03.03- 1/1/91-00335

DRAFT

FIELD SAMPLING PLAN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
at
HADNOT POINT INDUSTRIAL AREA
MARINE CORPS BASE CAMP LEJEUNE
NORTH CAROLINA

Prepared for:

MARINE CORPS BASE
Camp Lejeune, North Carolina

Prepared by:

HUNTER/ESE INC.
RUTHERFORD, NEW JERSEY

HUNTER/ESE PROJECT NO. 49-02036

03.03-1/1/91-00335

FIELD SAMPLING PLAN

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1.0 INTRODUCTION

This document presents the Field Sampling Plan (FSP) for the RI/FS at the Hadnot Point Industrial Area (HPIA) located within the Marine Corps Base (MCB) Camp Lejeune.

The FSP presents the procedures to be used during the field investigation. Field procedures presented in this FSP were prepared in accordance with EPA and Navy guidelines, and the site-specific Health and Safety Plan (HASP).

1.1 SITE LOCATION AND DESCRIPTION

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

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

The HPIA is comprised of approximately 75 buildings/facilities. These include maintenance shops, gas stations, administrative offices, commissaries, snack bars, warehouses, storage yards, and a dry cleaning facility. A steam plant and a training facility occupy the southwest portion of HPIA. In addition, numerous underground storage tanks, stormwater drains, and oil/water separators are present on site. A transformer storage yard (Site 21) and a fuel tank farm (Site 22) are located within the northern portion of HPIA.

2.0 GENERAL SITE OPERATIONS

1.1 BRIEF DESCRIPTION OF THE SAMPLING PROGRAM

The principal objectives of the field sampling program are:

- to collect additional data to facilitate the design of the selected remedial action for shallow groundwater;

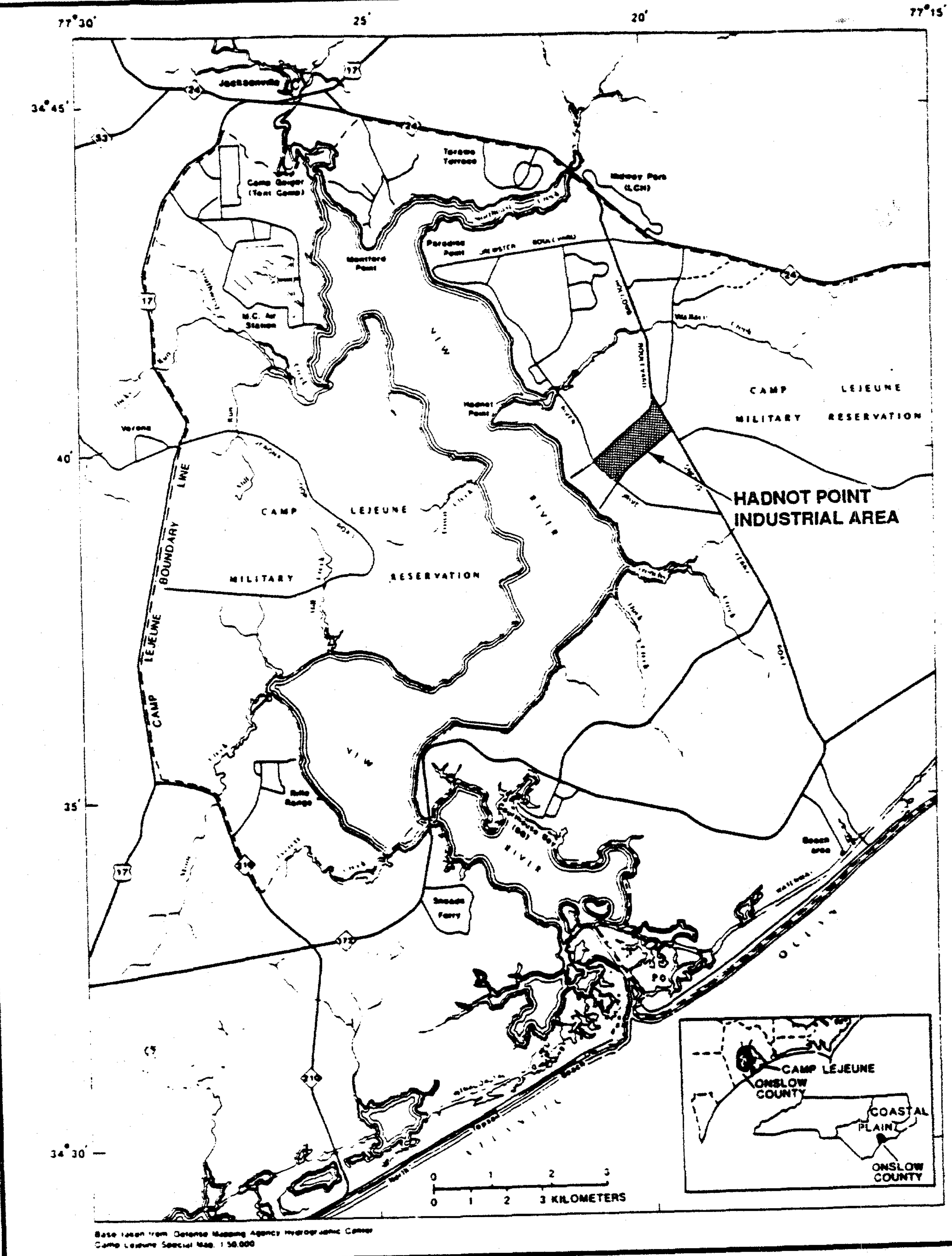

Figure 1-1
SITE LOCATION

SOURCE: HARNET *et al.*, 1989.

REMEDIAL INVESTIGATION
HADNOT POINT INDUSTRIAL AREA
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

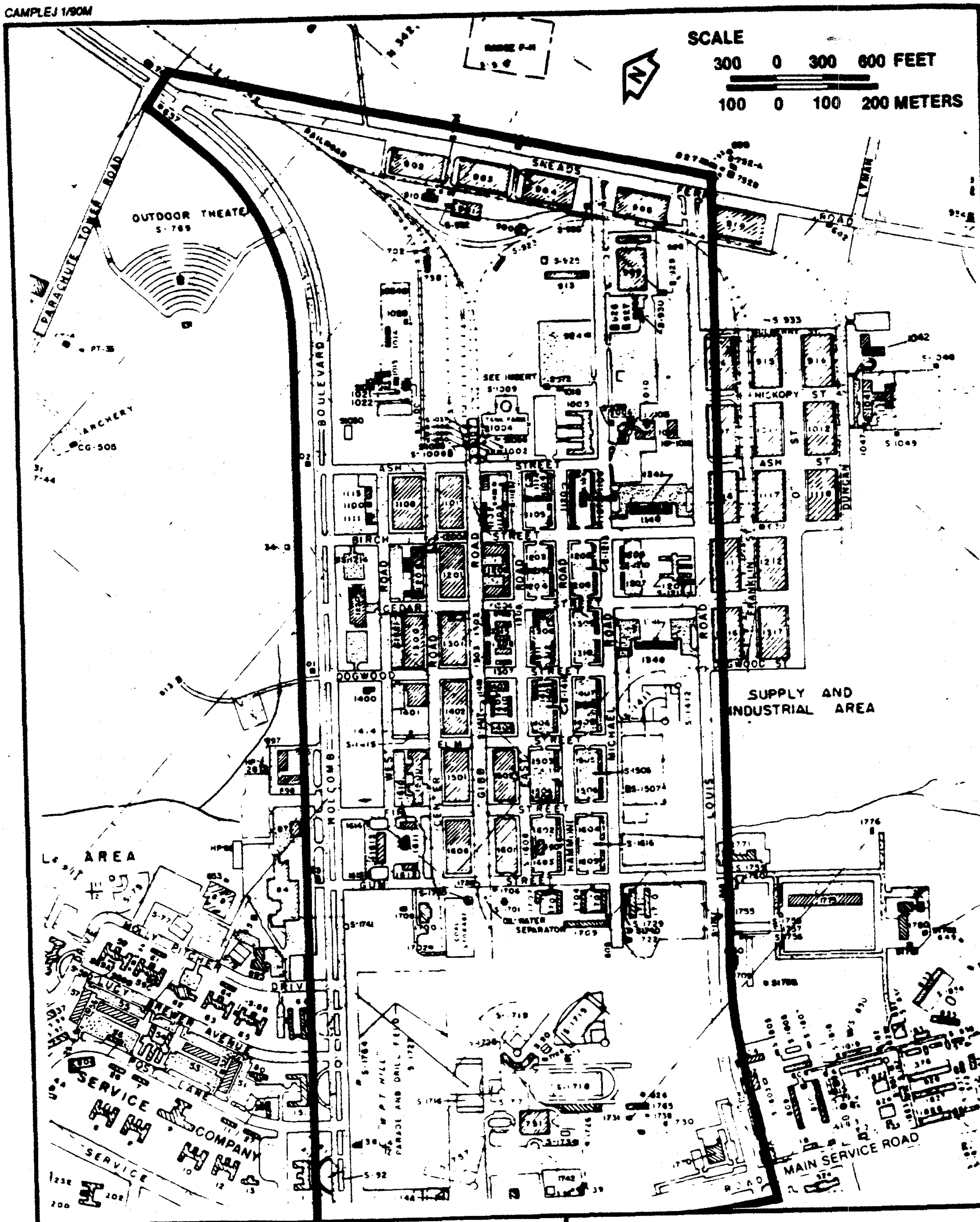

Figure 1-2
HADNOT POINT INDUSTRIAL AREA

SOURCE: CAMP LEJEUNE, 1987.

REMEDIAL INVESTIGATION
HADNOT POINT INDUSTRIAL AREA
MARINE CORPS BASE
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- to collect data necessary to conduct a Risk Assessment and Feasibility Study for deep groundwater, and

- to collect data necessary to conduct a Risk Assessment and Feasibility Study for shallow soil contamination adjacent to Buildings 1602, 902, and 1202.

The field sampling program consists of groundwater and shallow soils sampling. General site operations and field methods are presented in the following sections.

2.2 FIELD TEAM PERSONNEL AND RESPONSIBILITIES

The field team will consist of the following personnel:

- Field Operations Leader (FOL) -- Responsible for the day-to-day management and supervision of the field investigation including scheduling of work, and ensuring that project-specific plans are in compliance with appropriate guidelines. The FOL will provide consultation and decision-making on issues pertaining to sampling activities including potential changes to the field program.

- Site Geologist -- Responsible for overseeing sampling and monitoring well activities, ensuring that standard and approved drilling and monitoring well installation methods are followed and ensuring that pertinent drilling and testing information is obtained.

- Project Hydrogeologist -- Responsible for planning and overseeing the groundwater investigations including determining the number of data points, wells, and reference measuring points needed to adequately define groundwater flow, obtaining accurate water level measurements to generate groundwater contour maps, and assessing the groundwater flow regime and subsurface conditions which could affect that flow regime.

- Sampling Personnel -- Responsible for the proper collection, preservation, packaging, documentation, and initial chain-of-custody of samples until released to another party for storage or transport to the analytical laboratory.

- Health and Safety Officer (HSO) -- Responsible for ensuring that field activities are conducted in accordance with the HASP. The HSO will have the authority to stop work if conditions exceed allowable limits and, as appropriate, will assume certain sampling responsibilities.

- Health and Safety Officer Designee -- The project HSO may not be onsite at all times, therefore a sampling team member will be designated to monitor procedures and report inconsistencies, as they apply to the HASP, to the HSO.

- Drilling Personnel -- Responsible for drilling permits and clearances and supplying all services (including labor), equipment, and material required to perform the drilling, testing, and well installation. The drilling personnel will also be responsible for the maintenance and quality control of required equipment and for following decontamination procedures specified in the FSP and HASP. Upon completion of the work, drilling personnel will be responsible for demobilizing all equipment, cleaning any materials deposited onsite during drilling operations, and properly backfilling any borings.

- Surveying Subcontractor -- Responsible for establishing the locations and elevations of soil borings and monitoring wells and plotting these locations on an existing topographic map. Required horizontal and vertical control are to the nearest 0.1 and 0.01 feet, respectively.

2.3 SAMPLE IDENTIFICATION SYSTEM

Each sample collected will be identified with an alphanumeric code. The code will indicate the site name/number, the matrix sampled, and the sample location (ie: monitoring well or soil boring number). Soil borings will also contain a sequential number which can be correlated to the sample depth.

The site, matrix and sample location codes required for this field investigation are as follows:

- Site Codes:

  HP = Hadnot Point Industrial Area
  21 = Site 21
  22 = Site 22

- Matrix Codes:

  GW = Groundwater
  SO = Soil

- **Sample Locations:**

  GW#-# = monitoring well # - screen depth indicator*
  (*2 =intermediate, 3 = deep)
  SB# = soil boring #

The following can be used as a general guide for sample identification:

Site - Matrix - Well/Soil Boring - Depth Indicator

Some examples of sample identifications are as follows:

HPGW1-3 = groundwater sample collected from GW#1-3 (deep well) located at HPIA.

HPSO1-a = first (0-2 foot) soil sample collected from SB#1 located at HPIA.

2.4 ANALYTICAL PROGRAM

Table 2-1 presents a summary of the analytical program proposed at HPIA. Sample container requirements, preservation requirements, holding times and analytical methods to be performed on each sample are specified in Table 2-2.

All samples collected during this field laboratory investigation will be analyzed at the Hunter/ESE Laboratory. This laboratory fulfills all the requirements outlined in the Navy's Quality Assurance Program (QAP), and has been pre-approved by the Navy.

Sample analysis will be conducted at DQO Level D ensuring that analytical methods comparable to EPA's CLP program will be used. DQO Level D correlates to EPA Level 4, and is required for sites that are on or about to be on the National Priorities List (NPL). CLP-type data packages will be generated by the lab for each sample.

2.5 SAMPLE PACKAGING AND SHIPPING

Each sample will be identified by affixing a pressure sensitive gummed label on each sample jar. Sample labels will reflect the following information: sample ID number, collection date, collection time, name of sampler, etc.

Samples will be packaged and shipped in accordance with the Navy's QA Plan requirements (NEESA 20.2 - 047B) as follows:

Shipping containers shall be secured using nylon strapping tape and custody seals to ensure that samples have not been disturbed during transport. The custody seals shall be

TABLE 2-1

HADNOT POINT INDUSTRIAL AREA
PROPOSED ANALYTICAL PROGRAM

	MATRIX(a)	FIELD SCREENING(b)	FULL TCL(c) + ketones(d)	TCL VOCs + ketones(d)	Pb ONLY	EP TOXICITY (metals)(e)
GROUNDWATER:						
Existing Shallow Wells (29)	GW	29	9	20	20	-
Existing Deeper Wells (6)	GW	6	6	-	-	-
New Deeper Wells (8)	GW	8	8	-	-	-
Water Supply Wells (9)	GW	9	9	-	-	-
Duplicate Samples (f)	GW	-	3	3	3	-
TOTAL GROUNDWATER SAMPLES	GW	52	35	23	23	-
SOIL:						
Soil Borings (10)	SO	30-110(g)	3-11(g)	27-99(g)	-	27-99(g)
Duplicate Samples (f)	SO	-	1	2-9	-	2-9
TOTAL SOIL SAMPLES	SO	30-110(g)	4-12(g)	29-108(g)	-	29-108(g)
BLANK SAMPLES (h):						
Equipment Blanks	AQ	-	10	8	8	4
Field Blanks	AQ	-	1	-	-	1
Trip Blanks	AQ	-	-	15	-	-
TOTAL BLANK SAMPLES	AQ	-	11	23	8	5
COMPOSITED CUTTINGS	SO	-	-	-	-	(i)

NOTES:
(a) GW = groundwater, SO = soil, AQ = aqueous
(b) Field screening for groundwater: pH, temperature, specific conductivity
Field screening for soils: HNu and/or OVM
(c) Full TCL = TCL VOCs, Extractables (includes BNAs, pesticides and PCBs), Metals and Cyanide
(d) ketones = methyl ethyl ketone and methyl isobutyl ketone
(e) EP Toxicity to include analysis for RCRA metals only
(f) Duplicate sample numbers based on a frequency of 10%
(g) Number of soil boring samples presented as a range due to the range of depth to water (6-22 feet)
(h) Equipment blank totals are approximate and based on 1/day/sampling procedure
Trip blank totals are approximate and based on 1/day of aqueous TCL VOC sampling
(i) Number of composited drill cutting samples to be determined in the field

TABLE 2-2

HADNOT POINT INDUSTRIAL AREA
SUMMARY OF ANALYTICAL METHODS, PRESERVATION AND HOLDING TIMES

MATRIX	SAMPLING DEVICE	ANALYSIS	SAMPLE CONTAINER	SAMPLE PRESERVATION	HOLDING TIME FROM COLLECTION	ANALYTICAL METHOD
Groundwater/ blanks	stainless steel or teflon bailer	TCL VOCs +ketones (a)	3-60ml glass vials with teflon septum caps	HCL to pH<2 Cool to 4 C	14 days analyze	CLP-IFB-SOW (2/88)
	"	TCL BNAs, pesticides and PCBs	2-1 liter amber glass	Cool to 4 C	7 days extract 40 days analyze	CLP-IFB-SOW (2/88)
	"	TCL Metals (or Pb)	1-1 liter poly-ethylene	HNO_3 to pH<2 Cool to 4 C	6 months (Hg - 28 days)	CLP-IFB-SOW (7/87)
	"	Cyanide	1-1 liter poly-ethylene	NaOH to pH<2 Cool to 4 C	14 days analyze	CLP-IFB-SOW (7/87)
Soil	split-spoon	TCL VOCs	1-60ml glass vial with teflon-lined cap	Cool to 4 C	14 days analyze	CLP-IFB-SOW (2/88)
	"	TCL BNAs, pesticides and PCBs	1-8oz glass	Cool to 4 C	14 days extract 40 days analyze	CLP-IFB-SOW (2/88)
	"	TCL Metals	1-8oz glass	Cool to 4 C	6 months	CLP-IFB-SOW (7/87)
	"	Cyanide	1-8oz glass	Cool to 4 C	14 days analyze	CLP-IFB-SOW (7/87)
	"	TCL Metals (RCRA metals only)	1-8oz glass	Cool to 4 C	6 months	CLP-IFB-SOW (7/87)
Cuttings	-	"	1-8oz glass	Cool to 4 C	6 months	CLP-IFB-SOW (7/87)

NOTES: (a) ketones = methyl ethyl ketone and methyl isobutyl ketone placed on the containers so they cannot be opened without breaking the seal.

Samples shall be packed in shipping containers so as to guard against damage during shipment (e.g. bubble wrap, vermiculite). Samples which must be kept at 4° C shall be shipped in insulated containers with either freezer forms or ice. If ice is used, it shall be placed in a container so that the water will not fill the cooler as the ice melts. The samples shall be shipped within 24 hours of collection to allow the laboratory to meet holding times. Shipping will be in accordance with Department of Transportation regulations.

Copies of the signed Chain-Of-Custody forms (Figure 2-1) shall be delivered with the data packages. The originals shall remain on file.

2.6 SAMPLE DOCUMENTATION

Each field team member will be required to maintain a field logbook to document all field activities at the site. The field logbook will be a bound, weatherproof notebook.

Entries will be made into the field logbook on a daily basis. Information to be noted in the field logbook include daily weather conditions, personnel on site, sample particulars such as sample number, sampling time, sampling method, sample description and name of sampler, field measurements and geologic and hydrologic data. Any deviations from procedures documented in the Sampling Plan will also be noted in the logbook.

In addition to logbook documentation, boring logs and monitoring well construction sheets will be generated once a boring or monitoring well are complete. Sampling data records will be filled out for each sample collected. Chain-of-custody forms will be filled out for all samples sent to a laboratory for analysis. Examples of each form are presented in Figures 2-1 through 2-4.

2.7 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The QA/QC requirements for field activities conducted at HPIA are presented below.

2.7.1 Field Instrumentation Calibration

Instruments which measure pH, temperature, specific conductivity and organic vapors will be used during the field investigation. Calibration and maintenance information for each instrument used at the site will be recorded on Calibration and Field Instrument Quality Assurance Record Forms (Figures 2-5 through

Hunter/ESE, Inc.   03-29-89   *** FIELD LOGSHEET ***   FIELD GROUP: XXXXXX

PROJECT NUMBER   PROJECT NAME:XXXXXX   LAB COORD. JEFF SHANIS

XXXXXX

ESE #	SITE/STA	HAZ?	FRACTIONS(CIRCLE)	DATE	TIME	PARAMETER LIST
*1			C EC N			XXXXXX
*2			C EC N			XXXXXX
*3			C EC N			XXXXXX
*4			C EC N			XXXXXX
*5			C EC N			XXXXXX
*6	F.DUPE		C EC N			XXXXXX
*7	EQPBLK		C EC N			XXXXXX

NOTE -CHANGE OR ENTER SITE ID AS NECESSARY, UP TO 9 ALPHANUMERIC CHARACTERS MAY BE USED
-CIRCLE FRACTIONS COLLECTED. ENTER DATE,TIME,FIELD DATA (IF REQUIRED), HAZARD CODE AND NOTES
-HAZARD CODES: I-IGNITABLE C-CORROSIVE R-REACTIVE T-TOXIC H-OTHER ACUTE HAZARD; IDENTIFY SPECIFICS IF KNOWN
-PLEASE RETURN LOGSHEETS WITH SAMPLES TO Hunter/ESE, Inc.

RELINQUISHED BY: (NAME/COMPANY/DATE/TIME)	VIA:	REC'D BY (NAME/COMPANY/DATE/TIME)
1		
2		
3		

SAMPLER: MORE SAMPLES TO BE SHIPPED? ___ IF YES, ANTICIPATED # ___ TO SHIP ON __/__/__

SAMPLE CUSTODIAN: Custody Seals Intact? ___ Samples Iced? ___ Preservations Audited? ___ Problems? ___

Figure 2-1
SAMPLE CHAIN-OF CUSTODY LOG SHEET

SOURCE: HUNTER/ESE, 1990.

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CAMPLEJ 1/90M

D20/LEG.F.BOR.LOG 1/90M

FIELD BORING LOG			BORING NO.
Project No.	Project Name		Page ___ of ___
Contractor	Driller	Date started	completed
Method	Casing Size	HMU 11.7/10.2	Protection Level
Ground El.	Soil Drilled	▼ below ground	Total Depth
Logged by	Checked by	Date	

Sample No.	Depth in Feet	Blows per 6 inches	Pen. / Rec.	Description	HNU jar	Comments on Advance of Boring	Monitoring	
							HNU	LEL

Figure 2-2
FIELD BORING LOG

SOURCE: HUNTER/ESE, 1990.

REMEDIAL INVESTIGATION
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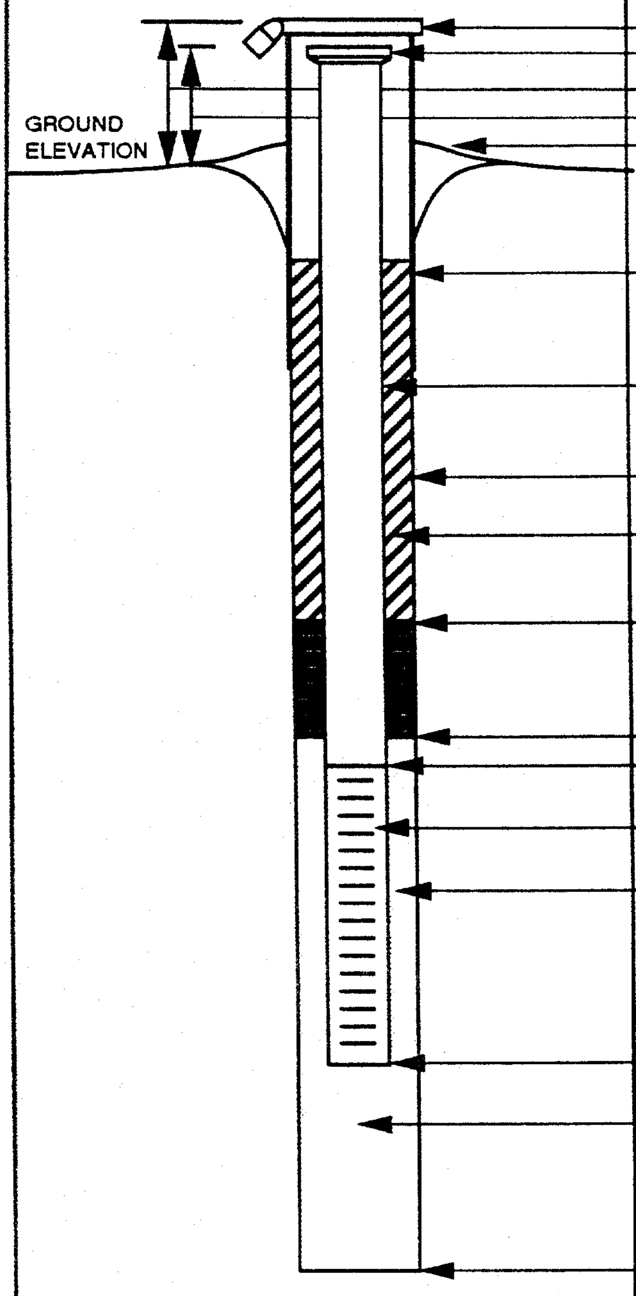
OVERBURDEN MONITORING WELL SHEET

WELL NO.____

PROJECT ______________________
PROJECT NO. ____________ BORING NO. __________
ELEVATION ____________ DATE __________
FIELD GEOLOGIST ______________________

DRILLER ____________
DRILLING METHOD ____________
DEVELOPMENT METHOD ____________



NOT TO SCALE

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

I.D. OF SURFACE CASING: __________
TYPE OF SURFACE CASING: __________

RISER PIPE I.D. __________
TYPE OF RISER PIPE: __________

BOREHOLE DIAMETER: __________

TYPE OF BACKFILL: __________

ELEVATION/DEPTH TOP OF SEAL: __________
TYPE OF SEAL: __________

DEPTH TOP OF SAND PACK: __________
ELEVATION/DEPTH TOP OF SCREEN: __________

TYPE OF SCREEN: __________
SLOT SIZE X LENGTH: __________
TYPE OF SAND PACK: __________

ELEVATION/DEPTH BOTTOM OF SCREEN: __________

ELEVATION/DEPTH BOTTOM OF SAND PACK: __________
TYPE OF BACKFILL BELOW OBSERVATION WELL: __________

ELEVATION/DEPTH OF HOLE: __________

Figure 2-3
MONITORING WELL CONSTRUCTION SHEET

SOURCE: HUNTER/ESE, 1990.

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GROUNDWATER FIELD SAMPLE DATA RECORD

PROJECT ______ JOB NO ______

STATION NO/LOCATION ______ DATE ______

SKETCH ON BACK YES ☐ NO ☐ PHOTOGRAPHS YES ☐ NO ☐ ROLL NO/EXPOSURE NO ______

FIELD DATA

TIME: START ______ AIR TEMP ______

END ______ WEATHER ______

WATER DEPTH ______ ☐ TOP WELL ☐ TOP CASING WELL DEPTH ______ WELL MATERIAL ______

WELL DIAM. ______

WELL STICK-UP ______ WELL/CASING ______

SAMPLING EQUIPMENT USED ______ VOLUME PURGED ______

FIELD DATA COLLECTION ☐ IN SITU ☐ IN BOTTLE

VOA LEVEL(PPM) AMBIENT ______

SAMPLE LOCATION ______

HEADSPACE ______

SAMPLE PURGE DATA

@ ______ GAL	@ ______ GAL	@ ______ GAL	@ ______ GAL
TEMP ______ °C	TEMP ______ °C	TEMP ______ °C	TEMP ______ °C
SP COND ______ @25°C	SP COND ______ @25°C	SP COND ______ @25°C	SP COND ______ @25°C
pH ______	pH ______	pH ______	pH ______
Eh ______	Eh ______	Eh ______	Eh ______

BOTTLE ID	LAB ID	VOL	MATERIAL	FILTERED	PRES./VOL.	ANALYSIS REQUESTED

REMARKS/OBSERVATIONS ______

SAMPLER ______

Figure 2-4
GROUNDWATER FIELD SAMPLE
DATA RECORD

SOURCE: HUNTER/ESE, 1990.

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2-7) on a daily basis. Items such as instrument type, instrument I.D. number, calibration method and results, and name of person performing calibration will be noted.

2.7.2 QA/QC Sample Collection

The following blank samples will be included in the analytical program to ensure QA/QC of sampling practices.

Trip Blanks

A trip blank is an aliquot of deionized analyte-free water that is sealed in a sample bottle at the laboratory and accompanies the sample bottles to and from the field. A trip blank establishes a mechanism of control on sample bottle preparation, blank water quality and sample handling, including cross-contamination of samples during shipping. Trip blanks should be handled, transported and analyzed in the same manner as the samples collected that day. Trip blanks are analyzed for volatile organics only and must accompany samples at a rate of 1/cooler. Trip blanks are required for aqueous volatile sampling only.

Equipment Blanks (Equipment Rinsate Blanks)

An equipment blank is used to evaluate potential contamination from ambient air and sampling equipment on site. Equipment blanks are collected by passing deionized, analyte-free water through clean (decontaminated) sampling equipment and into sample jars. Equipment blanks are collected at a frequency of 1/day/sampling procedure. Equipment blanks are analyzed for the same parameters as the environmental samples.

Field Blanks

A field blank is used to evaluate potential contamination from source water used for decontamination. At least one field blank is collected per event for the same parameters as the environmental samples.

Duplicate Samples

A duplicate sample creates a mechanism for the evaluation of a laboratory's performance by allowing a comparison of analytical results of two samples collected from the same location. Duplicate samples

ENVIRONMENTAL SCIENCE & ENGINEERING
WATER RESOURCES DIVISION
pH Meter Calibration Form

Date ______________________

Project Number ______________________

Instrument Serial Number ______________________

Calibrator ______________________

Battery (Condition or Voltage) ______________________

Ambient Temperature ______________________

Standard Buffer Value	Initial Reading	Final Reading
7.00	________	________
4.00	________	________
10.00	________	________

Condensed Calibration Procedure:

1. Fill in ALL information at the top of the form.
2. Activate unit and perform battery check (on units without a battery check switch, mark as "O.K." if LOW BATTERY isn't displayed).
3. Inspect unit and probe for physical damage.
4. Triple Rinse with Deionized water then rinse with pH 7.00 buffer.
5. Put probe in enough pH 7.00 buffer to cover probe. When reading is stable record the "Initial Reading".
6. Adjust the CALIBRATE knob to get the unit to read exactly 7.00. Record the "Final Reading".
7. Triple Rinse with Deionized water then rinse with pH 4.00 or 10.00 buffer whichever is appropriate for the present application.
8. Put probe in enough pH buffer (same buffer as step 7) to cover probe. When the reading is stable record the "Initial Reading".
9. Adjust the SLOPE (TEMP. on some) knob to get the unit to read exactly the same as the buffer and record the "Final Reading".
10. Triple Rinse with Deionized water then rinse with pH buffer that has yet to be used.
11. Put probe in enough pH buffer (same buffer as step 10) to cover probe. When the reading is stable record the "Initial Reading" and the "Final Reading"
12. Make sure the unit is turned off and the probe disconnected. Then return the unit to its proper case.

Figure 2-5
pH METER CALIBRATION FORM

SOURCE: ESE, 1990.

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ENVIRONMENTAL SCIENCE & ENGINEERING
WATER RESOURCES DIVISION
SCT Meter Calibration Form

Date ____________________

Project Number ____________________

Instrument Serial Number ____________________

Calibrator ____________________

Zero (unit off, Pass/Fail) ____________________

Redline (Pass/Fail) ____________________

Parameter	Standard	Reading
Temperature		________ C
Conductivity:		
High Conc. Stnd	________	________
Middle Conc. Stnd	________	________
Low Conc. Stnd	________	________
Salinity (if used):		
High Conc. Stnd	________	________
Middle Conc. Stnd	________	________
Low Conc. Stnd	________	________

Having performed a full calibration of this instrument, I certify that to the best of my knowledge this unit is completely operational and accurate. The only exceptions are those explicitly defined in the comments below.

Comments: ____________________

Signature ____________________ Date ____________________

Figure 2-6
CONDUCTIVITY METER CALIBRATION FORM

SOURCE: ESE, 1990.

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FIELD INSTRUMENTATION QUALITY ASSURANCE RECORD

PROJECT ____________________ DATE ____________

JOB NO ____________

CALIBRATION DATA

EQUIPMENT I.D. ____________________

ELECTRICAL, BATTERY VOLTAGE: ☐ OK ☐ REPLACE

TEMPERATURE PROBE CALIBRATED: ☐ YES ☐ NO DATE OF LAST CALIBRATION ____________

SPECIFIC CONDUCTIVITY PROBE/METER CALIBRATION:

CONDUCTIVITY STANDARD ________ umhos/cm ________ METER READING

________ umhos/cm ________ METER READING

________ umhos/cm ________ METER READING

pH/Eh PROBE CALIBRATION pH BUFFER ____ 4 ____ 7 ____ 10

Eh MILLIVOLT ____ 4 ____ 7 ____ 10

DISSOLVED OXYGEN METER CALIBRATION ____________

WINKLER CALIBRATION

AVERAGE WINKLER TITRATION VALUE ________ PPM METER CORRECTION ☐ YES ☐ NO

OTHER: ____________________

____

SAMPLING EQUIPMENT/DECONTAMINATION RECORD

SAMPLING EQUIPMENT USED: ☐ ELECTRIC SUBMERSIBLE PUMP ☐ PERISTALTIC PUMP ☐ GRAVITY CORER

☐ BLADDER SUBMERSIBLE PUMP ☐ TEFLON/S.S. BAILER ☐ ________

☐ ________

DECONTAMINATION FLUIDS USED: ☐ DISTILLED WATER ☐ METHANOL ☐ ________

☐ ISOPROPANOL ☐ TCP ☐ ________

FILTRATION EQUIPMENT USED: ☐ VACUUM FILTRATION ACID-RINSED: ☐ YES ☐ NO

☐ PRESSURE FILTRATION FILTRATION BLANK PREPARED: ☐ YES ☐ NO

SAMPLER ____________________

Figure 2-7
FIELD INSTRUMENTATION QUALITY ASSURANCE RECORD

SOURCE: HUNTER/ESE, 1990.

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are collected for each matrix sampled at a frequency of 10%.

Matrix Spike and Matrix Spike Duplicate (MS/MSD) analyses will be performed on all duplicate aqueous samples collected. MS/MSD samples require triple the normal sample volume which will require additional collection containers in most cases.

3.0 FIELD INVESTIGATION AND SAMPLING

This section describes the field investigation and sampling activities to be conducted at the site.

The field investigation will consist of the following subtasks:

1. Mobilization and Demobilization;
2. Monitoring Well Installation;
3. Groundwater Sampling and Water Level Monitoring;
4. Soil Sampling, and
5. Surveying of Sampling Points.

3.1 MOBILIZATION AND DEMOBILIZATION

This subtask will consist of field personnel orientation, equipment mobilization, and the staking of sample locations.

Field team members will attend an orientation meeting to become familiar with the history of the site, health and safety requirements, and field procedures.

Equipment mobilization will entail the ordering and purchasing of all sampling equipment necessary for the field investigation. Locations for soil borings and monitoring well clusters will be staked at the start of the field investigation.

A survey of existing facilities equipped with floor drains and an evaluation of these facilities to serve as a decontamination area for heavy equipment will be performed during the mobilization phase of the field investigation. If a suitable decontamination area cannot be established from existing facilities, a decontamination pad will be constructed on site at this time.

Demobilization will consist of equipment demobilization, and will be performed at the completion of each phase of the field investigation, as necessary.

3.2 MONITORING WELL INSTALLATION

The monitoring well installation program is designed to obtain additional data on deep groundwater conditions downgradient of four areas of concern at HPIA.

Monitoring well clusters will be installed downgradient of Buildings 1602, 902, and 1202, and the Industrial Area Tank Farm (Site 22) (Figure 3-1).

The direction of horizontal groundwater flow within the deeper (>75 feet) portion of the aquifer below HPIA is not known at this time. The downgradient horizontal flow direction will be determined by water level measurements taken in existing deep wells at the site and, if available, water level data obtained from USGS files in Raleigh, N.C.

Four monitoring well clusters consisting of two wells each, for a total of 8 monitoring wells, will be installed during the field program. The wells will be screened at approximate depths of 75 and 150 feet. Exact screen depths will be determined in the field based on the permeability of the soils at these approximate depths. Proposed monitoring wells will be designated HPGW30-2 and HPGW30-3 through HPGW32-2 and HPGW32-3.

Monitoring wells will be drilled using the mud rotary method Split-spoon samples will be collected every 5 feet in deep well borings for geologic characterization. Split-spoon samples will be collected at the proposed screen interval in all well borings to determine the most appropriate depth for effective screen placement.

Monitoring wells will be constructed of 4-inch Outer Diameter (O.D.) Schedule 40, flush-joint PVC screen and riser pipe. Screens will be 10 feet long with slots 0.010 inch (or of an appropriate size to retain approximately 90% of the filter pack).

Drill cuttings and fluids generated during the well installation process will be containerized in 55-gallon drums. Camp Lejeune will be responsible for the transportation of drums to a secure area where the drums will be labeled and palletized. Samples from all drums will be composited and analyzed for EP Toxicity (metals). Disposal of these materials will be the responsibility of Camp Lejeune.

The detailed procedure for monitoring well installation is presented below.

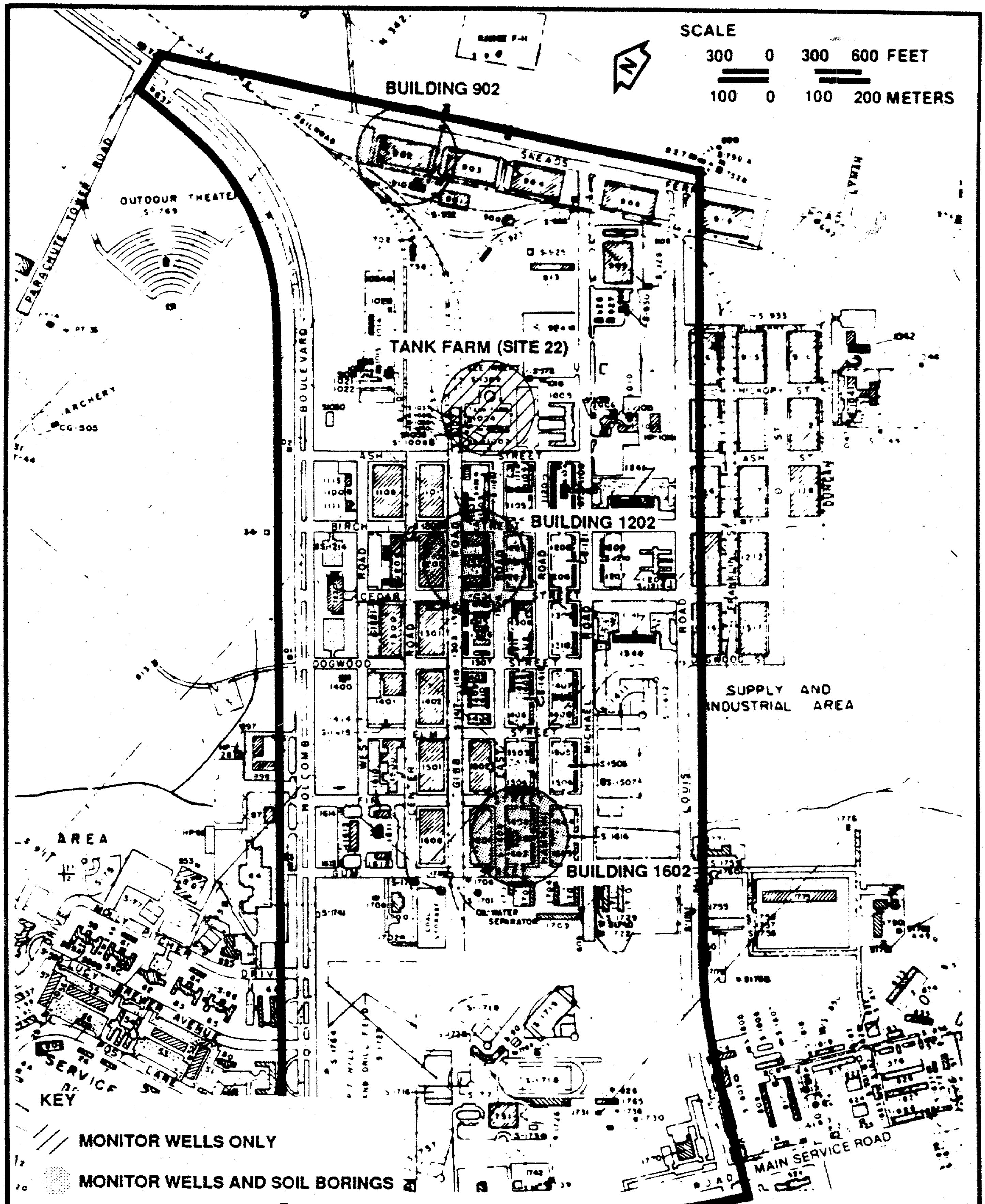

Figure 3-1
AREAS FOR INTERMEDIATE AND DEEP MONITORING WELLS AND SOIL BORINGS
SOURCE: CAMP LEJEUNE, 1987.

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3.2.1 General Monitoring Well Installation Procedure

The following general procedure will be used to construct monitoring wells at HPIA. Figure 3-2 illustrates a typical monitoring well configuration.

1) Wear the appropriate health and safety equipment as outlined in the Health and Safety Plan.

2) Drill borehole to approximate depth specified using the mud rotary drilling method.

3) Collect soil samples using a split-spoon sampler at 5-foot intervals in deep well borings for geologic characterization (see Section 3.4.1). Collect soil samples at the screened interval in all well borings and examine for permeability. Determine the optimum interval for screen placement based on permeability of soils.

4) Lower the decontaminated well screen and an appropriate length of riser pipe into the borehole so as to set the screen at the desired depth and allow the riser pipe to extend approximately 2-3 feet above the ground surface (if well not designated as a flush mount). The well screen and riser will be constructed of flush-joint, 4-inch O.D. PVC. The screen will have 0.010 inch slots (or be slotted at a size appropriate to retain approximately 90% of the filter pack).

5) Backfill the borehole and annular space from the bottom of the hole to approximately 2-3 feet above the well screen with a sand filter pack of appropriate size to retain most of the formation material. Install a 2-3 foot thick bentonite seal above the filter pack. Backfill the remainder of the annular space with a bentonite-cement grout installed with a tremie pipe.

6) Install a steel security casing with a locking steel cap at the top of each well. Security casings may be flush-mount, if warranted.

7) Construct a cement pad around the security casing contoured to slope away from the casing thereby directing surface runoff away from the well. Drill a drainage port through the base of the outer casing to prevent water containment in the annulus and reduce the risk of ice-expansion damage to the riser pipe and cement grout.

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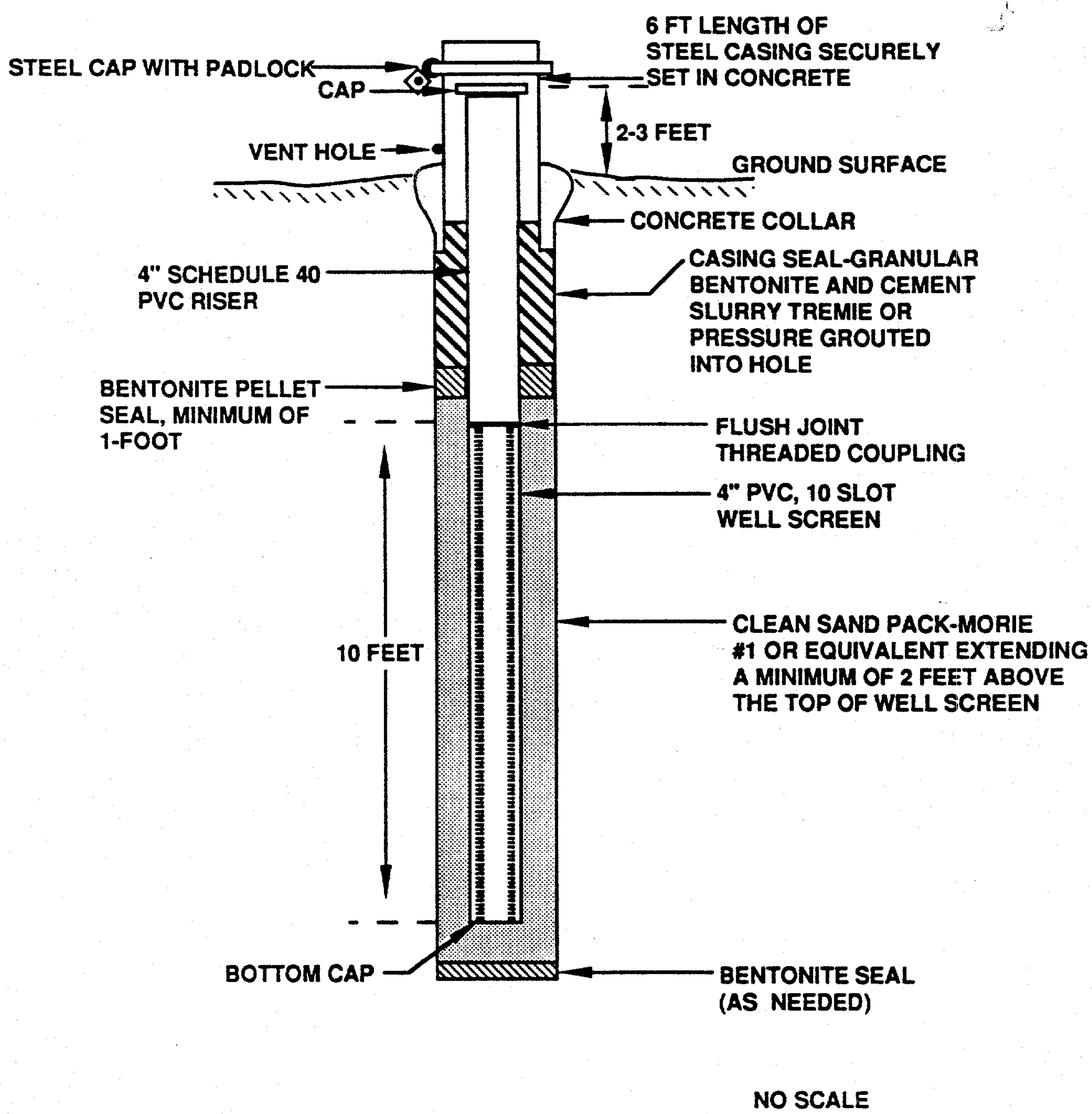

Figure 3-2
TYPICAL GROUNDWATER MONITORING WELL

SOURCE: HUNTER/ESE, 1990.

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8) Following well installation and a sufficient time for the grout to cure, develop the well using the pump and surge method. Wells may be developed by bailing if recovery is poor. Monitor the effectiveness of the development by measuring pumping rates, water color, pH, and conductivity. Continue development until the water generated is visibly free of fines, as determined by the site geologist.

   Collect all development water in drums. Camp Lejeune will be responsible for the storage, transport, and disposal of all development water.

9) Fill out the monitoring well construction sheet. (See Figure 2-3).

3.3 GROUNDWATER SAMPLING AND WATER LEVEL MONITORING

The objective of the groundwater sampling program is to obtain water quality data for shallow and deep groundwater in order to facilitate remediation design for shallow groundwater and fill data gaps needed to conduct a Risk Assessment and Feasibility Study for deep groundwater.

Twenty-nine existing shallow wells, 8 newly installed intermediate and deep wells, 6 existing intermediate and deep wells, and 9 water supply wells will be sampled during the field investigation. Figure 3-3 shows the location of the existing wells to be sampled. The monitoring wells to be sampled include HPGW1 through HPGW26, HPGW29, 22GW-1, and 22GW-2. The water supply wells to be sampled include 601, 603, 642, 602, 608, 630, 634, 637, and 652.

A minimum stabilization period of 72 hours will be required prior to sampling the new wells. Three to five well volumes will be purged by pumping or bailing prior to sampling. Water quality parameters such as temperature, pH, and specific conductivity will be measured at the start of purging operations and after each purged well volume. Stabilization of these parameters from successive purged volumes indicates that the groundwater within the well is at equilibrium. Purge water will be stored, transported, and disposed of by Camp Lejeune.

The wells will be sampled within three hours after water levels have recovered from purging. If a well is evacuated to dryness prior to the evacuation of 3 to 5 well volumes because of poor recovery, the well may be sampled as soon as a sufficient volume of water has entered the well. Groundwater samples will be obtained with a dedicated PVC bailer. The bailer can be suspended from Teflon-coated stainless steel wire or a polypropylene monofilament line with a stainless steel leader. The leader must be of

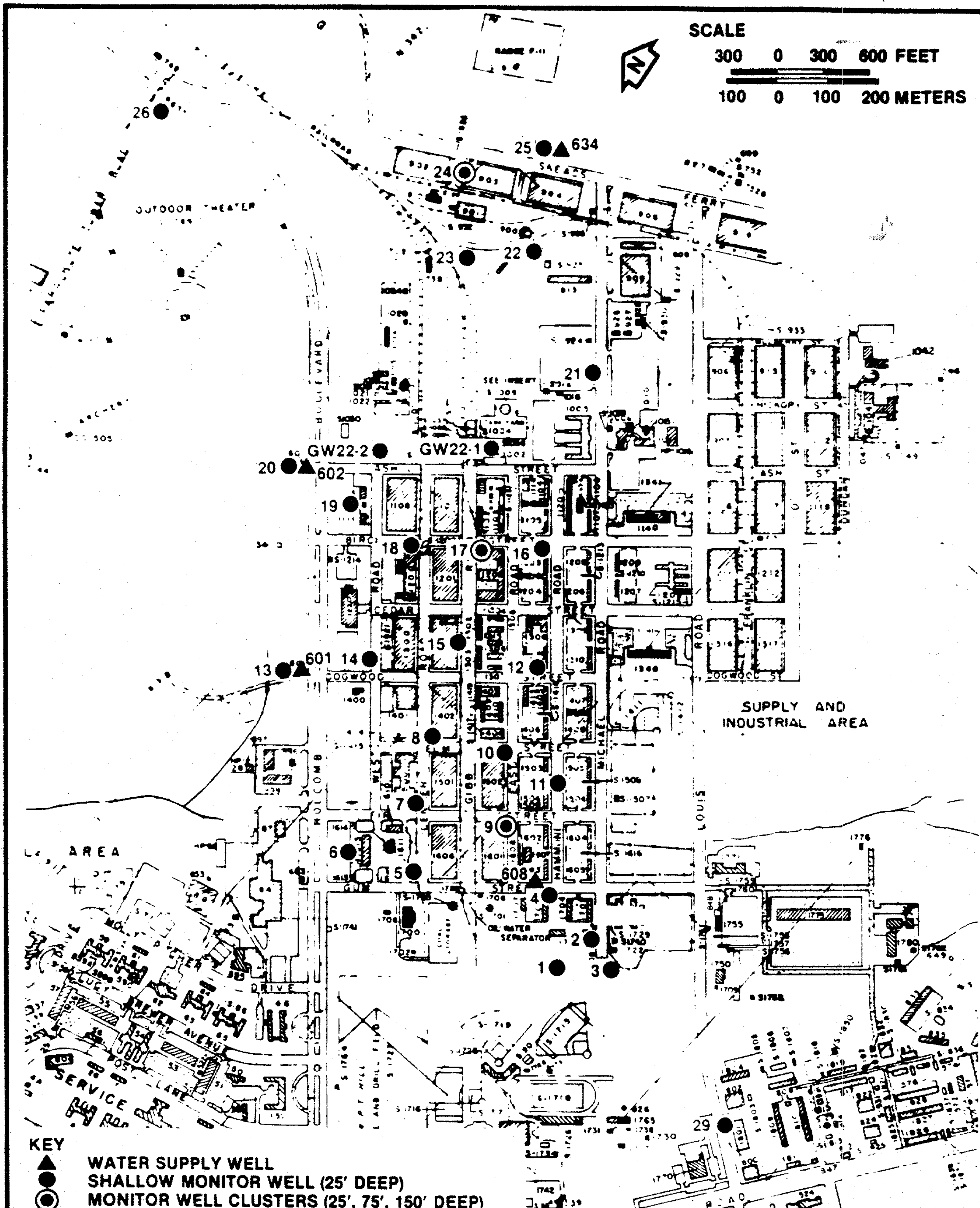

Figure 3-3
MONITORING WELLS AND WATER SUPPLY WELLS AT HADNOT POINT INDUSTRIAL AREA
SOURCE: ESE, 1987.

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sufficient length to ensure that the rope will not come in contact with the groundwater being sampled.

Of the 29 existing shallow wells, 20 will be sampled for volatile organics plus xylene, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), and lead (Pb). Nine of the existing shallow wells will be sampled for full Target Compound List (TCL) parameters. Shallow wells to be sampled for full TCL parameters will be distributed over the three shallow aquifer hot spots delineated in previous studies. (see Section 3.2 of the Work Plan). The water supply wells and intermediate and deep monitoring wells will be sampled for full TCL parameters.

Double volumes of sample fractions designated for Pb or TCL metals will be collected so that filtered and unfiltered samples may be analyzed. Samples will be filtered using 0.45 micron disposable filters. A filtered fraction will be included in the appropriate equipment blank samples.

A detailed monitoring well groundwater sampling procedure is presented in Section 3.3.1.

A minimum of two rounds of water level measurements will be taken during the field investigation to determine horizontal and vertical groundwater flow gradients at the site. Water levels will be measured to the nearest 0.01 feet with an electronic water level indicator and/or a steel tape and chalk. Water level measurements will be recorded in the field logbook.

3.3.1 Monitoring Well Groundwater Sampling Procedure

The following procedure will be used to obtain groundwater samples from monitoring wells.

1) Wear appropriate health and safety equipment as outlined in the Health and Safety Plan.

2) Visually examine the exterior of the monitoring well for signs of damage or tampering and record this information in the field logbook.

3) Unlock the security casing and remove the well cap.

4) Measure and record the ambient air and well head organic vapor concentrations using an HNu or OVM.

5) Measure and record the static water level in the well to the nearest 0.01 foot.

6) Calculate the volume of water in the well as follows:

Volume (gals.) = $0.163 \times T r^2$, where

T = well depth (ft) - static water level (ft)
r = well radius (inches)

7) Purge 3 to 5 volumes* of water from the well using one of the following pieces of decontaminated equipment:

a) Dedicated PVC bailer;
b) Submersible pump, and/or
c) Suction pump (hose must be polyethylene and dedicated to an individual well).

* If the well is slow to recover, evacuate the well to dryness.

8) Measure and record temperature, pH, and specific conductivity of each volume of well water purged.

9) After purging, remove purging equipment from the well and allow static water level to recover to approximate original level.

10) Collect a sample from the well using a dedicated PVC bailer. Measure and record temperature, pH, and specific conductance of sample. If possible, the time between purging and sampling should not exceed 3 hours.

11) Fill VOC sample bottles first, then fill all other required sample containers. Fill sample containers directly from the bailer.

12) Filter one of the sample fractions to be analyzed for Pb or TCL metals with a clean 0.45 micron filter.

13) Preserve all samples as required (See Table 2-2). If acidification of an aqueous sample for volatiles (VOCs) causes effervescence, preserve the remaining vials by cooling to 4° Celsius only. Note the occurrence of effervescence and the lack of preservation on the chain-of-custody form.

14) Replace well cap and lock outer steel casing.

15) Package samples according to QAP procedures (See Section 2.5). Cool analytical samples to 4° Celsius. Fill out sampling record forms, labels, chain-of-custody forms, and custody seals. Ship samples to the laboratory within 24 hours.

3.4 SHALLOW SOIL SAMPLING

The objective of the shallow soil sampling program is to evaluate the extent of shallow (above the water table) soil contamination at HPIA.

Ten soil borings are planned adjacent to Buildings 1602, 902, and 1202. Figure 3-1 presents the building locations.

Soil borings will extend to the water table, approximately 6-22 feet. Samples will be collected continuously, resulting in approximately 3-11 samples per boring. Hollow stem augers (6-1/4" inner diameter) with 3" O.D. carbon steel split-spoon samplers will be used to obtain the soil samples.

Ten percent (3-11) of all samples collected will be analyzed for full TCL parameters. The remaining 90% (27-99) will be analyzed for volatile organic compounds (VOCs) including xylene, MEK, MIBK, and EP Toxicity (metals only). The split-spoons will be advanced in accordance with the Standard Penetration Test (ASTM D1586-74).

Upon completion of each boring, the borehole will be grouted with a cement-bentonite mixture. Borehole cuttings will be containerized in 55-gallon drums. The drums will be transported to a secure area by Camp Lejeune personnel. Samples of the cuttings will be composited and analyzed as described for monitoring well drill cuttings in Section 3.2.

Section 3.4.1 presents the detailed soil sampling procedure to be used during the field investigation.

3.4.1 Split-Spoon Sampling Procedure for Soil Borings and Monitoring Wells

The following procedure will be used to obtain soil samples during the field investigation.

1) Wear appropriate health and safety equipment as outlined in the Health and Safety Plan.

2) Drill borehole to the desired sampling depth.

3) Drive a 3-inch O.D. carbon steel split-spoon sampler into the undisturbed soil to be sampled. Drive the split-spoon with blows from a 300-lb hammer falling 30 inches until approximately 2 feet have been penetrated or 100 blows within a six-inch interval have been applied (Standard Penetration Test ASTM D 1586-74).

4) Record the number of blows required for each six inches of penetration or fraction thereof.

5) Bring the sampler to the surface and remove both ends and one half of the split-spoon so that the recovered soil rests in the remaining half of the barrel. Place the split-spoon on clean plastic sheeting. Collect VOC samples as discrete grab samples with a decontaminated spatula or spoon immediately after the split-spoon is open, if applicable. Screen the entire length of the core for volatile organics using an HNu or OVM. Record the readings, a geologic description of the soils including color, moisture, grain size (modified Unified Soil Classification System based on visual observance), etc. and approximate recovery of the recovered soil in the field logbook.

6) Homogenize the recovered soil in a decontaminated stainless steel bowl or pan using a decontaminated stainless steel spoon or spatula. Fill appropriate sample jars using a stainless steel spoon or spatula.

7) Fill out labels, chain-of-custody forms, and custody seals. Cool analytical samples on ice to 4° Celsius and package samples according to the QAP procedures. Ship the samples to the laboratory within 24 hours.

3.5 SURVEYING OF SAMPLING POINTS

Upon completion of the field operations*, monitoring well and soil boring locations and elevations will be surveyed by a licensed surveyor and plotted on an existing topographic base map. Monitoring well elevations will include elevations for the ground surface as well as outer and inner casings.

*If USGS data fails to effectively determine the deep groundwater flow gradient at HPIA, existing well locations will be surveyed prior to initiation of monitoring well installation. Elevations and locations of existing monitoring wells will be required to process water level data for groundwater flow gradient determination.

3.6 DECONTAMINATION

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

Heavy equipment (e.g. drilling rigs, augers, and rods) will be steamcleaned prior to entering the site. Once onsite, heavy equipment will be steamcleaned prior to sampling, in between sampling locations, and prior to leaving the site. Gross contamination will be removed from drilling equipment with a brush when necessary. Well casings, screens, and riser pipes will be steamcleaned prior to installation. Steamcleaning will be conducted at a designated decontamination area.

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

1) Phosphate-free soap and potable water wash;
2) Potable water rinse, and
3) Deionized water rinse.

Extraneous contamination will be minimized by wrapping sampling equipment in aluminum foil when not in use, and changing the sampler's gloves prior to collection of each individual sample.

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