

# **Marine Corps Base Camp Lejeune, North Carolina**



**Department of the Navy  
Installation Restoration Program  
Field Investigation Photograph Album  
Sites 6, 9, 48, and 69**

**INSTALLATION RESTORATION PROGRAM**

**FIELD INVESTIGATION  
PHOTOGRAPH ALBUM**

**SITES 6, 9, 48, AND 69  
MARINE CORPS BASE CAMP LEJEUNE  
NORTH CAROLINA**

**CONTRACT TASK ORDER 0133**

*Prepared For:*

**DEPARTMENT OF THE NAVY  
ATLANTIC DIVISION  
NAVAL FACILITIES  
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*Prepared By:*

**BAKER ENVIRONMENTAL, INC.  
*Coraopolis, Pennsylvania***

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## LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOD	Department of Defense
DoN	Department of the Navy
EPA	U.S. Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
FFA	Federal Facilities Agreement
IAS	Initial Assessment Study
IRP	Installation Restoration Program
LANTDIV	Naval Facilities Engineering Command, Atlantic Division
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
NACIP	Navy Assessment and Control of Installation Pollutants
N.C.DEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
PA/SI	Preliminary Assessment/Site Inspection
PRAP	Proposed Remedial Action Plan
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
TCLP	toxicity characteristic leaching procedure
USACMDA	U.S. Army Chemical Material Destruction Agency

## **1.0 INTRODUCTION**

Marine Corps Base (MCB) Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) effective 4 November 1989 (54 Federal Register 41015, 1989). Subsequent to this listing, the United States Environmental Protection Agency Region IV (EPA), the North Carolina Department of Environment, Health and Natural Resources (DEHNR), and the United States Department of the Navy (DoN) entered into a Federal Facilities Agreement (FFA) for MCB Camp Lejeune.

The scope of the FFA included the implementation of a remedial investigation/feasibility study (RI/FS) at 18 sites throughout MCB Camp Lejeune. This Field Investigation Photograph Album describes the RI field activities that have been conducted at four of the 18 sites. These sites include: Site 6 (Storage Lots 201 and 203), Site 9 (Fire Fighting Training Pit at Piney Green Road), Site 48 (MCAS Mercury Dump), and Site 69 (Rifle Range Chemical Dump).

### **1.1 Purpose and Format of the Field Investigation Photograph Album**

The primary purpose of the Field Investigation Photograph Album is to provide the Navy/Marine Corps, and/or public, with an overview of the remedial investigation (RI) field activities that have been conducted at Sites 6, 9, 48, and 69. The field investigations were conducted by Baker Environmental, Inc. (Baker) for the DoN during the period August - November 1992. The overview of the RI contains figures and photographs of the sites, and of the various field investigations that were conducted during the RI.

This Field Investigation Photograph Album is formatted as follows. Section 1.0 provides an overview of the Department of Navy's Installation Restoration (IR) Program and IR activities conducted to date at MCB Camp Lejeune. Section 2.0 provides a description of the sites, and a summary of known waste disposal/handling activities. Both historical photographs, which document past disposal practices, and recent photographs (1992) have been included in this section to familiarize the user of this album with past and present site conditions. Section 3.0 describes the various field investigations conducted at Sites 6, 9, 48, and 69. Representative photographs of all field investigation activities (e.g., Groundwater Investigation, Soil Investigation, etc.) have been included in this section. Other field activities associated with the field investigations such as decontamination of field equipment and management of investigation-derived wastes are illustrated in Section 4.0.

## **1.2 Department of the Navy Installation Restoration Program**

Efforts to address the problem of hazardous waste sites on Department of Defense (DoD) installations preceded the Comprehensive Environmental Response, Compensation, and Liability Act and Superfund Amendments and Reauthorization Act of 1986 (CERCLA/SARA) by several years. The U.S. Army began a pilot program to investigate past waste disposal sites at DoD installations in 1975 (Navy/Marine Corps Installation Restoration Manual, 1992).

DoD installations were required, as of 24 June 1980, to identify all known abandoned waste disposal sites and to establish a prioritized program for conducting record searches. This program, which is referred to today as the Installation Restoration (IR) Program, is divided into the following four phases (Navy/Marine Corps Installation Restoration Manual, 1992):

- Phase I - Problem Identification
- Phase II - Confirmation and Qualification
- Phase III - Technology Development
- Phase IV - Planning and Implementation of Remedial Actions

Phase I of the IR Program begins with a preliminary assessment/site inspection (PA/SI). The PA/SI identifies potential threats to human health and/or the environment at a particular area of concern. The PA/SI involves a review of background information (e.g. records) and a limited amount of sampling. The second phase (Confirmation and Qualification) involves conducting a remedial investigation (RI) at those sites which are believed to pose adverse human health or environmental risks, based on the conclusions identified by the PA/SI. The RI focuses on the collection of environmental samples for chemical analysis in order to determine the nature and extent of contamination from the site, and to assess human health and environmental risks associated with contaminant migration and exposure.

Information collected during the RI is used to evaluate alternative methods of remediating the site, if necessary (Phase III). This evaluation is referred to as a feasibility study (FS). The purpose of the FS is to define a set of alternatives that can be implemented to mitigate existing or potential impacts to human health and/or the environment. The cleanup alternatives identified in the FS, along with the preferred alternative, are summarized in a Proposed Remedial Action Plan (PRAP). The PRAP is issued to the public and to various State and Federal regulatory agencies, who have the opportunity to comment on the preferred alternative along with any of the other alternatives. After the public comment period, a Record of Decision (ROD) documenting the final cleanup alternative is issued. After the ROD is issued, the remedial design (RD) is implemented and remedial action (RA) begins (Phase IV of the IR Program).

### **1.3 MCB Camp Lejeune Installation Restoration Program**

MCB Camp Lejeune has been actively involved in various environmental investigation and remediation programs since 1983, beginning with the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The first study conducted under NACIP to investigate potentially hazardous sites at MCB Camp Lejeune was an Initial Assessment Study (IAS). The IAS, which was conducted in 1983, identified 76 areas of concern (referred to hereafter as sites) that may potentially cause threats to human health and the environment as a result of past storage, handling, and/or disposal of hazardous materials. These sites were identified based on a review of historical records, field inspections, and personal interviews.

At present, 18 sites are in the second phase of the IR Program. These 18 sites are required to be investigated in accordance with the National Contingency Plan (NCP), CERCLA, and SARA, under the terms and conditions of the FFA. For purposes of expediting these studies, the 18 sites have been combined into nine operable units (see Figure 1-1). Additional sites could potentially be added (to existing operable units or as separate operable units), based on the conclusions and recommendations identified in the Site Inspection (Phase I of the IR Program). The four sites documented in this Field Investigation Photo Album are included in this listing of 18 sites.

Five of the original 76 sites have been eliminated from the IR Program mainly because they are applicable to the Underground Storage Tank cleanup program and therefore, are not regulated under CERCLA or SARA. The majority of the 76 sites are in Phase I of the IR program.

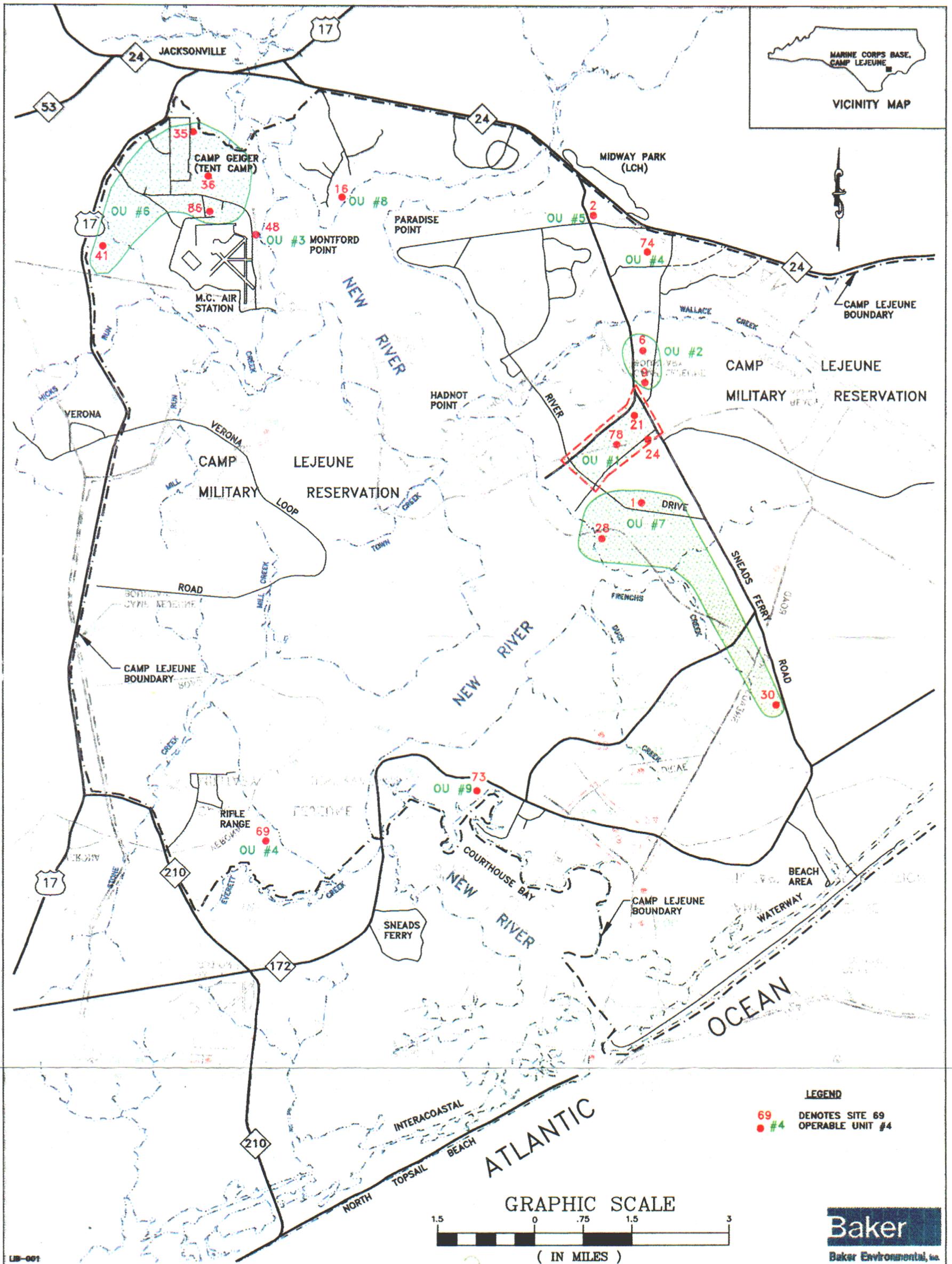


FIGURE 1-1  
 OPERABLE UNITS AND SITE LOCATIONS AT  
 MARINE CORPS BASE CAMP LEJEUNE  
 JACKSONVILLE, NORTH CAROLINA

## **2.0 SITE DESCRIPTIONS**

This section provides a description of the site location, setting, and the history of hazardous waste disposal activities for Sites 6, 9, 48, and 69. Historical photographs obtained through the U.S. EPA Environmental Photographic Interpretation Center (EPIC) depict past site conditions. Photographs taken during the 1992 RI field investigations depict current site conditions.

### **2.1 Site 6 (Storage Lot 201 and 203)**

This subsection addresses the site setting, location, and history of Site 6.

#### **2.1.1 Site Location and Setting**

Site 6 is located approximately 1.75 miles east of the New River and 2 miles south of Route 24 on the Mainside portion of Camp Lejeune (see Figure 1-1). The site is bordered to the west by Holcomb Boulevard, to the north by Wallace Creek, to the east by Piney Green Road, and to the south by Site 9 (the Fire Fighting Training Pit). Site 6 encompasses approximately 225 acres and is comprised of four main areas of concern: Storage Lot 201; Storage Lot 203; the wooded areas which surround these storage lots; and a ravine located between Storage Lot 203 and Wallace Creek. The site is depicted on Figure 2-1.

Storage Lot 201 is located in the south-central portion of the site. This lot is currently used to store military equipment (e.g., vehicles, lumber, hydraulic oils and lubricants, non-PCB transformers and other supplies). Lot 201 is approximately 25 acres in size (ESE 1990).

Storage Lot 203 is situated in the northern portion of Site 6, just north of Storage Lot 201. The actual area of the former storage lot slightly exceeds the existing fenced area, based on the review of historical photographs. The fenced portion of Lot 203 is approximately 46 acres in size (ESE 1990). Storage Lot 203 is no longer used as an active storage lot. The lot is littered with debris, drums, storage tanks, and abandoned equipment and supplies.

The ravine is located between Storage Lot 203 and Wallace Creek. The upper portion of the ravine was previously used as a disposal area, as evidenced by the presence of battery packs, drums, and other debris such as empty containers.

Woods and open fields surround both storage lots and make up the remaining area of Site 6. In some areas of the woods, evidence of past disposal activities can be found. Drums and other debris are randomly located throughout the wooded areas.

## 2.1.2 Site History

Site 6 has a long history of various uses, including the disposal and storage of wastes and supplies. Pesticides have reportedly been stored in the northeast and southeast portions of Lot 201 (Water and Air Research, 1983)(see Figure 2-1, Areas A and B). Transformers containing PCBs were reportedly stored in the southwest portion of Lot 201 (see Figure 2-1, Area C). Aerial Photograph 2-2 depicts the storage activities within Lot 201. Previous investigations conducted at this area revealed low levels of pesticides in both soil and sediment samples collected from Bear Head Creek.

Lot 203 previously served as a waste disposal and storage area from as early as the 1940s to the late 1980s (see Aerial Photograph 2-1). Reports detailing disposal activities within Lot 203 are vague; there is little indication of the types or quantities of material disposed of throughout the lot. Internal memorandums have indicated that pesticides, paints, solvents, and transformers were stored at the lot. The pesticide DDT is reported to have been disposed of at the southeast portion of this lot (see Figure 2-1). PCB transformers were reportedly stored in the northeast portion of Lot 203 (Water and Air Research, 1983).

Previous environmental investigations conducted at Lot 203 have revealed low levels of volatile organic contaminants in the shallow aquifer and Wallace Creek. One supply well (No. 651) was shut down due elevated levels of vinyl chloride and trichloroethylene. Historical photographs of the site indicate that numerous trenches were excavated throughout Lot 203 and nearby wooded areas. Subsurface investigations via test pitting of these areas have uncovered a wide variety of military debris such as fired casings and communication wire. Batteries and small canisters were also noted in some of the test pit excavations.

Photographs 2-1 through 2-10 depict the setting of Site 6.

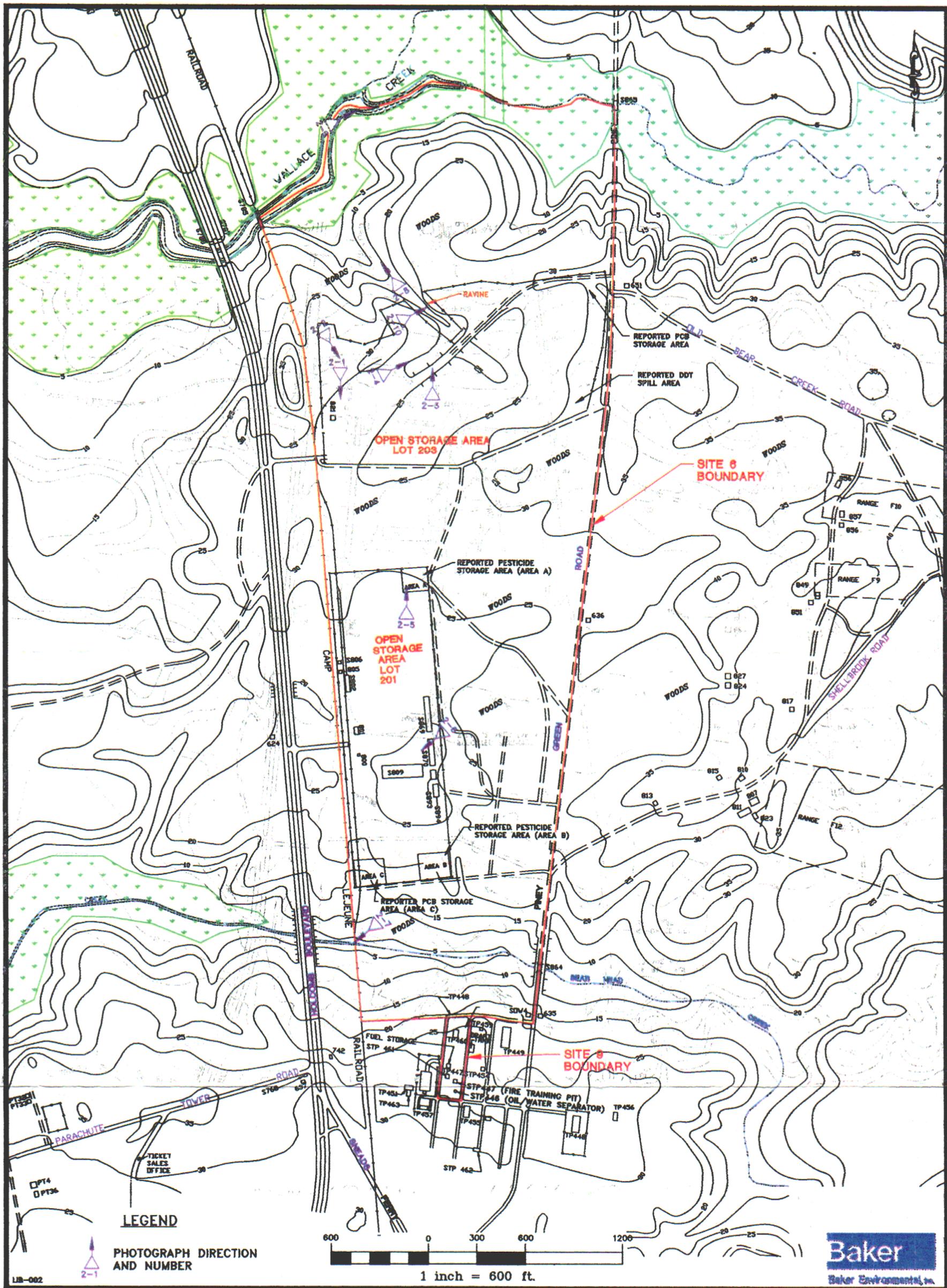
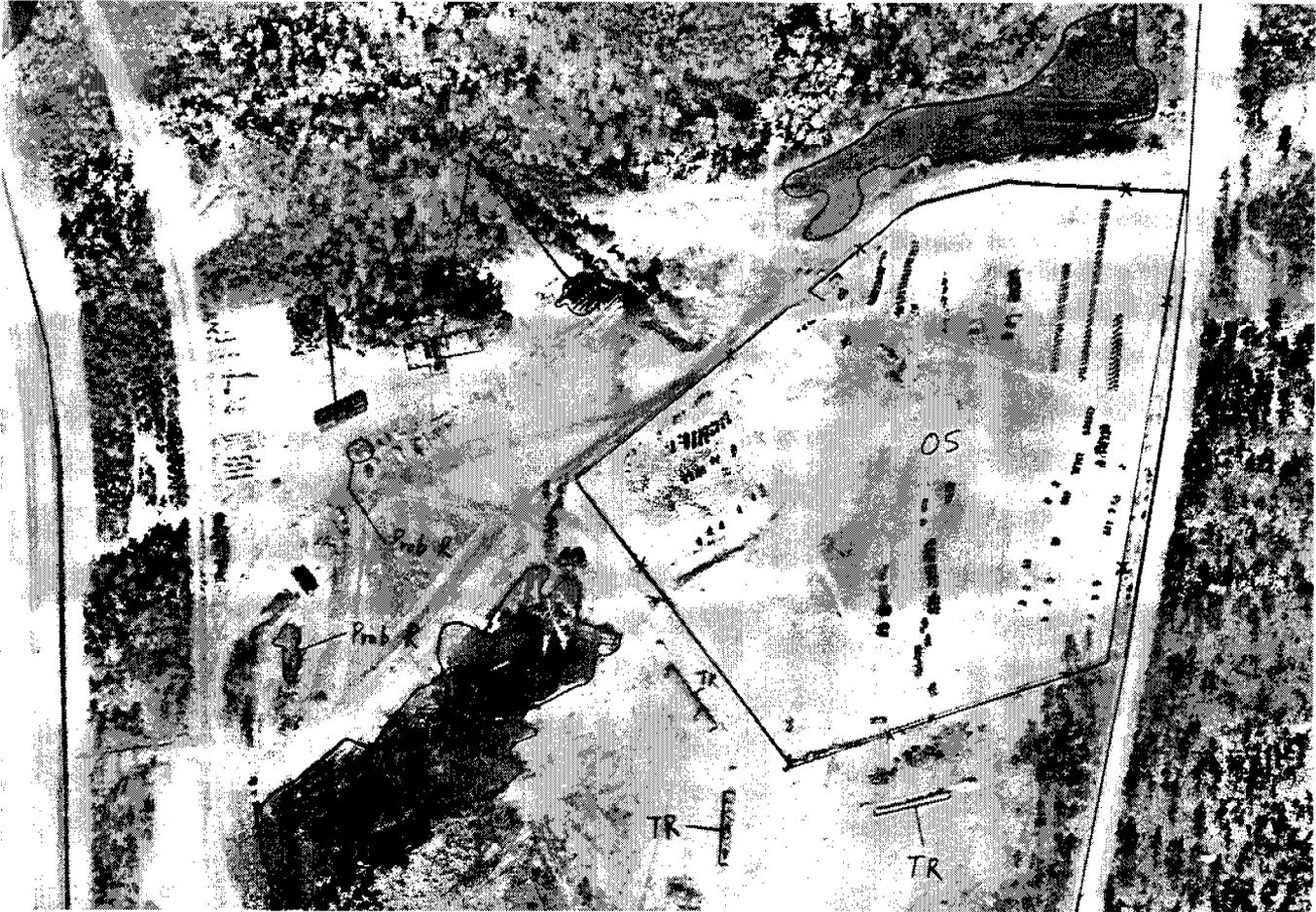


FIGURE 2-1  
 SITE 6 AND 9  
 GENERAL ARRANGEMENT MAP

MARINE CORPS BASE CAMP LEJEUNE  
 JACKSONVILLE, NORTH CAROLINA

SOURCE: LANTDIV, OCT. 1991



### Aerial Photograph 2-1

Annotated aerial photograph, dated 29 November 1960, depicting Lot 203 indicates trenching (TR) and probable refuse (Prob R) disposal activity within and surrounding the open storage (OS) area. Disturbed soil and ground scars are evident throughout the cleared areas.

B - Building

Dk O - Dark-Toned Object

Dk M - Dark-Toned Material

## SITE 6



### **Aerial Photograph 2-2**

Annotated aerial photograph depicts Lot 201 and surrounding wooded areas as of 29 November 1960. Probable staining (Prob ST) has been noted around the equipment maintenance/wash rack (EMWR) and in other areas within Lot 201.

Dk M - Dark-Toned Material

GR - Graded

OS - Open Storage



**Photograph 2-1**

View looking south across Lot 203, adjacent to the Acid Storage Yard. Vehicle storage bins are pictured in the foreground.

**SITE 6**



**Photograph 2-2**

View looking southeast across Lot 203 from the western fence line. Building 821 and above ground storage tanks are pictured in the background.

**SITE 6**



**Photograph 2-3**

View looking north from within Lot 203, toward the wooded area. Empty 1000-gallon tank is pictured adjacent to several 55-gallon drums.

**SITE 6**



**Photograph 2-4**

Photograph shows mounded rubber rafts located within Lot 203. Shredded vehicle tires and other miscellaneous rubber wastes are mounded in the background.

**SITE 6**



**Photograph 2-5**

View looking north from within the open storage area of Lot 201. Grid A, reported pesticide storage location, and survey markers are pictured.

**SITE 6**



**Photograph 2-6**

Building materials, lumber, and compressed gas cylinders are stockpiled in the covered storage area of Lot 201, pictured here. This lot is currently in use by MCB Camp Lejeune.



**Photograph 2-7**

Bear Head Creek culvert where railroad line intersects waterway, south of Lot 201.

**SITE 6**



**Photograph 2-8**

Photograph taken facing northwest from within the ravine. Channel erosion evident as a result of intermittent storm water flow.



**Photograph 2-9**

View looking east, upstream, on Wallace Creek. Ravine drainage empties into Wallace Creek from the right bank.

**SITE 6**



**Photograph 2-10**

Baker personnel pointing at one of several partially buried battery packs found within the ravine area.

## **2.2 Site 9**

This subsection addresses the site location, setting, and history of Site 9 (Fire Fighting Training Pit).

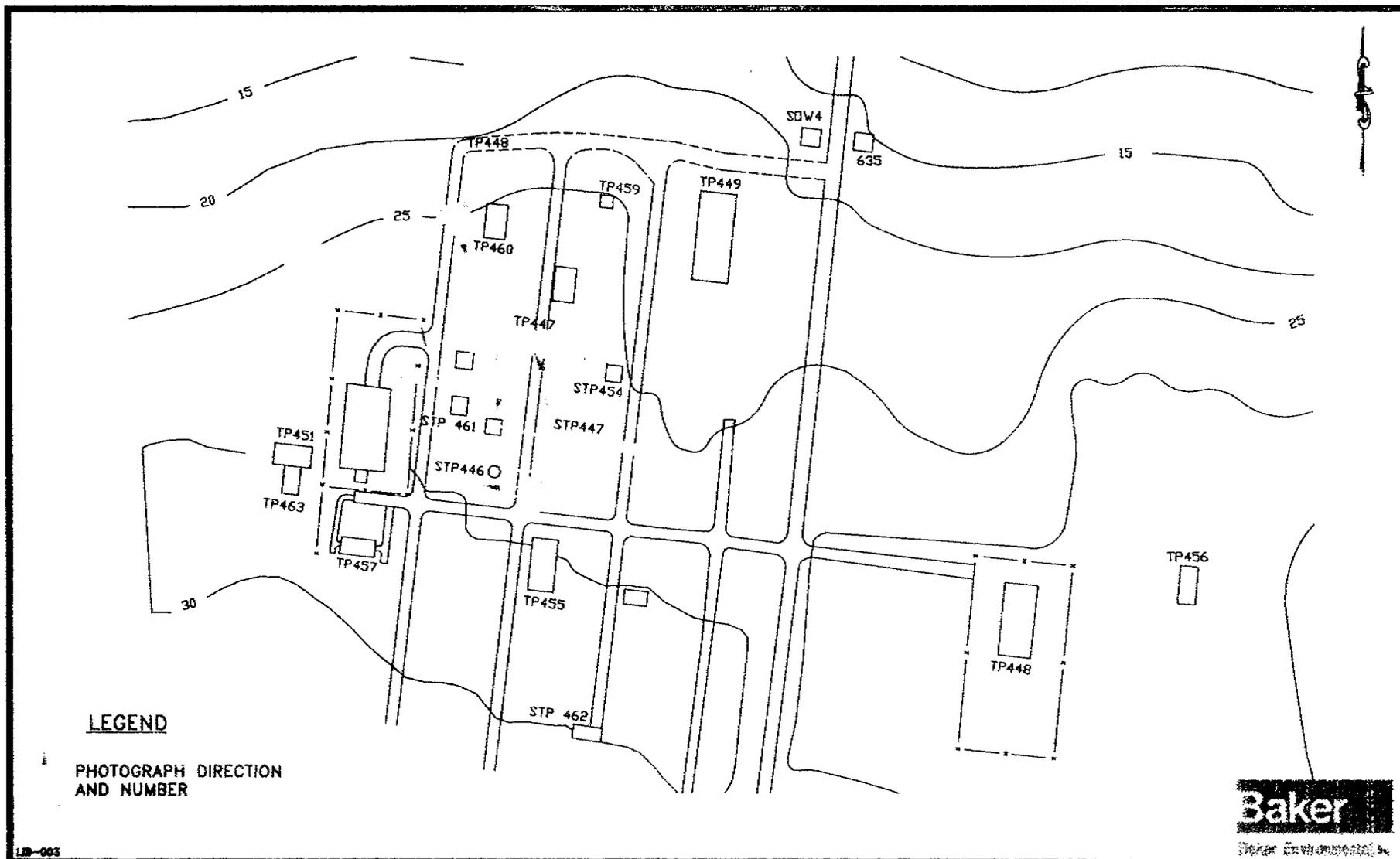
### **2.2.1 Site Location and Setting**

Site 9 is located between Piney Green Road and Holcomb Boulevard along the southern border of Site 6. Bear Head Creek is located approximately 500 feet to the north of the site. This site is bordered by local streets to the east and west and encompasses an area of approximately 2 acres. Adjacent properties border the site to the south and west as shown in Figure 2-2. None of the adjacent buildings are located within the site boundary. An asphalt-lined pit used to conduct training exercises for extinguishing fires is present at the site. Two aboveground storage tanks are located just west-northwest of the training pit. The storage tanks, which are reportedly empty, were used to store fuel for purposes of fire training. An oil/water separator is located just south of the pit as shown on Figure 2-2.

### **2.2.2 Site History**

Site 9 has been used for fire fighting training exercises from the 1960s to the present (see Aerial Photograph 2-3). Until 1981, training exercises were conducted in an unlined pit. The pit is currently asphalt-lined. Flammable liquids including used oil, solvents, and contaminated fuels (non-leaded) were burned in the pit. Approximately 30,000 to 40,000 gallons per year of JP-4 and JP-5 fuels were used during training exercises. Previous investigations at the site have identified low levels of volatile organic contaminants in groundwater.

Photographs 2-11 through 2-14 depict the setting of Site 9.



LB-003

FIGURE 2-2  
SITE 9  
GENERAL ARRANGEMENT MAP

MARINE CORPS BASE CAMP LEJEUNE  
JACKSONVILLE, NORTH CAROLINA

SOURCE: LANTDIV, FEB. 1992



**Photograph 2-12**

Shallow well number 9GW1 is pictured in the foreground with the oil/water separator directly behind.

**SITE 9**



**Photograph 2-13**

View looking northwest across Site 9 toward two above ground storage tanks, two propane tanks, and the fire training tower.



**Photograph 2-14**

Photograph taken from northern end of Site 9, adjacent to fire training tower, looking south toward above ground storage tanks.

## **2.3 Site 48**

This subsection addresses the site location, setting, and history of Site 48 (MCAS Mercury Dump).

### **2.3.1 Site Location and Setting**

The Marine Corps Air Station (MCAS) Mercury Dump is located west of the New River between the MCAS and the banks of the New River (see Figure 1-1). The site is defined as the area which is bordered by the New River to the east, a manmade drainage ditch to the north, Longstaff Road to the west, and Building AS-811 to the south (see Figure 2-3).

Building AS-804, which formerly operated as a photo lab, is located at the center of this site. This building currently serves as a training location. The area immediately surrounding this building is grass covered and well maintained. The grass area extends to the banks of the New River. Young saplings and heavy vegetation line the property along the banks of the New River and the manmade drainage ditch.

### **2.3.2 Site History**

Building AS-804 was once used as a photo lab during the period from 1956 to 1966. It has been reported that metallic mercury was periodically drained from the delay lines of the radar units and disposed in a 100- to 200-foot wide corridor extending from the rear of the building to the New River (see Aerial Photograph 2-4). Approximately one gallon per year of mercury was reportedly disposed of during a 10-year period. The mercury was reportedly carried by hand and dumped or buried in small quantities at randomly selected areas (Water and Air Research, 1983). Previous environmental investigations conducted at this site revealed low levels of mercury in soil and sediment collected from the New River and marsh area.

Photographs 2-15 through 2-19 depict the setting of Site 9.

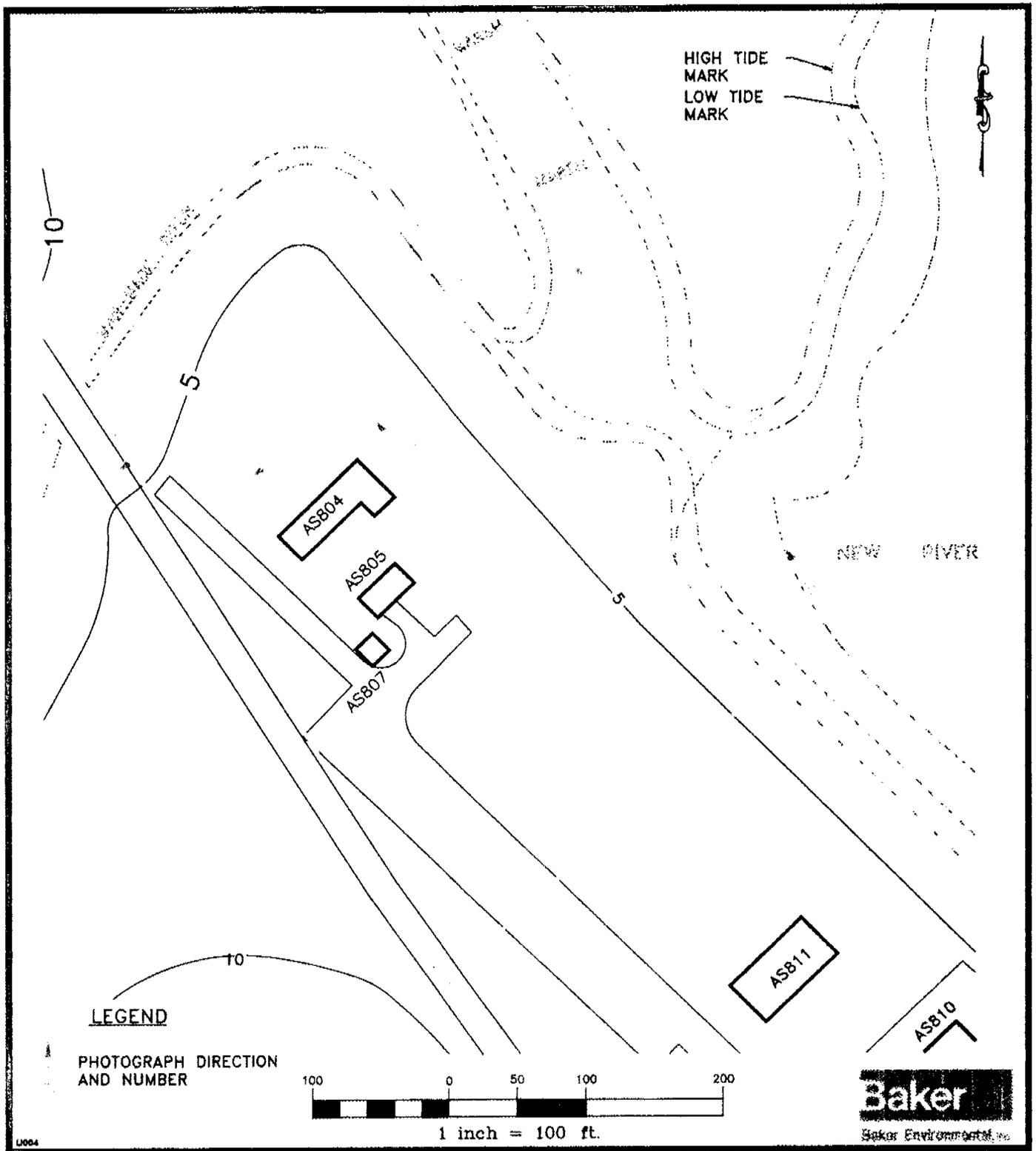


FIGURE 2-3  
 SITE 48  
 GENERAL ARRANGEMENT MAP

MARINE CORPS BASE CAMP LEJEUNE  
 JACKSONVILLE, NORTH CAROLINA

SOURCE: LANTDIV, FEB. 1992



### Aerial Photograph 2-4

Annotated aerial photograph depicts Site 48 as of 4 October 1970. The probable mercury disposal area (Prob DA), northeast of Building AS804, appears to have been graded over and revegetated (REV).

Poss LT R - Possible Light-Toned Refuse

Poss LT C - Possible Light-Toned Container

WG - Wet Ground

**SITE 48**



**Photograph 2-15**

Photograph taken facing southwest across Longstaff Road adjacent to Building AS804, former photo lab. Historical photographs depict ground disturbance and revegetation in this area.



**Photograph 2-16**

View looking northwest toward shallow well number 48GW1, across eastern portion of Site 48. Suspected mercury dump is pictured immediately in the foreground.

**SITE 48**



**Photograph 2-17**

Photograph facing southwest across Longstaff Road toward man-made drainage ditch that borders Site 48. Ground scars were identified on historical photographs in this area.



**Photograph 2-18**

View looking southeast, downstream, toward the New River from an unnamed tributary bordering the site. This tributary receives runoff from other sources via a man-made ditch.

**SITE 48**



**Photograph 2-19**

Photograph taken from the New River looking northwest toward the unnamed tributary that borders Site 48.

## 2.4 Site 69

This subsection addresses the location, setting, and history of Site 69 (Rifle Range Chemical Dump).

### 2.4.1 Site Location and Setting

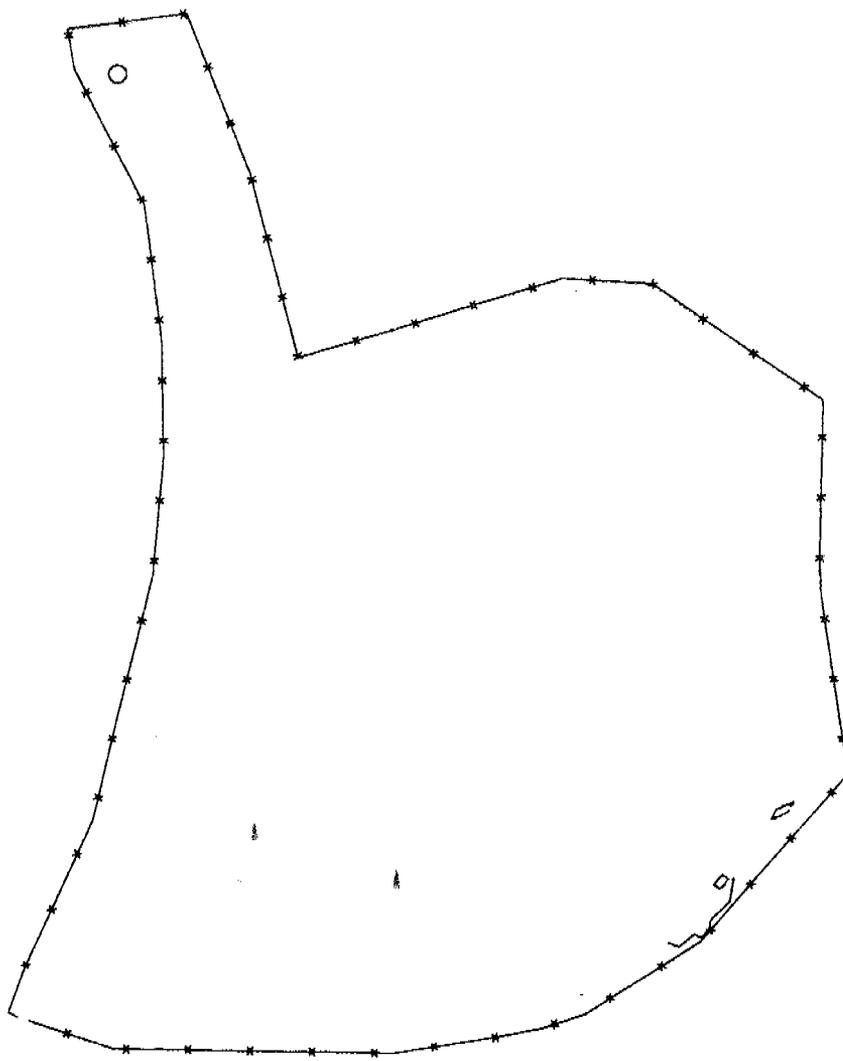
Site 69, the Rifle Range Chemical Dump, is located west of the New River estuary in the area of Camp Lejeune known as the Rifle Range (see Figure 1-1). The site is a former disposal area (landfill) and is approximately 6 acres in size (see Figure 2-4). The site is located about one-quarter mile east-southeast of the intersection of Route 17 and Route 210. The New River is located approximately one-quarter mile east of the site. Everett Creek is located about one-half mile south of the site. An unnamed tributary to the New River is situated about one-quarter mile north of the site. A light duty road borders the site to the west. The site is heavily vegetated and wooded. Two small areas of stained soil have been noted during various site visits. In addition, evidence of trenching activities are present (depressions and mounding of the surface).

### 2.4.2 Site History

Site 69 was used as a chemical dump between 1950 and 1976. The waste materials were reportedly disposed in pits or trenches, 6 to 20 feet deep (see Aerial Photograph 2-5). Various wastes have been reportedly disposed at the site including: PCBs, fire retardants, pentachlorophenol, DDT, TCE, malathion, diazinon, lindane, calcium hypochlorite, gas cylinders, HTH, chemical agent test kits for chemical warfare training, and fired and unfired blank rifle cartridges (Water and Air Research, 1983). One memorandum describes the burial of approximately 50 drums of material containing possible nerve gas or mustard gas. The memorandum indicates that the workers dressed in "moon suits" and handled the drums with rubber padded equipment and trucks for protection.

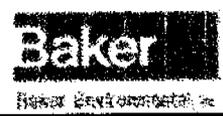
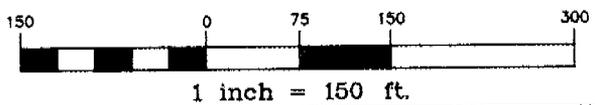
In 1970, an explosion reportedly occurred at Site 69 during a disposal operation. Containers of DDT, TCE, and calcium hypochlorite were being covered with earthen material when the explosion and fire occurred. A number of drums were blown by the explosion 40 yards away and subsequently started a forest fire (Water and Air Research, 1983). Site 69 is inactive at the present time. Access to the site is restricted by a chain-link fence.

Photographs 2-20 through 2-24 depict the setting of Site 69.



LEGEND

▲ PHOTOGRAPH DIRECTION AND NUMBER



UB-005

FIGURE 2-4  
SITE 69  
GENERAL SITE ARRANGEMENT

MARINE CORPS BASE CAMP LEJEUNE  
JACKSONVILLE, NORTH CAROLINA

SOURCE: LANTDIV, FEB. 1992



**Aerial Photograph 2-5**

Annotated aerial photograph depicts Site 69 as of 10 February 1964. Past trenching (TR) activity is visible despite continued revegetation.

CA - Cleared Area

DG - Disturbed Ground

MM - Mounded Material

REV - Revegetated

**SITE 69**



**Photograph 2-20**

Surface staining evident within the fenced area of Site 69.



**Photograph 2-21**

Photograph depicts Baker personnel inspecting Site 69 as part of the initial site visit. Surface staining is pictured immediately in the foreground.

**SITE 69**



**Photograph 2-22**

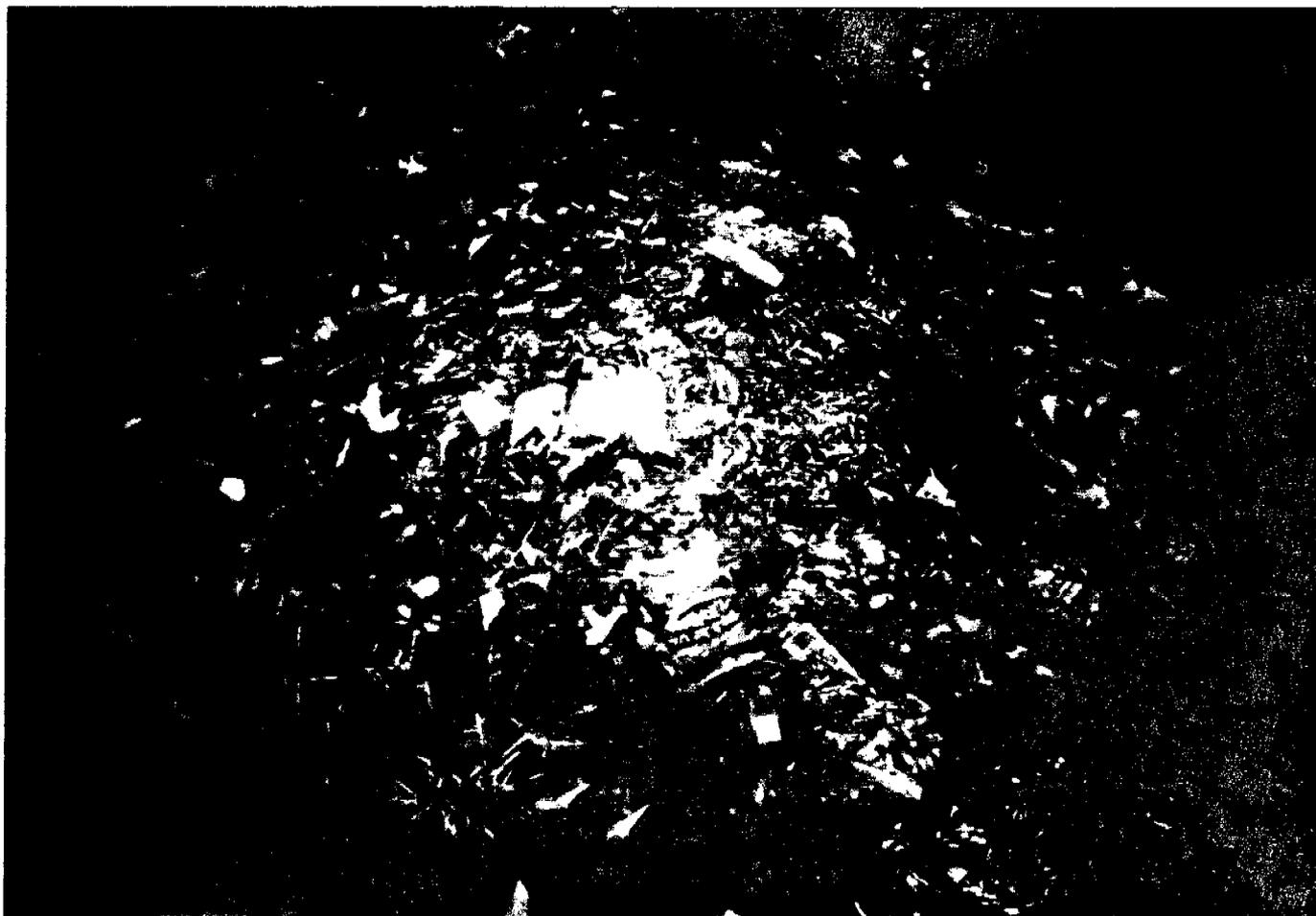
Photograph taken facing east toward the New River from an unnamed tributary north of Site 69.



**Photograph 2-23**

View looking northwest from the New River, in the general direction of Site 69.  
Site 69 is approximately 1500-feet from the New River.

**SITE 69**



**Photograph 2-24**

Photograph depicts the partial burial of chemical agent test kits that were used for chemical warfare training.

### **3.0 FIELD INVESTIGATIONS**

This section provides both a site-specific summary and general overview of field investigations conducted at Sites 6, 9, 48, and 69.

#### **3.1 Site-Specific Investigations**

This subsection addresses and enumerates the specific investigations that were conducted at each site.

##### **3.1.1 Site 6 Investigation**

The various sampling and investigation programs conducted at Site 6 included: a groundwater investigation; a soil investigation; a surface water and sediment investigation; an aquatic/ecological investigation; a subsurface investigation; a drum investigation; and a geophysical investigation. These investigations were conducted at Lot 201, Lot 203, the Ravine Area, Wallace Creek, Bear Head Creek, and the wooded areas that border these storage areas.

The groundwater investigation involved the construction of over 25 shallow monitoring wells throughout the site in order to evaluate potential impacts to groundwater as a result of past disposal activities. In addition to shallow monitoring wells, five deep monitoring wells were installed to evaluate the migration of volatile organic contamination that was detected during previous groundwater investigations.

The soil investigation focused on various areas of concern within Lot 201, Lot 203, the ravine, and the wooded areas. Sampling grids were surveyed throughout these areas to collect representative data at each area of concern. Surface and subsurface soil samples were collected at 5-foot intervals during the drilling of test borings at each grid station. Subsurface investigations also involved the excavation of test pits at those areas of concern (trenches, alleged disposal areas, etc.) identified by historical photographs and the results of the geophysical investigation.

The surface water and sediment investigation, and the aquatic/ecological investigation, were conducted on Wallace Creek and Bear Head Creek. A limited number of surface water and sediment samples were collected from the ravine.

Over 50 drums were identified via a drum survey during the RI. The drums were located within Lot 203, in the ravine, and throughout the wooded areas of Site 6. Samples of drum contents were collected to characterize the drum contents for disposal.

### **3.1.2 Site 9 Investigation**

A soil investigation and groundwater investigation were conducted at Site 9. The surface water and sediment investigation of Bear Head Creek, which is located just north of Site 9, was conducted as part of the Site 6 Field Investigation. The soil investigation involved the collection of over 100 surface and subsurface soil samples at two areas of concern: the aboveground storage tank area; and the fire training pit/oil water separator area. Sampling grids were established at each of these areas in order to obtain representative data, and to determine the extent of soil contamination. The groundwater investigation resulted in the installation of five shallow wells and one deep monitoring well. The wells were constructed in order to determine the vertical and horizontal extent of groundwater contamination detected during previous investigations.

### **3.1.3 Site 48 Investigation**

The sampling and investigation programs conducted at Site 48 included: a groundwater investigation; a soil investigation; a surface water and sediment investigation; an aquatic/ecological survey, and a geophysical investigation. The geophysical investigation was employed to identify potential mercury disposal areas behind the building. The groundwater investigation focused on determining on-site and off-site shallow groundwater quality. No previous investigations were conducted to define groundwater quality. Five shallow monitoring wells were installed.

The soil investigation focused on evaluating various areas of concern that were identified in historical aerial photographs. Sixteen test borings were drilled and 29 soil samples were collected for chemical analysis.

The surface water/sediment investigation and the aquatic/ecological investigation focused on evaluating the impacts to the New River and marsh areas near Site 48. The investigation included 10 sampling stations.

### **3.1.4 Site 69 Investigation**

The sampling and investigation programs conducted at Site 69 include: a geophysical investigation; a surface water and sediment investigation; and an aquatic/ecological survey. Due to the high probability that chemical agents are buried at the site, intrusive soil and groundwater investigations were not conducted. Soil and groundwater investigations are planned during 1993, following consultation with the U.S. Army Chemical Material Destruction Agency (USACMDA).

The geophysical investigation focused on defining potential areas of drum disposal. The results will be used to define the upcoming soil and groundwater investigations. Surface water and sediment investigations and aquatic/ecological investigations were conducted on the New River, Everett Creek, and the unnamed tributary located north of the site.

## **3.2 General Investigations**

This section describes the general investigative procedures employed during the field program.

### **3.2.1 Groundwater Investigation**

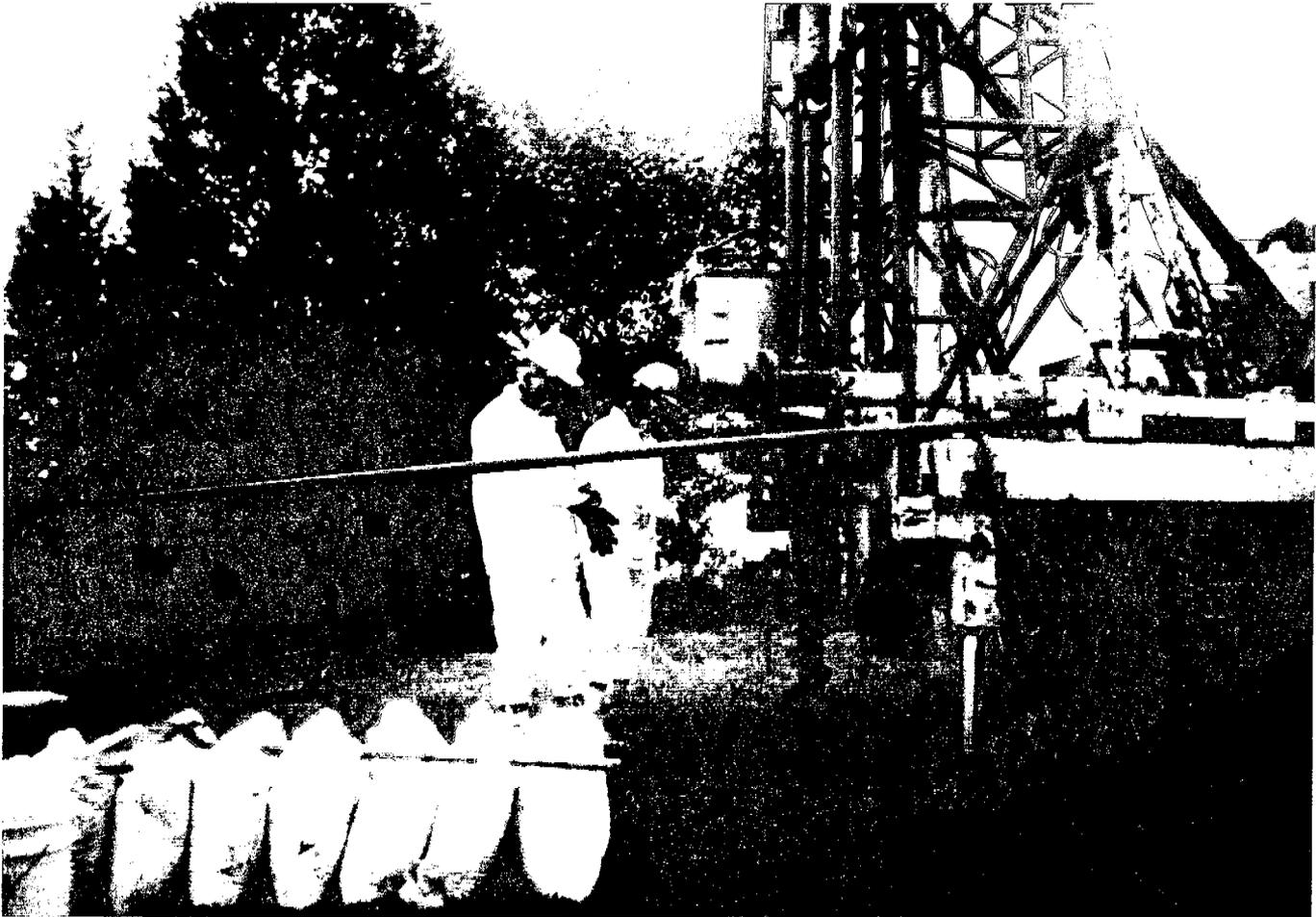
Groundwater investigations were conducted at Sites 6, 9, and 48 in order to fully characterize and delineate potential groundwater contamination, assess human health and ecological risks, and evaluate possible remedial technologies. Monitoring wells were installed to evaluate groundwater quality and to estimate aquifer characteristics such as flow rates and flow direction. Well locations were based upon areas of concern identified on historical (EPIC) aerial photographs, and background information regarding the history and usage of the site.

Monitoring wells were constructed of four-inch PVC casing with a 0.01-inch screen. Four-inch wells were selected as to allow for the pump and treatment of groundwater, if necessary. Outer steel casing was employed during deep well installation (i.e., Type III wells) where conditions permitted, such as the occurrence of a confining clay layer. A medium-grained sand pack was placed between the borehole wall and screen extending approximately 2 feet above the top of the screen. A 1- to 2-foot bentonite pellet seal was then placed above the sand pack. In the case of deep wells, bentonite cement was employed as backfill. The remaining footage was then backfilled with Portland cement for the construction of a pad. Finally, an above ground steel protective casing and a PVC locking cap were fitted at the top of each well. All wells have been identified and registered with the North Carolina DEHNR.

Following well construction and curing of the bentonite seal, each well was developed in order to remove fine-grained sediments and to establish the well within the formation. The newly installed monitoring wells were

developed through a combination of pumping and surging, in the case of shallow wells, or air-compressed evacuation and surging, in the case of deep wells. Investigation-derived wastes generated during this investigation (e.g. purge water, development water, drilling mud) were containerized and sampled.

Groundwater samples were collected from both newly installed and existing monitoring wells. Samples were collected in order to confirm the presence or absence of contaminants and to evaluate the extent of groundwater contamination. Groundwater sampling procedures were performed in accordance with EPA Region IV guidelines.



**Photograph 3-1**

Photograph depicts shallow well installation operations at Site 48, east of Building AS804, the suspected mercury dump. Drilling operations were conducted using Level-C health and safety protection.

## Groundwater



**Photograph 3-2**

The 8.25-inch hollow-stem auger, pictured here, is being used for shallow well installation at Site 6.



**Photograph 3-5**

Baker personnel preparing to sample groundwater using teflon-coated leader and four-inch teflon bailer.

### 3.2.2 Soil Investigation

Soil investigations were conducted at Sites 6, 9, and 48 in order to fully characterize and delineate potential soil contamination, assess human health and ecological risks, and evaluate possible remedial technologies. The drilling and sampling program focused on suspected disposal/storage areas. Historic (EPIC) aerial photographs and background documents (e.g. memos, reports, etc.) were used to locate potential areas of concern.

Drilling operations employed a truck mounted drill rig and the use of decontaminated hollow-stem augers. Surface (top 6 inches) and subsurface soil samples were collected to evaluate the horizontal and vertical extent of potentially impacted soils. Surface soil samples were collected from the auger cuttings using a decontaminated stainless-steel spoon. Deeper subsurface soil samples were collected with a decontaminated split-spoon sampler. Soil sampling was conducted in accordance with EPA Region IV guidelines. Drill cuttings were containerized and sampled in order to evaluate disposal options.

In addition to organic and inorganic chemical analysis, a limited number of samples were collected and analyzed for both geotechnical and chemical engineering parameters. Chemical parameters (total TCLP, residual chloride, total fluoride, organic nitrogen, total alkalinity, and RCRA hazardous characteristics) were analyzed in order to evaluate process options for treatment of potentially impacted soils and disposal options. Geotechnical parameters (grain size, moisture density, permeability) were collected for evaluation of subsurface physical conditions.



**Photograph 3-8**

Baker personnel logging soil sample description.

## Soil



**Photograph 3-9**

Photograph illustrates a composite soil sample within a stainless steel mixing bowl. The sample is surrounded by monitoring equipment used during the soil investigation.



**Photograph 3-10**

Photograph depicts Baker personnel logging a hand-augered soil sample from within the Ravine Area of Site 6.

## Soil



**Photograph 3-11**

The hand-augered soil sample displayed here contained green corrosive material. This sample was collected from within the Ravine Area of Site 6.

### **3.2.4 Aquatic/Ecological Investigation**

Aquatic/Ecological surveys were conducted on Bear Head Creek, Wallace Creek, Everett Creek, the New River, and an unnamed tributary to the New River. These surveys were performed in order to evaluate whether possible contaminant migration from the sites near these waterways has adversely impacted aquatic habitat.

The surveys included benthic macroinvertebrate studies and fish population studies along the various waterways. Sampling stations were chosen upgradient from the sites to determine background conditions, as well as adjacent to and downgradient from the sites in order to evaluate ecological stresses.

Benthic macroinvertebrates were collected using ponar dredges. Fish were collected via electroshocking, gill nets, and haul seines. Following the collection of benthic macroinvertebrates and fish from sampling stations, the organisms were identified and counted. Abnormal markings such as tumors or lesions were also noted. Statistical summaries were then performed in order to determine faunal densities, species richness, and species diversity. These parameters are used to evaluate stresses to the environment.

A limited number of fish and shellfish were collected for chemical analysis in order to evaluate whether contaminants in the surface water or sediment have bioaccumulated in the organisms. Heavy metals such as mercury and lead, along with PCBs and pesticides can easily bioaccumulate in organisms from ingestion.



**Photograph 3-13**

The ponar grab, pictured here, was used to collect benthic macroinvertebrates. The sediment was filtered through a 500-micron sieve; the remaining material was then placed in jars containing preservative.

The haul seine being deployed in this photograph was used as a method of collecting aquatic organisms.

**Photograph 3-14**





**Photograph 3-15**

This photograph depicts a gill net being deployed. This method was used to catch fish for subsequent evaluation and, in some cases, chemical analysis.



**Photograph 3-16**

The long-nose gar, pictured here, is in the process of being measured, weighed, and logged.



**Photograph 3-17**

This photograph shows a fish being removed from a gill net.

### **3.2.5 Subsurface Investigation**

A subsurface investigation was performed at Lot 203 to address areas of concern that were identified on the historical (EPIC) aerial photographs that indicated possible trenching and/or burial operations. The subsurface investigation was carried out in Level B health and safety protection. A Case 580 backhoe was utilized to excavate test pits perpendicular to the suspected trench/borrow pit. The excavated soil was periodically screened with air monitoring instruments. Samples were obtained where visual contamination was apparent or air monitoring results were elevated. The test pits were approximately 15-feet long by 8-feet deep. Many of the test pits revealed military training debris such as communication wire, fired casings, battery packs, and general debris. One test pit revealed over 100 small canisters. The contents of the canisters was not identifiable; however, samples were collected in order to characterize the contents.

## Subsurface



**Photograph 3-18**

The test pit, shown here, was excavated perpendicular to the suspected disposal trench, indicated by the yellow line. Former disposal trenches were located based on existing historical photographs provided by the EPA's Environmental Photographic Interpretation Center (EPIC).

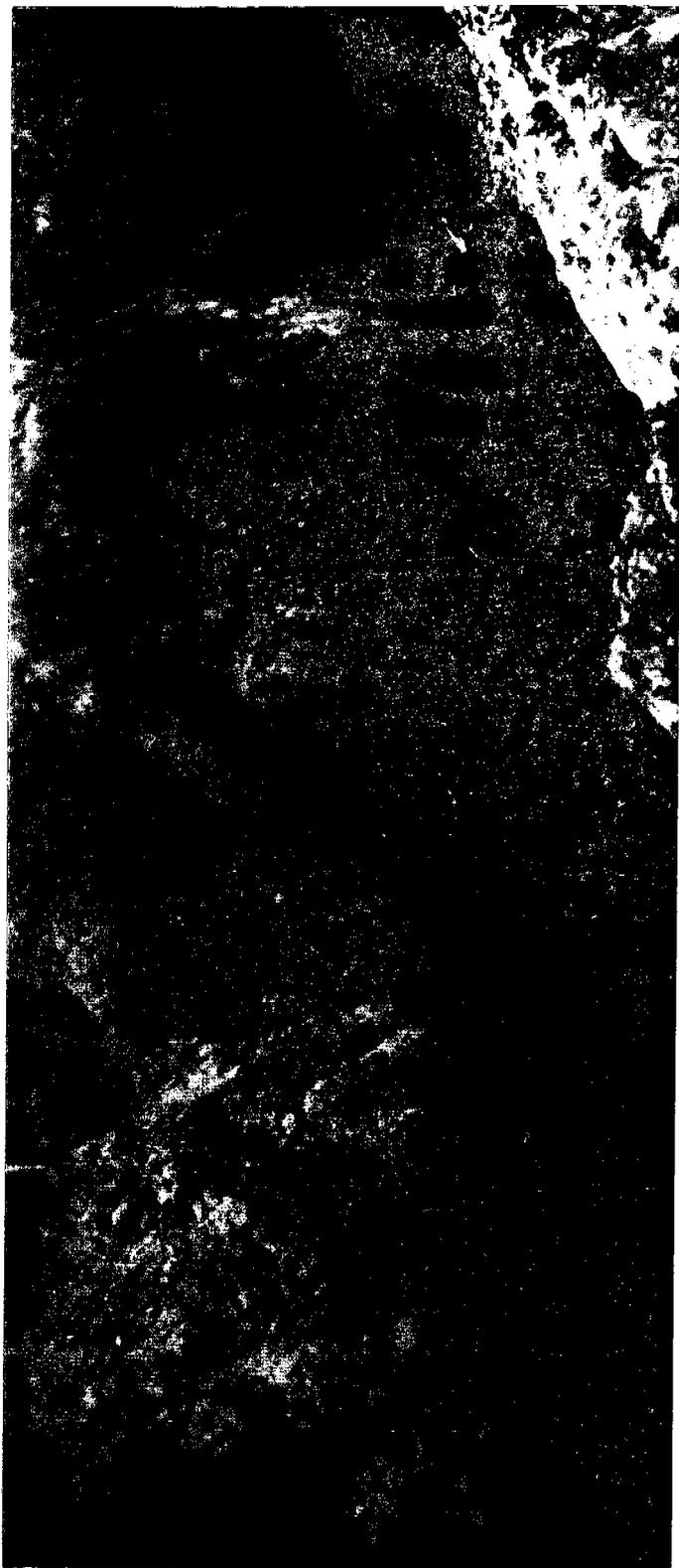


**Photograph 3-19**

During excavation of the test pit pictured here at Site 6, communication/detonation wires were uncovered near the surface. This material was uncovered throughout Storage Lot 203 and the surrounding wooded areas.

**Subsurface**

## Subsurface



**Photograph 3-20**

This picture depicts the bluish-green layer found at depth in several adjacent test pits within Storage Lot 203, Site 6. This material is believed to be the result of corrosion. Samples of this material were collected for chemical analysis.



**Photograph 3-23**

Ground penetrating radar, pictured here, was used to determine the extent of buried metal debris.

## Geophysical



**Photograph 3-24**

Baker personnel analyzing output from ground penetrating radar. Data generated in the field is used to make “onsite” field decisions to aid in the placement of test borings, monitoring wells, and test pits.

## 4.0 INVESTIGATIVE PROCEDURES

This section addresses both the decontamination and derived waste containment and handling procedures used throughout the remedial investigation of Sites 6, 9, 48, and 69.

### 4.1 Decontamination Procedures

Decontamination procedures performed in the field were initiated in accordance with EPA Region IV guidelines. Routine sample collection equipment and heavy equipment were decontaminated using separate methods. The drill rig, hollow-stem augers, and drill rods were considered heavy equipment. Split-spoons, stainless-steel spoons, and teflon-coated bailers were considered routine sample collection equipment.

Heavy equipment was decontaminated using brushes and high-pressured steam and then allowed to air dry. Routine sample collection equipment was decontaminated through the following process: scrub off caked-on soil with brush and alconox soap solution; rinse with potable water; rinse with organic-free deionized water; rinse twice with diluted nitric acid; rinse thoroughly with deionized water; rinse twice with isopropanol alcohol; air dry; and wrap in aluminum foil.

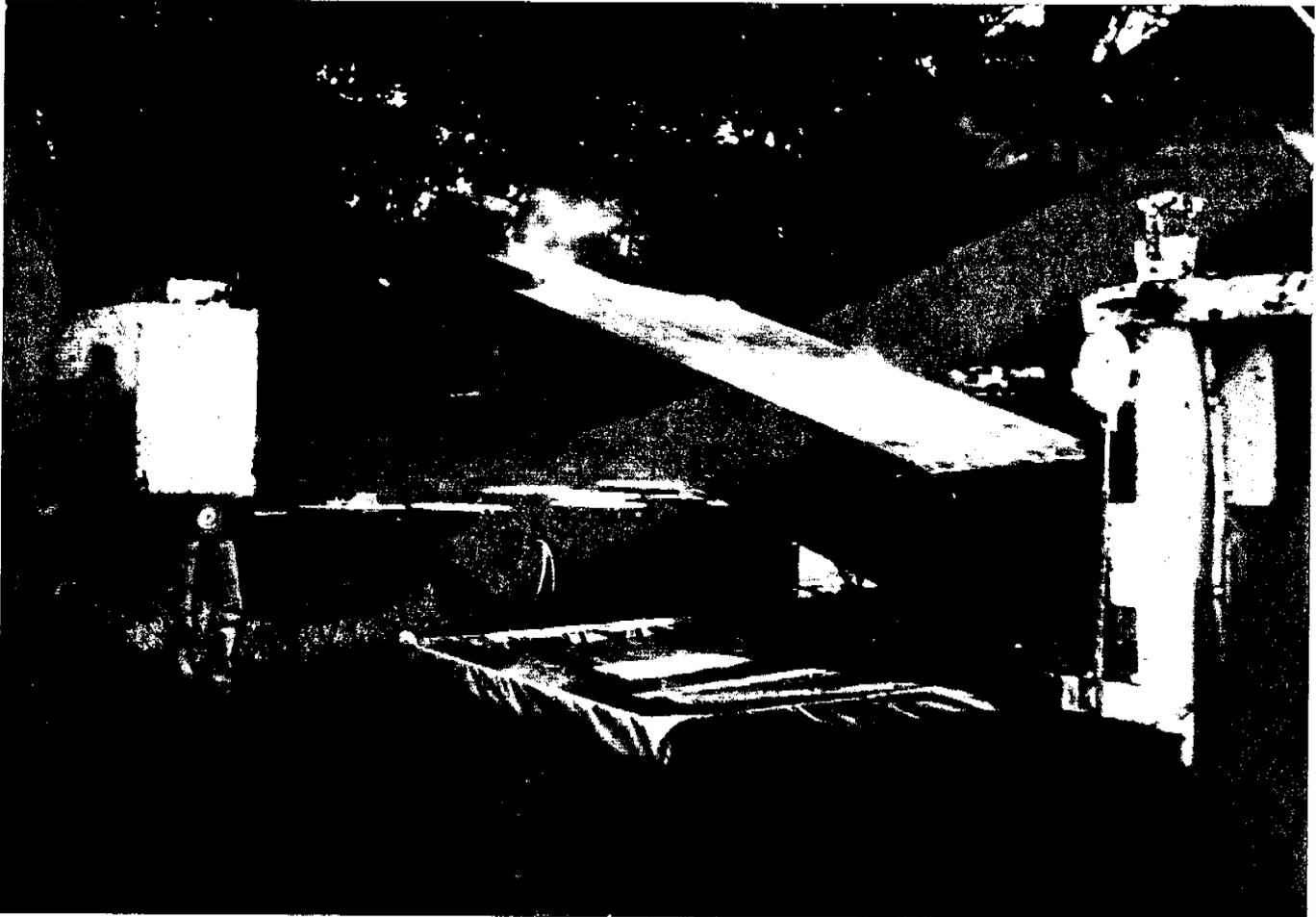
Temporary decontamination pads were constructed for both procedures in order to minimize spillage and subsequent infiltration into soil, and to collect the decontamination fluids. Decontamination fluids generated during the field program were containerized and handled according to procedures outlined in the following section.

## Decontamination



**Photograph 4-1**

This photograph illustrates the split-spoon decontamination procedure used during both the soil and groundwater investigations.



**Photograph 4-2**

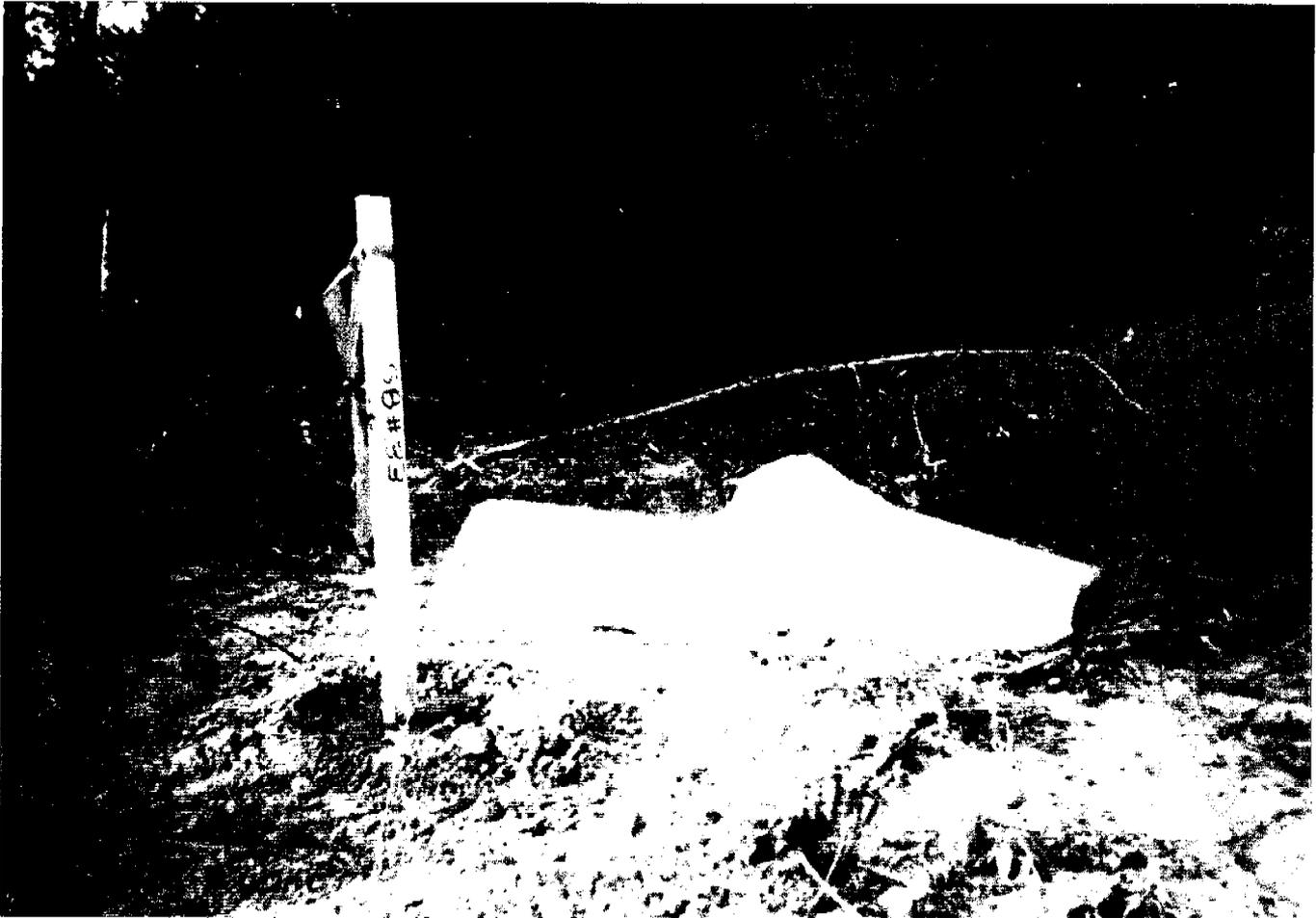
The rotary bin, pictured above, and other drilling support equipment were decontaminated with pressurized steam.

## 4.2 Investigation-Derived Waste Containment and Handling

Investigation-derived wastes were generated during investigations at Sites 6, 9, and 48. These wastes included soil cuttings, drilling mud, development water, purge water, and decontamination fluids. Solid wastes were stored in a total of five roll-off boxes located within Storage Lot 203. Liquid wastes such as purge water and well development water were containerized in a combination of 500-gallon steel tanks, 55-gallon steel drums, and a 10,000-gallon tanker truck.

Containerized wastes of both media were collected for laboratory analysis. A single composite sample, composed of three grab samples from each roll-off box, was submitted for laboratory analysis of full TCLP compounds and RCRA hazardous waste characteristics. Liquid wastes were first segregated into four groups prior to sampling: Group 1, potentially non-contaminated water; Group 2, potentially contaminated water; Group 3, excess water from drums containing drilling mud; and Group 4, decontamination fluids. The segregation of waste fluids was based on field observation and screening. The resulting four groups were then sampled and shipped for laboratory analysis.

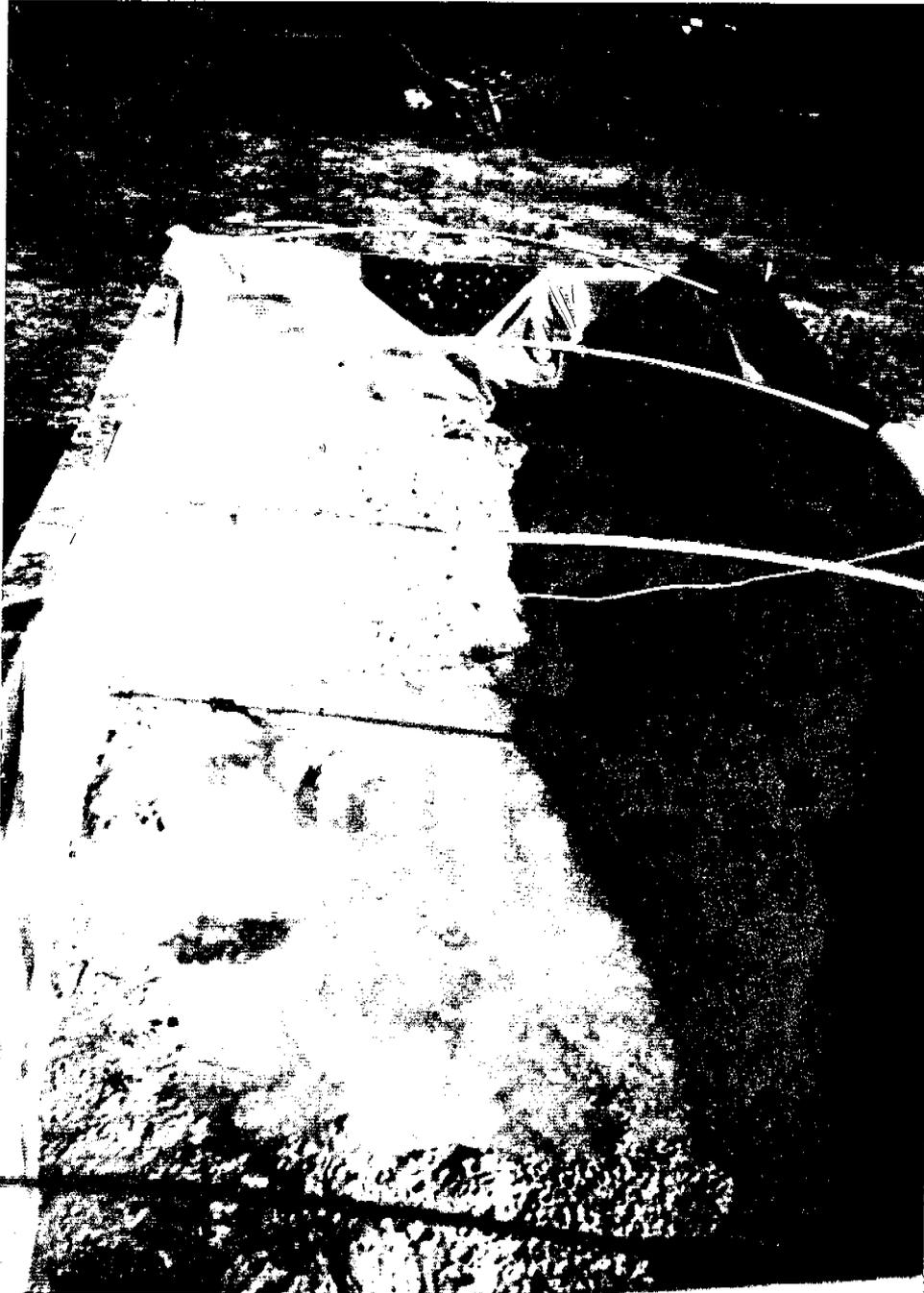
Auger cuttings from remote drilling operations were temporarily covered with a plastic barrier and later transferred to a roll-off box.



**Photograph 4-3**

The above photograph illustrates the temporary stockpiling of waste soil upon completion of a soil boring. The open borehole is backfilled with a bentonite grout.

## Derived Waste



**Photograph 4-4**

Derived waste from both the soil and groundwater investigations were collected in a total of five roll-off boxes, as pictured.