore, the interim response actions are not time critical, however the actions should be completed due to localized areas of contamination.

**VII. OUTSTANDING POLICY ISSUES**

As noted herein, both Federal (USEPA) and state (NC DENR) agencies are currently involved in environmental planning for OU No. 6 at MCB, Camp Lejeune. The general public is also involved via the RAB, the announcement of available site related information, and the published request for public comment. A Public Meeting was held on June 18, 2002 and presented the proposed interim response actions at these sites. All of the agency and public comments received in relation to this Action Memorandum will be taken into consideration prior to the start of the interim response actions at Sites 36 and 43.

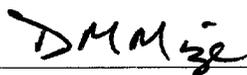
**VIII. ENFORCEMENT**

The DoN can and will perform the approved response actions for Sites 36 and 43 promptly and properly.

**IX. RECOMMENDATION**

This decision document presents the selected interim response actions for Site 36 – Camp Geiger Area Dump and Site 43 – Agan Street Dump. These interim response actions were developed in accordance with CERCLA as amended, and are consistent with the NCP.

Approval by:



Major General D.M. Mize  
Commanding General  
Marine Corps Base, Camp Lejeune

20 NOV 2002

Date

## **X. REFERENCES**

Baker, 2002a. "Final Engineering Evaluation/Cost Analysis, Operable Unit No. 6", Baker Environmental, Inc. October 2002.

Baker, 2002b. "Draft Pre-Final Version 4, Record of Decision, Operable Unit No. 6, Sites 36, 43, 44, and 54", Baker Environmental, Inc. October 2002.

Baker 2001. "Annual Monitoring Report, Operable Unit No. 6 - Sites 36 and 54", Baker Environmental, Inc. October 2001.

Baker, 1998b. "Final Feasibility Study Report, Operable Unit No. 6, Site 36", Baker Environmental, Inc. June 1998.

Baker, 1996. "Final Remedial Investigation Report For Operable Unit No. 6, Site 36," Baker Environmental, Inc. August 1996.

Baker, 1996b. "Final Remedial Investigation Report For Operable Unit No. 6, Site 43," Baker Environmental, Inc. August 1996.

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USEPA, 1990. "Superfund Removal Procedures, Action Memorandum Guidance." EPA/540/P-90/004. December 1990.

USEPA, 1993. "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA."  
EPA/540-R-93-057. August 1993.

USEPA, 1999. "Region IX Preliminary Remediation Goals", March 2000

**FIGURES**

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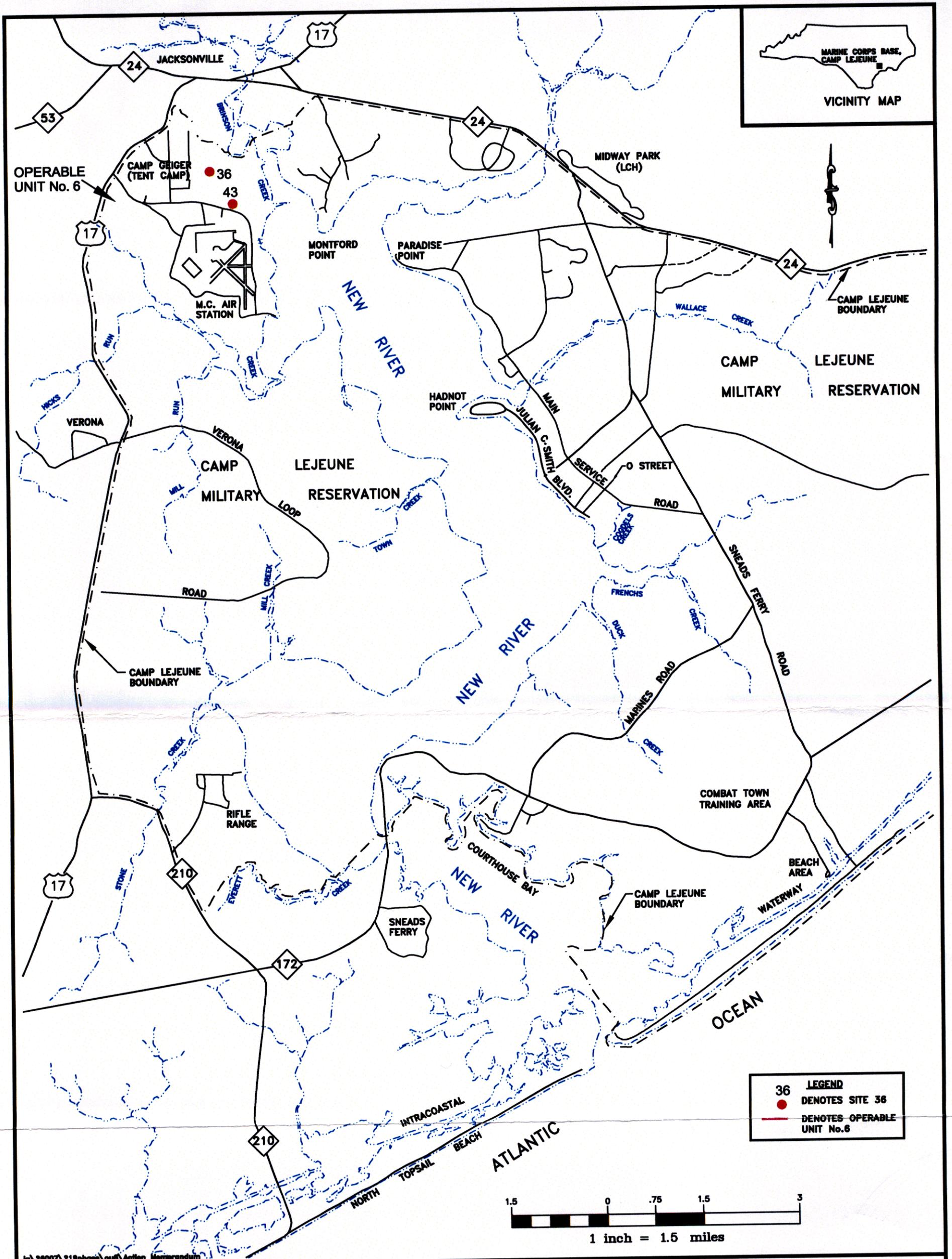
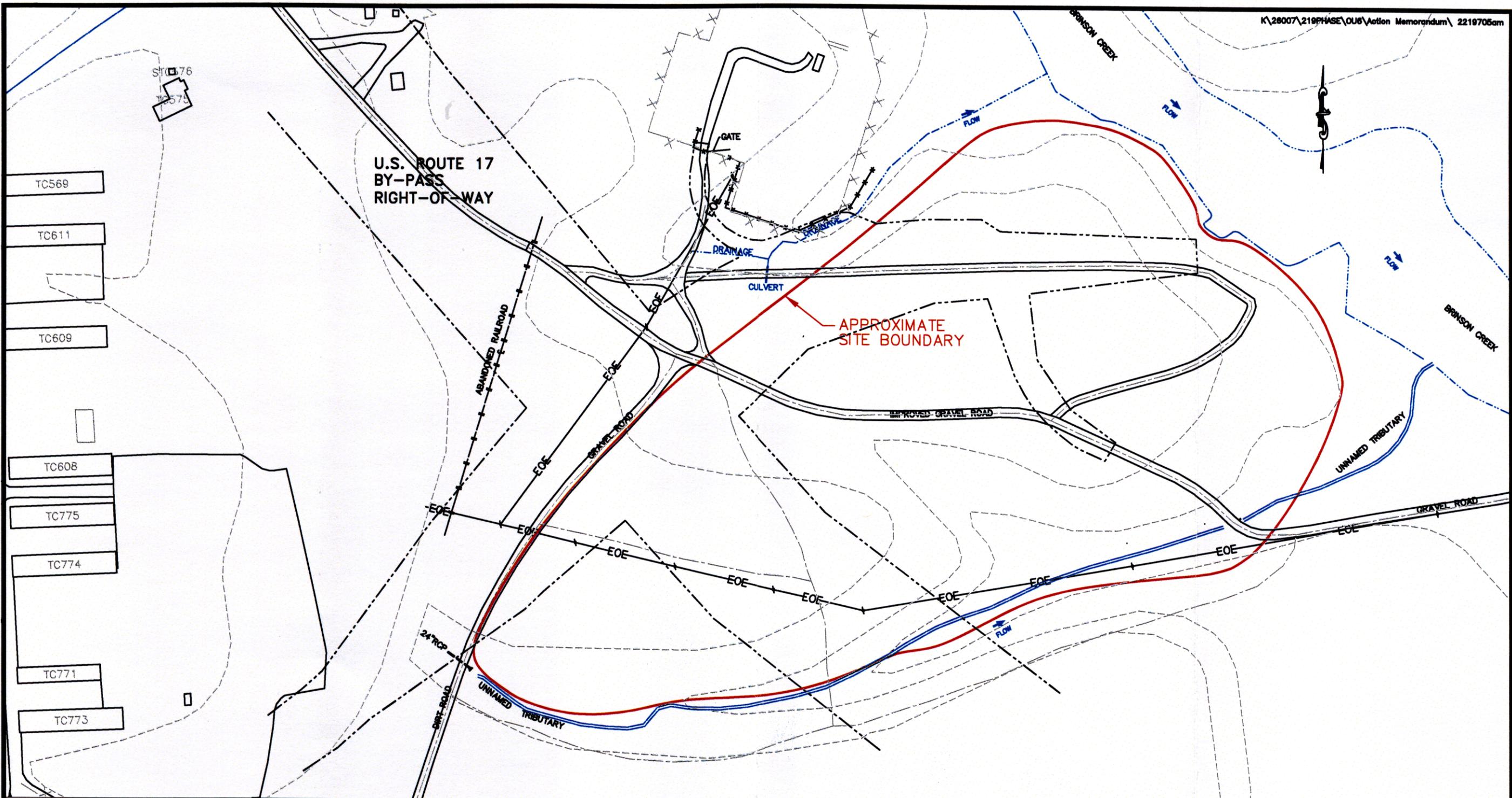


FIGURE 1  
 SITE LOCATION MAP  
 ACTION MEMORANDUM  
 OPERABLE UNIT No. 6 - SITES 36 AND 43  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



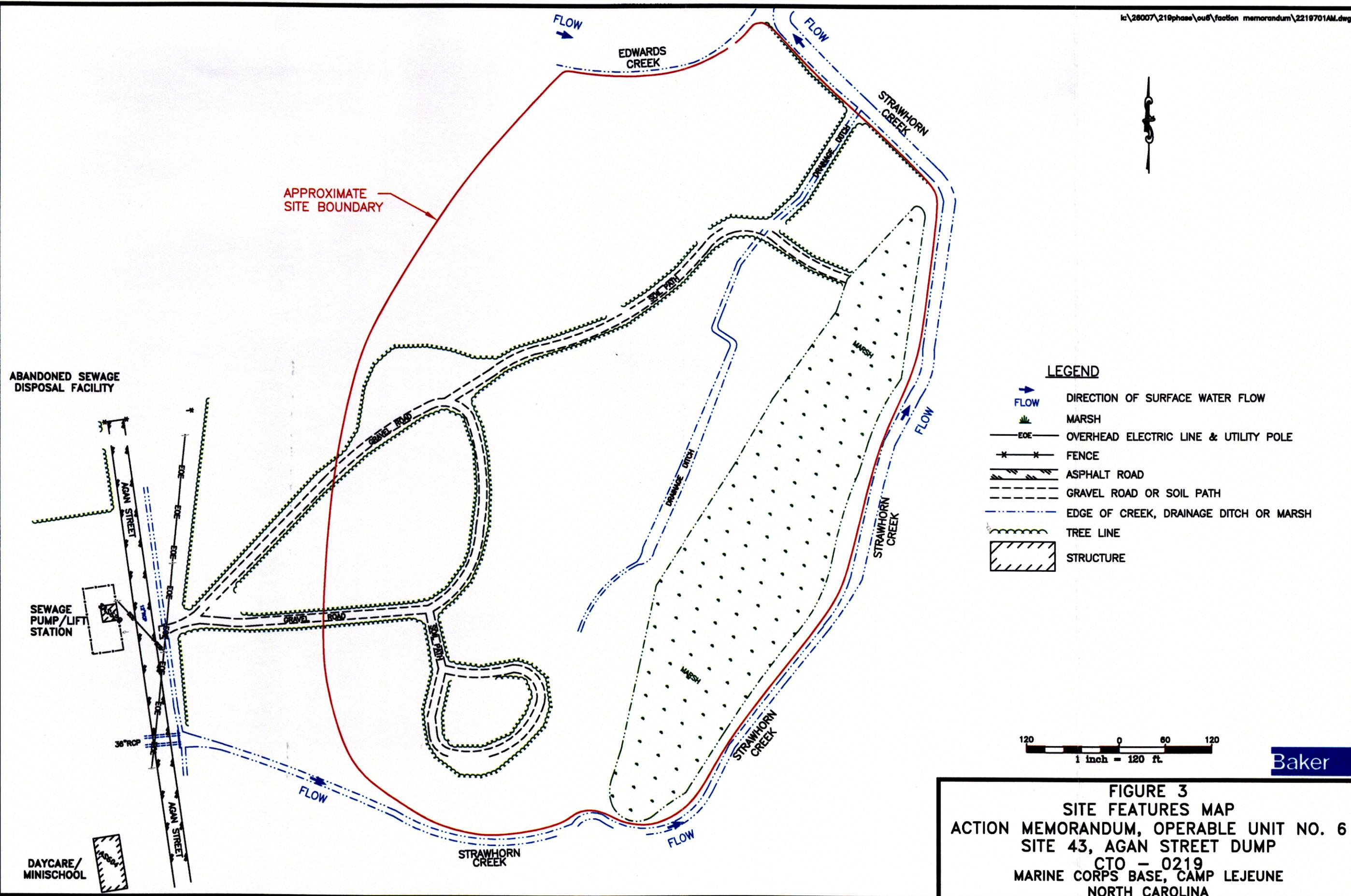
**LEGEND**

- DIRECTION OF SURFACE WATER FLOW
- OVERHEAD ELECTRIC LINE & UTILITY POLE
- FENCE

- ASPHALT ROAD
- GRAVEL ROAD
- STREAM
- US 17 JACKSONVILLE BYPASS EASEMENT LIMITS

SOURCE: LANTDIV, MARCH 2000

**FIGURE 2**  
**SITE FEATURES MAP**  
 ACTION MEMORANDUM, OPERABLE UNIT NO. 6  
 SITE 36, CAMP GEIGER DUMP AREA  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



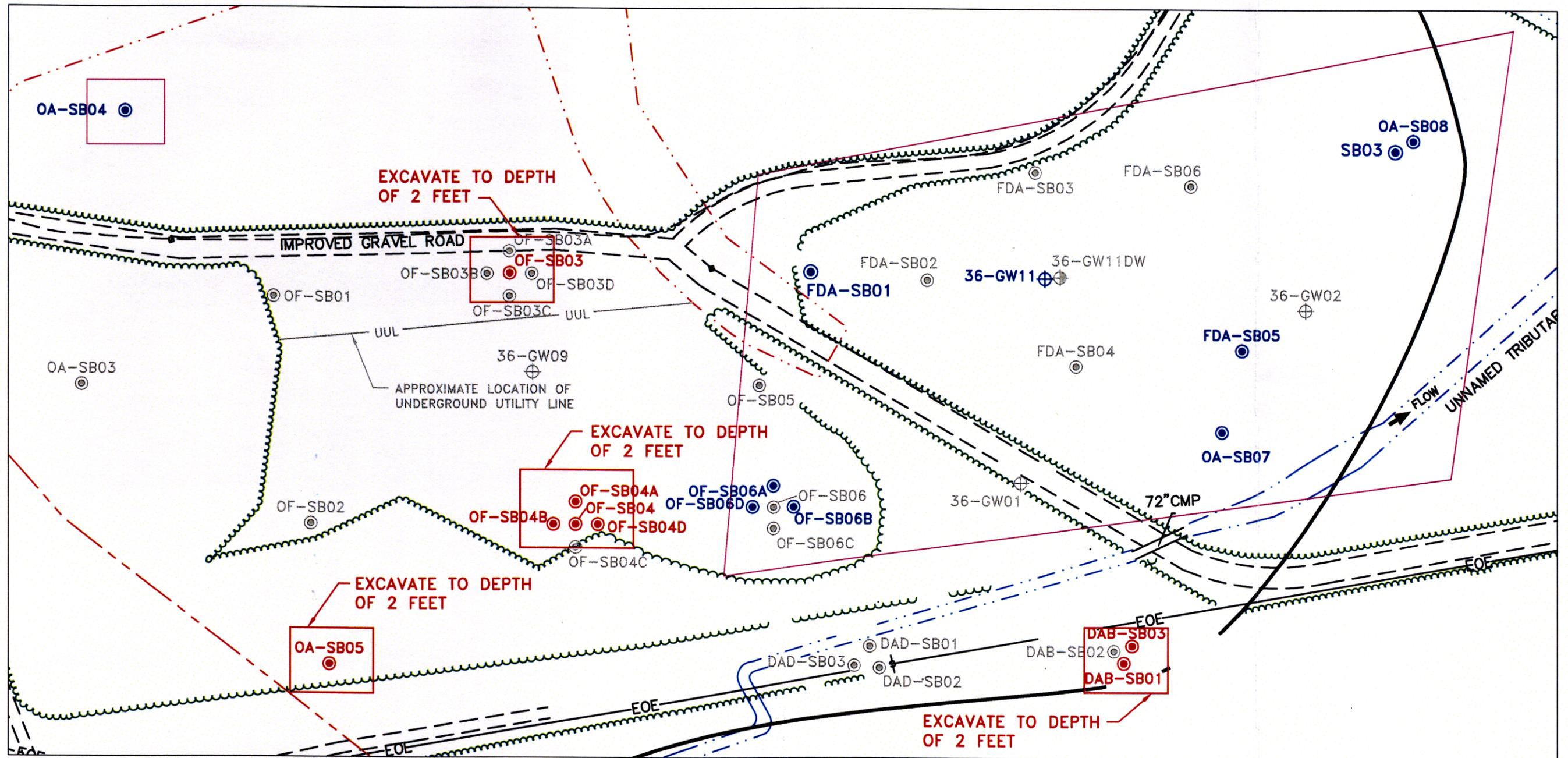
**LEGEND**

	FLOW	DIRECTION OF SURFACE WATER FLOW
	MARSH	MARSH
	EOE	OVERHEAD ELECTRIC LINE & UTILITY POLE
	FENCE	FENCE
	ASPHALT ROAD	ASPHALT ROAD
	GRAVEL ROAD OR SOIL PATH	GRAVEL ROAD OR SOIL PATH
	EDGE OF CREEK, DRAINAGE DITCH OR MARSH	EDGE OF CREEK, DRAINAGE DITCH OR MARSH
	TREE LINE	TREE LINE
	STRUCTURE	STRUCTURE



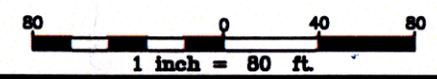
**Baker**

**FIGURE 3**  
**SITE FEATURES MAP**  
 ACTION MEMORANDUM, OPERABLE UNIT NO. 6  
 SITE 43, AGAN STREET DUMP  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA



NOTE:  
 SOIL BORINGS IN RED EXCEED REGION IX RESIDENTIAL PRGs.  
 SAMPLE LOCATIONS IN BLUE EXCEED USEPA OSWER DIRECTIVE FOR LEAD (400 ppm).

LEGEND	
⊕	SHALLOW MONITORING WELL
⊕	INTERMEDIATE MONITORING WELL
⊕	DEEP MONITORING WELL
●	SOIL BORING LOCATION
-UUL-	UNDERGROUND UTILITY LINE
==	GRAVEL ROAD
- - -	DRAINAGE DITCH
~~~~	TREE LINE
- . . -	US 17 JACKSONVILLE BYPASS EASEMENT LIMITS
---	INSTITUTIONAL CONTROL BOUNDARY FOR LEAD



**FIGURE 4**  
 SITE 36 EXCAVATION AND OFF-SITE DISPOSAL AND INSTITUTIONAL CONTROLS FOR LEAD  
 ACTION MEMORANDUM, OPERABLE UNIT NO. 6  
 SITE 36, CAMP GEIGER AREA DUMP  
 CTO - 0219  
 MARINE CORPS BASE, CAMP LEJEUNE  
 NORTH CAROLINA

LOCATION	43-WA-SB01A2-00
DATE SAMPLED	05/01/95
SEMIVOLATILE (ug/kg)	
ACENAPHTHENE	45 J
FLUORENE	53 J
PHENANTHRENE	1000
CARBAZOLE	280 J
FLUORANTHENE	2200
PYRENE	2100
BUTYLBENZYLPHTHALATE	50 J
BENZO(A)ANTHRACENE	980
CHRYSENE	1500
BENZO(B)FLUORANTHENE	2300
BENZO(K)FLUORANTHENE	700
BENZO(A)PYRENE	1300
INDENO(1,2,3-CD)PYRENE	1300
DIBENZO(A,H)ANTHRACENE	280 J
BENZO(G,H,I)PERYLENE	1200

LOCATION	43-WA-SB01A1-00
DATE SAMPLED	05/01/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	610
CARBAZOLE	120 J
FLUORANTHENE	1500
PYRENE	1200
BENZO(A)ANTHRACENE	560
CHRYSENE	890
BENZO(B)FLUORANTHENE	1100
BENZO(K)FLUORANTHENE	420
BENZO(A)PYRENE	690
INDENO(1,2,3-CD)PYRENE	590
DIBENZO(A,H)ANTHRACENE	110 J
BENZO(G,H,I)PERYLENE	560

LOCATION	43-WA-SB01B-00
DATE SAMPLED	03/14/95
SEMIVOLATILE (ug/kg)	
FLUORANTHENE	130 J
PYRENE	150 J
BENZO(A)ANTHRACENE	67 J
CHRYSENE	120 J
BENZO(B)FLUORANTHENE	600
BENZO(K)FLUORANTHENE	280 J
BENZO(A)PYRENE	770
INDENO(1,2,3-CD)PYRENE	590
DIBENZO(A,H)ANTHRACENE	110 J
BENZO(G,H,I)PERYLENE	380 J

LOCATION	43-WA-SB01C-00
DATE SAMPLED	03/14/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	54 J
FLUORANTHENE	350
PYRENE	430
BENZO(A)ANTHRACENE	280 J
CHRYSENE	340 J
BENZO(B)FLUORANTHENE	500
BENZO(K)FLUORANTHENE	200 J
BENZO(A)PYRENE	480
INDENO(1,2,3-CD)PYRENE	550
DIBENZO(A,H)ANTHRACENE	47 J
BENZO(G,H,I)PERYLENE	480

LOCATION	43-WA-SB01-00
DATE SAMPLED	02/28/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	260 J
FLUORANTHENE	530
PYRENE	470
BENZO(A)ANTHRACENE	190 J
CHRYSENE	370 J
BENZO(B)FLUORANTHENE	410
BENZO(K)FLUORANTHENE	200 J
BENZO(A)PYRENE	260 J
INDENO(1,2,3-CD)PYRENE	270 J
DIBENZO(A,H)ANTHRACENE	73 J
BENZO(G,H,I)PERYLENE	280 J

LOCATION	43-WA-SB02-01
DATE SAMPLED	02/28/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	430
CARBAZOLE	73 J
FLUORANTHENE	850
PYRENE	1800 J
BUTYLBENZYLPHTHALATE	39 J
BENZO(A)ANTHRACENE	390 J
CHRYSENE	740 J
BENZO(B)FLUORANTHENE	780
BENZO(K)FLUORANTHENE	340 J
BENZO(A)PYRENE	570
INDENO(1,2,3-CD)PYRENE	890
DIBENZO(A,H)ANTHRACENE	170 J
BENZO(G,H,I)PERYLENE	790

LOCATION	43-WA-SB01A-00
DATE SAMPLED	03/14/95
SEMIVOLATILE (ug/kg)	
2-METHYLNAPHTHALENE	74 J
ACENAPHTHENE	2900
DIBENZOFURAN	870
FLUORENE	1700
PHENANTHRENE	5900 J
ANTHRACENE	820
CARBAZOLE	350 J
FLUORANTHENE	60000
PYRENE	64000
BENZO(A)ANTHRACENE	41000
CHRYSENE	46000
BENZO(B)FLUORANTHENE	52000
BENZO(K)FLUORANTHENE	20000
BENZO(A)PYRENE	39000
INDENO(1,2,3-CD)PYRENE	27000
DIBENZO(A,H)ANTHRACENE	12000
BENZO(G,H,I)PERYLENE	24000

LOCATION	43-WA-SB01A4-00
DATE SAMPLED	05/01/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	67 J
FLUORANTHENE	230 J
PYRENE	170 J
BENZO(A)ANTHRACENE	51 J
CHRYSENE	110 J
BENZO(B)FLUORANTHENE	170 J
BENZO(K)FLUORANTHENE	57 J
BENZO(A)PYRENE	79 J
INDENO(1,2,3-CD)PYRENE	90 J
BENZO(G,H,I)PERYLENE	87 J

LOCATION	43-WA-SB01A3-00
DATE SAMPLED	05/01/95
SEMIVOLATILE (ug/kg)	
ACENAPHTHYLENE	71 J
ACENAPHTHENE	63 J
DIBENZOFURAN	35 J
FLUORENE	59 J
PHENANTHRENE	1300
ANTHRACENE	210 J
CARBAZOLE	300 J
FLUORANTHENE	6400
PYRENE	6500
BUTYLBENZYLPHTHALATE	100 J
BENZO(A)ANTHRACENE	3200
CHRYSENE	4500
BENZO(B)FLUORANTHENE	6800
BENZO(K)FLUORANTHENE	1300
BENZO(A)PYRENE	4700
INDENO(1,2,3-CD)PYRENE	3600
DIBENZO(A,H)ANTHRACENE	710
BENZO(G,H,I)PERYLENE	3400

LOCATION	43-GW01DW-00
DATE SAMPLED	02/28/95
SEMIVOLATILE (ug/kg)	
PHENANTHRENE	720
ANTHRACENE	44 J
CARBAZOLE	99 J
FLUORANTHENE	1400
PYRENE	1100
BENZO(A)ANTHRACENE	570
CHRYSENE	1000
BENZO(B)FLUORANTHENE	1500
BENZO(K)FLUORANTHENE	580
BENZO(A)PYRENE	760
INDENO(1,2,3-CD)PYRENE	500
DIBENZO(A,H)ANTHRACENE	110 J
BENZO(G,H,I)PERYLENE	420

© OA-SB02

© WA-SB03

**LEGEND**

- 43-GW01DW PILOT TEST BORING FOR DEEP MONITORING WELL
- OA-SB01 SOIL BORING LOCATION
- WA-SB01A SURFACE SOIL SAMPLE LOCATION
- GRAVEL ROAD OR SOIL PATH
- TREE LINE

**RESIDENTIAL REGION IX PRELIMINARY REMEDIATION GOALS (PRGs)**

SEMI VOLATILE ORGANIC COMPOUNDS	REGION IX PRGS-RESIDENTIAL
2-METHYLNAPHTHALENE	NE
ACENAPHTHENE	3,700,000
ACENAPHTHYLENE	NE
DIBENZOFURAN	290,000
CARBAZOLE	24,000
FLUORENE	2,600,000
PHENANTHRENE	NE
FLUORANTHENE	2,300,000
PYRENE	2,300,000
BUTYLBENZYLPHTHALATE	12,000,000
BENZO(A)ANTHRACENE	620
CHRYSENE	62,000
BENZO(B)FLUORANTHENE	620
BENZO(K)FLUORANTHENE	6,200
BENZO(A)PYRENE	62
INDENO(1,2,3-CD)PYRENE	620
BENZO(G,H,I)PERYLENE	NE
DIBENZO(A,H)ANTHRACENE	62

- NOTE:
1. CONCENTRATIONS PRESENTED IN MICROGRAMS PER KILOGRAM.
  2. EXCEED REGION IX RESIDENTIAL PRG SHOWN IN RED.



**FIGURE 5**  
**SITE 43**  
**EXCAVATION AND OFF-SITE DISPOSAL**  
**ACTION MEMORANDUM, OPERABLE UNIT NO. 6**  
**SITE 43, AGAN STREET DUMP**  
**CTO - 0219**  
**MARINE CORPS AIR STATION, NEW RIVER**  
**NORTH CAROLINA**

**ATTACHMENT A**  
**TABLES AND FIGURES**

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**TABLE 1**  
**REMEDIAL INVESTIGATION RESULTS FOR SITE 36**  
**OPERABLE UNIT NO. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB CAMP LEJEUNE, NORTH CAROLINA**

Media	Fraction	Detected Contaminants	Screening Criteria <sup>(2)</sup>	Site Contamination		Maximum Location	Detection Frequency	Distribution
				Min.	Max.			
Surface Soil	Volatiles	Trichloroethene	2,800	4	4	FDA-SB03	1/61	eastern, former disposal area
		Tetrachloroethene	5,700	2	3	36-GW12	3/61	northern, ground scar area
		Toluene	520,000	8	98	OF-SB01	4/61	south central, open field
		Styrene	1,700,000	39	39	GS-SB03	1/61	northern, ground scar area
		Xylene (total)	210,000	7	7	OF-SB06B	1/61	south central, open field
	Semivolatiles	n-Nitro-di-n-propylamine	69	320	320	DAB-SB03	1/57	southeastern, drum area
		Naphthalene (PAH)	56,000	48	120	OF-SB04	2/57	1 south central, 1 western
		2-Methylnaphthalene	1,600,000	54	82	OA-SB01A	2/57	1 south central, 1 western
		Acenaphthene (PAH)	3,700,000	330	330	OF-SB04	1/57	south central, open field
		Dibenzofuran	290,000	150	150	OF-SB04	1/57	south central, open field
		Fluorene (PAH)	2,600,000	200	200	OF-SB04	1/57	south central, open field
		Phenanthrene (PAH)	NA	59	2,500	OF-SB04	4/57	scattered
		Anthracene (PAH)	22,000,000	780	780	OF-SB04	1/57	south central, open field
		Carbazole	NA	240	240	OF-SB04	1/57	south central, open field
		Fluoranthene (PAH)	2,300,000	54	5,500	OF-SB04	5/57	4 southeastern, drum area
		Pyrene (PAH)	2,300,000	41	11,000	OF-SB04	8/57	5 southeastern, drum area
		Butylbenzylphthalate	12,000,000	51	290	OA-SB03	3/57	western
		B(a)anthracene (PAH)	620	46	3,900	OF-SB04	2/57	1 south central, 1 southeastern
		Chrysene (PAH)	62,000	51	4,600	OF-SB04	5/57	3 southeastern, drum area
		B(b)fluoranthene (PAH)	620	51	3,600	OF-SB04	3/57	scattered
		B(k)fluoranthene (PAH)	6,200	39	1,500	OF-SB04	2/57	1 south central, 1 southeastern
		Benzo(a)pyrene (PAH)	62	40	3,300	OF-SB04	2/57	1 south central, 1 western
		I(1,2,3-cd)pyrene (PAH)	620	46	2,700	OF-SB04	3/57	scattered
		D(a,h)anthracene (PAH)	62	720	720	OF-SB04	1/57	south central, open field
		B(g,h,i)perylene (PAH)	NA	2,400	2,400	OF-SB04	1/57	south central, open field
	Pesticides	gamma-BHC (Lindane)	440	4	4	OF-SB06D	1/57	south central, open field
		Aldrin	29	5	5.1	OF-SB03	3/57	1 open field, 2 adjacent to SB01
		Heptachlor	110	1.9	1.9	FCA-SB12	1/57	southwestern, former cleared area
		Heptachlor epoxide	53	2	67	OA-SB01I	10/57	scattered, 3 adjacent to SB01
		Endosulfan I	370000	8.3	36	OA-SB01E	3/57	all adjacent to SB01
		Dieldrin	30	2	16,000	OF-SB03	21/57	scattered
		4-4'-DDE	1700	2.2	2,600	OA-SB01A	49/57	widely scattered, prevalent
		Endrin	18000	9.9	9.9	OA-SB08	1/57	eastern, former disposal area
		4-4'-DDD	2400	2.8	550	OA-SB01A	37/57	widely scattered, prevalent
		Endosulfan Sulfate	NA	2.5	4.2	OF-SB06	2/57	1 south central, 1 western
		4-4'-DDT	1700	1.8	12,000	OA-SB01A	48/57	widely scattered, prevalent
		Endrin Ketone	NA	15	15	OF-SB03	1/57	south central, open field
		Endrin aldehyde	NA	12	12	OF-SB02	1/57	south central, open field
		alpha-Chlordane	1600	1.2	980	OA-SB05	15/57	scattered
		gamma-Chlordane	1600	1.2	840	OA-SB05	10/57	scattered
	PCBs (1)	Aroclor 1248	220	68	24,000	OA-SB01I	9/57	western, surrounding SB01
Aroclor 1254		220	92	530	OA-SB01	3/57	western, surrounding SB01	
Metals	Aluminum	76,000	1,010	17,600	FCA-SB09	52/52	scattered	
	Antimony	31	3.3	31.7	OA-SB08	7/46	scattered	
	Arsenic	22	0.39	10.4	OA-SB08	43/52	scattered	

TABLE 1 (continued)  
 REMEDIAL INVESTIGATION RESULTS FOR SITE 36  
 OPERABLE UNIT NO. 6, SITES 36 and 43  
 ACTION MEMORANDUM, CTO-0219  
 MCB CAMP LEJEUNE, NORTH CAROLINA

Media	Fraction	Detected Contaminants	Screening Criteria <sup>(2)</sup>	Site Contamination		Maximum Location	Detection Frequency	Distribution
				Min.	Max.			
Surface Soil (Continued)	Metals (Continued)	Barium	5,400	4.5	141	OA-SB08	51/52	scattered
		Beryllium	150	0.18	0.18	FCA-SB10	1/52	1 detection southwest
		Cadmium	37	0.7	6.3	OA-SB08	8/52	scattered
		Calcium	NA	106	103,000	OF-SB06	51/52	scattered
		Chromium	210	1.6	51.6	OA-SB08	52/52	scattered
		Cobalt	4,700	0.88	9	OA-SB08	10/52	scattered
		Copper	2,900	0.6	445	OA-SB08	39/52	scattered
		Iron	23,000	863	86,200	OA-SB08	52/52	scattered
		Lead	400	4.3	836	OA-SB08	48/52	scattered
		Magnesium	NA	52	1,020	DAD-SB01	52/52	scattered
		Manganese	1,800	2.1	940	OA-SB08	52/52	scattered
		Mercury	23	0.1	2.4	OA-SB05	18/52	scattered
		Nickel	1,600	1	48.3	OA-SB08	26/52	scattered
		Potassium	NA	33.7	676	FCA-SB05	32/52	scattered
		Selenium	390	0.32	0.53	36-SB06D	12/52	scattered
		Silver	390,000	0.6	12	OF-SB04	8/48	3 south central
		Sodium	NA	9.6	358	DAD-SB01	31/52	scattered
		Vanadium	550	2.9	46	OA-SB08	50/52	scattered
Zinc	23,000	2.1	1,320	OA-SB08	50/52	scattered		
Subsurface Soil	Volatiles	Acetone	1,600,000	12	480	GS-SB03	8/62	1 exceeds blank, ground scar area
		1,2-Dichloroethene (total)	63,000	4	4	OA-SB01	1/62	western
		Trichloroethene	2,800	3	5	FDA-SB01	3/62	2 eastern, 1 western
		Benzene	670	3	3	FDA-SB01	1/62	eastern, former disposal area
		Toluene	520,000	5	17	OF-SB06	5/62	south central, open field
		Xylene (total)	210,000	2	6	FDA-SB06	8/62	scattered
	Semivolatiles	1,4-Dichlorobenzene	3,400	97	97	DAB-SB02	1/57	southeastern, drum area
		2-Methylphenol	3,100,000	510	510	DAB-SB01	1/58	southeastern, drum area
		4-Methylphenol	310,000	43	43	DAB-SB01	1/58	southeastern, drum area
		Isophorone	510,000	2,100	2,100	DAB-SB01	1/58	southeastern, drum area
		Naphthalene (PAH)	56,000	41	41	OA-SB01A	1/57	western
		2-Methylnaphthalene	1,600,000	65	85	FDA-SB02	2/57	1 eastern, 1 western
		Phenanthrene (PAH)	NA	48	190	OA-SB07	3/57	scattered
		Di-n-butylphtalate	6,100,000	56	56	OA-SB01	1/58	western
		Fluoranthene (PAH)	2,300,000	130	320	OA-SB07	3/57	2 eastern, 1 south central
		Pyrene (PAH)	2,300,000	59	320	OA-SB07	5/57	scattered
		Butylbenzylphtalate	12,000,000	42	170	OA-SB03	3/57	scattered
		B(a)anthracene (PAH)	620	69	140	OA-SB07	3/57	scattered
		Chrysene (PAH)	62,000	41	200	OA-SB07	5/57	3 eastern, former disposal area
		B(b)fluoranthene (PAH)	620	44	170	OA-SB07	5/57	4 eastern, 1 south central
		Semivolatiles	B(k)fluoranthene (PAH)	6,200	42	68	OA-SB07	3/57
Benzo(a)pyrene (PAH)	62		72	450	GS-SB03	4/57	3 eastern, 1 northern	
I(1,2,3-cd)pyrene (PAH)	620		48	110	OA-SB07	3/57	eastern, former disposal area	
B(g,h,i)perylene (PAH)	NA		42	89	OA-SB07	2/57	eastern, former disposal area	

TABLE 1 (continued)  
 REMEDIAL INVESTIGATION RESULTS FOR SITE 36  
 OPERABLE UNIT NO. 6, SITES 36 and 43  
 ACTION MEMORANDUM, CTO-0219  
 MCB CAMP LEJEUNE, NORTH CAROLINA

Media	Fraction	Detected Contaminants	Screening Criteria <sup>(2)</sup>	Site Contamination		Maximum Location	Detection Frequency	Distribution
				Min.	Max.			
Subsurface Soil (Continued)	Pesticides	gamma-BHC (Lindane)	440	4	4	OF-SB06D	1/56	open field
		Aldrin	29	1.5	16	36-GW11	5/56	3 southeastern, 2 eastern
		Heptachlor Epoxide	53	3.4	14	36-GW11	3/56	3 eastern, former disposal area
		Dieldrin	30	2.2	1,200	FDA-SB05	17/56	scattered
		4,4'-DDE	1,700	2.3	1,700	OA-SB01A	29/56	widely scattered, prevalent
		Endrin	18,000	2.4	5	OF-SB06B	5/56	scattered
		Endosulfan II	NA	2.0	2.0	OF-SB06B	1/56	south central, open field
		4,4'-DDD	2,400	2.3	1,300	FDA-SB05	30/56	widely scattered, prevalent
		4,4'-DDT	1,700	2.8	3,100	OA-SB01A	28/56	widely scattered, prevalent
		Endrin Aldehyde	NA	3.5	32	FDA-SB05	3/56	2 south central, 1 eastern
		alpha-Chlordane	1,600	1.6	750	36-GW11	12/56	primarily eastern
		gamma-Chlordane	1,600	2.3	770	36-GW11	9/56	primarily eastern
		PCBs (1)	Aroclor 1248	220	19	850	OA-SB01	5/56
	Metals	Aluminum	76,000	752	19,700	FDA-SB05	51/51	scattered
		Antimony	31	4.9	21.6	36-GW11	7/44	eastern
		Arsenic	22	0.2	25.9	FDA-SB01	41/51	eastern and central
		Barium	5,400	2	475	36-GW11	50/51	scattered
		Beryllium	150	0.17	0.18	FCA-SB10	2/51	southwestern
		Cadmium	37	0.7	42.8	36-GW11	11/51	eastern and central
		Calcium	NA	15	46,300	OF-SB06B	49/51	scattered
		Chromium	210	1.4	71.9	36-GW11	50/51	eastern and central
		Cobalt	4,700	0.48	9.4	OA-SB07	16/51	scattered
		Copper	2,900	0.5	1,320	OF-SB06B	31/51	scattered
		Iron	23,000	408	132,000	36-GW11	51/51	scattered
		Lead	400	1.2	2,680	OA-SB07	50/51	scattered
		Magnesium	NA	20.2	2,700	36-GW11	51/51	scattered
		Manganese	1,800	0.85	1,260	FDA-SB01	47/51	scattered
		Mercury	23	0.12	3.9	OA-SB07	13/51	east/southeastern
		Nickel	1,600	1.1	72.1	DAD-SB02	24/51	scattered
		Potassium	NA	47.2	1,640	FDA-SB06	32/51	scattered
		Selenium	390,000	0.4	1.2	OF-SB06	4/51	southcentral
		Silver	390	0.55	0.89	36-GW11	3/48	east central
		Sodium	NA	5.2	501	FDA-SB06	34/51	scattered
Vanadium	550	1.6	52.6	OF-SB06	49/51	scattered		
Zinc	23,000	0.9	2,580	FDA-SB05	41/51	scattered		

Notes:

- Organic concentrations are presented in ug/kg for soils (ppb) and metal concentrations for soils are presented in mg/kg (ppm).

(1) PCB contaminated soil was removed during the removal action that OHM conducted in 1997.

(2) Screening criteria are provided as a reference point and are Region IX Residential PRGs for surface and subsurface soil.

NA - Not applicable  
 BEHP - bis(2-ethylhexyl)phthalate

ND - Not detected  
 PAH - Polynuclear aromatic hydrocarbon

**TABLE 2**  
**REMEDIAL INVESTIGATION RESULTS FOR SITE 43**  
**OPERABLE UNIT NO. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB CAMP LEJEUNE, NORTH CAROLINA**

Media	Fraction	Detected Contaminants	Screening Criteria <sup>(1)</sup>	Site Contamination		Maximum Location	Detection Frequency	Distribution
				Min.	Max.			
Surface Soil	Volatiles	ND	--				0/7	
	Semivolatiles	4-Methylphenol	310,000	120	120	DA1-SB02	1/28	northeastern portion of site
		2-Methylnapthalene	1,600,000	74	74	WA-SB01A	1/28	clearing adjacent to 43-GW01
		Acenaphthylene	NA	71	71	WA-SB01A	1/28	clearing adjacent to 43-GW01
		Acenaphthene (PAH)	3,700,000	45	2,100	WA-SB01A	3/28	clearing adjacent to 43-GW01
		Dibenzpufuran	290,000	35	870	WA-SB01A	2/28	clearing adjacent to 43-GW01
		Fluorene (PAH)	2,600,000	53	1,700	WA-SB01A	3/28	clearing adjacent to 43-GW01
		Phenanthrene (PAH)	NA	54	5,900	WA-SB01A	8/28	clearing adjacent to 43-GW01
		Anthracene (PAH)	22,000,000	44	820	WA-SB01A	3/28	clearing adjacent to 43-GW01
		Carbazole	NA	99	350	WA-SB01A	5/28	clearing adjacent to 43-GW01
		Fluoranthene (PAH)	2,300,000	49	60,000	WA-SB01A	10/28	clearing adjacent to 43-GW01
		Pyrene (PAH)	2,300,000	49	64,000	WA-SB01A	10/28	clearing adjacent to 43-GW01
		Butylbenzylphthalate	12,000,000	50	420	OA-SB03	3/28	maximum northeast of clearing
		B(a)anthracene (PAH)	620	51	40,000	WA-SB01A	9/28	clearing adjacent to 43-GW01
		Chrysene (PAH)	62,000	110	46,000	WA-SB01A	9/28	clearing adjacent to 43-GW01
		B(b)fluoranthene (PAH)	620	44	52,000	WA-SB01A	10/28	clearing adjacent to 43-GW01
		B(k)fluoranthene (PAH)	6,200	57	20,000	WA-SB01A	9/28	clearing adjacent to 43-GW01
		Benzo(a)pyrene (PAH)	62	79	39,000	WA-SB01A	9/28	clearing adjacent to 43-GW01
		I(1,2,3-cd)pyrene (PAH)	620	42	27,000	WA-SB01A	10/28	clearing adjacent to 43-GW01
		D(a,h)anthracene (PAH)	62	47	1,200	WA-SB01A	8/28	clearing adjacent to 43-GW01
		B(g,h,i)perylene (PAH)	NA	87	24,000	WA-SB01A	9/28	clearing adjacent to 43-GW01
	Pesticides	Heptachlor epoxide	53	2	2	WA-SB01A	1/7	clearing adjacent to 43-GW01
		4-4'-DDE	1,700	5.7	1,000	DA1-SB03	5/7	maximum northeast
		4-4'-DDD	2,400	3,000	3,000	DA1-SB03	1/7	northeastern portion of site
		4-4'-DDT	1,700	10	1,000	DA1-SB03	4/7	maximum northeast
		Endrin aldehyde	NA	5.4	5.4	DA2-SB03	1/7	north of clearing
	PCBs	ND	--	--	--	--	0/7	
	Metals	Cadmium	37	0.7	1.7	WA-SB02	2/21	separate areas
		Chromium	210	1.1	106	DA1-SB02	21/21	scattered

**TABLE 2 (continued)**  
**REMEDIAL INVESTIGATION RESULTS FOR SITE 43**  
**OPERABLE UNIT NO. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB CAMP LEJEUNE, NORTH CAROLINA**

Media	Fraction	Detected Contaminants	Screening Criteria <sup>(1)</sup>	Site Contamination		Maximum Location	Detection Frequency	Distribution
				Min.	Max.			
Surface Soil (continued)	Metals (continued)	Copper	2,900	0.5	55.7	DA2-SB01	17/21	north of clearing
		Lead	400	4.3	246	DA2-SB01	20/21	scattered
		Manganese	1,800	2.8	189	DA2-SB01	21/21	scattered
		Mercury	23	0.1	0.5	DA1-SB02	3/21	drum areas
		Nickel	1,600	1.1	5	DA2-SB01	8/21	scattered
		Zinc	23,000	1.5	595	DA1-SB02	21/21	scattered
Subsurface Soil	Volatiles	ND	--				0/7	
	Semivolatiles	Phenanthrene (PAH)	NA	430	430	WA-SB02	1/20	clearing adjacent to 43-GW01
		Carbazole	NA	73	73	WA-SB02	1/20	clearing adjacent to 43-GW01
		Fluoranthene (PAH)	2,300,000	850	850	WA-SB02	1/20	clearing adjacent to 43-GW01
		Pyrene (PAH)	2,300,000	1,800	1,800	WA-SB02	1/20	clearing adjacent to 43-GW01
		Butylbenzylphtalate	12,000,000	39	440	OA-SB03	2/20	north of clearing
		B(a)anthracene (PAH)	620	390	390	WA-SB02	1/20	clearing adjacent to 43-GW01
		Chrysene	62,000	740	740	WA-SB02	1/20	clearing adjacent to 43-GW01
		B(b)fluoranthene (PAH)	620	780	780	WA-SB02	1/20	clearing adjacent to 43-GW01
		B(k)fluoranthene (PAH)	6,200	340	340	WA-SB02	1/20	clearing adjacent to 43-GW01
		Benzo(a)pyrene (PAH)	62	570	570	WA-SB02	1/20	clearing adjacent to 43-GW01
		I(1,2,3-cd)pyrene (PAH)	620	890	890	WA-SB02	1/20	clearing adjacent to 43-GW01
	B(g,h,i)perylene (PAH)	NA	790	790	WA-SB02	1/20	clearing adjacent to 43-GW01	
	Pesticides	4,4'-DDE	1,700	9	9	DA1-SB03	1/7	northeastern portion or site
		4,4'-DDD	2,400	1,200	1,200	DA1-SB03	1/7	northeastern portion or site
		4,4'-DDT	1,700	45	45	DA1-SB03	1/7	northeastern portion or site
	PCBs	ND	--				0/7	
Metals	Copper	2,900	0.4	3.6	OA-SB01	6/20	north of clearing	

Notes:

- Organic concentrations are presented in ug/kg for solids (ppb), metal concentrations for soils are presented in mg/kg (ppm).
- (1) Screening criteria are provided as a reference point and are Region IX Residential PRGs for surface and subsurface soil.

ARAR - Applicable or Relevant and Appropriate Requirements  
 NA - Not applicable

ND - Not detected

**TABLE 3**  
**SITE 36 FINAL SOILS COCs**  
**OPERABLE UNIT NO. 6, SITES 36 AND 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB CAMP LEJEUNE, NORTH CAROLINA**

Contaminant
<b>SEMIVOLATILES</b>
Benzo(a)anthracene (PAH)
Benzo(a)pyrene (PAH)
Benzo(b)fluoranthene (PAH)
Dibenz(a,h)anthracene (PAH)
Indeno(1,2,3-cd)pyrene (PAH)
n-Nitro-di-n-propylamine
<b>PESTICIDES</b>
4-4'-DDE
4-4'-DDT
Dieldrin
Gamma-Chlordane
Heptachlor epoxide
<b>METALS</b>
Lead

Notes:

The PRGs were used to estimate the approximate area and depth of the removal actions, and were used for cost estimating purposes. The actual volumes proposed for removal will be determined in the field during the remedial action. For lead, the EPA OSWER Action level was used to establish the institutional control boundaries.

**TABLE 4**  
**SITE 43 FINAL SOILS COCs**  
**OPERABLE UNIT NO. 6, SITES 36 AND 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB CAMP LEJEUNE, NORTH CAROLINA**

Contaminant
<b>SEMIVOLATILES</b>
Benzo(a)anthracene (PAH)
Benzo(a)pyrene (PAH)
Benzo(b)fluoranthene (PAH)
Benzo(k)fluoranthene (PAH)
Dibenz(a,h)anthracene (PAH)
Indeno(1,2,3-cd)pyrene (PAH)

**Notes:**

The PRGs were used to estimate the approximate area and depth of the removal actions, and were used for cost estimating purposes. The actual volumes proposed for removal will be determined in the field during the remedial action.



**TABLE B-1**  
**SITE 36 CAPPING AND INSTITUTIONAL CONTROLS FOR LEAD CONTAMINATED AREAS**  
**BUDGETARY COST ESTIMATE <sup>(1)</sup>**  
**OPERABLE UNIT No. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Cost Item	Quantity	Units	Unit Cost	Total Cost	Assumptions (Basis of Cost Estimate)
<b>DIRECT CAPITAL COSTS</b>					
<b>I. Site Preparation</b>					
A. Mobilization/Demobilization	1	LS	\$10,000	\$10,000	Engineering Judgement
B. Erosion Protection (Silt Fence)	820	LF	\$0.93	\$763	Means Site Work 2002 (02370-550-1000)
C. Clearing and Grubbing	0.28	AC	\$2,150	\$603	Means Site Work 2002 (02200-200-0010)
<i>Subtotal</i>				\$11,365	
<b>II. Capping and Site Restoration</b>					
A. Decontamination Of Equipment	1	LS	\$500	\$500	Engineering Estimate
B. Capping (12" soil cap)	400	CY	\$15.52	\$6,208	Means Site Work 2002 (02320-200-0540) (G1030-210-1350), Assume borrow source is within 3 miles of site, includes placement/compaction
C. Top Soil (6-inches)	200	CY	\$29.63	\$5,926	Means Site Work 2002 (02315-200-7000) (02320-200-0550) (02315-300-8200), Assume source is within 5 miles of site, includes delivery, placement, compaction
D. Fine Grading/Stormwater Controls	1	LS	\$500	\$500	Engineering Estimate
E. Revegetation	0.28	AC	\$8,000	\$2,243	Engineering Estimate
<i>Subtotal</i>				\$15,377	
<b>III. LUCIP</b>					
A. Plat Map	1	LS	\$3,000	\$3,000	Includes survey crew cost
<i>Subtotal</i>				\$3,000	
<b>TOTAL - DIRECT CAPITAL COSTS</b>				<b>\$29,700</b>	
<b>INDIRECT CAPITAL COSTS &amp; CONTINGENCY <sup>(3)</sup></b>					
I. Scope & Bid Contingency Allowance	1	LS	\$7,425	\$7,425	Assume 25% of total direct capital cost
II. Design/Engineering Support	1	LS	\$15,940	\$15,940	Assume 20% of total direct capital cost, additional cost added for Design/SPECS
III. Construction Management	1	LS	\$19,455	\$19,455	Assume 15% of total direct capital cost, additional cost for Work Plan, HASP
IV. Project Management	1	LS	\$7,970	\$7,970	Assume 10% of total direct capital cost, additional cost for mgmt of plans, etc.
V. Institutional Controls	1	LS	\$10,000	\$10,000	Institutional Controls: Intrusive boundaries, legal fees, land use controls, etc.
<b>TOTAL - INDIRECT CAPITAL COSTS</b>				<b>\$60,790</b>	
<b>ANNUAL OPERATION &amp; MAINTENANCE COSTS</b>					
A. Cap Inspection and Maintenance	1	LS	\$3,538	\$3,538	Assumes annual inspection (10% of cap to be replaced) / periodic minor maintenance
B. Annual LUCIP Review	1	LS	\$2,500	\$2,500	Engineering Estimate
<b>TOTAL - ANNUAL O&amp;M COSTS</b>				<b>\$6,038</b>	
<b>TOTAL PROJECT COST SUMMARY</b>					
<b>DIRECT CAPITAL COSTS</b>				\$29,700	
<b>INDIRECT CAPITAL COSTS</b>				\$60,790	
<b>PRESENT WORTH OF ANNUAL O&amp;M COSTS</b>				\$97,461	Present worth over 30 Years @ 5% discount rate
<b>TOTAL PROJECT COST</b>				<b>\$187,951</b>	

Notes:  
(1) Estimated accuracy of cost estimate is -30% to +50%. Cost estimate is to be used primarily for comparison of costs relative to other response action alternatives.  
(2) Includes SVOC and pesticide areas  
(3) USEPA 2000, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002, OSWER 9355.0-75, July 2000

**TABLE B-2**  
**SITE 36 EXCAVATION AND OFF-SITE DISPOSAL AND INSTITUTIONAL CONTROLS FOR LEAD CONTAMINATED AREAS**  
**BUDGETARY COST ESTIMATE <sup>(1)</sup>**  
**OPERABLE UNIT No. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Cost Item	Quantity	Units	Unit Cost	Total Cost	Assumptions (Basis of Cost Estimate)
<b>DIRECT CAPITAL COSTS</b>					
<b>I. Site Preparation</b>					
A. Mobilization/Demobilization	1	LS	\$10,000	\$10,000	Engineering Judgement
B. Erosion Protection	1090	LF	\$0.93	\$1,014	Means Site Work 2002 (02370-550-1000)
C. Clearing and Grubbing	0.40	AC	\$2,150	\$860	Means Site Work 2002 (02200-200-0010)
<i>Subtotal</i>				\$11,874	
<b>II. Excavation and Site Restoration</b>					
A. Excavation of Contaminated Soil <sup>(2)</sup>	950	CY	\$3.33	\$3,168	Means Site Work 2002 (02315-400-1250) (02315-400-0020) Add 10% for Level D
B. Confirmatory Sampling	62	EA	\$304	\$18,833	Analysis for SVOCs & Pesticides. Includes \$50/sample for collection/handling. Assume 20' grid and 72-hour turnaround
C. Base Landfill Disposal	1,430	Ton	\$10	\$14,300	Transport to Base Landfill, distance of 10 miles each way (estimate)
D. Decontamination Of Equipment	1	LS	\$500	\$500	Engineering Estimate
E. Backfill (bring site to within 6" of original grade)	710	CY	\$15.52	\$11,019	Means Site Work 2002 (02320-200-0540) (G1030-210-1350), Assume borrow source is within 3 miles of site, includes placement/compaction
F. Top Soil (6-inches)	240	CY	\$29.63	\$7,111	Means Site Work 2002 (02315-200-7000) (02320-200-0550) (02315-300-8200), Assume source is within 5 miles of site, includes delivery, placement, compaction
G. Fine Grading/Stormwater Controls	1	LS	\$500	\$500	Engineering Estimate
H. Revegetation	0.40	AC	\$8,000	\$3,200	Engineering Estimate
<i>Subtotal</i>				\$58,631	
<b>III. LUCIP</b>					
A. Plat Map	1	LS	\$3,000	\$3,000	Includes survey crew cost
<i>Subtotal</i>				\$3,000	
<b>TOTAL - DIRECT CAPITAL COSTS</b>				<b>\$73,500</b>	
<b>INDIRECT CAPITAL COSTS &amp; CONTINGENCY <sup>(4)</sup></b>					
I. Scope & Bid Contingency Allowance	1	LS	\$18,375	\$18,375	Assume 25% of total direct capital cost
II. Design/Engineering Support	1	LS	\$24,700	\$24,700	Assume 20% of total direct capital cost, additional cost added for Design/SPECS
III. Construction Management	1	LS	\$26,025	\$26,025	Assume 15% of total direct capital cost, additional cost for Work Plan, HASP
IV. Project Management	1	LS	\$7,350	\$7,350	Assume 10% of total direct capital cost
V. Institutional Controls	1	LS	\$10,000	\$10,000	Institutional Controls: Intrusive boundaries, legal fees, land use controls, etc.
<b>TOTAL - PROFESSIONAL &amp; CONTINGENCY COSTS</b>				<b>\$86,450</b>	
<b>ANNUAL OPERATION &amp; MAINTENANCE COSTS</b>					
A. Annual LUCIP Review	1	LS	\$2,500	\$2,500	Engineering Estimate
<b>TOTAL - ANNUAL O&amp;M COSTS</b>				<b>\$2,500</b>	
<b>TOTAL PROJECT COST SUMMARY</b>					
<i>DIRECT CAPITAL COSTS</i>				\$73,500	
<i>PROFESSIONAL &amp; CONTINGENCY COSTS</i>				\$86,450	
<i>PRESENT WORTH OF ANNUAL O&amp;M COSTS</i>				\$40,352	
<b>TOTAL PROJECT COST</b>				<b>\$200,302</b>	

Notes:

- (1) Estimated accuracy of cost estimate is -30% to +50%. Cost estimate is to be used primarily for comparison of costs relative to other response action alternatives.
- (2) Includes SVOC and pesticide areas
- (3) Confirmatory Sampling will be conducted on a 20' by 20' grid on the bottom of the excavation and at 20' spacing along the side walls
- (4) USEPA 2000, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002, OSWER 9355.0-75, July 2000

**TABLE B-3**  
**SITE 43 CAPPING**  
**BUDGETARY COST ESTIMATE <sup>(1)</sup>**  
**OPERABLE UNIT No. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Cost Item	Quantity	Units	Unit Cost	Total Cost	Assumptions (Basis of Cost Estimate)
<b>DIRECT CAPITAL COSTS</b>					
<b>I. Site Preparation</b>					
A. Mobilization/Demobilization	1	LS	\$10,000	\$10,000	Engineering Judgement
B. Erosion Protection (Silt Fence)	370	LF	\$0.93	\$344	Means Site Work 2002 (02370-550-1000)
C. Clearing and Grubbing	0.19	AC	\$2,150	\$416	Means Site Work 2002 (02200-200-0010)
<i>Subtotal</i>				\$10,760	
<b>II. Capping and Site Restoration</b>					
A. Decontamination Of Equipment	1	LS	\$500	\$500	Engineering Estimate
B. Capping (bring site back to acceptable grade plus 12" soil cap)	277	CY	\$15.52	\$4,293	Means Site Work 2002 (02320-200-0540) (G1030-210-1350), Assume borrow source is within 3 miles of site, includes placement/compaction
C. Top Soil (6-inches), delivered, spread, compacted	138	CY	\$29.63	\$4,098	Means Site Work 2002 (02315-200-7000) (02320-200-0550) (02315-300-8200), Assume source is within 5 miles of site, includes delivery, placement, compaction
D. Fine Grading/Stormwater Controls	1	LS	\$500	\$500	Means Site Work 2002 (02310-440-0010)
E. Revegetation	0.19	AC	\$8,000	\$1,548	Engineering Estimate
<i>Subtotal</i>				\$10,938	
<b>TOTAL - DIRECT CAPITAL COSTS</b>				<b>\$21,700</b>	
<b>INDIRECT CAPITAL COSTS &amp; CONTINGENCY <sup>(2)</sup></b>					
I. Scope & Bid Contingency Allowance	1	LS	\$5,425	\$5,425	Assume 25% of total direct capital cost
II. Design/Engineering Support	1	LS	\$14,340	\$14,340	Assume 20% of total direct capital cost, additional cost added for Design/SPECS
III. Construction Management	1	LS	\$18,255	\$18,255	Assume 15% of total direct capital cost, additional cost for Work Plan, HASP
IV. Project Management	1	LS	\$7,170	\$7,170	Assume 10% of total direct capital cost, additional cost for mgmt of plans, etc.
V. Institutional Controls	1	LS	\$10,000	\$10,000	Institutional Controls: Intrusive boundaries, legal fees, land use controls, etc.
<b>TOTAL - INDIRECT CAPITAL COSTS</b>				<b>\$55,190</b>	
<b>ANNUAL OPERATION &amp; MAINTENANCE COSTS</b>					
A. Cap Inspection and Maintenance	1	LS	\$3,235	\$3,235	Assumes annual inspection (10% of cap to be replaced) / periodic minor maintenance
B. Annual LUCIP Review	1	LS	\$2,500	\$2,500	Engineering Estimate
<b>TOTAL - ANNUAL O&amp;M COSTS</b>				<b>\$5,735</b>	
<b>TOTAL PROJECT COST SUMMARY</b>					
<i>DIRECT CAPITAL COSTS</i>				\$21,700	
<i>INDIRECT CAPITAL COSTS</i>				\$55,190	
<i>PRESENT WORTH OF ANNUAL O&amp;M COSTS</i>				\$92,573	Present worth over 30 Years @ 5% discount rate
<b>TOTAL PROJECT COST</b>				<b>\$169,463</b>	

Notes:  
(1) Estimated accuracy of cost estimate is -30% to +50%. Cost estimate is to be used primarily for comparison of costs relative to other response action alternatives.  
(2) USEPA 2000, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002, OSWER 9355.0-75, July 2000

**TABLE B-4**  
**SITE 43 EXCAVATION**  
**BUDGETARY COST ESTIMATE <sup>(1)</sup>**  
**OPERABLE UNIT No. 6, SITES 36 and 43**  
**ACTION MEMORANDUM, CTO-0219**  
**MCB, CAMP LEJEUNE, NORTH CAROLINA**

Cost Item	Quantity	Units	Unit Cost	Total Cost	Assumptions (Basis of Cost Estimate)
<b>DIRECT CAPITAL COSTS</b>					
<b>I. Site Preparation</b>					
A. Mobilization/Demobilization	1	LS	\$10,000	\$10,000	Engineering Judgement
B. Erosion Protection	405	LF	\$0.93	\$376.65	Means Site Work 2002 (02370-550-1000)
C. Clearing and Grubbing	0.19	AC	\$2,150	\$400.03	Means Site Work 2002 (02200-200-0010)
<i>Subtotal</i>				\$10,777	
<b>II. Excavation and Site Restoration</b>					
A. Excavation of Contaminated Soil	752	CY	\$3.33	\$2,506	Means Site Work 2002 (02315-400-1250) (02315-400-0020) Add 10% for Level D
B. Confirmatory Sampling <sup>(2)</sup>	31	EA	\$304	\$9,416	Analysis for SVOCs & Pesticides. Includes \$50/sample for collection/handling. Assume 72 hour turnaround
C. Base Landfill Disposal	1,551	Ton	\$10	\$15,513	Transport to Base Landfill, distance of 10 miles each way (estimate)
D. Decontamination Of Equipment	1	LS	\$500	\$500	Engineering Estimate
E. Backfill (bring site to within 6" of original grade)	646	CY	\$15.52	\$10,030	Means Site Work 2002 (02320-200-0540) (G1030-210-1350), Assume borrow source is within 3 miles of site, includes placement/compaction
F. Top Soil (6-inches)	159	CY	\$29.63	\$4,719	Means Site Work 2002 (02315-200-7000) (02320-200-0550) (02315-300-8200), Assume source is within 5 miles of site, includes delivery, placement, compaction
G. Fine Grading/Stormwater Controls	1	LS	\$500	\$500	Engineering Estimate
H. Revegetation	0.19	AC	\$8,000	\$1,488	Engineering Estimate
<i>Subtotal</i>				\$44,673	
<b>TOTAL - DIRECT CAPITAL COSTS</b>				<b>\$55,400</b>	
<b>INDIRECT CAPITAL COSTS &amp; CONTINGENCY <sup>(3)</sup></b>					
I. Scope & Bid Contingency Allowance	1	LS	\$13,850	\$13,850	Assume 25% of total direct capital cost
II. Design/Engineering Support	1	LS	\$21,080	\$21,080	Assume 20% of total direct capital cost, additional cost added for Design/SPECS
III. Construction Management	1	LS	\$23,310	\$23,310	Assume 15% of total direct capital cost, additional cost for Work Plan, HASP
IV. Project Management	1	LS	\$5,540	\$5,540	Assume 10% of total direct capital cost
<b>TOTAL - PROFESSIONAL &amp; CONTINGENCY COSTS</b>				<b>\$63,780</b>	
<b>ANNUAL OPERATION &amp; MAINTENANCE COSTS</b>					
<b>TOTAL - ANNUAL O&amp;M COSTS</b>				<b>\$0</b>	
<b>TOTAL PROJECT COST SUMMARY</b>					
<i>DIRECT CAPITAL COSTS</i>				\$55,400	
<i>PROFESSIONAL &amp; CONTINGENCY COSTS</i>				\$63,780	
<i>PRESENT WORTH OF ANNUAL O&amp;M COSTS</i>				\$0	
<b>TOTAL PROJECT COST</b>				<b>\$119,180</b>	

- Notes:
- (1) Estimated accuracy of cost estimate is -30% to +50%. Cost estimate is to be used primarily for comparison of costs relative to other response action alternatives.
  - (2) Confirmatory Sampling will be conducted on a 20' by 20' grid on the bottom of the excavation and at 20' spacing along the side walls
  - (3) USEPA 2000, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002, OSWER 9355.0-75, July 2000